Low Carbon Energy Use in Emerging Markets:

An Overview on Policies and Initiatives

Background Paper for

"Towards a Low Carbon Economy: Dialogue Forum on Sustainable Energies for Industries"

organised by National Institute of Ecology (INE) & InWEnt – Capacity Building International, 24 – 27 November 2010 in Cancún

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"Current global trends in energy supply and consumption are patently unsustainable - environmentally, economically, socially," said the International Energy Agency in its World Energy Outlook 2008. The IEA outlines the challenge to tackle the two central energy priorities of the 21st century: securing the supply of reliable and affordable energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally benign system of energy supply. Especially in the wake of the recent global economic crisis, the world has started to look increasingly towards emerging economies to fuel global growth. The growing middle class in emerging economies provide for new sources of demand; China has overtaken the US as the world's largest car market. According to the Fortune Global 500, China has 37 of the world's largest 500 companies, Brazil 6, India 7, and Mexico 4.[1]

Against this backdrop, new challenges for sustainable development arise: an alternative low-carbon growth path developed from best practices for energy efficiency and renewable energy must be found. This will involve not only north-south technology transfer and dialogue but also exchange among emerging economies, which may have insights into common issues and challenges that governments, firms, and communities face. There are some incidents that developing countries are getting greener faster, earlier, and at lower income levels than their developed country counterparts.[2] However, decision makers in emerging economies also face different uncertainty problems. These uncertainties arise, partly because decision makers do not want policies that would impede the countries' current economic development and partly because of a lack of infrastructures (i.e. issues of grid capacity or availability) and/or affordable alternative technologies (i.e. clean technologies). Accordingly, policy makers need accurate information not only about the tradeoffs of economic growth and mitigation strategies but also future development of affordable technologies. The barriers, limits and costs of adaptation are not fully understood, partly

[1] Fortune Global 500. CNN Money. http://money.cnn.com/magazines/fortune/fortune500/2010/

[2] Perkins, Richard. "Globalizing Corporate Environmentalism? Convergence and Hetrogeneity in Indian Industry". 16 November 2007. Springer Science + Business Media, LLC.

because effective mitigation or adaptation measures are highly dependent on specific geographical and climate risk factors as well as institutional, political, and financial constraints. In addition, in cases of countries with decentralized political system, the preferences these countries' various regions must be included in any policy-making process as well as in effective policy implementation.

On the other hand, many firms from emerging economies are not waiting to play catch up but have instead have leapfrogged their developed country counterparts to become world leaders in their sectors. Embraer's airplanes compete in certain markets with Airbus and Boeing. CEMEX is now a major player in cement manufacturing in more than 50 countries worldwide. Tata and Mittal have taken over major European steel manufacturers. Accordingly, it is interesting to know how are industries from these new global economic players adapting their business practices to environmental realities? To what extent have companies and countries leapfrogged over dirty carbon intensive development to sustainable systems? What are best practice examples in these countries? What regulatory frameworks would be required to have them take the most important steps towards sustainable growth?

In this report we outlined a general overview of current policy solutions undertaken by Brazil, China, Egypt, India, Indonesia, Mexico, and South Africa. We attempt to identify selected innovative policy responses or hidden opportunities at these countries that might offset the level of CO2 emissions, encourage a low-carbon growth, and provide incentives to industries to switch to cleaner energy portfolios. This overview serves as a basis for the Dialogue Forum "Towards a Low Carbon Economy: Dialogue Forum on Sustainable Energies for Industries" in Cancún, 24-27th of November 2010- organized jointly by National Institute of Ecology (INE) and InWEnt. It does not claim to offer a complete collection of policies and initiatives but aims at inspiring the discussion among the Forum's participants.

I. Energy Efficiency

Efficiency is known as the low hanging fruit of a low-carbon economic transition. McKinsey Global Institute estimates that EE measures could slow the growth of developing country energy demand by over half in the next 12 years from 3.4% (Base Case) to 1.4% per year. McKinsey further estimates that more than half of these countries' capital stock will be replaced by 2020, and that measures must be taken as soon as possible to avoid high carbon lock-in. These measures can be accomplished with existing technology and would pay for themselves, saving consumers and businesses up to $600 million by 2020.[3]

What prevents countries from implementing increased efficiency measures? Governments, firms, and individuals often lack the information they need to make the right choices. A lack of financing to make the upfront investment in EE often is another obstacle even if the investment would pay off in the short to medium term. Such market failures are often aggravated by misguided regulations including subsidies which shield firms and individuals from the true price of energy, with or without externalities.

[3] McKinsey Sustainability & Resource Productivity. Energy efficiency: A compelling global resource

a) Fuel Subsidies

Fuel subsidies encourage inefficient use of energy. Since consumers are not exposed to the true market price, they overuse, and their overuse in turn reduces energy productivity. According to the Global Subsidies Initiative, a program of the International Institute for Sustainable Development, most governments, rich and poor alike, subsidize fossil fuels amounting to $557 billion in 2008; according to the International Energy Agency, half of fossil fuel subsidies are paid out by developing country governments[4]. This subsidy price tag amounts to more than the cost of replacing infrastructure to the most efficient standards. Helping the poor with high fuel costs would be more cheaply and efficiently accomplished with conditional cash transfer programs like those in Brazil.

b) Regulation

Liberalization of energy markets has taken different forms and gone to varying extents in different places. Still, there tends to be an incentive for many power companies to sell more energy. Energy regulations that encourage energy efficiency could help to help consumers to make informed decisions about how much power to use and when to use it. Smart metering programs, for instance, would be conducive to consumer awareness of how much energy they are using and help them contain costs and energy use.

c) Building/Appliance Standards

Building and appliance standards for energy efficiency are other major areas in which governments can promote energy efficiency. The major challenge here is the fragmented nature of the goal: savings would be found in hundreds of millions of various locations and devices spread across the country. Measuring, evaluating, and enforcing are challenges, and must be accompanied by an information campaign. Measuring energy savings is harder than measuring overall consumption.

d) Financing

Even if a small investment would pay off over the relatively short to medium term, the initial cost may prove to be dissuasive. Financing instruments are worthy investments and as such must be developed and promoted to help in this area.

II. Renewable energy

While energy efficiency is certainly the low hanging fruit of a low-carbon economic transition, renewable energy must also be part of the process in the short, medium, and long term. Even apart from the negative externalities of green house gasses (GHG) and other pollutants, the volatile price swings of fossil fuels mean that renewable energy can play a major money saving and risk-hedging role in industry. Sunshine and wind are free. Therefore future costs are predictable once the initial investment has been made. Sustainable biomass can be locally sourced to safeguard their users from international market swings. This provides a relatively inexpensive method of hedging costs and risk.

[4] International Energy Agency, 9 June, 2010. http://www.iea.org/files/energy_subsidies.pdf

Further, diminishing global fossil fuel resources mean that without a transition to sustainable energy sources, many countries, especially those in the developing and emerging world, will experience energy shortages and increased energy insecurity. Renewable energy is especially suited to various conditions in developing and emerging countries, on or off the grid, in urban and rural applications.

a) Private Generation (on or off the grid)

In many developing and emerging economies, electricity demand outstrips supply; a problem that will continue and be exasperated as demand for electricity grows. Electricity shortages lead to unpredictable brown or black outs, which negatively affects economic productivity. To make up for insufficient or unreliable supply, or in some cases, because electricity rates from the grid are so high, firms that can afford them often install private generators for backup or general use, commonly fueled by diesel engines. Dependence on fossil fuels and the associated price volatility are additional major expenses for industry. The supplementary expense of a backup generator and the associated fuel bill pose a large cost and a barrier to entry for smaller firms (small and medium sized enterprises). Further development of renewable energy can help on several levels.

For large industry, when private generation (backup or otherwise) is necessary, fuel costs, volatility, and uncertainty can be avoided with renewable energy. Solar power provides peak supply during the day when electricity demand from industry tends to be at the highest. This is especially the case in tropical countries where cooling may be an important factor in business productivity. Without the added cost of fuel, the barrier to entry for smaller industries may be reduced, and their productivity increased.

b) Rural generation (off the grid)

Though it may seem less applicable for larger industry, electrification of rural areas is an important generator of economic activity. Electrification brings productivity, development, and new markets for global industry. Initiatives, however, often come with prohibitive costs, which in turn lead to the lack of or underdevelopment of smaller markets. Many markets remain undeveloped because they are either too small for a major power plant of their own, or because the cost of extending the grid is too high for the size of the existing market demand. Decentralized development of renewable energy (wind, solar, small hyro) brings power to rural areas without the cost of fuel transportation, major centralized power infrastructure, or grid extension. Electrification brings new opportunity for industry and increases productivity.

c) Electricity Market Regulation

A major obstacle to the development of renewable energy is that in many countries, the state, or state-owned companies have traditionally had a monopoly on the production (even in some cases, for private use), distribution, and sale of power. These monopolies have often been slow to adopt new technology especially in the realm of renewable energy. In some countries, some progress has been made towards liberalization in the power market but legislation is patchy and, in many cases, major incentives are yet to materialize. One basic incentive is the ability to sell power back to the grid. Net metering allows independent power producers (who may also be consumers, depending on the time of day, year, or

weather conditions) to monitor their production and usage and gives them credits for what is fed back into the grid.

d) Incentives for Renewable Energy Use

There are a variety of tools that a number of countries use to encourage renewable development. These include laws requiring utilities to purchase all electricity generated from renewables, policies calling for a certain percentage of all power generation to come from renewables (Renewable Portfolio Standards, RPS, or Renewable Portfolio Obligations, RPO), subsidies for component manufacturers, tax exemptions for manufacturers, and feed-in-tariffs. To date over 50 countries have set some kind of renewable energy target ranging from 5 to 20%.[5] South Africa instituted a feed-in-tariff in March 2009[6], it is now one of 45 countries to have a feed-in-tariff on the national level, and 18 further states/provinces/territories have them on the sub-national level.[7] The IEA estimates that solar energy alone could provide up to 22.3% (11% PV and 11.3% CSP) of global energy demand by 2050.[8] Wind could supply an additional 12%.[9] At present, some subsidy structures implemented with good intentions are not effective in meeting their goals. For instance in some emerging economies, subsidies are given for capacity installed instead of actual energy produced. In some instances, this has led completed but not operational RE projects.

III. Renewable Energy Industries in Emerging Markets

Investments in renewable energy in developing countries are growing quickly. In 2008, $36.6 billion was invested in renewable energy, a 27% increase over 2001. Notable among the leading investors were China, India, and Brazil (total global investment was approximately $120 billion). Though they started from lower levels, thanks to growth, emerging economies have become major players in RE. In 2008, the top 5 countries in order of installed renewable capacity (excluding large hydro) were China, United States, Germany, Spain, India, and Japan. China was number three in new renewable capacity investment, Brazil number 5. In terms of wind power added in 2008, China was number two, India number three. From 2003 to 2008, China doubled its wind power capacity every year. Brazil and China are also among the five leaders in ethanol production and the installation of solar hot water heaters. [10] Egypt has been expanding wind power capacity on the Suez Gulf and expects the Saidi region to supply 20% of Egyptian power by 2020.[11]

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[5] Jha, Veena. "Trade Flows, Barriers and Market Drivers in Renewable Energy Supply Goods, The Need To Level the Playing Field". ICTSD Global Platform on Climate Change, Trade and Sustainable Energy. Issue Paper No. 10. December 2009. http://ictsd.org/downloads/2010/01/veena-jha-paper.pdf

[6] UNEP 2009

[7] Renewables Global Status Report Update 2009.

[8] Roeberts, Martin. "Solar can provide 22 percent world's power by 2050: IEA". Reueters. Madrid. Tue May 11, 2010 11:40am EDT

[9] Technology Roadmap Wind Energy. IEA. Paris. 2009 http://www.iea.org/papers/2009/Wind_Roadmap.pdf

[10] REN21 Renewables Global Status Report 2009 Update (http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf)

[11] „Egypt Takes Lead in Middle Eastern Renewable Energy". AMEInfo. January 22, 2009

Emerging markets are also increasingly major industrial players in the renewable energy technology scene. Suzlon, an Indian company, had 8.1% of the global market share for wind power turbines in 2008. Suntech Power Holdings Ltd. is a Chinese photovoltaic firm that has grown rapidly in the last few years to be neck and neck with developed world companies from Japan, Germany, and the United States. As of 2008, China is also the world's largest PV manufacturer, though 95% of its manufacturing capacity is exported.[12]

Though this growth is impressive, and there are many lessons to be learned from south-south dialogue. The experiences of these countries can serve as serve as both best practice examples to emulate as well as less successful cases to avoid. Further, there is still major cause for concern. China's energy demand will double over the next ten years[13]. Goldman Sachs expects renewable to play a decreasingly significant role relative to other sources of energy.[14] In India, it is thought that 20-25% of all renewable capacity is for private use or "captive power" and not connected to the grid. 42% of Indian installed wind capacity is concentrated in one state of Tamil Nadu[15], 90% is concentrated in four states including Tamil Nadu.[16] Various emerging economies have made progress in various areas, and in many cases the industry and the private sector can lead the push towards a low carbon economy. Dialogue must continue in the run up to, through and long after the Cancun climate change talks in 2010.

IV. Policies and best practice examples in emerging economies:

It is worth examining initiatives that different emerging economies are taking to encourage low carbon growth. Though not comprehensive, here we provide a short overview of policies in various emerging markets to promote renewable energy and energy efficiency from the public policy sphere, and give a few examples of private sector best practice cases for Brazil, China, Egypt, India, Indonesia, Mexico, and South Africa.

a) Brazil:

Public sector initiatives:

Brazil relies on larger scale hydro for much of its electricity generation[17]. Though a low carbon alternative, it makes the country dependent on rainfall and leads to power outages during droughts. However, there are a number of initiatives to diversify energy supply.

- The Electrical Sector Act 10.438/2002 also sought to diversify the national energy portfolio through guaranteeing power sale contracts to the first 3300 MW of projects which use renewable technologies (wind, biomass and small hydro). Under the

[12] New Energy Finance
[13] Economist Intelligence Unit, European Voice Special Report – Smart Grids. May 20th 2010
[14] Goldman Sachs. BRICs and Beyond. 2007. http://www2.goldmansachs.com/ideas/brics/book/BRIC-Full.pdf
[15] Jones, Jackie. Unleashing the Wind Tinger. Renewable Energy World International Magazine. May/June 2010. Volume 13 Issue 3
[16] Rao, K. U. and V. V. N. Kishore, Renewable Energy 34, 983 2009.
[17] GTZ TERNA Country Survey 2009, http://www.gtz.de/de/dokumente/gtz2009-en-terna-analysis-complete.pdf

program, Electrobrás buys electricity produced from the various renewable resources under contracts of up to 15 years. The act further established the Energy Development Account (CDE) primarily to promote universal access to electricity[18].

- Efforts to diversify the electricity production portfolio include auctions for electricity from renewable energy sources. Distributors must then enter into a Purchase Power Agreement. For a recent wind energy auction in December 2009, the government auctioned 10,055 MW of power with PPA's for 20 years.[19] This has been built on similar models for other energy sources.
- Law No. 9991 obliged holders of concessions for public services of electricity distribution to allocate at least 0.75% of their net operational revenues in R&D in the electricity sector per year, and at least 0.25% in end use efficiency programs. Until Dec 31, 2005 the minimum investment was 0.5%, both for R&D and for energy efficiency programs in energy supply and use. Companies that generate electricity solely from wind-driven, solar, or biomass facilities, and small hydroelectric plants were exempt from this obligation through the end of 200520.
- Since 2002, the BNDES (Brazilian National Development Bank) makes special financing programs available for renewables projects that are eligible for PROINFA (Programme of Incentives for Alternative Electricity Sources)[21]. BNDES can finance up to 70% of capital costs (excluding site acquisition and imported goods and services) at the basic national interest rates (TJLP) plus 2% of basic spread and up to 1.5% of risk spread. Interest is not charged during construction and amortization is of 10 years. Payments are due 6 months after commercial operation.

Brazilian private sector best practice examples:

Celulose Irani is Brazil's first pulp and paper CDM project. The company has experienced rapid growth from 2000-2003, the company increased production capacity by 77%. Corporate predictions expect electricity use would grow 16% from the average 2004-2007 relative to the average for 2008-2024. Though the company had long used, along with hydroelectricity, some on-site biomass electricity generation, previous sourcing from the grid made up for 44%. The new 9.43 biomass generation plant has reduced the company's need to draw from the gird by 33,271 MWh/yr from 2004-2008. The plant uses waste biomass that would have otherwise been disposed of in a landfill, releasing methane as it decomposed [22]

Natura is a Brazilian cosmetics company that manufactures fragrances, bath and skin goods as well as a line of merchandise for babies and pregnant women. It has a market capitalization of over 1.961,5 million Euros. According to their reports, they invest R$ 500,000 (US$ 283,000) per year in energy efficiency and renewable energy and plan to maintain this rate of investment into the future. Investments include:

[18] (World Resources Institute)
[19] http://iea.org/Textbase/pm/?mode=re&id=4482&action=detail
[20] (World Resources Institute)
[21] (OECD/IEA)
[22] EcoSecurities

- Use of prismatic domes for lighting in some administrative sectors;
- Several projects for reducing energy matrix (electricity, natural gas, and oil) in air-conditioners, compressed air, and processes.[23]

b) China:

Public sector initiatives:

China is exercising an array of tools to encourage energy efficiency and renewable energy development. Some market based mechanisms, some direct regulations. This list is by no means comprehensive, but gives an idea of some of the policy tools being implemented.

- China's top pricing and tax decision-making group has developed a pricing system for electricity generated by renewable energy, a variation on feed in tariffs. The plan requires raising rates at which generators of electricity can sell their power to grid companies. The rate increase will vary by region depending on the level of economic development. The customer will pay the additional cost of producing renewable energy[24].
- Value added tax (VAT) has been adjusted for certain sectors. The standard value added tax (VAT) is 17%[25], while VAT for small hydro-projects is 6%, VAT for biogas is 13%, and VAT for wind is 8.5%[26].
- Import duties for renewable energy technologies have been lowered. Such duties are now 3% for components of wind power plants, 12% for photovoltaic systems, and 6% for wind turbines (the average import duty now stands at 23%)[27].
- Subsidies for coal and petroleum have been reduced or eliminated, in some cases subject to further phasing out. A two-tiered price structure was introduced for coal and petroleum prices, allowing for quantities beyond production quotas to be sold at higher prices.
- In the area of financing, the government has further introduced other promotional policies, such as the Green Credit policy. This policy introduces a requirement that commercial banks to incorporate environmental protection criteria into lending decisions. These policies have attracted US$331 million venture capital investments in 2009[28].
- In an effort to scale down coal consumption and to spur switching to cleaner burning fuels, Beijing has introduced a tax on high-sulfur coals. Other efforts include establishing 40 "coal-free zones" in an attempt to phase out coal from the city center, and formulating plans to construct natural gas pipelines[29].

[23] Carbon Disclosure Project
[24] (World Resources Institute)
[25] (World Resources Institute)
[26] (World Resources Institute)
[27] (World Resources Institute)
[28] (Asia Briefing Ltd.)
[29] (World Resources Institute)

Private sector best practice examples

China Mobile Communications is the largest communications company in the world in terms of customer base.[30] In 2010, it had 544,213,000 customers. In 2007 it initiated a Green Action Plan with an emphasis on energy efficiency, emission reductions, and public participation in environmental protection. A main feature of the plan is to reduce energy use per unit of telecommunications traffic by 40% from the 2005 levels. In 2008, the company reduced energy use per unit by 11% over 2007. Its total number of subscribers increased 23%, while its total carbon emissions increased only 14%.[31] Energy efficient measures include the introduction of energy management software in wireless network equipment, 'Smart' technology in base stations which monitors volume and supplies only as much carrier frequency as needed, new lighting, air conditioning and heating technology to increase building energy efficiency (new lighting systems LED and 'smart' systems increased lighting energy efficiency by 20%). In order to increase renewable energy use, the use of fuel cells and hydropower at some base stations are tested. By the end of 2008, 2,130 base stations were using alternative energy[32]

China Vanke Co. is China's largest publicly traded property developer (primarily residential). It has invested approximately RMB 50-100/m2 ($US 7-15/m2) in the new properties it develops to meet enhanced energy-saving standards. It expects to develop 6 million m2 in 2010. The company has invested RMB 35 million (US$ 5 million) in solar PV systems at its company facilities. [33]

Beijing Deqingyuan Agricultural Science and Technology Co. Ltd. is a Chinese chicken and egg company. The farm has three million chickens, which produce 220 tons of manure and 170 tons of wastewater per day. With an investment of RMB 60 million (US$ 8.8 million), the company installed GE 'Jensbacher' turbine engines. Fueled by the waste and other sewage biogas, the plant now provides energy to create 14,600 MWh of electricity each year, offsetting 95,000 tons of CO2 per year which were previously emitted from burning coal to produce electricity. Heat formerly produced as a byproduct of the farm is now recycled to heat the chicken living areas in the winter and support the waste fermentation process year round. GE estimates that the biogas addition to the plant saves the company US$1.2 million a year in electricity costs, as well as producing CERs for the CDM.[34]

c) Egypt:

Public sector initiatives:

[30] Hoovers
[31] http://www.chinamobileltd.com and China Mobile Communications Corporation 2008 CSR Report
[32] China Mobile Communications Corporation 2008 CSR Report
[33] Carbon Disclosure Project
[34] "GE's Jenbacher Gas Engines Power China's First Chicken Manure-Biogas Plant" 5 August, 2008. Businesswire and Carbon Disclosure Project

Egypt has set a goal to generate 20% of its energy needs from renewables by 2020. The 'New National Renewable Energy Strategy' (effective as of 04/2007), included the 20% by 2020 goal, with 12% coming from wind.

- There are two policy phases planned to bring this about. There will be competitive bids for tenders to build wind plants, supported with long term power purchase agreements, and the introduction of a feed in tariff.
- Egypt's Electricity Minister announced in September 2010 that Egypt is working on establishing a photovoltaic solar plant in Aswan's Kom Ombo town. The plant will cost approximately four billion pounds, will produce 100 megawatts of energy, and will be financed by the African Development Fund and the United Nation's Clean Development Mechanism carbon offsetting scheme. Egypt is also building further renewable energy plants: a 200-MW capacity wind plant, a 50-MW solar thermal energy plant, and a 20-MW photovoltaic cells plant.[35]
- Government standards and labeling programs cover energy efficiency for basic appliances.[36]

Private sector best practice examples:

SEKEM, an Egyptian holding company with a variety of lines of business including food production, cotton/textiles, and pharmaceuticals/herbal supplements, established a biogas plant to turn solid agricultural waste (rice husks) into biofuel through fermentation. The company has further earned CDM credits through the installation of measures to capture and flare methane from landfills, for a CO2 equivalent of 60,000 tons over 10 years.

d) India:

Public sector initiatives:

India too has deployed a number of initiatives to promote renewable energy and energy efficiency – especially as part of its National Action Plan on Climate Change (NAPCC) and its eight missions.

- The Energy Conservation Act of 2001, for example, founded the Bureau of Energy Efficiency (BEE), the nodal agency for developing policy and strategies in energy conservation.[37] The BEE's regulatory functions include developing minimum energy performance standards and labeling for specific equipment and appliances; developing the Energy Conservation Building Code; certifying energy managers and auditors.[38]
- Starting in July 2010, India started levying a new tax on coal. The tax rate is currently set at 50 Rupees per every ton of coal. This is estimated to generate annual revenue

[35] (Global Arab Network)
[36] http://ec.europa.eu/energy/international/international_cooperation/doc/2010_01_solar_plan_report.pdf
[37] (India Climate Portal)
[38] (India Climate Portal)

of nearly $535 million, which would be used entirely to set up a National Clean Energy Fund, to finance renewable energy projects including those in the National Solar Mission[39]. Further the government announced that they would phase out direct subsidies for gasoline, diesel, kerosene, and natural gas. [40]

- Further, there have been subsidies and other financial incentives for renewable energy. The Indian government will further exempt renewable machinery, such as solar equipment, parts for rotor blades used in wind turbines, and electric vehicles, from a goods production tax. Taxes on renewable energy equipment are to be reduced by 5%. Raw materials and photovoltaic components are exempt from excise duties and benefit from concessional import duties. Geothermal heat pumps will be totally exempt from import duties. Small hydropower projects (up to 25 MW) are eligible for incentives such as concessional customs duties and income tax exemptions for 10 years. Biomass projects for power generation receive fiscal incentives including subsidies, income tax holidays, excise duty and sales tax exemptions, and accelerated depreciation.
- A kind of feed in tariff, effective as of 2008, India subsidized solar power plants to the amount of 12 rupees (30 cents) per kilowatt hour. This plan will last for five years, and is expected to generate 10 billion rupees ($253.7 million) in private investment[41].
- Also, in order to encourage foreign investment in solar photovoltaic technology, the government allows an automatic approval procedure for up to 74% of foreign direct investment in joint venture projects. Up to 100% foreign direct investment is permitted if approved by the Foreign Investment Promotion Board.

Private sector best practice examples

Larsen & Toubro is India's largest engineering company, and with US$2.5 billion in sales, and a $3.1 billion market value.[42] It has invested INR 2.8 million (US$ 63,000) in energy efficiency measures at one office location. It estimates that its various energy efficiency practices, yield annual savings of INR 8 million (US $ 175,000).[43] The company generates 14163 MWh of electricity per year using renewables excluding biomass and has taken further measures to reduce energy use and emissions, such as energy conservation in electrical systems, the use of energy-efficient lamps, electronic ballast and installation of programmable timer-based lighting arrangements in workshops, the establishment of separate lighting arrangements for gangways and assembly line in workshops, the use of energy-saving lamps in street lighting, the installation of power LED lights in passages and toilets and acrylic roofing provided in shops to improve daytime illumination. Renewable energy sources use has been improved by establishing solar water heater for canteen and dishwashing, solar powered photo voltaic cells for producing 200 units of electricity, spending

[39] (Jaiswal)
[40] (Bajaj)
[41] (Kuncheria und Williams)
[42] Forbes Global 2000
[43] Carbon Disclosure Project

INR 520 million (US$11.4 million) order placed for wind power development. Two additional sites wind are also under consideration.

Ambuja Cements, an Indian cement company with US$ 1,426 million in sales (fiscal year 2008), says that climate change is a concern especially with regards to future access to water supply needs. The company invested INR 105 million (US$ 2.6 million) in 2009 to convert some coal fired kilns to run on biofuel. The company has a 20% reduction target in kg of CO2 per ton of cementous material by the end of the year 2010 from a 1990 baseline. They achieved a 13% reduction by 2007 (current figures unavailable). Ambuja further plans to spend INR 90 million in 2010 on further energy efficiency and renewable energy measures. The company currently has two registered CDM projects and has undertaken a major R&D project to improve energy efficiency.[44]

Wipro is an Indian USD 5.04 Billion (FY 09) global conglomerate active in information technology and infrastructure engineering. Wipro has been a pioneer in energy efficiency and renewable energy use in India. It has an overall plan to reduce its GHG intensity from 4.8 tons per employee in 2008-2009 to 2.5 tons of CO2 per employee by 2015. To date, primary investments have been made in solar thermal heating for offices and corporate guest houses, mircowind demonstration projects, solar PV, LED lighting, and biogas waste-to-heat converters. Energy efficiency measures include increased use of chillers for AC systems, LED use instead of CFL or conventional lighting, increased occupancy per square meter of workspace, auto-hibernation of PCs, virtualization data in data centers, earth air tunnels, and geothermal cooling systems. Further, Wipro designs and constructs its buildings according to LEED standards (Leadership in Energy Efficient Design). Office campuses in Gurgaon (near Delhi) and Kochi in Kerala are LEED certified.

e) Indonesia:

Public sector initiatives

The 2005-2025 National Energy Blueprint identifies short- and long-term development objectives in the electricity sector.

- In addition to targets on increasing electrification levels, infrastructure expansion, reduction of subsidies and improvement in efficiency, the Blueprint establishes targets for electricity production from various renewable energy sources. A target of 15% of the country's electricity mix is to come from renewables by 2025. [45]
- The Ministerial Decree 14/2008 on Geothermal Pricing Policy[46] established a benchmark price for geothermal power generated by independent power producers. The benchmark ranges from USD 5.9-10 cents per kWh, with a current average price of electricity produced at geothermal plants standing at USD 4.52 cents per kWh.

Private sector best practice examples:

[44] Carbon Disclosure Project
[45] (REN21)
[46] (REN21)

PT Indo Tirta Suaka: A pig farm owned by Indonesia's biggest conglomerate, is taking methane released from manure and turning it into power**.**[47]

Indocement, one of the cement industry giants in Indonesia, reduces emissions by using fuel partially made from rice husks, sawdust and used tires.

Holcim. Homcim is another Indonesian cement industry giant certified under the United Nation's Framework Convention on Climate Change. The company cuts their coal use by firing kilns with alternative fuels made from plants and waste.[48] Holcim's waste processing facility, Geocycle, receives various types of waste such as off-cuts from the electronics industry - which make the printed circuit boards, or oil sludge materials, and/or municipal solid waste that has been composted. The materials go through a shredder, then they are used as fuel for the plant's two giant cement kilns. Geocycle takes in waste from more than 100 companies - ranging from garment manufacturers to candy producers.[49]

f) Mexico

Public sector initiatives:

In Mexico, there are a number of initiatives to promote renewable energy and energy efficiency.

- The Renewable Energy Development and Financing for Energy Transition Law went into effect in 2008)[50]. The law established the basis for various incentive schemes. A fund to support renewable energy was established in 2009, initially worth MXN 3 billion. It also obliges state-owned energy company CFE to purchase energy supplies generated through cogeneration, self-supply or small scale production.
- Regarding energy efficiency measures the Programme for Financing of Electric Energy Saving (PFAEE) is one long lasting effort. PFAEE has been started by the Electric Power Savings Trust Fund (FIDE) along with the Federal Electricity Commission (CFE) in 2002. The Programme finances the substitution of old, inefficient refrigerators and air-conditioners with modern and more efficient equipment. It also provides financial support for thermal insulation of homes. The cost of more efficient lighting is also financed, through a credit paid on electricity bills, which is largely recovered due to reduced electricity costs.
  The first phase of the programme ran from 2002 to 2006, with approximately 30.000 homes being insulated, and approximately 130 thousand refrigerators and 623 thousand air conditioning units being replaced. For the 2007-2012 phase, a new informational operational system has been put in place, to streamline interactions between manufacturers, distributors, collectors and appliance destruction centres. All substituted inefficient equipment will be destroyed, and an electronic billing system

[47] (News: Indonesian Businesses Find Savings Through Emission Reduction Plans)
[48] (News: Indonesian Businesses Find Savings Through Emission Reduction Plans)
[49] (News: Indonesian Businesses Find Savings Through Emission Reduction Plans)
[50] (REN21)

provides timely registration and billing of credit. The Programme is also being extended to households being supplied by the Luz y Fuerza del Centro, representing a potential market of an additional 1.8 million domestic refrigerators that can be substituted.

Private sector best practice examples:

Cemex is a Mexican cement manufacturer and a world leader in its field. Active in over 50 countries, the company had sales of $US 21,695,000,000 in fiscal year 2008. CEMEX is an active member of the World Business Council for Sustainable Development (WBCSD) Cement Sustainability Initiative (CSI). The effort encourages knowledge sharing on sustainability issues and establishing recognized Sustainability Standards for the industry.

Cemex owns plants that are covered by the EU Emissions Trading System (ETS) in the following countries: Germany, Spain, Latvia, Poland, and the UK. In these countries it is held to European standards of production, energy efficiency, and climate measures. Across its global operations, the company has an overall goal to reduce inter alia CO2 emissions per metric tonne of cementitious product by 25% by 2015 (from a 1990 baseline)

It intends to meet these goals mainly by improving technical operation of installations, thereby reducing energy consumption, increasing the use of lower carbon fuels, increasing use of lower CO2 clinker substitutes, among others. Cemex has further invested in a 250 MW Eurus wind farm located in Oaxaca, Mexico. Electricity produced by the wind farm represents 25% of Mexican based operations' use of electricity.

The basic chemical reaction to transform calcium carbonate into calcium oxide, which accounts for 60-65% of emissions, has little room for innovation. Accordingly, the company is focusing on the combustion of fuels in the pyro-process. Here, measures are being taken to reduce clinker content, replace solid fossil fuels like petroleum coke and coal with biomass (e.g. wood waste, sewage sludge, meat and bone meal).

Fuel substitution means high variable costs for these projects, especially in developing countries because of a lack of a regulatory system and infrastructure to collect and dispose of waste. Some of these projects are therefore only feasible with support from the CDM. Cemex has a goal of substituting 15% of total fuel consumption with alternative fuels (5% of that being biomass) by 2015, with a further augmentation to 23% by 2020 (8% biomass). In 2008, alternative fuel usage was 10.3% (2.5% biomass) of total thermal consumption.

g) South Africa

Public sector initiatives:

The government of South Africa has taken different steps to promote a sustainable energy supply.

- In the Renewable Energy White Paper of 2003, the South African government set a target of 10 000 GWh (0.8 Mtoe) of renewable energy contribution to final energy

consumption by 2013, about 4% of total generating capacity. This was mainly to be achieved through the expansion of biomass, wind, solar and small-scale hydro. The renewable energy is to be utilized for power generation and non-electric technologies such as solar water heating and bio-fuels.[51]

- The Central Energy Fund Act (1977, amended 1994) provided for a fuel levy. The use of the money held by the fund is limited to certain specific purposes which include research and the promotion of renewables. The South African government has further decided not to approve new coal fired power plants without carbon capture readiness built in.
- The South African government's Renewable Energy Subsidy Scheme as a once-off capital grant made available for project developers in 2005/06 - 2007/08 financial years. The subsidy was not allowed to exceed 20% of the total capital cost, and minimum project size wass 1 MW (for electricity), implying a subsidy amount of ZAR 250, 000. [52]
- In 2006, the State owned Utility Company, Eskom distributed more than 7 million free and subsidized CFLs to replace incandescent bulbs. Approximately 50% were distributed on the same basis as the 3-million project at low-cost housing areas, and the remaining 50% will be offered to middle-and-high income consumers, through traditional retail outlets at a subsidized price. Normal retail prices at present are about USD 1.40 and the subsidized price was approximately USD 0.80 cents.[53]

Private sector best practice examples:

Sasol, a South African mining, energy, and chemicals group has a goal of at least a 15% reduction in GHG emissions per ton of product by 2020 (from a 2005 baseline) with an intermediary reduction of 10% by 2015. Sasol intends to pursue GHG mitigation-related financial instruments such as CDM to reduce their carbon footprint.

The company spent ZAR 100 million (US$ 13.45 million) in 2008 on energy efficiency measures. Expenditure covered costs for compressor upgrades (which account for 330,000 tpa GHG reductions), a heat recovery project (30,000 tpa reductions), and reduction of electricity use of 40-80 MW. The company has recently approved ZAR 4800m in capital expenditures until fiscal year 2012 on a new 280 combined gas turbine that will initially be fueled by natural gas, and further steam turbine and compressor upgrades. Further GHG emissions savings efforts are expected through the reduction of flares and waste heat recovery projects. Costs for these measures are estimated to be ZAR10 billion through 2015.

A new energy division has been established at Sasol to identify other energy efficiency improvements and to explore further cleaner energy options. This is part of an overall commitment to a 15% energy intensity improvement target by 2015 (2000 baseline).

[51] (Glazewski 4)
[52] (World Resources Institute)
[53] (World Resources Institute)

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