Climate Investment Funds

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BACKGROUND INFORMATION NOTE ON THE ROLE OF SUBSIDIES IN RENEWABLE ENERGY PROMOTION

I. Background

1. In reviewing the document Elements of Financing Modalities (SREP/SC.2/4), at its meeting in March 2010, the Sub-Committee requested the Administrative Unit, in collaboration with the MDB Committee, to prepare a background note for consideration at the next meeting of the Sub-Committee, on the use of subsidies as a financial tool under the SREP.

2. This note discusses various issues pertaining to how subsidies have been used in the past for scaling-up renewable energy, type of subsidies, their rational and role, and their applicability to grid and off-grid applications with some country examples. These issues are covered in this paper in order to provide an overview for SREP financing.

3. The MDB Committee recommends that a note be prepared, in collaboration with the CIF Administrative Unit, that will include recommendations about how subsidies might be used, the rationale for supporting certain schemes, and the impacts of subsidies as part of a broader enabling policy framework in the specific context of SREP countries. This note will be presented for consideration at the next meeting of the Sub-Committee.

II. Introduction

4. Over 1.6 billion people in the developing world still lack access to electricity and 2.6 billion continue to depend on traditional biomass for their energy needs[1]. Increasing access to modern energy services is one of the most critical challenges for low income countries in developing their economies and achieving poverty eradication. The challenge is made doubly intense on account of the climate imperative to meet the energy goals in an environmentally sustainable manner.

5. The Program on Scaling up Renewable Energy in Low Income Countries (SREP), a targeted financial mechanism under the Climate Investment Funds (CIF) jointly implemented by the multilateral development banks (MDBs), aims to pilot and demonstrate, as a response to the challenges of climate change, the economic, social and environmental viability of low carbon development pathways in the energy sector by creating new economic opportunities and increasing energy access through the use of renewable energy[2].

6. The need to enhance access to energy and ramp up modern energy use in low-income countries coupled with the availability of abundant renewable energy resources – wind, hydro, biomass and solar energy – provides an opportunity to help countries promote sustainable energy systems to fuel their growing economies. However, renewable energy technologies have suffered from a range of barriers – to varying degrees in different countries – that impeded their progress in the past. Some of the barriers include high upfront costs of RE and the inability to spread these costs over long term making them unaffordable to the poor; continued subsidization and distorted pricing policies for fossil fuels, which create an uneven playing field for renewable; lack of enabling policies and regulations that could attract private investment into RE sector; low investments in building technical and operational capacity to ensure high quality products and services, etc.

[1] REN21. 2010. *Renewables 2010 – Global Status Report* (Paris: REN Secretariat)
[2] SREP Design Document, www.climateinvetmentfunds.org

7. Providing direct and indirect subsidies, technical assistance and other policy incentives have been some of the key ways in which the barriers have been addressed in promoting RE over the last three decades, with varying degrees of success. Determining the type and level of assistance – including possible subsidies – to be provided under SREP will be one of the important aspects of successfully scaling up the RE in the selected countries.

8. The purpose of this note is to provide a broad overview of the past use of subsidies for RE, their rationale and role, types of subsidies, and their applicability to grid and off-grid applications with some country examples. It is suggested that a deeper analysis of the imperatives and impacts of subsidies as part of a broader enabling policy framework should be undertaken in the specific context of the respective SREP countries to arrive at recommendations on specific subsidy mechanisms that aid the scale-up effort.

III. Subsidies: Definitions, Rationale, and Role

9. The International Energy Agency (IEA) defined the energy subsidy as any government action that concerns primarily the energy sector and that lowers the cost of energy production, raises the price received by energy producers, or, lowers the price paid by energy consumers[3]. The US EIA defines energy subsidy as any government action designed to influence energy market outcomes, whether through financial incentives, regulation, research and development or public enterprise. Energy subsidies have been common across developing and developed countries of the world, and governments intervene in energy markets for a variety of reasons including energy access, social welfare, economic development, energy security, energy independence, technology promotion, and combating climate change.

10. Subsidy has a particularly strong rationale for efforts expanding the energy access to the poor in the developing countries. Many rural households in developing countries are far from the national electricity grid. Even in densely populated countries where rural households are close to the electricity grid, the low electricity demand of rural households precludes the economic installation of secondary and tertiary transmission and distribution systems to provide low-voltage supply. Further, the use of traditional biomass fuels for their cooking and heating needs and diesel for electricity generation has serious economic, environmental and health implications. Thus, compared to the cost of extending national electricity grids to serve rural areas, it may be relatively more economical to serve rural communities from stand-alone or off-grid energy systems through subsidized RE systems.

11. Thus, regardless of the definition, the goal of RE subsidy programs can be to provide a social good, such as improving a given population's quality of life through access to modern energy and fulfill national energy policy strategy goals including energy security or limiting foreign exchange for fuel imports and meeting environmental goals. The rational for subsidies support is that these societal benefits may not accrue without government intervention since RE supply, in general, has several barriers which need be removed. And enabling policies including regulatory and market-based interventions are required to induce desired changes in the energy markets, which lead to subsidies of one form or another being offered to the producer or the consumer. Subsidies for RE could be considered in the context of a) providing startup financing that may not be available in the private financial markets; b) promoting the development of promising RE systems through subsidies to provide a level playing field with conventional fossil

[3] IEA. 1999. Looking at Energy Subsidies: Getting the Price Right. (Paris: International Energy Agency)

fueled options; and c) crediting RE producers for the environmental and energy security benefits they provide.

12. Though subsidies have been around for a long time, there is no widely accepted methodology for calculating subsidies or a harmonized reporting mechanism (even in such a unified market as the European Union). Nor is precise information on global subsidies for renewable energy (RE) readily available. Quantification of subsidies is difficult given the myriad ways in which subsidies are channeled to energy producers and/or consumers. Further, there are implicit subsidies, which are not easily captured; for instance, public spending on safety or health impacts of energy production. Thus, most available statistics are estimates by reputed agencies like IEA and EIA.

13. Estimates show that fossil fuel subsidies are 10-12 times more than the amount of subsidies provided for renewable energy, and the imbalance is across both developed and developing countries (Box 1). One major distinction is that energy subsidies in industrialized countries tend to be more towards to production whereas developing countries use the subsidies to support energy consumption[4].

14. Even at lower volumes compared to fossil fuels, subsidies, in addition to other policies, have done much to expand the RE[5] market globally[6]. However, there are many critics who argue that energy subsidies do not always benefit the intended target population, or stimulate the market as planned; can distort markets and hinder development of long-term sustainable markets for RE; encourage rent seeking; and discourage the rational

Box 1. **Subsidies: Fossil fuels vs. Renewables**

The July 2010 report of the Bloomberg New Energy Finance (BNEF) shows the wide disparity between renewables and fossil fuels in the matter of subsidies. In 2009, BNEF estimated a total subsidy of $43-46 billion for renewable energy and biofuels, which is in sharp contrast to the 2008 figure of $557bn for fossil fuels as reported by IEA. These fossil fuel subsidies do not include the substantial security and public health costs or that of major environmental catastrophes like the Gulf Coast spill.

USA leads in providing clean energy subsidies with $18.2bn in 2009 (60% RE and 40% biofuels); $3.8bn was through a grant program of the Treasury. Feed-in-tariff in Europe accounted for $19.5bn with Germany hosting the single largest clean energy subsidy program with $9.5bn.

Among the developing countries, China provided nearly $2bn in direct subsidies for renewable energy, which, along with low interest loans from public banks and active policy push, contributed to becoming the 2009 world leader in wind.

While the gap is expected to narrow a little in the immediate future – on account of various global stimulus funds for clean energy, and the reduced amounts countries need to spend on fossil fuels due to relatively low oil prices – a level playing field is likely to continue to elude renewable.

Source: **RenewableEnergyWorld.com** 29/07/2010.

[4]Summary Note on Literature Review on Energy Subsidies. Energy and Water Department, World Bank. 2006. This note also provides estimates of energy subsidies in various countries during 1991-2005.
[5]RE discussion here does not include large hydro, the development of which does not involve subsidies.
[6]REN21. 2010. *Renewables 2010 – Global Status Report* (Paris: REN Secretariat)

use of energy[7]. There is however a growing demand, and support, to displace or reduce subsidies for conventional fossil fuels in favor of subsidies for RE sources and technologies given their potential to alleviate the impacts of global climate change.

IV. Types of Subsidies

15. Many varieties of subsidies have been developed to promote RE. They may take the form of direct subsidies to producers or customers through production or consumption driven subsidies, or they could be through tax exemptions or through expenditure for R&D. The type of RE subsidy best suited to a country depends on the specifics of the country-situation, the barriers to be overcome, and the desired outcomes. It is also dependent on the energy delivery subsystem; grid-connected RE systems compete with conventional fuel power generation plants and may require subsidies that bring parity of RE costs or prices with the average cost or price of generation on the grid system.

16. For instance, as shown by a recent WB/ESMAP study for India[8], about 3 GW of renewable energy is economically feasible at the avoided cost of coal-based generation at Rs 3.08/kWh (6 cents). About 59 GW of renewable energy in wind, biomass, and SHP is available at less than Rs 5/kWh (10 cents) and the entire cumulative capacity of 68 GW in these three technologies can be harnessed at less than Rs 6/kWh (12 cents). About 62 GW, which is 90% of cumulative renewable capacity in wind, biomass, and SHP, could become economically feasible when the local and environmental premiums of coal are brought into consideration. Thus, by offering appropriate levels of feed-in-tariff for RE, and providing other incentives, different levels of RE potential can be harnessed, which is the strategy currently being pursued by India.

17. Feed-in-tariff is a popular policy that has spurred growth of RE in many countries. Feed-in-tariff provides a strong incentive to RE investors through preferential price, guaranteed over a period when combined with long-term power purchase agreements (PPAs). Feed-in-tariff first gained popularity in Germany in 2000 and by now over 63 countries offer feed-in-tariffs[9]. However, while feed-in-tariff is undoubtedly attractive to investors, there is a question on who will pay for the higher cost of power in low-income countries where consumers do not have the capacity to procure expensive power, and federal government may have to guarantee payments.

18. Accelerated depreciation benefits, sales tax rebates, tax holidays, import duty concessions, and generation based incentives are some of the other indirect subsidies or incentives used to promote grid-based RE generation, apart from the Feed-in-Tariff, which is prevalent in many developed as well as developing countries.

19. Off-grid RE systems, for electrification in developing countries where grids frequently do not extend to rural areas, often require subsidies to offset their high upfront costs so as to make them affordable to the end-users. Direct grants to meet part of full cost of RE equipment, provision of low-interest credit lines for banks to lend to end-users, capital subsidies to equipment manufacturers/suppliers, etc. are some of the types of subsidies designed to promote technologies such as biogas digesters, improved cook stoves, solar water heaters, solar home systems, etc..

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[7]For a summary of arguments against and in favor of RE subsidies, please see Govind Raj Pokharel (2002), Subsidy for renewable energy technologies in developing countries: some useful discussions. Appropriate Technology Forum

[8]WB 2010.Food for Thought: Unleashing the Potential of Renewable Energy in India. South Asia Energy Department, World Bank (DRAFT REPORT).

[9] "Renewables Global Status Report: 2009 Update," REN21, (2009). Paris: REN21 Secretariat.

20. Table 1 captures various forms of RE subsidies/incentives that have been developed in different markets based on policy needs and market and political considerations.

TABLE 1			
Category of Subsidy	**Type of Subsidy**	**Likely Benefit**	**Country Examples**
Fiscal Measures	Capital grants to RE producers	Lowers cost of RE production	India, Cape Verde
	Consumer grants: one-time connection fee	Lower cost to consumers	Bolivia, Benin, Togo
	Subsidized RE tariffs	Lowers cost of RE to consumers	China, Argentina,
	Low interest or preferential loans and lines of credit, credit guarantees	Low cost debt attracts private investment	India, Sri Lanka, Philippines
	Direct public sector investment in RE infrastructure	Lowers cost of RE production	India, China, Sri Lanka
	Feed-in Tariffs or preferential tariffs and price controls	Stimulates private sector investment in RE through preferential pricing; has budget implications	Philippines, India, most EU countries and US
Preferential tax treatments	Rebates or exemption on royalties, sales taxes, and other levies, duties and tariffs for RE equipment	Lowers cost of production of RE	India, Kenya, Tanzania
	Accelerated depreciation allowances on RES equipment	Encourages RES investments through accelerated or modified depreciation rates	India
	Investment tax credits	Can attract foreign investment into RE	US, India, Sri Lanka
	Production tax credit	Lowers cost of production of RE and lower cost to consumers	US
	Income tax holidays	Higher profits to investors	Philippines, India
	Personal tax exemptions and tax credit	Lowers tax burden for RE purchasing consumers	US, Australia
Non Fiscal Measures	Public research and development	Potentially lowers cost of production of RE	US, Germany
	Regulation of the energy sector: Mandated purchase of RES by utilities, or RPS, or Renewable Energy Certificates	Enables RE market by guaranteeing sale of RE	India
	Net Metering	Encourages customer installation of RE; additional revenue from sales; beneficial to utility	US, Sri Lanka, South Africa, some states in India

21. A UNEP study[10] also summarized different types of RE subsidies and this is provided in Annex A.

[10] Reforming Energy Subsidies: Opportunities to Contribute to the Climate Change Agenda, UNEP 2008

V. Impacts of RE Subsidies

22. Subsidies have greatly spurred the growth of RE systems around the world. Subsidies can encourage producers to bring new technologies to market and build market confidence in the commercial viability of the technology. While subsidies can potentially promote RE, there is limited information available on outcomes achieved through specific subsidies. In the US, for instance, the EIA closely tracks spending on subsidies, but there is little or no information available on the specific outcomes achieved by specific subsidy mechanisms. In other words, it is difficult to quantify the growth in RE and attribute it to specific subsidy vehicles.

Subsidies for Grid-connected RE Systems.

The Indian Experience

23. India is a good example of how subsidies have been used in different phases of the county's renewable energy program (See Box 2). Given the current economic boom in India and the consequent high demand for energy, the country is vigorously promoting renewable energy to supplement other sources of energy. The Ministry of New and Renewable Energy (MNRE) has recently announced new incentives for grid-connected renewable wind power generation, in which the producers would receive a premium of Rs 0.50 (1 cent) per unit of electricity fed into the grid (average wind power price is about 6 cents per unit.); the government would invest Rs 3.8 billion ($81.6 million) in the program[11]. The government is

Box 2. **Subsidies and Renewable Energy in India**

India has a long history of promoting renewable energy with subsidies and other incentives since early 1970s. The program and the incentives used have evolved in three broad phases.

In the first phase (1974-91), the emphasis was on promoting small scale, stand-alone RE applications (for cooking and lighting) with direct cash subsidies to the consumers. These were mostly government-administered 'national' programs with little private sector involvement. A part of the system cost was directly paid to the beneficiaries, and the proportion was determined by the economic status, system capacity, etc. Biogas digesters, biomass gasifiers, improved cook stoves and a range of solar equipment got promoted in this way.

During the second phase (1992-2002), the focus shifted to RE market development through enabling environment. Direct cash subsidies got gradually tapered down (though they still exist for some rural RETs), and financial and fiscal incentives were provided including accelerated depreciation, capital subsidies, import duty concessions, wheeling and banking facilities, sales tax reductions, etc. This greatly contributed in demonstrating the commercial viability of large scale RETs such as wind and biomass power.

The third phase, which has begun in early 2000s with the restructuring and reforming of the Indian power sector has targeted mainstreaming RETs in response to the burgeoning energy demand. Feed-in-tariffs and renewable energy portfolio obligation across different states, and the recent generation-based incentives are replacing the earlier subsidy regime. Further innovation is coming in the form of RE certificate trading that would boost private sector participation. Further, one of key programs under the National Action Plan on Climate Change (NAPCC) is the National Solar Mission to achieve an installed capacity of 20,000 MW by 2022.

[11] India offers new subsidies for grid-connected wind power, December 17, 2009, http://cleantech.com/news/5434/india-offers-new-subsidies-grid-con, Accessed May 25, 2010.

also promoting the use of RE for supplying power to wireless mobile towers. Under the scheme, the Department of Telecommunications will provide up to Rs. 5million (US$105K) of financial assistance per pilot project. The subsidy support from the government would be up to a maximum of 75% of the project cost[12].

24. Feed-in-tariffs exist for other technologies such as small hydro and biomass. With a wide array of incentives, India envisages that 10% of its new power capacity addition would be through renewables by2012. The experience of India and other countries with RE has relevance to SREP; but the issues to be addressed will be the level of subsidies which reduce the burden of payment for higher-priced RE supply, and the period of time over which such subsidies be provided.

The European and US Experience

25. In Europe, feed-in-tariffs for wind and solar energy have attracted investors and promoted substantial capacity growth. In Germany, RE from projects that qualified for feed-in tariffs between 2004 and 2008 is estimated to cost consumers €122.3 billion between 2008 and 2030. And in Spain, renewable energy from projects started under the country's feed-in tariff between 2006 and 2008 are expected to cost €53 billion over 25 years, a 75% premium over the likely cost of the same amount of conventional power[13]. The feed-in-tariffs in Spain were so successful that by September 2008, the country had already reached 344 of the 400 megawatts it had targeted to install by 2010 through the subsidy program. However, the continuing global economic slump has prompted Germany and Spain to reconsider their RE subsidy policies in recent months.

26. Wind energy in the US was given a big boost with the introduction of the Production Tax Credit (PTC) in 1992. The PTC, which is 2.1 c/kWh for wind, is available to generators of renewable power over the first ten years of a project's operation so they could sell it that much below actual cost. The subsidy is granted as credit on taxes, though following the American Recovery & Reinvestment Act (ARRA) in mid 2009, an investment tax credit of 30% may be claimed instead for a wind plant placed in service before 2013 (if construction begins before the end of 2010).

Subsidies for Off-grid RE Systems

27. While many off-grid RE operations are reported to be fully or nearly-commercial in certain countries (the WB report on off-grid RE cites examples of solar PV in China and Kenya; several PV company operations in India; micro-wind in China and Mongolia; and pico-hydro in Laos and Vietnam), it is quite likely that off-grid RE in least developed countries may require subsidies to make them affordable to consumers, depending on location specific conditions. The provision of subsidies to rural households is not inconsistent with the provision of subsidies in many countries to grid-connected consumers, and may serve to bring parity in provision of social benefits.

[12] India offers USO subsidy for renewable energy cell site pilots, Posted by Tony Chan on Aug 6, 2009, http://www.greentelecomlive.com/2009/08/06/india-offers-uso-subsidy-for-renewable-energy-cell-site-pilots/ (assessed May 24, 2010).
[13] Clean Energy Sources: Sun, Wind and Subsidies, Jeffrey Ball quoting from New Energy Finance, *Wall Street Journal*, 15 January 2010.

28. The WB reports that various countries such as, Bolivia, Laos, Nepal, Papua New Guinea, Philippines, Tanzania, and Zambia provide subsidy support through rural electrification or rural energy funds that transparently cover the subsidy portion of electrification costs.

29. Several World Bank projects provided different levels of subsides to promote solar home systems, based on system costs, willingness-to-pay levels and policy support from the government, ranging from 12% to 90% of the cost (Table 2).

TABLE 2. **Subsidy Levels for Solar Home Systems in World Bank Projects**	
Country	Subsidy Range (% of cost)
China	15-22
Bangladesh	12
Argentina	Up to 50
Tanzania	13-21
Sri Lanka	10-25
Philippines	20-60
Mexico	Up to 90
Source: Designing Sustainable Off-Grid Rural Electrification Projects: Principles and Practices, The Energy and Mining Sector Board, The World Bank 2008	

30. Subsidies have driven the initial installation of RE systems in several developing countries, supported by World Bank and other donors. Over 400,000 solar home systems in China and 500,000 systems in Bangladesh have been installed due to such subsidy-driven programs. Nearly 4.2 million biogas digesters, 600,000 solar home systems and 800,000 solar lanterns were disseminated in India by early 2010 fueled by government subsidies[14].

31. A World Bank paper of 2000 reports that over 24,000 solar home systems had been installed under a government program in Mexico, along with nearly 10,000 PV-based telephones, and in Kenya, over 100,000 solar home systems have been installed by the private sector without much public assistance.[15] This paper also provides RE case studies from six countries which all have an element of subsidy, ranging from tariff subsidies in Argentina, to access cost subsidies and declining operational cost subsidies in Benin and Togo, to first-cost subsidies for installation of micro PV systems in Cape Verde. These country programs provide important lessons for SREP.

32. Incentives could also be provided to public/private developmental or commercial banks – low cost credit lines or partial risk guarantees -- to persuade them to offer preferential lending in RE sector. IREDA experience in India (supported by World Bank, ADB, KfW, etc.) is a major example of this approach. Governments have also provided duty exemptions for RE - Kenya and Tanzania have duty exemptions for solar PV systems. Governments could also subsidize the capital costs of installing RE, which would lower electricity supply costs to consumers; biomass power in India has benefited from this. Another option is to regulate tariffs and provide a commensurate subsidy to the energy service provider, as for operations of PV micro-grids in China. The Renewable Energy for Rural Markets Projects (PERMER), initiated in Argentina in 1999 was a concession model where franchise rights to rural-service territories were granted to concessionaires that required the lowest subsidy to provide electricity.

[14] www.mnre.gov.in 25 October 2010

[15] Regulatory Approaches to Rural Electrification and Renewable Energy: Case Studies from Six Developing Countries, Eric Martinot and Kilian Reiche* World Bank, Washington, DC, Working Paper, June 2000.

33. The Global Partnership for Output Based Aid (GPOBA) provides grant assistance for off-grid electrification, which could be one-off, transitional, and ongoing subsidies (e.g. Nicaragua rural electrification program). One-off subsidies are to partially off-set capital costs, and transitional subsidies are to help fill the gap between supply costs and costs recovered through tariffs. Ongoing subsidies are for bridging perpetual gaps between affordability and cost recovery, including consumption costs. The Bolivia Decentralized Electricity for Universal Access Project obtained US$5.2 million in grants from GPOBA to finance, on an output basis, the installation of 7,000 PV systems for rural households, schools, clinics, and micro and small enterprises.

34. While there are many successful examples of the role of subsidy thus, one important negative aspect of heavily-subsidized off-grid RE systems, especially when given away virtually free to the end-users through government subsidy programs, is that they are not perceived to be 'owned' by the users and are neglected in their post-installation maintenance resulting in system failures. Such a process over time reduces the confidence in the technology eventually leading to non-acceptance. The experience of many developing countries is that the system works best when the community or households are given a socio-economic 'stake' in the success of the program through their direct involvement in management and maintenance of the RE system. See Box 3 for guidance on designing off-grid programs compiled from the lessons learnt from various World Bank projects. The key lesson that emerges is that providing subsidy would not automatically lead to technology diffusion, unless accompanied by a number of other enabling aspects.

Box 3. **Guidance for Off-Grid Project Design**

- The conception and implementation of the off-grid project must be consistent with the overall rural electrification plan for the region.
- Project design must not be technology driven.
- In the early stages, efforts must be made to maximize community awareness, involvement, and support, which are vital to success.
- Both the government and implementing agency must take full ownership of the project.
- Government's upfront commitment should be obtained to pick up the subsidy slack when external grant co-financing ends to ensure implementation momentum.
- Competence of the local PMU is critical to success.
- For private-sector projects, simplest delivery mechanisms commensurate with local realities should be adopted.
- Light-handed regulatory mechanisms which minimize the transaction cost for private sector participants should be put in place.
- Appropriate training is necessary for different stakeholders

Source: Designing Sustainable Off-Grid Rural Electrification Projects: Principles and Practices, The Energy and Mining Sector Board, The World Bank 2008

VI. Implications for SREP

35. The key goal of SREP is to pilot and demonstrate the economic, social, and environmental viability of low carbon development pathways in the energy sector in low income countries by creating new economic opportunities and increasing energy access through the use of renewable energy. The principal barriers to be addressed are: strengthen the institutional capacity of local government agencies to foster RE, address the lack of access to capital and high first cost of RES, engage public and private sectors in the development of RE, and provide affordable energy services. In order to address these barriers, well-designed and

targeted subsidies and incentives should form part of a broad SREP portfolio of supporting measures including policy/regulatory reform, institutional capacity building, operational infrastructure and technical assistance.

36. In designing subsidy mechanisms, it is important to consider subsidies that are efficient (focused on the most economic projects), targeted (can reach poor consumers), and effective (are made part of implementation programs that work), and most importantly, designed for the specific conditions prevalent in the targeted countries. An important lesson for the SREP program emerging from the past experience with energy subsidies is that policies and subsidy mechanisms must be tailored to local market conditions, directed to the right constituents, help alleviate barriers to widespread use of RE, promote efficient competitive markets, and send the right price and market signals. Subsidies that ignore these essential elements are likely to distort the market in the long-term.

37. The form and choice of subsidy to be considered under SREP depends on the barriers to be addressed, desired market outcomes, impact on the target population, and the cost of administering and financing the subsidy program. Ideally, subsidies should serve as a short-term instrument designed to influence the market for societal good and create the necessary market conditions, which render the subsidy unnecessary in the longer-term.

38. In least developed countries, such as those selected under SREP, a key challenge is to improve the ability of low-income consumers to pay for high upfront costs in the short run as well as leveling the playing field in the long run for conventional and RE power. While designing and preparing projects in these countries, it is important to include socio-economic studies to ensure that subsidies and incentives would reach the intended target group.

39. Many World Bank–supported off-grid RE projects have demonstrated higher economic rates of return when gains to consumers resulting from access to higher-quality energy compared to traditional fuels are added to the avoided fuel costs - for PV, for example, the economic rate of return with consumer surplus ranged from 27 to 94 percent for projects in Bolivia, China, Indonesia, Philippines, and Sri Lanka[16]. The SREP should include socio-economic studies to evaluate these additional benefits and estimate the true cost (generally lower) of the subsidy program.

40. SREP may consider dynamic subsidies that are responsive to changes in market conditions, advances in technology and lowering of costs. While dynamic subsidies are more expensive to design and implement, they help overcome the limitations of fixed or static subsidies, which have the potential to distort the market in the long run. At the same time, SREP should ensure that dynamic subsidy mechanisms do not result in uncertainty that can hinder market development and investor confidence. A telling example is the development of wind energy in the US, which has been catalyzed by the PTC - investments plummeted to zero in years when the PTC was withdrawn (see Annex B).

41. Martinott, et al[17] have succinctly summarized the role of subsidies as follows, and this may serve as a guiding principle for subsidies :

- Subsidies are unlikely to lead to sustainable markets unless they explicitly create the conditions where they are no longer needed,

[16] Operational Guidance for World Bank Group Staff: Designing Sustainable Off- Grid Rural Electrification Projects: Principles and Practices, November 2008.

[17] Renewable Energy Markets in Developing Countries, Eric Martinott, et al., Annual Review of Energy and Environment, 2007.

- Subsidies can undermine private investments and business in new markets and should be applied with attention to private-sector conditions in a particular market,
- Subsidies can be used effectively to build up initial market volume, local expertise, user awareness, appropriate technology adaptation, quality standards, and entrepreneurial activities,
- Subsidies are more effective when tied to operating performance rather than investment, and
- Continuing subsidies may be needed for poorer segments of the population.

42. SREP offers an excellent opportunity to internalize the lessons learnt from earlier experiences on subsidies, and design programs that target subsidies and other incentives in a 'smart' way. As discussed above, subsidies need to be used judiciously to achieve not only short term quantitative benefits but also long term impacts in terms of enabling environment and enhanced role for the market. For this, incentive mechanisms need to be designed taking into account the country's specific conditions and potential for RE to contribute to the transformative impact towards a low carbon path of development.

Annex A: Types of RE Subsidies

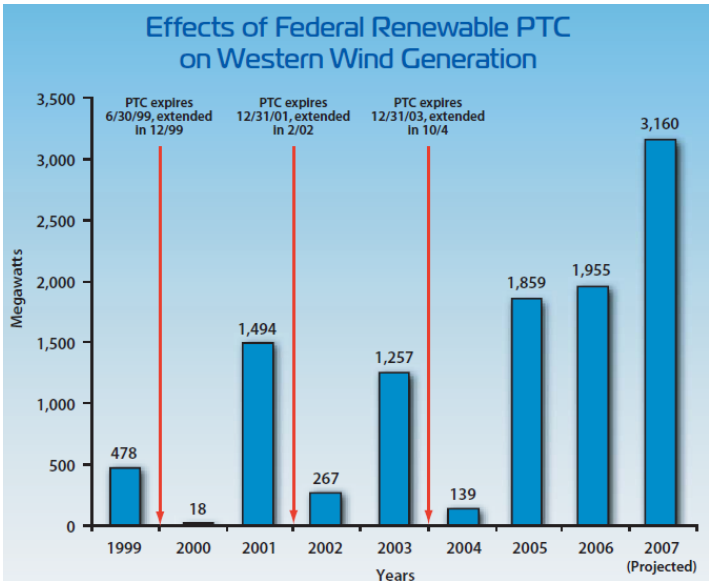
A UNEP study has summarized the types of subsidies offered in various countries, as shown in the Table below.

Government intervention	Example	How the subsidy usually works		
		Lowers cost of production	Raises price to producer	Lowers price to consumer
Direct financial transfer	Grants to producers	●		
	Grants to consumers			●
	Low-interest or preferential loans	●		
Preferential tax treatment	Rebates or exemptions on royalties, sales taxes, producer levies and tariffs	●		
	Tax credit	●		●
	Accelerated depreciation allowances on energy-supply equipment	●		
Trade restrictions	Quotas, technical restrictions and trade embargoes		●	
Energy-related services provided directly by government at less than full cost	Direct investment in energy infrastructure	●		
	Public research and development	●		
	Liability insurance and facility decommissioning costs	●		
Regulation of the energy sector	Demand guarantees and mandated deployment rates	●	●	
	Price controls		●	●
	Market-access restrictions		●	

Source: Reforming Energy Subsidies: Opportunities to Contribute to the Climate Change Agenda, UNEP 2008

Annex B: US Experience with RE Subsidies

The graph below shows the impact of the Production Tax Credit (PTC) on investments in wind power in the US. Since the PTC was designed to lapse every 2 years and was to be extended by the US congress, it created uncertainty among investors. Investments plummeted to zero in years when the PTC was withdrawn. The periodic expiration and extension of the PTC for wind power since 1992 illustrates the effect of tax incentives. Between 1997 and 2007, nearly 16,000 MW of wind capacity was installed in the US. A total of 8,438 MW of wind capacity was placed in service in 2006 and 2007 alone as the PTC was extended to wind facilities commissioned before January 1, 2008[18]. Apart from PTC, the other major driver for wind energy has been the introduction of mandatory renewable portfolio standards (RPS) in 27 states, which required that 4 to 25% of electricity sales be provided from RE by certain dates. While the magnitude of subsidies for wind energy in the US was smaller than that for conventional fuels, on a per unit generation basis, wind power received a fairly high subsidy of about $23.37 per MWh.



Source: American Wind Association. Data for 2004 and 2005 based on industry estimates

Subsidy schemes can go wrong if not carefully designed – the State of New Jersey in the US established a solar energy subsidy program that would pay on average $20,000 for residential projects and more than $1 million for large commercial installations. The state was inundated with applications resulting in long wait times for approvals, and the subsidy program had reportedly cost the state $170 million in 2008, and The Board of Public Utilities estimates the rebates would total $11 billion by 2020[19], raising serious questions regarding its sustainability.

[18] "How much does the Federal Government spend on energy-specific subsidies and support?" EIA website, Accessed May 24 2010.

[19] Big Renewable-Energy Subsidies Backfire, Jennifer Kho, June 26, 2008, http://www.greentechmedia.com/articles/read/big-renewable-energy-subsidies-backfire-1059/ (accessed on May 24, 2010).