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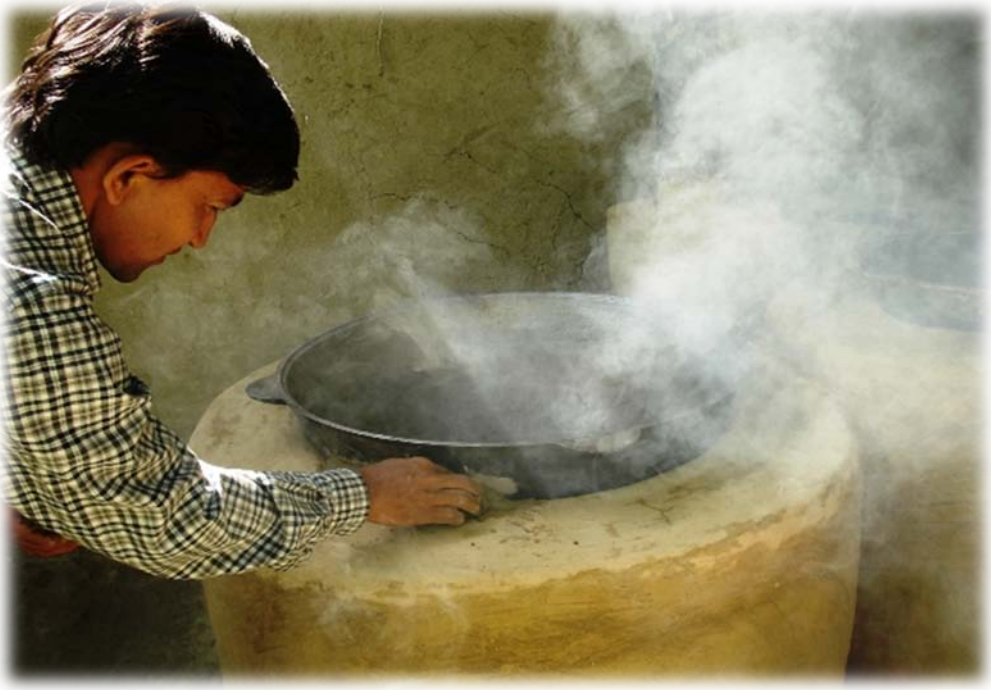
TRANSFER OF CLIMATE- FRIENDLY TECHNOLOGIES



HOW CAN NGOS CONTRIBUTE?

The improvement of living conditions for the poor in developing countries can be combined with combating climate change. The transfer of technology can help to reduce emissions from energy use. This report is focusing on simple, decentralised technologies that cover the basic needs for cooking, lightning and electric appliances. Non-governmental organisations have an important role in the transfer of this type of energy technology.

NORGES NATURVERNFORBUND
FRIENDS OF THE EARTH NORWAY

TRANSFER OF CLIMATE-FRIENDLY TECHNOLOGIES

How can NGOs contribute?

Tore Braend

Oslo, September 2008

Foreword

This report is written by Tore Braend for Norges Naturvernforbund/Friends of the Earth Norway. It is part of a climate information campaign called “Climate seen from the South”. The campaign is run by a group of voluntary development, solidarity and environmental non-governmental organisations, including Friends of the Earth - FOE - Norway. NORAD – The Norwegian Agency for Development Cooperation, finances the campaign.

The author wishes to thank Dag Arne Høystad, Yngvild Lorentzen, Kay Asbjørn Knutsen Schjørlien, Kjersti Album and Jean Mohou of FOE Norway and Thomas Martinsen of IFE, Norway for their comments and input of text during my work on the report. All remaining errors and misunderstandings are the sole responsibility of the author.

1 Children playing in Tajikistan.

Introduction

This report is investigating in what ways environmental NGOs and developmental NGOs have a potential for stepping up their current activities, as well as for taking on new roles through cooperation, both with other NGOs and with other actors doing technology transfer.

The different relevant mechanisms and processes agreed upon under the Climate Convention and the Kyoto Protocol for the purpose is called Technology Transfer.[i] Technology transfer has gained increased priority during the last round of Climate negotiations - COP13 - at Bali in December 2007. Climate friendly technologies include both mitigation and adaptation, e.g. technologies for both reducing the emissions of greenhouse gases as well as for adapting to climate change. The report is briefly outlining the main mechanisms and processes for technology transfer, but also some general development mechanisms. This serves as a background for looking at how voluntary non-governmental organisations – or short NGOs[ii] can help to speed up the transfer.

In part 3, there is a short description of the relevant mechanisms for technology transfer under the Climate Convention and the Kyoto Protocol; The Special Climate Change Fund, the Least Developed Countries Fund and the Adaptation Fund. Part 3 includes a description of the Global Environmental Facility, as well as the Clean Development Mechanism under the Kyoto Protocol. There is also a short mention of ordinary, official development aid (ODA) and multinational funds, as well as the United Nations Development Programme - UNDP - and their respective roles as financers of technology transfer projects.

Part 4 has a discussion about a working definition of technology for the purpose of this report, and in part 5 there is a discussion about what the appropriate technologies for transfer to developing countries are in more general terms. In part 6 an attempt is made to define what is the most appropriate technology in the context of climate change. A narrowing of focus to what kind of technologies that are best at combining the Millenium Development Goals with combating climate change is done in part 7. Both technologies that are mitigating emissions of Greenhouse Gases – GHGs - as well as technologies that helping people to adapt to the negative effects of climate change are included here.

In part 8 the criteria for successful technology transfer is discussed and defined. The financial needs for funding of climate friendly technologies, and the barrier this represent for technology transfer as well as the limitations of particular financial mechanisms is described and discussed in part 9. In part 10, an attempt is made to see how climate and development goals can be brought together in the UN Millennium Development Goals, and how decentralized, small-scale and simple technologies can help to achieve many of these goals at the same time. An example of a cooperation project between an NGO and a commercial actor – Grameenphone - is analysed in 11. The example is used to illustrate how an NGO through cooperation can increase the willingness of commercial actors to get involved in a technology transfer project. In the last part of the report, the lessons from the examples and the analysis of risk in connection with technology transfer projects are brought together and used to point out some possible new roles for NGOs in technology transfer. This is discussed in part 12.

Summary and conclusions

The developing countries need technology, for general development as well as for combating the negative effects of climate change and for the decarbonisation of their economies. Technology can include all sorts of tools, implements and methods that help people to survive and prosper. Technology, in the usage of this report, may also include all kinds of knowledge essential for survival and prosperity in dealing with the material world. This is sometimes also called know-how.

The need for technology transfer is of such a scale that activities in this field must be increased by many magnitudes, on all levels. There is an immense need to establish technology transfer projects that may be the seed for an upscaling of the transfer volume. This development is in its turn dependent on the right mix of incentives and regulations to provide an enabling development, not only for technology transfer, but also for commercial enterprises.

The needed energy services can and have to be provided by different sources and by different means, and must not be confused with a need for so much electricity or barrels of oil. The question should be: “what kind of energy services do these people need, and how can they be satisfied?” Then the answer will include a much wider range of appropriate, individual technologies that can satisfy the needs for energy services than if you focus on the volume of energy in itself.

The appropriate technologies are different at the national, regional, urban/municipal and village/family levels. Supply of electricity to a national or regional grid represents the top end of a scale that is covering the distance from the national level and down to the village or single family. There is a need for technology transfer at all these levels, and for financing and other mechanisms facilitating this transfer.

In the long run, the only sustainable road to development is to increase efficiency of energy use and to use renewable energy. In the rich countries efficiency should increase with perhaps a factor of ten, meaning that we should only use 10 % of what we use today in order to provide the energy services required. Renewable energy sources can then cover the remaining energy service needs. Without a huge increase in efficiency, renewable energy cannot do the job, neither in the industrial countries nor in the developing world. The UN Commission on Environment and Development came to this conclusion in 1987, and the conclusion has been confirmed by numerous, more recent reports.

This increased efficiency could be easily achieved through simple technologies. In order to create sustainable future energy systems, also “low” technology need to get much bigger attention immediately. Simple technologies can solve day-to-day problems, can be transferred and spread immediately, can reduce pressure on natural resources substantially, and can lay basis for a further development into societies with sufficient energy services on a low emission basis. Efficiency measures are by far the cheapest (actually often profitable) and most efficient way of reducing GHG-emissions, also in developing countries. The use of decentralized, small-scale, low-cost and relatively simple technologies on a village/household level has many benefits. In the context of the Millennium Development Goals perhaps the most important is that such technologies has the most direct benefits for the poorest part of the population in the developing countries.

Energy for the poor will basically consist of many small projects or units. The energy is delivered in small quantities and many

participants are involved. Increased efficiency, which is very beneficial for the energy users, is of little or no commercial interest and the results are not very visible. Increased efficiency and the use of technologically relatively simple, decentralised solutions to cover the needs for energy services among poor people are mutually dependent. Without increased efficiency, it is not possible to cover the needs for energy services among the poor with simple technologies. In the first place efficiency measures, but also small-scale energy services are often ignored by and are uninteresting for commercial companies. One of the reasons is that the introduction of efficiency measures and small-scale energy service solutions often depend on transfer of know-how and organisation, rather than complicated technological solutions. This is an area where voluntary organisations have special skills and knowledge.

Voluntary organisations can play an important role in wide dissemination of simple technologies, in information and in changing popular attitudes. However, often NGOs do not have the expertise necessary to handle projects involving big-scale technologies needed on a national, regional or urban/municipal level. On the other hand, when the transfer of technology is basically transfer of know-how and organisation, and not so much complicated technical equipment, NGO`s are eminently suited for this task. Know-how and organisation are areas where voluntary organisations have special skills and knowledge.

While the non-governmental organisations need to continue and greatly expand their work at local level, the great need for technology transfer also open up for new types of cooperation. Other actors, both private and public, must be mobilised to work with technology transfer, alone or together in different constellations. This situation also opens up a number of challenges as well as possible new roles for NGO`s, and increases the importance of other and more traditional roles. NGOs in the future must both work with commercial partners as well as with political authorities in order to speed up the transfer of climate friendly technologies. There is a pressing need for national NGOs in the developing countries also to involve themselves in policy making in addition to the carrying out of specific projects.

The existing financial channels/mechanisms/facilities described in the report all have limitations. The most severe limitation may be the problem of how to finance small-scale, decentralized and sustainable energy technology solutions at a village/household levels. The United Nations Development Programme – UNDP - is perhaps the most promising channel for increasing funding for technology transfer in the short- and medium term. It has an established infrastructure in the form of national and regional offices in most countries. Therefore it can probably quickly increase the amount of financing for small-scale projects aimed at the poorest section of the population in many developing countries. In case the Norwegian government should want to increase this amount, it would be a concrete gesture towards the developing countries, showing a commitment to help with the technology transfer. It would also help to build trust much needed to bring about a new climate agreement in Copenhagen in 2009 to follow the Kyoto Protocol in 2013.

Background

This chapter contains background information about the Climate Convention, the Kyoto Protocol and some of funds for technology transfer set up as part of the Convention and the Marrakech Accords under the Kyoto Protocol.

Public interest in the global climate has reached new heights, not least because of the most recent report of the UN Intergovernmental Panel on Climate Change – IPCC. According to the IPCC we must reduce the global emissions of greenhouse gases by between 50 and 85 % by 2050 if we want to avoid a global warming higher than + 2 Degrees C. within this century. Even if we were to stop all emissions of greenhouse gases from human activities today, the global average temperature will continue to rise. This is because of the gases that has already been emitted and which will stay in the atmosphere for a long time to come. But if we succeed in reducing the man-made emissions to the atmosphere, it is still possible to limit the amount of GHG in the atmosphere, and so also limit the global warming and avoid the worst consequences.

It was recognized by the parties of the Climate Convention from Rio de Janeiro in 1992 that the developing countries need financial and other assistance to make a contribution to the solution of the climate crises. The assistance is needed both regarding mitigation, e.g. how to reduce emissions as well as in adapting to the climate change that is taking place.

Several such mechanisms, facilities or channels for financing technology transfer have been initiated in the context of the Climate Convention, as well as under the Kyoto Protocol. TT was given an important role in the solution of the climate crises already under the Climate Convention from Rio de Janeiro in Brazil in 1992.

The following is a short description of some possible sources for funding of technology transfer for mitigation and adaptation purposes. The list is not exhaustive. Those who are interested in a comprehensive overview of the multinational mechanisms that can be used for the financing of climate projects in developing countries should consult the report by Thomas Martinsen. [1]

In part *9. Financial barriers,* there is a discussion about possible shortcomings and advantages of the mechanisms briefly described in the present part of the report.

No special mechanisms or funds were set up for the purpose of supporting technology transfer under the Climate Convention in 1992. On the other hand, a general financial mechanism – the Global Environmental Facility, or GEF - had been established in 1991. The purpose was to fund projects under all the different environmental conventions that later was adopted in Rio de Janeiro in 1992.[2] The GEF claims to be the biggest environmental financial funding mechanism in the world.

Under the Kyoto Protocol, three so-called flexible mechanisms were established. These enable the Annex 1-parties – the industrialised, rich countries that took on quantified emission reduction commitments - to fulfil their obligations outside their own countries. One of these, the Clean Development mechanism (CDM for short) was designed with two purposes in mind: to provide development benefits to the developing country taking on a GHG-reducing project (host country), and a GHG - emission

1 Thomas Martinsen. Technology Transfer related to energy and climate change mitigation – Brief overview of technology transfer initiatives and mechanisms. IFE/KR/E-2004/959 p 22

2 http://thegef.org/interior.aspx?id=108 Read February 2008

reduction benefit to the industrial country financing the project.

Several funds have been set up under the Climate Convention and the Kyoto Protocol. The funds have been established to fund adaptation to climate change, as well as help to mitigate the causes of climate change, The funds are the following: The Special Climate Change Fund[3] and the Least Developed Countries Fund[4] have been set up under the Convention, while the Adaptation Fund[5] is organised under the Kyoto Protocol. The final decisions about the terms and conditions for these funds are currently under review. The reason for the long period of indecision in this matter is disagreement about the use of the funds between the industrial countries, which would be the main donors to the funds, and the developing countries, which are the beneficiaries.

The Adaptation Fund seem to have moved one step closer to being operational, since an agreement about the governance of the fund was reached in Bali.

At the COP13 in Bali, the developing countries also proposed setting up a special technology fund to pay a substantial part of the technology transfer to the developing countries. A decision about such a fund has naturally not been reached.

Outside the Convention and the Protocol, substantial funding is available from the official unilateral development aid –ODA – given by the industrial countries and also from the multinational financial institutions – MFIs - for energy technologies in developing countries. The ODA and MFI-funding is not, however, directed to covering the needs for mitigation or adaptation. The funding is instead intended to finance projects with development goals.

UNDP – United Nations Development Program – is a UN institution with a mandate to support development. It does not have a primary climate agenda as such. Neither does it have a technology transfer agenda. All the same, many of its development projects can help countries to adapt to climate change. Other projects have a similar potential to mitigate GHG-emissions in the developing countries.

On the other hand, UNDP has already helped to prepare an increase of technology transfer. One of the most important is the funding of reports in many developing countries for the assessment of technology relevant for developing countries in a climate context and the technology needs for specific countries. One example is a report prepared in Ghana. [6]

2 Making solar cookers in Togo. Photo: NNV

[3] http://unfccc.int/cooperation_and_support/financial_mechanism/special_climate_change_fund/items/3657.php

[4] http://unfccc.int/cooperation_and_support/financial_mechanism/least_developed_country_fund/items/3660.php

[5] http://unfccc.int/cooperation_and_support/financial_mechanism/items/3659.php

[6] Ghana`s Climate Change Technology Needs and Needs Assessment Report.(Version 1 January 2003) Under the United Nations Framework Convention on Climate Change.

What is technology?

To answer the question "What is technology transfer?" we must take one step back and answer the question: what is *technology*? After having found, hopefully, a satisfying explanation or definition of what technology is, the next question is what is the *right* technology to transfer? Another way of phrasing this question is perhaps what is the *appropriate* technology to transfer to the developing countries seen from an environmental and developmental perspective?

What we in the rich countries usually associate with the word "technology" is probably hi-tech, complicated equipment such as PCs, mobile phones or Ipods. Or, maybe we are thinking of big, expensive and complicated power plants or factories. In a vague, but emotionally appealing way, technology is also connected with "modernity". But, technology in a wider sense of the word is more than hi-tech and modern equipment. Technology can also be tools and equipment used to cover basic human needs such as shelter, warmth and growing food. In the developing countries, these tools or technologies are often based on wood, stone and other natural materials.

Sometimes technology transfer may not involve the physical transport of any piece of machinery at all, but is basically only instructions for how to make simple tools for energy collection. The making of simple solar cookers let villagers cook their food with the heat from the sunlight. Strong sunlight is necessary, so the technique is mostly appropriate for year-round use in the tropical regions. The materials needed are quite simple: cardboard and reflecting metal foil. Solar cookers reduce the need to collect and burn scarce firewood. Less use of firewood has a positive climate effect: less use of firewood=less cutting of trees=keep the living trees growing=CO2 locked in living trees instead of releasing it to the atmosphere.[7] The solar cookers are made of cardboard to provide a base for the reflective metal foil. Once the foil is shaped in a way that concentrates the sun`s rays in a cooking pot, the job is done. This is yet another example of technology that is easy to teach others, and villagers can take on the task of going to the next village and spread the information.

We must not think, as the preceding examples indicate, exclusively of technology in terms of mobile phones, Ipods, PCs, big factories, power stations etc. etc. Technology can include all sorts of tools, implements and methods that help people to survive and prosper. Technology may also be immaterial, and include all kinds of knowledge essential for survival and prosperity in dealing with the material world. Even if some will reserve "technology" for materials and physical equipment, I therefore choose to include know-how in my definition of technology for the purpose of this report. Technology can therefore broadly be defined as:

".....the sum of knowledge and tools that increases the human ability to transform nature. Such transformation may have a productive goal – to increase human satisfaction of needs. It may also be used in a destructive manner, to increase the destructive power in war. "[8]

3 **Workshop on solar cookers. Photo: NNV**

[7] Togo: solar cooker project http://www.naturvern.no/cgi-bin/naturvern/imaker?id=108521 Read 19 May 2008
[8] PaxLeksikon, Oslo 1981

What is appropriate technology?

As we have discussed in part 4, it is important not to confuse the needs for better tools, equipment and methods in the developing countries with our simplified ideas of what technology is. Neither must we confuse their needs for increased energy services with a need for so much electricity or barrels of oil. When you ask the question: "what kind of energy services do these people need?" the answers tend to be different than if you ask: "how many kilowatt-hours or how much oil do they need?" If we also broaden our horizon regarding what technology is, we will see a much wider range of appropriate, individual technologies that can satisfy the needs of the population in the developing countries than before. The example below illustrates this point.

Light for household use

People in a village need artificial light in their home after dark. This can be provided in many different ways. Here is a list of some possible solutions:

- Light from the cooking fire,
- Petroleum lamps,
- Light bulbs supplied with 240/120 volt electricity from the power grid,
- Electricity from a local wind turbine,
- Electricity from a local micro-hydropower station,
- Electricity from a local power station fuelled by biomass or
- Energy efficient 12-volt lamps supplied from a battery, charged by photovoltaic solar cells (PV-cells).

The listing of the many alternatives illustrates that the range of possible solutions are much wider than if we simply assumed that electricity from the grid would be the only answer. But the list does not answer what the appropriate solution for the individual village or household might be. Before we decide, we should ask is what kind of *energy service* we need: is it light, power for a radio or a television set, a refrigerator or may be machines for a small business? Then the next question would be how we might get that energy service for the lowest cost, assuming a satisfactory level of security of supply and that environmental considerations have been taken into account. It is assumed that people everywhere are looking for the most efficient use of resources, including energy, within the environmental constraints necessary to build a sustainable energy system.

In the case of the hypothetical village above, the energy service needed is primarily light. The amount of energy or the kind of energy itself needed to provide the service is relatively un-important. If I, as a villager, can get satisfying artificial light using a few watts of electricity from a solar PV-panel, I have no pressing, real need for electricity from the grid. Granted, a grid connection with 240-volt electricity supply can provide me with maybe many thousands of watts in comparison to the few watts that a solar PV-system can provide in the course of a day. A grid-connection will in addition to the provision of electric light also make it possible to use more power-consuming electrical equipment such as electric motors. With this motor I can run for example a saw-mill, which cannot be powered with solar PV-cells, at least not at a sensible cost. On the other hand, a sawmill could also get its electricity from a diesel generator. The provision of electricity from the grid for the whole village may not be necessary in order to satisfy a specific energy service needed for one economic activity, when the majority of the population simply needs electric light in their homes. A combination of different supply technologies can therefore be a cheaper, more flexible and also more reliable alternative to grid connection.

In a similar fashion, people in villages all over the developing countries can get a satisfactory way of cooking their food by using an energy-efficient cooking stove made out of local clay, or a solar cooker. They do not automatically need an electric stove, using electricity from a big hydropower plant, a coal-fired power station or even a nuclear power station. The electricity from big, centralized generation facilities usually comes at a far higher direct cost for the users, and indirectly for society as a whole and for the environment. This would be visible in the cost of electricity if the environmental effects had a price, and the real cost reflected in the cost of the electricity supplied by the grid. Today, this is not the case, and so the most environmentally sustainable solutions suffer from unfair competition from alternatives that pass on their real cost to the environment and the future generations.

The majority of the people in our village can probably get the energy service, in this case light, from a solar PV-panel at a lower cost and using far less energy than with electricity from the grid. This conclusion depends on a number of circumstances. The most important is the distance of the village from the nearest grid. The closer to the grid, the less will it cost to connect the village. If somebody else than the villagers themselves covers the cost, the answer may also tip in favour of a grid connection. However, many developing countries lack resources to connect outlaying villages to the grid. Here, the villagers usually have no options but to continue using perhaps petroleum lamps, if they can afford it, unless they can afford to invest in more modern, decentralised methods of electricity supply as listed above.

Electricity from the grid is often promoted as the modern solutions to the developing countries needs for better energy services. The reasons for the popularity of the big, centralised and conventional power supply options are many and complicated, and need not be discussed here in great detail. Part of the answer lies in the identification of certain technologies with modernity, which has been described above. Other explanations have to do with vested interests in the promotion of the conventional energy sources. Beliefs and assumptions about the superiority of the business-as-usual energy sources and solutions are deeply embedded in the educational systems for engineers and technical experts, both in industrial and developing countries. The same beliefs are often also paramount in the development aid agencies, because of the professional and educational background of the employees. Finally, the economic interests behind the large-scale power production technologies also have great power to influence governments both in donor countries as well as in the developing countries in their choice of technologies.

Which technologies should be promoted?

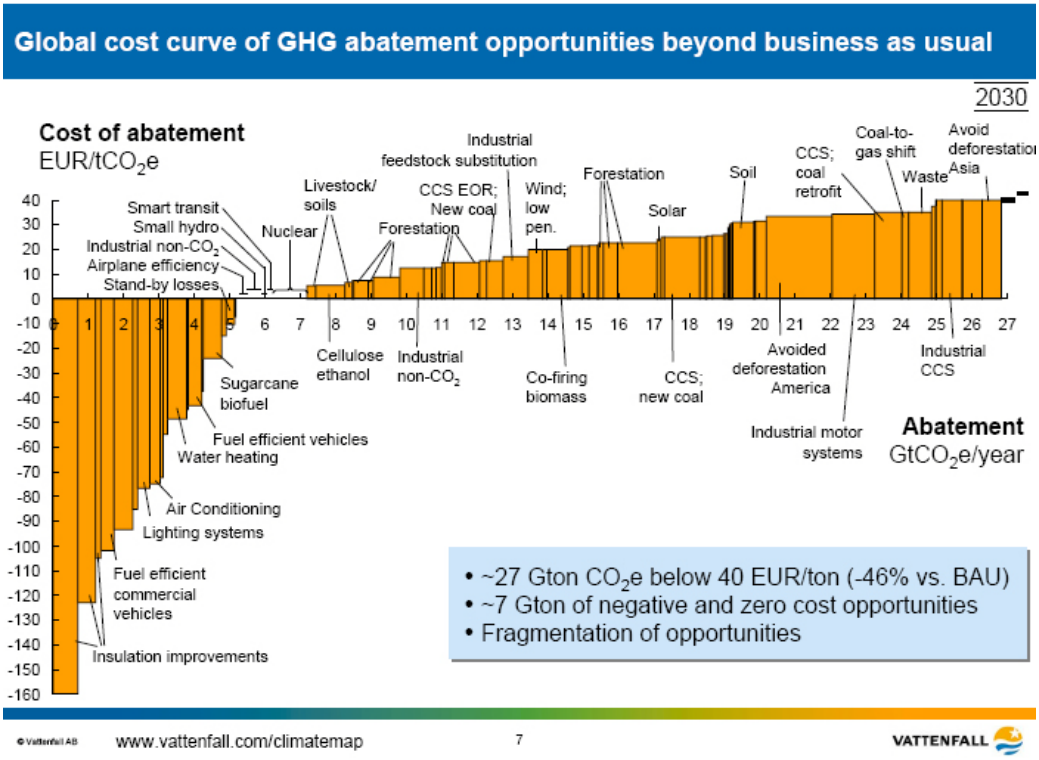
After this discussion about appropriate technology in general, the next question is: what is the appropriate, climate-friendly technology that ought to be promoted in the developing countries through technology transfer? In the long run, the only sustainable alternative worldwide is to increase efficiency and use renewable energy. In the rich countries efficiency should increase with perhaps a factor of ten, meaning that we only use 10 % of what we use today. Renewable energy sources can then cover the remaining energy service needs. Without a huge increase in efficiency, renewable energy cannot do the job.[9] The UN Commission on

Environment and Development[10] in 1987 said much the same, and the answer is still valid.[11]

The question is; how does this match the expectations in the developing countries? The Climate Convention and in the Kyoto Protocol states clearly that the developing countries must have the possibility to increase their energy use in order to develop. What is missing is a definition of what *level* of development and consequently what level of energy use they should aspire to.

In the long run, the only sustainable road to development is to increase efficiency of energy use and to use renewable energy. A doubling of global efficiency would reduce the CO2-emissions by around 55 %, while in comparison a doubling of the production of new renewable energy sources would reduce the emissions with about 10 %. In most of the of countries in Africa south of Sahara, main energy consumption per capita, as well as on national level, consist of traditional and inefficient biofuels, e.g. fuels made from biological material such as wood, straw, crops etc. If the efficiency for the traditional consumption of biofuels could be doubled, many of these countries would be able to reduce almost half their total energy consumption, and still get the same energy services, e.g light, heat, cooking food etc

It is far easier to double the efficiency of the energy use than to double production. The following graph showing abatement cost for GHG-emissions, illustrates this.



In the graph, the cost (both real cost and negative cost=economic savings) connected with GHG abatement (avoided emissions of Greenhouse gases to the atmosphere) is measured on the vertical axis, while the amount of GHG-emissions not entering the atmosphere is measured along the horizontal axis. The different technologies and measures is also ordered so that the greatest economic savings are at the left and the greatest cost is at the far right of the graph. In the graph, one can clearly see that a number of efficiency measures such as increased insulation in buildings etc are actually saving a lot of money, at the same time as both energy use and the GHG-emissions are greatly reduced. The conclusion, that efficiency measures are by far the cheapest (actually often profitable)

[10] In Norway known as the "Brundtland Commission" after its chairperson, the former Norwegian Prime Minister, Gro Harlem Brundtland.
[11] The UN Commission on Environment and Development: Our Common Future, 1987

and most efficient way of reducing GHG-emissions and saving energy, is also highly applicable in developing countries.

If you ask politicians in the developing countries, as well as the man in the street, it is most likely they will say that they want the same level of energy services that we in the industrialized countries have. No one could seriously dispute the fairness of such a claim. On the other hand, if they should use energy in the same wasteful manner that we do, this goal cannot be fulfilled. There are just not enough resources on our planet if everybody should have the same per capita energy use as the average in the OECD-countries [12]

If we apply the principle of equality of all human beings, regardless or race, gender or country of origin, there is only one possible conclusion regarding the course of action to follow. *If it is not possible for everybody on this planet to consume the amount and types of energy as we do, then nobody can.* If we advocate the use of technologies and a level of consumption in the developing countries that are sustainable, both locally and on a global level, we can only do so provided that we also are willing to reduce consumption in the rich part of the world. [iii] Since there is a close link between per capita energy use and per capita GHG-emissions, the consequence of this would also be a significant reduction in the GHG-emissions per capita in the rich countries. [13]

In the short and medium-term it is probably not possible to avoid also an increase in the use of fossil fuels in the developing countries. In some cases, increased fossil fuel use is the only viable alternative, because of local and national circumstances, and also because of the difficulties inherent in all big systems to change course.

A low absolute level of consumption per capita is no guarantee for efficient use of energy. Even the small amount of energy that the poorest people in developing countries use can be spent in a very wasteful manner because of inferior technology. The open cooking-fire is the most common way of cooking for hundreds of millions of people. This is usually three stones in a ring, or sometimes a bit more elaborate fireplace. Only a minor percentage of the fuel is actually heating the food. The rest becomes waste heat. Most of the energy is not performing a useful energy service, unless it is also there is a need for space heating in the house and/or light.

If the family is using charcoal for its food preparation, the waste could be even bigger, because of the energy lost in the charcoal making. A family in Zambia use typically 3 kilograms of charcoal every day for cooking. To make the charcoal, you must use 20 kilograms of wood. The energy content of the wood (before processing into charcoal) is 60-70 KWh. If multiplied with 365 days a year, the energy from wood used to supply the family`s charcoal consumption amounts to 23750 KWh/year. This can be compared to the energy consumption of an average Norwegian home, which is about 20000KWh - 25000 kWh/year.[1]

What we may deduce from this example is that is far easier to double the efficiency of the energy use than to double production. The effort to increase efficiency for household consumption of charcoal is a far easier task than to double the production of new renewable energy sources. A doubling of global efficiency would likewise reduce the CO2-emissions by around 55 %, while a in comparison a doubling of the production of new renewable energy sources would reduce the emissions with about 10 %.

[12] State of the World 2004, WordlWatch Institute/Earthscan, London 2004, p.49
[13] ibid. p.58

The main effort also in the developing countries must nevertheless go into increased efficiency and to find a sustainable alternative to fossil fuels. Above all, the potential for an increase in energy efficiency are probably just as high or even higher in many developing countries, compared to many industrial countries. It is estimated that people in developing countries can reduce their energy consumption by about 75 % by using more efficient products for preparing food, heating and lighting.[14] In developing as well as in developed countries, the facts remain the same: the easiest emissions to reduce are those that are never emitted, e.g. if we can avoid use of fossil fuels, the task of mitigation become much simpler.

Here we have a win-win situation, where development with low emissions also may be the most beneficial in terms of development which will benefit the poorest part of the population. In this respect, this area also offers a common ground between aid agencies and environmental NGOs with projects aimed at helping the poorest with low-cost, low-emission solutions.

Energy for the poor will basically consist of many small projects or units. The energy is delivered in small quantities and many participants are involved. Increased efficiency, which is very beneficial for the energy users, is of little or no commercial interest and the results are not very visible. Increased efficiency and the use of technologically relatively simple, decentralised solutions to cover the needs for energy services among poor people are mutually dependent. Without increased efficiency, it is not possible to cover the needs for energy services among the poor with simple technologies. In the first place efficiency measures, but also small-scale energy services are often ignored by and are uninteresting for commercial companies. One of the reasons is that the introduction of efficiency measures and small-scale energy service solutions often depend on transfer of know-how and organisation, rather than complicated technological solutions. This is an area where voluntary organisations have special skills and knowledge.[15]

National level

Since a certain increase in the use of fossil fuels may be necessary in many developing countries, this will then be one of the options at a national level in most developing countries. The range of options goes all the way from renewable hi-tech solar PV-cells for lighting and electrical equipment to fossil-fuelled, more efficient and cleaner power stations running on gas, oil or coal, supplying the growing cities of the developing countries. Space heating, e.g. the heating of homes, offices etc. is a big energy consuming energy service in the industrialised countries in the north. Similarly, there is a growing demand for energy used for space cooling or air-conditioning in the cities in Southern, developing countries. A possible role for NGOs is to show how this can be achieved with less energy consumption. Several examples of such low-energy-consuming cooling technologies are shown in the publication by the Norwegian Forum for Environment and Development, “Pick the low-hanging fruit.”[iv]

Supply of electricity to a national or regional grid represents the top end of a scale, stretching from the national level and down to the village or single family. The appropriate technologies are different at the national, regional, urban/municipal and village/family

[14] ibid p 57

levels. There is a need for technology transfer at all these levels, and for financing and other mechanisms facilitating this transfer. NGOs usually carry out projects involving transfer of technologies appropriate for a village/family level. On the other hand, there are many different roles for NGOs also working at a national, regional and urban level. Some ideas about the possible new roles NGOs may play in TT will be discussed later in the report in part 12.

Village/household level

The individual household represents one extreme end of a scale, with the national level at the other end. Solar PV-cells have already been described, together with other small-scale, decentralised supply options, in part 5. It is typically a technology appropriate for "stand-alone" systems. These are either single technologies or combinations of energy technologies designed to provide electricity to single family homes or local communities/villages, without a grid connection. For schools, clinics, shops and family homes in the villages, solar PV-cells would often be an appropriate technology to supply low-voltage electricity for lighting and electronic equipment. For the purpose of cooking, one may similarly look at a range of technologies stretching from for example the use of bottled gas via electric stoves and solar cookers[v] or more energy-efficient cooking stoves[16] in the villages. For a more comprehensive example of combinations of different small-scale renewable energy technologies, see *Appendix B – Solar Powered Clinics in Rwanda.*

In most villages in the developing countries, covering the needs for light and low-voltage electricity and cooking respectively would also cover the most basic needs for energy services in the rural population as a whole.

[16] Asia Improved Cookstove Program: http://www.arecop.org/ Read February 2008

Villages also have other energy service needs such as transportation, cooling of vaccines and medicines in village clinics, running PCs, etc, but they are not described in detail here.[vi] Electronic communication, in this case connection to cell phone services is discussed in part 11, using the example of Villagephone in Bangladesh.

4 Efficient cooking stoves in Tajikistan. Photo: NNV.

Efficient cooking stoves and solar PV-cells are examples of technologies that will help to improve living conditions for the local people, as well as having beneficial effects for the climate. The PV-cells provide electricity without burning fossil fuels in a power plant, and therefore help to avoid CO2-emissions. The improved cooking stove likewise help to reduce the use of firewood, and thereby help to reduce the destruction of remaining forest cover. Deforestation – the removal of the natural forest cover – makes up about 20 % of the total global emissions of CO2 on a yearly basis.[17] Any technology that helps to reduce deforestation such as the energy-efficient cooking stoves, is therefore also contributing to the reduction of CO2-emmissions.

They are also well suited for their purpose because they have the right *energy quality* for the energy service they are providing. If you need to heat food to a temperature of 100-

[17] IPCC Third assessment Report. http://www.ipcc.ch/ipccreports/tar/vol4/english/index.htm Read February 2008

150 degrees C, this can be done with may different technologies and energy sources as mentioned above. It is not necessary to use electricity that can be used for many other electricity-specific purposes that can only be solved by electricity. E\examples of electricity specific purposes are provision of light, running a TV-set or other electronic equipment. For these purposes, only electricity can do the job. As discussed above, the electricity can on the other hand be provided by different technologies.

As a principle, *one should use an energy source that has adequate quality for the purpose, but not more.* Very often this principle is not followed in practice today, and the result is in-efficient use of energy and waste of valuable resources. In a country like Norway, which historically has had abundant and cheap electricity from hydropower plants, space heating is done to a large extent by electric resistance heating. The US scientist and energy efficiency "crusader" Amory Lovins has compared this practice to using a chainsaw for cutting butter, e.g. an absolute overkill in terms of energy quality.[18]

The provisions of light, as well as the provision of the means for cooking food, are very universal energy services needs. However, the amount of energy needed to provide these services to the billions of people who do not have modern energy supply is not very large. There seems to be an inverse relationship between the number of people and their absolute energy consumption and also their needs. The majority of people in the world consume the least energy per capita today. The impact of even a small increase in the disposable energy per capita would also have a relatively much larger positive impact in their quality of life, compared to us in the rich the rich part of the world.

Unfortunately, in the real world decisions about technology is often done according to very irrational criteria. Sometimes the value of certain technologies as a symbol of modernity seems to be the over-riding concern for the decision-makers. At other times it is the fringe benefits provided by the sales-representatives to the decision-makers that tip the scale in favour of one technology before another. These irrational motives influence decisions in rich and developed countries, and not only in developing countries.

In principle, choosing the appropriate technology for satisfying energy service needs should be based on rational decisions. The guiding principle should be to select technologies that are appropriate for the task, taking into account the local conditions and not harming the environment. One cannot say that a solar PV-cell made of very refined and pure silica crystals is an inherently superior technology compared to an efficient clay oven. Both are well suited for their particular purposes, and just adequate for providing respectively light/electricity service and cooking service. Both help to satisfy basic human needs in a way that conserves scarce resources. They can be adapted to the economic and social circumstances where it is used, they are decentralised solutions to the peoples needs, and therefore they also contribute to the villager's freedom from domination from energy suppliers.

[18] He's universally credited with the line that heating your house with electricity is like cutting butter with a chainsaw, but he didn't say it first, and every time he runs into Doug Kelbaugh, a professor at the University of Washington, he apologizes. http://outside.away.com/outside/culture/200803/green-archives-amory-lovins-1.html Read 19 May 2008

Technology transfer

As discussed in the previous part, it is important to transfer the most appropriate technologies, bearing in mind the need to adapt the technology to the local conditions and using the right quality of energy for the energy services that are provided. IPCC – the United Nations Intergovernmental Commission on Climate Change – uses the following definition of technology transfer:

Technology Transfer is a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGO\s) and research/education institutions. [19]

As stated in the definition above, TT is more than shipping of equipment to a developing country. It also involves know-how and experience. And most often it involves all three together in the same project in order to make a successful transfer. As an example, you can take the case of introducing solar photovoltaic cells or short PV-cells in a developing country. The technology transfer involves the physical transfer of the PV-cells (since few if any developing countries have their own production facilities) and the related electronic equipment such as batteries and control panel. A successful technology transfer must also include the knowledge of how to install and run the equipment correctly to generate electricity from the sun. A service organisation with trained technicians can be an important part of a successful transfer. In cultures without experience in maintaining industrial technology products, the homeowner's own ability to do maintainence on the PV-cells and batteries may be limited. The technicians can make regular visits to check and maintain the solar PV-systems. This will make the system function in a satisfactory manner for longer periods of time, and the equipment may also last longer.

A system for taking care of the highly toxic lead-acid batteries when they need replacement is also needed. Otherwise, the widespread use of solar PV-systems may lead to a new source of dangerous pollution for humans and animals. In addition to the problem of toxic waste, recycling the batteries also make sense in a life-cycle perspective. The batteries contain materials that have required quite a lot of energy to produce. By recycling a lot of energy is saved compared to producing a battery from fresh raw materials. Since mining of lead also causes environmental problems, recycling also help to reduce other environmental damages. In the longer run, research may come up with new types of batteries that do not use toxic materials. Even if some non-toxic batteries is not collected and disposed of in a proper manner, they will then not represent a health hazard.

The case of the batteries is also illustrating in the sense that in the real world there are never perfect technological solutions. There are always trade-offs between different priorities. In this case the trade-off is between the provision of energy services for the poor in developing countries and the problem of handling the worn-out batteries in an environmentally responsible manner. Compared to the trade-off when for example using nuclear energy (electricity versus extremely toxic, long-lived radioactive waste), this problem is still quite easy to manage. The necessity to take care of used batteries should in no way stop the spread of PV-cells in the developing countries.

[19] http://www.ipcc.ch/pdf/glossary/tar-ipcc-terms-en.pdf Read May 2008

In comparison there is little or no physical transfer of equipment or materials in the case of more energy-efficient cooking stoves made of clay. The important transfer is the knowledge of how to design and build such clay ovens. The dimensions of the internal combustion chamber needs to follow certain ground-rules, otherwise it will not burn the firewood in the most efficient way. That knowledge exists in the form of written manuals, instructional videos and/or in the mind of experienced instructors. Basically only the knowledge of the improved design and its construction method is transferred: the clay and other raw materials for the construction are found on site. There is also comparatively little need for a service system with trained technicians. Most villagers can repair cracks in the clay by applying a new layer or patch of clay when needed! There are no toxic chemicals involved that may endanger the health of the inhabitants. On the contrary, an important cause of illness and early death will disappear. Open cooking fires pollute the indoor environment in the villages in millions and millions of village homes today. A modern, energy-efficient cooking stove will have a chimney that leads the smoke out of the house and reduce the indoor pollution. Calculations have been made that indoor air pollution – IAP – mainly from cooking fires, constitutes a serious health hazard, and that it is the cause of numerous deaths in the developing countries.

"*Conservative estimates of global mortality due to IAP from solid fuels show that in 2000, between 1.5 million and 2 million deaths were attributed to this risk factor (14,15). This accounts for approximately 4–5% of total mortality worldwide."*[20]

Reduction of the indoor air pollution from wood-smoke would therefore contribute to bettering the health of many inhabitants of developing countries who rely on wood for cooking. More energy-efficient cooking stoves may therefore also reduce health problems.

As we have seen from the example of the improved, energy efficient cooking stove, solving the need for cooking food in an energy efficient way can also solve other problems. The reduction of indoor pollution from smoke reduces for example many health problems that often afflict women in the developing countries. There are also other beneficial side effects of such cooking stoves. The time needed to collect firewood for cooking will also be reduced, as the need for fuel diminishes. An efficient cooking stove directs more of the heat from the firewood to the cooking pot, compared to a traditional fireplace. Consequently, less fuel is needed for cooking a meal. Less fuel consumption means less time and effort used to collect firewood, time which can be used for other activities, particularly for women and children. They are the family members who usually have firewood gathering as their responsibility. This is quite time-consuming in many places. A reduction in the time needed for this chore will free time for the women to look after their children, and do other types of household work or income earning activities. The children, and particularly the girls, will have more time for school and doing homework. In places where the security of women is not guaranteed outside the village, the reduced need for firewood also increases their security. The improved, energy efficient cooking stove generates in this manner a bundle of benefits in addition to the climate benefits. This illustrates the need to look at the totality of the development needs when one is assessing what the appropriate technologies are in a climate context.

20 M. Ezzati1 and D. M. Kammen 2002

Three elements of successful technology transfer

Technology transfer should ideally set off a broad technological, economic, social, educational and cultural change in the recipient country. A small initial investment should somehow initiate a self-sustaining process, where people and institutions learn the advantages of the new technology, and this in turn creates a demand. The demand will lead to the implementation of the new technology in wider and wider circles geographically, around the initial localities where it first was introduced. Then the success of one new technology according to this model could be the base for a self-sustaining change process.
Experience from technology transfer projects has shown that successful projects usually have three crucial elements present. A successful dissemination of a new technology in the sense that it becomes a self-sustaining process, as described above, requires that all these elements contribute. Otherwise, the technology transfer project can be an isolated event, without any further impacts in the receiving country. This may be the case even if the project itself is success in terms of the new technology introduced have been adopted by the population in the project area.

On the other hand, there are plenty of examples also of failed projects. Typical examples are where an NGO, a foreign official aid organisation or a national government organisation has come in and installed a new technology, which the local villagers have not asked for, and does not see the practical value of. After a malfunction or technical breakdown of the installed equipment, the villagers make no effort is made to repair the equipment. It falls in disuse, and the whole investment is a waste of time and effort.

Even when a local population actively want a technology, and even when the technology is being used and maintained, one cannot say that the technology transfer process is a success according to the more ambitious criteria for success. To contribute to the avalanche of change described at the start, there are still three elements that must be in place for a successful transfer of the technology. The three elements are:

1. **Training** of technicians and engineers to install and service the new technology on site in the developing country.
2. **Technology research co-operation** between universities and technical research institutions in donor country and developing country receiving the technology.
3. **Funding of pilot projects** in order to demonstrate the value of the new technology.

5 **Insulating windows in Ukraine. Photo: NNV.**

A fourth area for technology transfer is chiefly applicable for low-cost, simple technologies at a household level. This is the dissemination of information about low-cost, simple energy technologies, which goes hand-in-hand with efforts to change attitudes towards energy use and sources of energy in the population. This requires people and resources, and may be seen also as a pre-requisite for successful transfer of more complex technologies, as

well as an end in itself. Information and efforts to change attitudes also contribute to more general social change process in the developing countries.

Training of technicians may be a key to the successful transfer of many technologies. Solar PV-cells is an example of relatively high-tech equipment, which needs proper care and maintenance in order to function. The longevity of the batteries sometimes depends on regular up-keep. The villagers may not be able to repair and maintain the equipment themselves. Where equipment has been properly installed and maintained, the chances for a successful spread of the new technology is also much higher. The neighbours in the village and outside will see that it functions, that it provides light and electricity for running TVs and maybe charging the batteries of a cell phone/mobile phone. All these energy services are attractive, and they would want it for themselves. A broken solar PV-cell-system on the other hand, does not attract new users. Proper maintenance, either by the villagers themselves after having received proper training from instructors, or by professional service personnel, is therefore a key factor in spreading some types of technology.

The transfer of scientific knowledge necessary for the adaptation and development of technology is a key aspect in other cases. Introduction of more efficient cooking stoves, locally made of clay found on site, does not need a service organisation to maintain. On the other hand, the successful transfer sometimes requires a study of the local food habits. If the housewife is used to cook food in three separate pots, a clay-stove with only two holes for pots is not satisfactory. This may reduce the attractiveness of the new technology significantly compared to an oven designed according to local customs. And there may still be need for advanced research and testing of prototypes of new models, work that must be done with the help of a theoretical knowledge about combustion, different types of clay, proper design of the fire-chamber to maximize energy output etc.etc. This would require scientists and technologists with laboratories and equipment, and training in the use of these tools.

Developing a certain technology to a qualitatively new kind requires scientific and technological knowledge on a deeper level than what is necessary to maintain and service it. Knowledge of the technology must therefore be systematically developed in a country receiving it. Agreements about technological cooperation, and programs for exchange of researchers and scientists between universities and technological research institutions in industrialized and developing countries, are therefore key elements.[21]

Providing funding for pilot- and demonstration projects is maybe the most common element in development projects involving technology transfer. But as previously stated, these pilot projects may be without any long-term consequences if they are not systematically followed up with training and research.

The introduction of one technology, even if it is successful in itself, is really not enough to solve the basic problems in the developing countries. It is only one step in a long and broad process of societal change. The successful introduction and gradual spread of one technology should help the introduction of the next technology. These technologies may either be a further development of the initial technology, or it may be another technology. Introduction of solar PV-cells may lead to a more advanced type of solar

21 Thomas Martinsen. Technology Transfer related to energy and climate change mitigation – Brief overview of technology transfer initiatives and mechanisms. IFE/KR/E-2004/959 p 22

electricity generation. Improved cooking stoves may lead to the use of biomass in other types of efficient heat generation, or for example electricity production fuelled by biomass.

An "enabling environment" is necessary for the successful implementation of technology transfer projects, consisting of laws, regulations and a number of other elements that help to introduce new technology. This environment differs on a village, regional and national level. Many single technology transfer projects will also push for positive changes in the enabling environment, and can help other projects indirectly.

Successful technology transfer depends on the three key elements: training, technology research co-operation and funding of pilot projects. These three elements are necessary, but not sufficient to initiate a self-sustaining process of technology transfer. A fourth element, dissemination of knowledge about low-cost, simple technologies as well as changed attitudes among the population to energy use, can also go hand-in-hand with the steps necessary for the more complex technologies. The spread of information and efforts to change attitudes both contribute to a general social change process. Unless such a social change process is initiated in the developing countries, the spread of climate friendly technologies will be too slow to play the role envisioned in the Climate Convention and Kyoto Protocol in helping to solve the climate challenge that are facing us.

The Financial Barriers

The financial needs for funding of climate friendly technologies are staggering. For adaptation alone the needs are huge. The UNFCCC secretariat has estimated that by 2030 developing countries will require USD 28 – 67 billion in funds to enable adaptation to climate change. This is approximately 0.2 – 0.8 per cent of global investment flows, or just 0.06 – 0.21 per cent of projected global GDP, in 2030. Current global funding for adaptation is very small compared to this figure and access to these funds for developing countries is often lengthy and complex.[22] Funding of mitigation technologies then comes in addition to the adaptation needs. The amount of money needed is then a barrier in itself.

Funding is used in this report to describe both grants and subsidies, which are not supposed to be paid back from the receiving party, loans (both on commercial terms and with special low interest etc.) as well as cases where the financing institution is becoming co-owner of a project.

The beginning of a long march always starts with one small step. Likewise, the start of the gigantic process of technological change in the developing countries must start with the first projects. To fund these projects, there are some possible sources, even if they cannot provide at present the amounts indicated by the UNFCCC secretariat above. The different alternatives described here are not a comprehensive overview. As previously stated those interested in an overview of all the multilateral mechanisms and initiatives relevant for technology transfer can find these in a report by Thomas Martinsen.[23] However, getting access to the money from the sources described in this part is not without problems, and therefore represents further barriers for the developing countries. These barriers are discussed here.

22 Climate change impacts, vulnerabilities and adaptation in developing countries. UNFCC 2007

23 Thomas Martinsen. Technology Transfer related to energy and climate change mitigation – Brief overview of technology transfer initiatives and mechanisms. IFE/KR/E-2004/959

In the beginning of 2008 there has been a very lively debate about a number of new initiatives proposed by the World Bank. A conclusion has not been reached about these proposals at the time of writing this report, and will therefore not be discussed here.

Another debate is the need to distinguish between funds that are primarily aiming at solving the climate crisis, as opposed to the funding of energy for the poor. A strong increase in Climate Change Mitigation and Adaptation in the South is absolutely necessary. In the last few years the threat from global climate change and the necessity of massive efforts in mitigation and adaptation has climbed to the top of the international agenda. The environmental non-governmental organisations give their full support to a large-scale and absolutely necessary technology transfer and sharing of climate friendly technology in the South for mitigation purposes. This effort will, however, have reduction in emissions of Greenhouse gases – GHG - as the primary goal, and not poverty reduction. Technology transfer and sharing of technology for climate mitigation purposes are primarily aiming at reduced emissions. These technologies must therefore be defined as a separate program and be additional to clean energy in development cooperation.

Clean energy in development cooperation must have poverty reduction as its primary goal, and must have focus on technologies and programs that reach the poorest. The goal must be a fast increase in access to the energy services that are necessary for a fulfilment of the Millennium goals, in a sustainable manner. At the UNFCCC climate negotiations on Bali in December 2007 it became clear that funding of technology transfer and sharing may be an important factor in making countries in the South willing to consider stronger actions in a post-2012 climate agreement. However, climate change mitigation actions are very different regarding needs for investments and direction compared to what is needed to provide clean energy services to fulfil the Millennium goals. Funding of Climate Change mitigation actions must therefore come IN ADDITION TO the funding of clean energy in development cooperation.

Global Environmental Facility - GEF

Seen from a developing country perspective, the main problem with the GEF is that GEF can only give limited support to projects with a positive climate mitigation effect or adaptation effect. GEF can only finance the part of a project that is directly linked to an environmental benefit. It cannot finance an entire project. Even if GEF is willing to finance one part of a project, the developing country must still look for financing for the main part from another source. This complicates the application process and often leads to projects not being carried out when the main financing is not forthcoming. This is a result of the GEFs mandate, which is "…providing new, and additional, grant and concessional funding to meet the agreed incremental cost to achieve agreed global benefits".[24]

Despite this overall limitation on what kind of funding that GEF can provide, a review of the GEF programme has concluded that it has been very effective in promoting energy efficiency and has achieved some success in promoting grid connected renewable energy.[25]

The so-called GEF Small Grants Fund, which is especially dedicated to financing small projects, is filling an important function in many countries. Both municipalities and

24 Thomas Martinsen. Technology Transfer related to energy and climate change mitigation – Brief overview of technology transfer initiatives and mechanisms. IFE/KR/E-2004/959 p 19

25 ibid p 22

NGO`s can apply from the fund and get co-financing for projects that is too small to get funding from the major programs. If the project has no main source of financing, also the GEF Small Grants Fund is unable to provide financing. Despite these limitations, its operation is enabling municipalities and NGOs to carry out small projects that can later be scaled up if they prove successful. The possibility to try out new methods and gain experience can be useful when the funding expands to a level that can make a real impact on the environmental situation.

Marrakech Accords Funds

The establishment of these funds are also a result of the developing countries unhappiness with the statutes of GEF, as has been described above. The developing countries want funding of whole projects, and not just the environmental benefit, which is the GEFs mandate. So far, very little actual money has been put into the three funds established under the Marrakech Accords. (For more details, see part 3. Background) until the issues of governance, terms and conditions are solved, the rich countries will not put money into these funds. This is clearly not increasing the speed of technology transfer.

Clean Development Mechanism - CDM

Many in the developing countries have had great hopes and expectations for the Clean Development Mechanism - CDM - as a major source for funding of climate-friendly development projects. However, practical experience has shown that many types of projects under the CDM may cause serious social and environmental problems in the host country. In the long run, some popular types of projects such as tree planting may also not lead to real reductions in overall global GHG emissions. Finally, the CDM mechanism itself is geared towards the use of the most cost-effective technologies in the market. Therefore CDM cannot provide the necessary incentive for real technology development in the financing country or capacity building in the host country. CDM is most suited for financing the spread and dissemination of existing technologies.

During the climate negotiations on Bali in Indonesia in December 2007, Climate Action Network – CAN - demanded that a review of the CDM should be more than an attempt to revise the mechanism within the existing framework, because of the many problems that has appeared when trying to implement it. According to CAN, a review of CDM should not only aim to improve the CDM within its current structure, but also review:

"…whether fundamental restructuring away from project-based emissions trading is needed. The review must evaluate the accuracy of current additionality testing procedures and, more broadly, the feasibility of accurately testing additionality on a project-by-project basis. It should also appraise the social and environmental impacts of CDM projects and ways to prevent projects which cause substantial harm or human rights abuses from generating carbon credits."[26]

Many of the problems connected with the CDM is thus not lack of finances, even though lack of funding is the main problem with the speeding up of technology transfer itself. Before we go into a discussion about the possible future mechanisms and ways that can help to speed up technology transfer, let us first look briefly at some of the financial needs and the barriers that lack of funding represents.

The experience from CDM projects so far underlines the need to look for other solutions in addition to the CDM in order to speed up the rate of technology transfer. CDM, even if it is reformed in a way that

[26] ECO No.7, COP13 & COP/MOP3, Bali, 10 December 2007

solves the other objections mentioned by CAN, may not be the most important mechanism for technology transfer in the future. This is due to the safeguards being built into the application process and controls that are necessary to guarantee the environmental integrity of the projects. The procedures are time-consuming and costly, and reduces the number of applications that can be successfully processed, and eventually lead to CO2-reductions. The safeguards are necessary to ensure additionality, both financially (a project that would be carried out without CDM, should not get emission certificates) and in terms of CO2-reductions (the CO2-reductions must not have been made anyway, without CDM). Despite criticism and efforts to reduce the safeguards in the name of efficiency, they are likely to remain in place also in a possible project-based future CDM. Because of these limitations, it is therefore doubtful if CDM by itself can provide enough funding for the massive transfer of technologies that the developing countries need. But the most serious critisism in our context is perhaps that even when CDM works, it does not provide any sustainable development benefits. This is contrary to the stated goal of CDM, when it was agreed upon. Karen Olsen of The Risøe Laboratories in Denmark, draws this conclusion from a review of the literature on this theme. [27]

ODA & MFI funds

Official development aid from single countries – ODA -, as well as a number of different programs and funds within Multinational Financial Institutions – MFIs, can provide funding for technology transfer. However, they are not specifically geared towards technology transfer in a climate context, but directed towards more general development goals. An additional problem is that these funds are partly also directed towards the wrong type of energy sources, seen from a climate perspective. Instead of funding efficiency and renewable energy sources, the funding goes to climate-unfriendly energy sources such as oil, gas and coal. The World Bank and other public financial institutions, as well as the private financial sector, are quite happy to lend money for investments in for example oil, gas and coal exploitation, as well as for building fossil fuelled power stations in the developing countries. The EU is another, big financer of un-sustainable energy technologies. Through the European Investment Bank - EIB - and their export promotion agencies, EU governments continue to subsidise billions of euros in exports and investments that encourage fossil fuel-intensive development. These types of investments will remain in place and contribute to climate change for the next 10 to 50 years. Yet the EIB and the ECAs could be playing a much more positive role in the transition to more sustainable energy.

Patent rights

Patent rights or intellectual property rights also represents a serious obstacle according to some developing countries, such as China. The owners of some sought-after technologies are mostly private companies in industrial countries. They demand a high price for allowing license-production of their technologies in other countries. The developing countries claim they cannot afford to buy these technologies. The price of some relevant technologies can therefore be viewed as a financial barrier against the application of these technologies in the developing countries.

One example of patented technologies that are much sought after by some of the bigger

[27] *The clean development mechanism's contribution to sustainable development: a review of the literature*
Karen Holm Olsen, Springer Science + Business Media B.V. 2007

developing countries is car hybrid engines, e.g. cars with a combination of a regular gasoline-driven engine and an electric motor. Such engines may contribute to reduced emissions from cars. If one or a few automaker have almost all the patents to this technology, it clearly does not act as an incentive for other car manufacturers, since they would then have to pay for expensive licence production rights to the owners. This is but one example of how patent rights might block low-carbon products from being more widely used.

United Nations Development Programme - UNDP

The strength of the UNDP as a channel for financing of technology transfer in a climate context is that it has national and regional offices in most developing countries, and has unique local and regional insight and knowledge. The UNDP offices are the local link with GEF and the different types of funding provided by GEF, and therefore have extensive experience in financing of development. Most important is perhaps the UNDPs experience in handling the Small Grants Programme described earlier.

UNDP does not work through the government in the countries where it is represented, and are therefore independent regarding what kind of projects it funds. Since the UNDP has an infrastructure in place, the organisation could fairly quickly expand its operations. While we are waiting for a solution to the problems with the other channels and mechanisms, the UNDP can cover the lack of feasible channels. It may also have a more long-term and much bigger role in the financing of development projects with a climate benefit. To do so, UNDP then probably needs to add a climate element to its mandate, and the Millennium goals may be the way to do this.

Can the financial barriers be overcome?

The funding of climate-unfriendly technologies is a barrier in many different ways, and not only financial:

- Funding is not available for the appropriate technologies (financial)
- The climate-unfriendly technologies (coal, oil, gas) will act as a block for the more climate-friendly technologies: once an investment is made in a coal-fired power station, the owners will not be interested in building renewable generating capacity which may compete with their original investment. (“Technological lock-in”) (Financial)
- The attention of politicians and technical experts will be directed towards other technological solutions than the climate-friendly ones. (“Mental lock-in”) (Non-financial).

The existing financial channels/mechanisms/facilities described under 4.0 all have limitations that reduce their efficiency as means of financing the massive need for technology transfer to the developing countries in a climate context. The most severe limitation is maybe the problem of how to finance small-scale, decentralized and sustainable energy technology solutions at a village/household level. The problems are partly the unwanted consequences of financing mechanisms (CDM), partly the limitations of what kind of financing that can be provided (GEF), and partly disagreement between the donors and recipients countries about the governance and modalities of the proposed financing mechanisms (the Marrakech Accords Funds). Some of the existing ODA-funding for energy development is directed towards climate-unfriendly energy

sources and technologies. The focus of ODA-funding need to be shifted more towards efficiency and small-scale, decentralised renewable energy sources. Finally, we have the problem of patents or intellectual property rights: some developing countries want access to technologies owned by private companies in the industrialised countries for use in their own industry and energy systems. The owners naturally are reluctant to give away their property without compensation.

Some or all of these problems may be solved in the future, but will nevertheless remain an obstacle for an unimpeded flow of technology to the developing countries for some years to come. If we want a massive increase in the financing of technology transfer to the developing countries, these obstacles must clearly be removed in the long run.

However, in a shorter time-perspective the UNDP points itself out as a possible channel for increasing funding for technology transfer in a climate context rapidly, up to a certain level at least. UNDP may also have limitations regarding the amount of money it can handle, and especially how much it can expand its funding over a short time period. However, because of the established infrastructure, it should better able to increase the amount of financing for small-scale projects aimed the poorest section of the population in many developing countries than many other institutions. In case the Norwegian government should want to increase this amount as a concrete gesture towards the developing countries, and in order to build trust much needed to bring about a new climate agreement to follow the Kyoto Protocol in 2013, the UNDP for many reasons stand out a candidate for the administration of these funds.

How can we increase the speed?

Bali expectations

Climate Action Network - CAN – made a statement before the COP13 on Bali, Indonesia in December 2007, as to how technology transfer can be speeded up:

"Technologies exist today that can significantly reduce emissions and get us well along the path to keeping global warming below 2°C. A dramatic scale-up is needed in a range of measures to shift investments into clean renewable energy sources, energy efficiency and other low-carbon technologies. Strict emission caps and carbon pricing policies will contribute to shifting investments and technological advancement. Faster deployment of new technologies requires redirection of investment flows and makeover of existing infrastructures.

National policies should be supported by a robust international mechanism. The UNFCCC negotiations on a post-2012 climate regime must lead to binding agreements on new and effective forms of clean technology cooperation and deployment combining financing with set goals and policies.

Elements of this mechanism would be: binding targets for industrialized countries' R&D in clean, efficient, renewable technology; global actions plans to promote various technologies such as wind energy or phase-out of industrial greenhouse gases; a funding mechanism also to finance broader capacity building activities in developing countries; sector-specific programs to implement best technologies and eliminate others; removal of trade barriers in industrialized countries on clean technology; end dates for subsidies on fossil fuel production and use in industrialized countries as well as IFI funding for these purposes."
(CAN expectations for COP13/ COPMOP3, Bali 2007)

The Millennium Development Goals

But first, let us look at a description of what the main developmental goals of the UN are. In our context these are goals, which simple energy technologies may help to achieve.

The UN formulated the Millennium Development Goals – MDG - in 1999, ahead of the World Summit in 2000. The goals are formulating the most common and obvious goals that the world community must work for in order to create a just and sustainable world for all of us.

The Millennium Development goals gives us a rough framework of the total development needs that technology transfer also should help to achieve. The Millennium Goals may also help to define the energy needs (or rather energy service needs) of the developing countries as a whole. As discussed in part 6., the Kyoto Protocol does not say how much energy the developing countries should use in the future. What is missing in the Kyoto Protocol is a definition of what *level* of development and consequently what level of energy use they should aspire to.

In order to reach many of the Millennium development goals of the UN, more energy is necessary. However, there are different ways of getting this energy. You can either use Business as usual - BAU - technologies such as coal and oil for electricity production, or you can use a combination of efficiency measures and a mix of renewable energy technologies such as solar panels, wind energy, bio-energy etc. Scenarios made by the Indian Governments Planning Commission shows for example that it is possible to reach India's most important Millennium development goals, such as increased literacy, better health care etc, by a relatively low increase of greenhouse gas emissions using this last alternative. [28]

Indirectly then, the Millennium Development Goals can serve as a starting point for an estimate of how much energy is needed to fulfil the most basic needs of the population in the developing countries. The governments of these countries probably have ambitions that are higher. This is quite understandable and quite legitimate to strive for. The global limitations on the total use of resources, including energy, require on the other hand a total consumption that is sustainable. As stated in part 6., this means that if the developing countries cannot consume as much energy in the future as we do today, nobody can. We in the rich countries must reduce our consumption drastically to make room for the developing countries to achieve a quite modest growth in their use of non-renewable energy resources.

Reaching the Millennium development goals in most developing countries probably make it necessary to increase the consumption of fossil fuels. Increased speed in the transfer of climate friendly technologies can help the developing world to cause much lower increases in the emissions of CO2 from this use than business-as-usual technologies. Technology Transfer can therefore be an important tool in the overall reduction of the total global emissions.

Climate change is already happening, and it is altering the living conditions for millions of people in the developing countries. What was earlier only a theoretical possibility is today a stark reality. Climate change is amplifying serious problems that the developing countries are already grappling with. Climate change is a threat against the lives and health of especially the poorest people on our planet. In this respect, one may say that the developing countries are coming from the

[28] Climate Change Dialogue India Country Presentation Surya P. Sethi Adviser, Energy Planning Commission, India May 2006

ashes to the embers[29]. An already difficult situation has become even more difficult. The poor people in the South suffer already because of climate change. It is a paradox that the developing countries, which historically have the least responsibility for climate change, are also the countries that may suffer the worst consequences. They also have the least resources to adapt to the problems caused by climate change.

Because of the negative effects of climate change on the lives of millions of people in the developing countries, climate change is now also a development problem. Climate change is already threatening to cancel out or reverse hard-won improvements in the living conditions for many poor people. Achieving the Millennium Development goals have therefore also become much more difficult. On the other hand, by choosing appropriate technologies to provide energy services in the developing countries, it is possible to combine developmental and climate goals and achieve both in one and the same project.

New roles for NGOs in technology transfer?

The need for a wider project horizon

The previous discussion indicates that the number, size and often also the complexity of projects that combine development and climate protection will need to be increased massively. This represents a huge challenge for all parties engaged in technology transfer, including the NGOs working in developing countries. The need for technology transfer is of such a scale that voluntary organisations cannot possibly carry out enough projects to cover the needs. Neither do they usually have the expertise necessary to handle projects involving big-scale technologies needed on a national, regional or urban/municipal level. A whole host of other actors, both private and public, must be mobilised to work with technology transfer, alone or together in a multitude of different constellations. The need for new types of cooperation opens up also a whole range of challenges as well as possible new roles for NGO`s, and increases the importance of other, already exiting roles.

In order to participate in this great mobilisation for increased technology transfer, NGOs will need to increase their knowledge in a number of fields. When designing their own projects, development NGOs will need to understand the demands of environmental sustainability and design their projects accordingly. Environmental NGOs will need to learn about development objectives, and see how these may be fulfilled at the same time as climate protection and environmental considerations is taken care of. All NGOs working in this field also need a better understanding of the potential non-NGO partners they can be cooperating with in joint projects or as suppliers of certain services to projects run by others. Among other things, all NGOs participating in technology transfer will need to learn about the way of thinking prevalent in financing institutions. An increase in the NGO`s knowledge in all these different fields will be useful for them in many different ways:

- It will help NGOs to frame their own projects in a manner that better communicate their intentions to the potential financers of their own projects.
- It will help NGOs to better formulate demands regarding policies at a national and regional level that combine development and climate protection

[29] Fra asken til ilden. FIVAS/Forum for utvikling og miljø 2007

- ❖ It will help the NGOs to formulate demands to the terms and conditions set for the project financing of different national and multinational financing institutions.
- ❖ Finally, it is crucial for the NGOs` understanding of how they can provide services for and/or enter into partnership with one or many other actors in multipurpose projects with a strong technology transfer component.

In the following part, the report will focus on the aspect of perceived risk associated with technology transfer projects, seen from the financing institutions point of view. This is a field which all NGOs will need to increase their understanding of, both in order to finance their own projects as well as to be efficient partners in projects together with non-NGO partners, and finally in order to provide limited services for projects run by others.

The main source of the description of perceived risk connected with technology transfer, and how it might be reduced, is a background paper for a workshop about technology transfer financing organised under the UNFCC Expert Group on Technology Transfer[30]. Paul van Aalst prepared the background paper for the UNFCCC secretariat.[31]

Risk of something new

Transferring technologies implies that something new is being undertaken: a technology is developed or applied in an area where it has not been applied before. Even replication of a known technology in another context creates 'first-time' elements. Identifying and mitigating these risks plays an important part in assessing the project. This holds true for private financing (interest rate may go up), as well as public financing (the new project needs to meet the policy criteria). The new element can be technological, policy issues or geographical or a new target group, new stakeholders, or a new component in an existing process. New partners or stakeholders may need to be involved in the process, e.g. with specific expertise in a new region. This may take time to organize and money (transaction costs) and creates additional risks. These partners can be from the finance-side or directly related to the technology-transfer. Innovative or creative options in financing often are developed around these two risk issues: detailed risk assessment and allocation of these risks to partners.

When a financer is assessing the risk of a certain project, there are certain types of risks that are most often in focus. For example: In any type of energy efficiency project or a project for renewable energy production, the price for the alternative sources of energy available for the consumer will always be an important element of the assessment. The competing energy resource may be oil, natural gas, coal or electricity from any sort of generation capacity. The financer's assessment of these competing sources will therefore be in the centre of attention. If the price of the energy saved or new energy generated from the project will be lower per unit than the commercially available competing energy sources, then the chances of a successful investment will be perceived to be higher than if the opposite were the case.

[30] The workshop took place in Montreal in Canada 27-29 September 2004.

[31] Innovative options for Financing the Development and Transfer of Technologies in the context of the United Nations Framework Convention on Climate Change (UNFCCC). Paul van Aalst, Amsterdam, September 2004

Risk of competing energy sources

The financiers' assessment of the likely development of oil prices will consequently be important for a decision to invest or give a loan to renewable energy project. Where the product (electricity, heat, charcoal, woodchips, bio ethanol etc.) is supposed to compete directly with oil and oil products, the vulnerability of a project to fluctuations in the price of competing energy sources is especially high. Renewable energy projects or energy efficiency measures will typically benefit from high oil prices, and vice versa. If the project has a strong element of subsidy in order to bring development benefits for example to a village, the competition with other energy sources will be less important.

The fluctuation in oil price is a type of project risk, which cannot be dealt with at project level. On the other hand, it is possible to design a project so that for example falling oil prices will not affect the outcome of the project to a degree that it fails. The customer could for example be made co-owner, and therefore interested in the continued operation despite falling oil prices which reduces the competitiveness in the short-term. Or the project may secure a subsidy or other economic benefits from different sources that make it competitive. The counter-measures against fluctuating oil price may in general reduce the perceived risk. Reduced risk increases the chances of getting the financiers interested in funding the project.

These examples serves to illustrate the perceived risk connected with technology transfer projects, as experienced by potential financiers. Perceived risk is a key concept that NGOs need to understand in order to mobilise more funding as well as more actors to promote technology transfer. The reduction of the perceived risk of a particular project increases the possibilities of getting it financed. It is therefore of outmost importance for anyone who is designing a technology transfer project and communicating its content to potential financiers. A good project description will anticipate the questions that a potential financer will want to ask in order to understand the project, and the potential risks involved.

"Perceived risk" implies that this is a subjective risk, something that is going on in the potential financers head(s), and which cannot be quantified in an objective way. Even so, different procedures and methods for breaking the risk down to its components and trying to assess them separately are useful in many ways. A more detailed analysis of the different risk components makes it possible, among other things, to identify the most crucial aspects in a potential project's total risk. Based on this knowledge, it is possible to concentrate the efforts to mitigate or avoid the problems identified.

The experience of TaTEDO

TaTEDO is short for Tanzania Tradional Energy & Development Organization, an NGO working in Tanzania to provide better energy services to the rural areas. It has more than 15 years of experience in this field. It has written a report about how one can use this experience in order to scale up the provision of renewable and sustainable energy, and especially electricity, to the rural areas of Tanzania.[32]

The main focus of the report is how to support small and medium sized enterprises (SMEs) that can provide electricity to the rural poor. The report shows how one can overcome the various barriers that SMEs and

[32] Energy situation: National Status and Options. Tanzania Country Report, author: Oscar P. Lema, Tatedo, Tanzania, 2004
www.tatedo.org

entrepreneurs that want to provide electricity especially in the rural districts of Tanzania are facing. The conclusion of the report is that most of the national policies needed to step up, escalate the expansion of the provision of modern energy supply, mainly in the form of rural electrification, seems to be in place. What is lacking is the operationalisation of the principles and policies to provide concrete action. Funding is a major obstacle in itself, and even when funding is available, it is difficult for the banks and government funds to take the risks involved in financing rural small scale electricity production. The report has an extensive discussion about the perceived risks of financing facing the would-be entrepreneurs in Tanzania, and many concrete proposals for how the perceived risk may be lowered.

Some of the proposals relates to funds that can provide low-cost capital, since the lack of capital for spending on energy projects with a long payback time is almost non-existent. It describes an impasse regarding the private banks and their willingness to give loans and face risks in the connection with energy projects. With too few projects to gain enough experience and confidence to face the risks, the banks will refuse to give such loans. Without loans that can finance enough projects to give the banks enough experience, the banks cannot achieve the experience necessary! If private financing should play a bigger role in the future development of the electricity supply in a country like Tanzania, it is obvious that this impasse must be broken. The solution is to provide more easily available capital for the small- and medium sized enterprises that are willing to start providing electricity in rural areas.

Case study – practical cooperation NGO-Commercial actor

NGOs may help to reduce risk in a technology transfer project in many different ways. One of them is by becoming a full partner in a project, together with commercial actors. The co-operation between commercial investors and NGOs may be illustrated by a technology transfer project in Bangladesh. The project exhibits a number of typical characteristic risk elements of technology transfer in general and how an NGO may help to reduce these risks.

Grameenphone

The example chosen is the establishment of the Grameenphone Company in Bangladesh, a cooperative venture between the Grameen Bank (an NGO) and the Norwegian telecom company, Telenor (a commercial actor).[vii] The technology transferred was a well-known technology for most people in industrialised countries: a network providing commercial cell phone service. The investor is the biggest provider of telephone services in Norway. The Norwegian government owns more than 50 % of its shares, but it operates on a strictly commercial basis. Grameen Bank and its founder, Muhammad Yunus, have gained worldwide fame because of their work with micro financing for development. Grameen Bank and Yunus received the Nobel Peace Prize in 2006 for their work.

Grammeenphone is today the biggest cellphone operator in Bangladesh, with more than 16 million customers. Commercially it is undoubtedly a success. At present it contributes a substantial profit to its two owners. However, this was by no means assured when the company started its operations. There were significant risks associated with the transfer of technology to a developing country, risks which needed to

be assessed and subsequently avoided or mitigated, if possible.

Grameen Bank's joint venture with Telenor may be used as an example of an NGO entering a new and innovative type of partnership/cooperation with a commercial partner. Grameen Bank share general characteristics of NGOs working in developing countries, which can be valuable assets in technology transfer projects. First of all, NGOs usually have extensive local knowledge, both nationally and on a local level, of conditions favourable or unfavourable for a technology transfer project. This was probably important for the Norwegian investor in the case of Grameenphone, since the transfer of even known technologies into a new context always involve a type of risk. Mobile phone services are as such a well-known technology. Nevertheless, its introduction to a developing country involved a number of new elements. Telenor entered a different political and bureaucratic context, with different economic characteristics among its potential customers than what could be expected in Norway, etc. etc. All of these elements represent risks for the investor. By teaming up with Grameen Bank, the risk could be significantly reduced in a number of ways described above.

Grameenphone, and especially Village Phone, has at the same time helped to realize the policy goal of Grameen Bank: to develop the rural economy by providing modern telecommunications

In sum, the partnership between Grameen Bank in Bangladesh and Telenor of Norway exhibit many characteristics that may be present in countless future partnerships involving technology transfer to developing countries. By providing knowledge and services, and by taking on several risk elements as their responsibility, Graven Bank reduced the risk for the foreign investor and made the technology transfer project not only feasible, but also attractive.
For more details, please see *Appendix C – The Grameenphone example*

The way forward - NGOs in technology transfer

The NGOs have in principle three different ways that they can engage themselves in technology transfer projects.

1. Carrying out their own projects
2. Entering into partnerships with other organisations, including commercial actors.
3. Providing services and take on limited tasks for projects run by others.
4. Policy development/policy/lobby

There is a need for both development organisations and environmental organisations to adapt their own projects so that environmental (read: climate) benefits and development benefits may be combined. The active partnership of NGO`s and commercial actors has been discussed, based on the example of Grameenphone.

Providing services and taking on limited tasks in projects combining development and climate goals run by others may open up a range of possible new roles for NGOs, as well as strengthening other roles they already have. NGOs may provide at least part of the expertise needed for financing institutions (both commercial and public) to accept new types of risks, and thereby increase the speed of TT to the developing countries.

There is an immense need to establish technology transfer projects that may be the seed for an upscaling of the transfer volume.

This development is in its turn dependent on the right mix of incentives and regulations to provide an enabling development, not only for technology transfer, but also for commercial enterprises.

As the NGOs gain experience in doing concrete technology transfer projects, a need to address local and national policies may naturally follow. For many NGO-people this is a new and unfamiliar ground, and getting involved in politics is in many countries also not without complications. Nevertheless, it is necessary if the NGOs should scale up their efforts from pilot- and demonstrations projects, to bigger projects with more people and more resources involved. Bigger projects may need other types of cooperation with authorities, and another financial and regulatory framework. The only way of achieving this is by influencing government policies at different levels.

Examples of other roles or tasks that NGOs may take on in addition to carrying out projects on their own are the following:

- Facilitate social adaptation
- Help to avoid possible negative environmental effects
- Provide know-how, information, motivation and training
- Dissemination of simple, low-cost technologies (mostly know-how)

Social adaptation

Social adaptation in connection with TT involves at least two different tasks:

1) Participating in adaptation of a proven technology, when applied to a new social setting
2) Giving the future users reliable information about the benefits and challenges of the new technology about to be introduced in their community.

The introduction of efficient clay cooking stoves in a village may serve as an example of both processes. When introducing the clay cooking stove in a village, it may be necessary to adapt the design to the local food habits. If the housewife usually makes meals requiring three separate pots, it will not do to provide only room for two pots on the stove. The villagers will also become interested in the new technology if the benefits of the new stove are explained, and questions from the villagers answered in beforehand. A public debate will quickly reveal what the possible psychological and other barriers against the new stove could be, and the concerns of the villagers can be addressed. Both types of social adaptation will make the possibility of a successful technology transfer project higher. Another example of an NGO helping with social adaptation is the cooperation between Friends of the Earth Norway`s local partner and the district heating system of the Ukrainian city described in *Annex A.*

There are many, and sometime conflicting goals involved when NGOs, aid organisations and national governments try to foster development through community-based projects. Many different approaches have been tried, and valuable experience has been gained. In the yearly publication from WorldWatch Institute, “State of the World 2008”, Jason S. Calder describes the result in this way:

“Over three decades of grassroots community development experiences that began as a search for an alternative to mainstream economic development have coalesced into new approaches to citizen and community empowerment that embrace partnerships with governments and markets while maintaining an emphasis on self-reliance and self-help.”[33]

[33] *Mobilizing Human Energy*, Jason S. Calder, in State of the World 2008, WorldWatch Institute/Earthscan, London 2008.

A basic problem is how one can scale up successful projects, and at the same time be able to adapt to different local cultural, economic and ecological circumstances. In the article, Calder describes several different approaches, and concludes that all of them have their merits. However, one method does not fit all circumstances. His article refers to many successful examples of how to scale up projects that has been successful in bringing the services and goods to the local population. Calder underlines that to be truly successful, such projects also have to become rooted in the local community.

6 Boy enjoying warm water from a solar heater. Photo: NNV

Avoiding possible negative environmental effects

Avoiding possible negative environmental effects is an extension of the role traditionally associated with environmental non-governmental organisations and their work. But development organisations also need to involve themselves in this work, as the introduction of new technologies in developing countries happens at an increasing rate.

Examples of possible negative environmental effects that must be avoided can be non-intentional side effects that may damage the health of the users or the local population. The dumping of used lead-acid batteries used to store electricity from solar PV-cells have been mentioned earlier as a possible effect of this type, a negative effect which needs to be avoided. Other effects may be the danger of harming vulnerable species in the local or regional environment, such as may occur as a result of damming a river for a hydropower plant. Where the villagers previously did not have the technical means to exhaust local resources, new and more efficient technology could provide them with this possibility. Or the use of previously untapped local resources may turn out to be damaging to the health of the inhabitants. An example from Bangladesh: the provision of deep wells with the aid of modern drilling equipment lead to arsenic poisoning of many villagers, since the groundwater contains natural high concentrations. A project with a good intention: providing drinking water free of bacteria and biological hazards turned out to create a new hazard because of lacking chemical analysis of the water quality before the drilling of tube wells. Luckily, a new filter may help to solve the problem. [34] These examples illustrate the need to try to foresee possible health or environmental problems before designing and carrying out development aid projects. Cooperation between the project-managing organisation and environmental NGOs may identify possible trouble spots early in a project, and provide enough time to call in expertise to find ways around them. Experts are at their best when they have precise tasks to perform, NGOs are best when there is a need for a generalist approach. The early phases of a project design is the time when environmental NGOs can provide the most valuable input.

[34] http://www.irinnews.org/Report.aspx?ReportId=76176

Know-how, motivation, information and training

Many NGOs, both development NGOs and environmental NGOs are already providing know-how, motivation, information and training in developing countries. This covers everything from teaching simple hygiene measures, to instructions about how to avoid land mines. These services are probably mostly done by the project organisations themselves, and not out-sourced to other organisations.

With the huge expansion of technology transfer projects needed, a future challenge will be for the NGOs how to develop such activities in partnership with, or as a service provider for the projects of other organisations. In developed economies such tasks may typically be sub-contracted to commercial companies. In developing countries, the situation is different. The economic sector in many developing countries is generally less developed. They do not have the variety of specialized technical, economic and other types of services that you will find in a developed economy. This may be a barrier for technology transfer projects. NGOs may fill the gap by acting as providers of services that are crucial for the success of commercial technology transfer projects.

Cooperation between NGOs and commercial partners as well as with local and national government are by no means always simple and straightforward. If one can make a partnership work, it can mobilize more resources to reach the development and environmental goals of the local communities, regions and nations.

An example of how a NGO can provide information service for a technology transfer project run by others is given in *Appendix A - District heating renovation.*

7 **Using the sun to heat up water in Kyrgyzstan. Photo: NNV**

Simple, low-cost technologies

Dissemination of simple, low-cost technologies (mostly know-how) is another field where NGOs may provide a very valuable part in the general mobilisation for increased technology transfer. This could be technology so simple that it only requires a training session for the local inhabitants, and possibly the provision of some simple tools and materials- Then the local people can take over further dissemination of the technology. Examples of such technologies are:

- Improved, more energy-efficient cooking stoves made of clay
- Weather-stripping of old windows in the former Soviet Union
- Making of solar cookers in Togo and other African countries

The environmental and developmental benefits of improved, more energy-efficient cooking stoves made of clay have been described in some detail in part 10. Here, it is used as an example of a type of technology that can provide many benefits simultaneously, and not just providing energy services. Many types of technologies can do that, but this is in addition a type of technology that does not need expensive and

technically difficult materials. The technology transfers rely on the spread of information and know-how. Villagers may continue to spread the knowledge about construction of the cooking stoves on their own, once they have mastered the building technique and seen and experienced the benefits themselves. It can also lead to the creation of small-scale businesses, where craftsmen are paid for building the improved stoves.

The need to reduce heat loss from buildings in cold developing countries is also very big. Weather-stripping of old windows is a form of technological retro-fitting. The aim is to reduce the amount of warm air leaking out through the cracks between the window and the frame. The method is using elastic ribbons, most often made of silicone rubber, to seal the cracks. One example of how this technology can be transferred is found in Central- and Eastern Europe as well as in the countries of the former Soviet Union. In Ukraine, a travelling team of several young people travel around to schools and teach local youth how to furnish old windows with weather-stripping. This is done with simple electric hand tools, and the use of weather-stripping of silicone rubber that provide a tighter seal between the window and the frame. The tighter seal reduces air leakage, and keep the heat inside the room. Less heat loss=less need for fuel for heating=less CO2-emissions from the burning of fossil fuels in district heating stations. The technique of weather-stripping old windows is also relatively simple. Once it is mastered, the participants in training session can do it on their own, with the aid of electric hand-tools. [35]

The making of simple solar cookers let villagers cook their food with the heat from the sunlight. Strong sunlight is necessary, so the technique is mostly appropriate for year-round use in the tropical regions. The materials needed are quite simple: cardboard and reflecting metal foil. Solar cookers reduce the need to collect and burn scarce firewood. Less use of firewood has a positive climate effect: less use of firewood=less cutting of trees=keep the living trees growing=CO2 locked in living trees instead of releasing it to the atmosphere.[36] The solar cookers are made of cardboard to provide a base for the reflective metal foil. Once the foil is shaped in a way that concentrates the sun`s rays in a cooking pot, the job is done. This is yet another example of technology that is easy to teach others, and villagers can take on the task of going to the next village and spread the information.

A more advanced example of do-it-yourself renewable energy technology is the building of solar collectors for water heating (not solar PV-cells). This technology requires slightly more technical skills, and more advanced materials than what is easily available in many developing countries. If a design using materials that are cheap enough and easy enough to assemble into a water heater can be made, it could have great potentials for use in developing countries. Training courses for do-it-yourself solar collectors of this type has been a great success in for example Austria, where thousands of people have built and installed their solar collectors to heat their hot tap-water. The early spread of self-building lead to technology innovation also in the commercial sector. As more people become familiar with the technology, more people became interested in buying the solar water heaters.

When the dissemination of technology takes this form, the need for costly materials and equipment can be very low or non-existent. If successful, the technology will continue to be spread by the word of mouth or with the help

[35] For details; see the International Energy Brigades Handbook at http://www.zmz.sk/doc/IEB_handbook_2004-1-4.pdf

[36] Togo: solar cooker project http://www.naturvern.no/cgi-bin/naturvern/imaker?id=108521 Read 19 May 2008

of the local people themselves. Not all technology transfer require so little outside resources, and even low-tech projects such as these may run into barriers of different types. These barriers will have to be avoided or overcome in order to continue the technology transfer process. NGOs will, with their local knowledge, be able to help in this process.

By using their expertise in this manner, the NGOs may help to expand the volume and speed of technology transfer to developing countries much faster than if they should only expand their own portfolio of projects. In many ways, a stronger involvement in technology transfer in cooperation with political authorities and business entities may represent new and unfamiliar roles for many NGOs. On the other hand, some NGOs are already actively working in partnerships with non-NGO partners in different types of projects. Their experience should be systematized and shared with others, so that more NGOs can profit from their experience. There is also a pressing need for national NGOs in developing countries to involve themselves in policy making, in addition to carrying out their own specific projects. In this way the NGO-community may help to speed up the transfer of technology to developing countries.

The needs for increased access to sustainable and poverty-oriented energy services are enormous, and all organisations that are interested should be included in the effort. Globalisation of actions within development assistance in general and especially within sustainable and poverty reduction-oriented energy services require robust environmental NGO`s that are able to follow the development and the actions that are implemented. The experience of Norges Naturvernforbund/FOE Norway is that local organisations have a good knowledge about the challenges, but lacks the competence and experience necessary for spreading know-how about practical solutions. Capacity building and transfer of competence to local organisations will therefore be important in order to strengthen their role in information dissemination about relevant technologies from below, and in order to influence their own authorities.

In interplay between Norwegian and local environmental voluntary organisations, the organisations will be able to contribute the following:

- Demonstrate the possibilities by carrying out practical pilot/demonstration projects.
- Participate in planning processes and analysis of needs, possibilities and challenges.
- Give advice and input to national and international authorities, influence on policy development.
- Disseminate information to all levels, from villages to national and international authorities.
- Strive for acceptance of proposed solutions that are sustainable and poverty reduction-oriented and influence the local authorities from below.
- Establish international networks for sharing of practical experiences.

End Notes

1 “Under the Convention, the developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly to developing countries to enable them to implement the provisions of the Convention (Article 4.5). This commitment is echoed in similar provisions under the Kyoto Protocol (Article 10 c). Parties have taken decisions to promote the development and transfer of environmentally sound technologies at each session of the COP.” (UNFCCC homepage: http://unfccc.int/cooperation_and_support/technology/items/1126.php)

[1] The abbreviation “NGO” in the usage of the UN means all organisations that are not governmental organisations – therefore non-governmental organisations. Included here are labour unions, industrial organisations etc., as well as voluntary, non-profit organisations working for ideal causes. In this report, I am using the term “NGO” meaning voluntary, non-profit idealistic non-governmental organisations.

[1] Before the Climate Negotiations in Bali, Climate Action Network stated the following regarding the desired outcome of the negotiations:

“Developing countries as a group will have to bend their emissions curves to lower Emissions trajectories, reducing their emissions compared to business as usual. This will need to be effected by new effective forms of technology cooperation and deployment combining financing with set goals and policies, as well as new mechanisms to promote low carbon development.

Expanded adaptation mechanisms, involving assistance, capacity building and compensation funded by industrialized countries, to deal with climate change impacts is essential to support LDCs and SIDs in coping with the climate impacts to which we are already committed. The scale of funding for adaptation must be appropriate to the need, at present it is at least two orders of magnitude lower.”

CAN also state that among others essential elements of a post-2012 climate agreement must be: “*Clean Technology Deployment Mechanism to scale up the research on, deployment and transfer of technologies, to a level to stop the growth in global emissions and be complementary to the new flexible mechanisms.”* [1]

[1] A necessary modification of this principle could be climatic conditions: those living in cold countries may need more energy for heating. However, this energy service can also be provided with the use of far less energy per capita than today, and will not necessarily excuse the present large difference in energy consumption between rich (and cold) countries on the one side and poor (and hot) countries on the other.

[1] (Vis til eksempler fra “Pick the low-hanging fruit”

[1] For a description of solar cookers, see this link: (til Togoprosjektet)

1 There may also be a use for high-voltage electricity for purposes that require more electricity that are practical or economical to supply from solar PV-cells. Examples of energy services that may be better run on high-voltage are the the powering of pumps for irrigation and electrical motors for other production purposes, but these needs may differ more from area to area. Sometimes the need can also be covered by other technologies: windmills for water pumping, diesel engines with generators for powering heavy electrical equipment etc.

[1] Financing of projects may be of different types, and the concept covers everything from providing equity, e.g. where the financer has an ownership in the project, via loans and finally subsidies and grants which are not supposed to be paid back.

1 In Norway, this cooperation is also known because of the conflict between Muhammad Yunus and Telenor about the ownership of Grameenphone. Yunus claimed that when Grameenphone was founded, Telenor and Grameen Bank had an agreement that Telenor should sell its controlling majority of shares in Grameenphone to Grameen Bank after some years. Telenor, when confronted with this claim, denied that an agreement of this sort had ever existed and refused to part with the by then highly profitably shares in Grameenphone. Later, it also was revealed that Telenor had used sub-contractors in Bangladesh that used child labour and was negligent with the workers safety. The conflict and the evidence of bad business practice does not, however, detract from the positive example of an NGO-business cooperation to reduce risk and thereby help to start a valuable service for the Bangladeshi population.

Appendix A - District heating renovation

An example of how a NGO can provide a service for a bigger technology project is the cooperation of an energy saving school project in Ukraine with a local district heating company. The district heating system in this particular city is being renovated, partly with financing from the United Nations Development Programme - UNDP. A number of new features is being introduced in the heating system, such as individual metering of the heat being used and payment according to amount used. In the old system without metering everybody was charged the same amount of money regardless of the real heat consumption. Residents who wasted the heat would not pay more than the efficient users. The old system clearly did not encourage energy efficiency, and this lead to unnecessary emissions of CO2. The heating system was fuelled by coal (?), and wasted heat increases the CO2-emissions from an unnecessary use of fossil fuels. Higher efficiency and reduced losses in the generation, transport and use of heat would therefore lead to a triple benefit. It would lead to a better heating services for the users, reduced consumption of fuel= less cost for the customer as well as for the public sector, and finally less CO2-emissions to the atmosphere, a climate benefit. The barriers for the project included among others the possible unwillingness of the inhabitants of the city to co-operate and accept for example the individual metering system. The information barrier is overcome by using the schools in the city to disseminate the information about the general environmental benefits of energy saving, and particularly the benefits of the new district heating system. The school project, initiated by the Friends of the Earth Norway and their Ukrainian partner, is providing valuable services, which makes the new technology more easily accepted. This increases the project's chances of success, and it is an example of cooperation between a public service provider and an NGO in a technology transfer project. The most significant new technology in this case is the individual metering system for the customers, where it is necessary to get their acceptance.

Even if Ukraine is not a developing country, similar district heating systems are also found in the central Asian countries (former Soviet republics), with a pressing need for renovation. This could be new area for cooperation between NGOs and the public sector.

Appendix B – Solar Powered Clinics in Rwanda

http://www.renewableenergyaccess.com/rea/news/story?id=51264 Read January 29, 2008

Renewable Energy Powers Rwandan Health Centers

Part 1 in our series on Renewable Energy in the Developing World focuses on how SELF teamed with Partners in Health to bring solar energy to rural health centers in Rwanda.

by Anita Blumenthal

Like all modern medical centers, the five rural health clinics in eastern Rwanda operated by Partners In Health (PIH) need reliable power 24/7. But unlike other offgrid facilities, each of these centers is powered by a hefty 4.4-kilowatt solar photovoltaic system designed and installed by the Solar Electric Light Fund (SELF). The solar systems have been up and running since February 2007.

As long as the system is properly installed and maintained -- and as long as the sun emits energy -- solar is the most reliable source of power for rural communities not connected to a national utility grid.

The five clinics represent a number of "firsts." For PIH - a Boston, Massachusetts-based non-profit healthcare organization dedicated to bringing modern medical care to those most in need - the project was its first foray into Africa and its first use of solar power. Also, this is the first time SELF has extended the solar technology envelope to supply such large amounts of electricity to rural health centers. This PIH project is supported by the Clinton HIV/AIDS Initiative, among other donors and NGOs.

At the five clinics - located in Mulindi, Rusumo, Rukira, Nyarabuye and Kirehe - solar power systems supply electricity for state-of-the-art laboratories, refrigeration, computer record-keeping and communication, including satellite dishes to transmit data. In the laboratories, solar electricity powers microscopes, blood analysis machines, centrifuges, portable X-ray machines and sterilization devices. The systems also provide extensive lighting, as these are 24-hour facilities with patient wards.

Solar vs. Diesel

This PIH/SELF partnership might never have happened if SELF had not persuaded the PIH staff to question the time-honored proverb, never look a gift horse in the mouth. Partners in Health had planned initially to use diesel generators that had been donated by The Global Fund to fight AIDS, tuberculosis and malaria. However, SELF staff assessed the Rwanda sites to determine the energy needed and the feasibility of solar - and they persuaded PIH that solar would be a better long-term solution to meet the electric power needs of its rural health centers. Solar does not emit carbon dioxide or other greenhouse gases, and while upfront capital costs are higher, solar is ultimately less expensive over time, and more reliable and sustainable.

"The generators might be 'free,' but diesel fuel costs would be a constant burden, assuming fuel is available," explained SELF Executive Director Bob Freling. "Currently, in fact, there is a national shortage of diesel in Rwanda," he said. "Further, diesel is a petroleum derived product, so even if obtainable, its cost will rise with the price of oil, which will always be unpredictable, subject to the whims of the market, availability of supply, and geopolitical constraints."

But solar power cannot be disrupted in this way. As long as the system is properly installed and maintained - and as long as the sun emits energy - solar is the most reliable source of power for rural communities not connected to a national utility grid.

The reliability argument won PIH to solar. In a hospital setting, where procedures are conducted all the time, reliable power is paramount. SELF designed hybrid systems that rely on solar energy to meet ninety percent or more of the clinics' needs, with generators providing back-up power during prolonged periods of rain or extra heavy electricity usage.

A key feature of SELF projects is that they must be locally sustainable. For the five clinics, SELF trained local staff to look after the solar systems. In addition, SELF has been working with the Rwandan Ministry of Health and the Kigali Institute of Science and Technology to develop a national training program for installing and maintaining solar electric systems.

The Power of Partnership

"This is a great example of the power of partnership," Freling said. "Two nonprofit organizations with different but overlapping agendas -healthcare for the poor and sustainable energy for the developing world - came together; SELF provided a service that enables PIH to fulfill its mission in an economical, sustainable, nonpolluting, carbon-free way."

SELF raised eighty percent of the funds for the solar power project. Although this amount was a small fraction of the millions of dollars PIH and donors have invested in the Rwanda health centers, it was nonetheless critical. "None of what PIH is hoping to accomplish can be done without a reliable source of electric power," said Jeff Lahl, SELF's Project Director.

More broadly, SELF's aim is to act as a catalyst to help PIH and other international organizations rethink their power strategy when they plan for community improvements in rural areas, from healthcare to education to economic development.

"Choosing solar electrification over diesel-powered generators represents a paradigm shift in the thinking of those in the international development sector," Lahl said.

"SELF's success with these projects will help create results-oriented, non-polluting, sustainable solutions that are replicable on a large scale."

Dr. Michael Rich, Country Director for PIH-Rwanda, commented: "SELF is raising the bar when it comes to what services a health center can and should provide. It does this through putting in place reliable solar energy systems designed to run for years and years. This allows the health center to maintain the cold chain in vaccinations, perform life-saving diagnostic laboratory tests, improves communications using cell phones and the internet, and increases the overall capacity of nurses to work at night. The difference in morale and function is remarkable."

Anita Blumenthal is a freelance writer based in Maryland.

Partners In Health (PIH), founded by Dr. Paul Farmer, is active in the Caribbean, Latin America, Africa, Russia and the United States. Through service, training, advocacy, and research, and by establishing long-term relationships with sister organizations, PIH strives to achieve two overarching goals: to bring the benefits of modern medical science to those most in need of them and to serve as

an antidote to despair. For more information, visit www.pih.org

The Solar Electric Light Fund (SELF) helps rural communities in the developing world power a brighter future for their people and the planet through innovative uses of solar energy. SELF's projects address vital needs including household lighting, water pumping and purification, vaccine refrigeration, microenterprise, and modern communications. In every action, SELF seeks to honor the integrity of indigenous cultures and to respect the delicate balance of the local and global ecosystem. SELF is working with PIH on additional projects. To learn more about SELF or to make a donation in support of one or all of these projects, visit the website at www.self.org.

Appendix C – The Grameenphone example

Risk of financing – a key concept

The large increase of volume in technology transfer projects will subject an increasing number of financers to a new and unfamiliar type of risks. Risk in itself does not represent a new challenge for financing institutions and their portfolio managers. On the contrary, assessment of the risk connected with financing[viii] of a specific project is the everyday work of financers. Those who provide financing on a commercial basis want to get their investment/loans repaid in time, and to reap a profit on top of that. If a project does not perform as well as expected or downright fails, it will not be able to generate a stream of income to pay back the original investment or interest on the investment. Consequently the potential financers will try to foresee in advance and if possible mitigate anything that might cause diminishing profits, or in the worst case, the loss of their investment. An assessment of risk for a project failure is always necessary before the financers commit themselves.

Public organisations and institutions that has invested in projects for the public benefit, will similarly be concerned about a projects performance. Their focus will be on its ability to fulfil its goals, such as poverty alleviation, strengthening women's position, ensuring energy services for the poor etc. If a project fails to deliver its policy objectives, the whole policy may be in danger. Naturally, anyone investing resources and time on projects for the common good will also want to assess the risk of getting involved in a project, before they commit public resources to the project.

In short: Anything that may cause the failure of the project to deliver the desired results, is a risk which must be assessed before the financers will be willing to put money into a project.

The risks may be on different levels, all the way from changes in economic policy of a country hosting a project down to events at village level that influences a certain project. Some of these risks cannot be influenced on a project level. Others may be mitigated or avoided, either at the design stage of the project or later in the implementation stage.

The familiar example of financing for a house-buyer may serve as an example of this kind of risk analysis and assessment. Paul van Aalst describes it in this manner:

If someone buys a house, a mortgage is usually needed. It is common knowledge that the interest rate goes up with a high mortgage in relation to the value of the house and to the buyer's income, the latter forming the basic security for a financier. When the buyer is new to the region or if the income is uncertain, it may cost time and resources (transaction costs) to
find a financier (the new party) that can be convinced that the income is secure and that the purchase price reflects the value of the property (risk assessment).[37]

This description contains a number of elements that is common for financing of all kinds of projects, and which will be analysed and discussed in connection with an example regarding technology transfer. The last part of the description involving a mortgage mentions a number of elements connected with the novelty, the "newness" of a project, and how that influences the perception of risk in the potential financers mind.) Fjerne?

[37] Paul van Aalst 2004, pp 7-8

The risks involved

The risks for the investor Telenor in building and operating a cell phone network in Bangladesh was basically the risk of not getting enough customers, and/or not getting payment from the mobile telephone customers for the use of their services. A problem would also be how to furnish the customers with cell phones, and how these could be financed. Bangladesh is a poor country, and the cost of even a simple cell phone model could be a barrier. Then there would be the issue of where to start building base stations for the telephone network. If they invested in areas where the population was too poor to buy mobile phones, or where the competition from other suppliers of cell phone services where already strong, they would risk not getting back the money invested in the network. The political risk was also important. Bangladesh is a developing country with volatile and often turbulent politics. Rampant corruption is thrown in as a complicating factor on top of this. New regulations regarding the running of the mobile phone business, rules regarding repatriation of profits and taxation etc. could make the investment unprofitable, or at least much less profitable than anticipated. Secure, stable and transparent rules and regulations for the telecom business as well as for foreign investors and business in general are important parts of what can be termed the "enabling environment" for a technology transfer project on this scale. A good enabling environment makes the transfer easier, lack of an enabling environment make the technology transfer more difficult.

The risk reduction potential of Grameen Bank

Grameen Bank is a non-profit, non-governmental organisation working for the common good in rural Bangladesh. It gives micro-loans to their mostly poor customers to promote development. Grameen Bank is not a charity. It expects to get the loan back with an interest on top. Any profit from this operation is used for development. The loans are given to individual women in the village communities, but the whole group of debtors in a village is collectively responsible for the repayment of the loan. The social pressure on the individual debtor is therefore very strong, and failure to repay the loans is very rare. The Grameen Bank has a unique knowledge of rural Bangladesh and its economy. Through its network of employees and contacts in the villages of Bangladesh, it has a unique ability to act as a partner for a telecom company wanting to break into a new market with cell phones. Grameen Bank has detailed knowledge that includes villages that would normally not be an interesting market for commercial cell phone operators because of low volume of potential traffic. But it is especially these villages that are important to reach with modern telecommunications from a development point of view. Grameen Bank has therefore designed a unique program, which it operates together with Grameenphone and IFC – International Finance Corporation, providing cell phone service to the villages and a new market for Grameenphone.

Village Phone – added value for Grameenphone?

The program operated by the partners is called Village Phone. The aim of the program is to provide cell phone services at an affordable cost to rural districts.[38] Grameen Bank lend money to villagers to buy their first mobile phone. The owners charge a fee whenever they let somebody else use the phone to make a call. This income is used to repay the loans. The customers use the phone for different purposes, many of them generating extra income or securing transfer of money. Farmers use the phone to check prices for products that they want to sell on the market. They can sell with a higher profit

[38] Wikipedia, article on Grameenphone 02012008.

at a time with high prices, based on the information received via the phone. Other business deals can also be made, in addition to private phone calls. The transfer of money to the villages from guest workers abroad can be made safer and easier with the aid of the Villagephone program.

Analysis of the technology transfer case

Grameen Bank reduced the risk for the Norwegian investor in many different ways. The Norwegian company Telenor did not have the local knowledge of the potential market for the services and technology it wanted to transfer. Grameen Bank provided at least part of this knowledge of the potential market, and reduced this element of risk for the Norwegian investor.

Next, Grameen Bank could provide the necessary financing for the mobile phones for a number of customers. The cellphone network operator Grameenphone did not have to take the risk of selling the phone on an instalment basis. Again, a significant reduction of risk for the investor.

Finally, the Grameen Bank`s knowledge of the rural economy of Bangladesh could help the Grameen Phone to make the right decisions about where to invest in base stations and where to expand the network. The risk of making the wrong investment decisions and expanding the network into areas where it would not be profitable was thereby reduced.

Grameenphone can be viewed as an added value to Grameen Bank in several different ways. The profits generated by Grameenphone are ploughed back into Grameen Banks development work. Grameenphone also contribute to the Banks development goals in other ways. Grameenphone gives added value to the investor Telenor by providing a new and profitable market in a high-risk environment for expensive technology transfer projects.

Especially the Village Phone program represents a significant added economic value for Grameenphone, as each cell phone generates about four times as much income for Grameenphone than the average cell phone subscriber.[39] Independent sources has documented that Village Phone is probably the biggest and best such program providing telecom services to villages in developing countries. [40] At present, the program has 55.000 subscribers [41]

The program provides added value for the villagers by providing cell phone service in areas normally looked upon as not very profitable. The telephone connection is generating profits for the villagers through better knowledge of the market for their products. It also provides better security for money transfers from villagers working abroad.

Grameenphone, and especially Village Phone, has at the same time helped to realize the policy goal of Grameen Bank: to develop the rural economy by providing modern telecommunications

The total number of subscribers for Grameenphones services has now exceeded 16 million, and it is largest cell phone service provider in Bangladesh. The purely economic value of Village Phone subscribers in Grameenphone`s total portfolio has therefore probably diminished. The commercial value of such a group of subscribers for a start-up company was nevertheless probably quite high. Grameen Bank and its Village Phone program has probably been a valuable base for the later expansion of the purely commercial service of Grameenphone.

[39] Grameen Telecom - Village Phone case study on-line
[40] Grameen Telecom - Village Phone case study on-line
[41] Wikipedia article on Grameenphone 02012007

End notes

i "Under the Convention, the developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly to developing countries to enable them to implement the provisions of the Convention (Article 4.5). This commitment is echoed in similar provisions under the Kyoto Protocol (Article 10 c). Parties have taken decisions to promote the development and transfer of environmentally sound technologies at each session of the COP." (UNFCCC homepage: http://unfccc.int/cooperation_and_support/technology/items/1126.php)

[ii] The abbreviation "NGO" in the usage of the UN means all organisations that are not governmental organisations – therefore non-governmental organisations. Included here are labour unions, industrial organisations etc., as well as voluntary, non-profit organisations working for ideal causes. In this report, I am using the term "NGO" meaning voluntary, non-profit idealistic non-governmental organisations.

[iii] A necessary modification of this principle could be climatic conditions: those living in cold countries may need more energy for heating. However, this energy service can also be provided with the use of far less energy per capita than today, and will not necessarily excuse the present large difference in energy consumption between rich (and cold) countries on the one side and poor (and hot) countries on the other.

[iv] (Vis til eksempler fra "Pick the low-hanging fruit"

[v] For a description of solar cookers, see this link: (til Togoprosjektet)

vi There may also be a use for high-voltage electricity for purposes that require more electricity that are practical or economical to supply from solar PV-cells. Examples of energy services that may be better run on high-voltage are the the powering of pumps for irrigation and electrical motors for other production purposes, but these needs may differ more from area to area. Sometimes the need can also be covered by other technologies: windmills for water pumping, diesel engines with generators for powering heavy electrical equipment etc.

vii In Norway, this cooperation is also known because of the conflict between Muhammad Yunus and Telenor about the ownership of Grameenphone. Yunus claimed that when Grameenphone was founded, Telenor and Grameen Bank had an agreement that Telenor should sell its controlling majority of shares in Grameenphone to Grameen Bank after some years. Telenor, when confronted with this claim, denied that an agreement of this sort had ever existed and refused to part with the by then highly profitably shares in Grameenphone. Later, it also was revealed that Telenor had used sub-contractors in Bangladesh that used child labour and was negligent with the workers safety. The conflict and the evidence of bad business practice does not, however, detract from the positive example of an NGO-business cooperation to reduce risk and thereby help to start a valuable service for the Bangladeshi population.

[viii] Financing of projects may be of different types, and the concept covers everything from providing equity, e.g. where the financer has an ownership in the project, via loans and finally subsidies and grants which are not supposed to be paid back.

Norges Naturvernforbund (Norwegian Society for the Conservation of Nature) is Norway's largest and oldest environmental organization. The organization was established in 1914 and is a non-governmental, nationwide, democratic member organization with around 20 000 individual members, 100 local groups, and regional branches in all counties. After more than 90 years with voluntary work for our common environment, for conservation of the extraordinary nature and wildlife we have in Norway, the organization is well known and respected. Although the organization has a national agenda, many environmental questions have proved to have an international or even global character. Development issues, resource allocations and international cooperation are very much parts of our everyday activities.

Norges Naturvernforbund works actively on international questions on environment, energy, climate and development towards decision makers, the general public and in our own organisation. The International Project Department frequently contributes with inputs on development issues for use in our internal and external information activities. Frequent seminars and workshops are being organized and the department is a regular participant in external forums.

Norges Naturvernforbund cooperates with environmental NGOs and support civil society development in a number of countries in East and South. The objectives are to strengthen our local partners' capacity and influence in their struggle for a better environment. Environmental Education, Sustainable Energy Solutions and Climate Change are key issues for the cooperation. At the present Norges Naturvernforbund initiate, implement and maintain projects regarding capacity building, energy saving, renewable energy, climate and education in 20 countries in former Soviet Union, Eastern-Europe and Africa.

SPARE (School Project for Application of Energy and Recourses) is the largest international school project on energy, climate and environment. 4500 schools and 175.000 pupils in so far 16 countries participate annually in the SPARE educational program. The SPARE program was created in 1996, by Norges Naturvernforbund and is today managed by the International Project Department.

Norges Naturvernforbund is a part of Friends of the Earth International.

Postal address: Norges Naturvernforbund, Grensen 9 B, 0159 Oslo, Norway
Visiting address: The Environmental House G9 in Grensen 9 B, Oslo
Phone: +47 23 10 96 10 **Fax:** +47 23 10 96 11
Mail: naturvern@naturvern.no

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