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Resource Efficient Greening of Industry Initiative for Pakistan

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CONTENTS

ABSTRACT

The proposed Resource Efficient Greening of Industry (REGI) initiative has the potential to be a new and significant component within a comprehensive and integrated strategy for resource and environmental management in the manufacturing sector of Pakistan. Its objective would be to kick start the process of decoupling the use of resource inputs used in production processes, primarily energy, from industrial output. To do so, the REGI initiative would require setting goals and specific targets for resource efficiency, adopting best environmental practice for resource use and shifting industry to the extent feasible to new and renewable energy. More importantly, it would be an industry driven effort with industry associations committing in negotiated agreements to decouple resource use and industrial output.

There are several Pakistani environment and energy laws and sub-laws that have the potential to force a shift to a more resource efficient and low carbon manufacturing sector. However, these laws and sub-laws have resulted in overlapping mandates and weak (if any) coordination among the implementing institutions. More importantly, these laws and sub-laws, plans and strategies are missing specific resource efficiency targets for the manufacturing sector and sub-sectors, programs to support the manufacturing sector achieve targets and programs to monitor progress in meeting specific targets.

There are several recently completed and on-going donor funded programs building capacity in various institutions to deliver resource efficiency advice and services to the manufacturing sector. However, these programs operate as single-purpose rather than multi-purpose efforts. Moreover, they are failing to create sufficient demand for services to improve overall resource efficiency (specifically energy) and to encourage the use of new and renewable energy resources, both of which are needed to reduce the release of greenhouse gases.

Several Asian countries are implementing programs to decouple energy use and industrial output, most often a 20 % decoupling from a business as usual scenario. The programs reviewed in this document are those of China, India, Indonesia, Japan, Malaysia, Thailand and Vietnam. No country, either developed or developing, has a program with specific targets for decoupling water, materials or chemical use from industrial output.

The proposed REGI initiative would consist of the following components--a goal and associated rationale for decoupling resource use (initially energy) and industrial output in order to move to a low carbon manufacturing sector, quantified sector and sub-sector targets for decoupling resource use (energy, water, raw materials and chemicals), a generic approach for integrating sub-sector resource efficiency targets into sector development plans, government programmes to assist industry in meeting targets, information dissemination and a comprehensive monitoring and evaluation scheme.

The Government of Pakistan (GOP) needs to take several actions to turn the proposed REGI initiative into a reality. Higher priorities actions would be (i) setting specific numerical targets for decoupling resource use and industrial output; (ii) involving business associations in setting sub-sector decoupling targets and getting their commitments to meet the targets for largest enterprises and (iii) finalizing a data base on resource use in order to monitor progress in meeting targets.

LIST OF ACRONYMS

CP	Cleaner Production
EERP	Thailand 20 Year Energy Efficiency Development Plan (2011-2030
ENERCON	National Energy Conservation Centre
FYP	Five Year Plan
GOP	Government of Pakistan
IFC	International Finance Corporation
ktoe	Kilo Tons of Oil Equivalent
kWh	Kilo-Watt Hours
MVA	Manufacturing Value Added
NPO	National Productivity Organization
OECD	Organization for Economic Cooperation and Development
REGI	Resource Efficient Greening of Industry
TOE	Ton of Oil Equivalent

1. INTRODUCTION

In the 1970s environmental management strategies focused on pollution reduction of industrial wastes using end-of-pipe pollution control technologies. Starting in the 1980s there was an increased recognition that a combination of pollution control and prevention would be a more cost-effective approach to pollutant reduction than pollution control alone. Pollution prevention (cleaner production) efforts encourage plants to first reduce inputs to production processes as a way to reduce costs and at the same time minimize the amount of waste that needs to be neutralized by end-of-pipe pollution control technologies.

Beginning in the 1990s, environmental management initiatives became more comprehensive with additional attention focused on reduction of production inputs as a way to reduce the demand for natural resources. One was the Factor Four, whose objective aims at halving resource consumption, while doubling welfare, thus improving the ratio of welfare to material input, i.e., eco-efficiency (von Weizsacker et al, 1997).[1] Another was Factor 10, which called for reduction of resource use on average by a 10:1 ratio (Schemidt-Bleck et al 1999). A review of these proposals and various country initiatives in the early 2000s found that in spite of the potential of these and other initiatives, national governments had implemented only a few input oriented resource management policies (Luken and Sedic, 2002).

Ten years later, primarily due to the need to reduce greenhouse gases, increasing attention is being paid to the imperative of stronger input oriented resource policies, particularly those focused on efficient energy use and increased availability of renewable energy resources. These policies are viewed as needed not only for environmental protection (vis a vis climate change) but also for energy security and enhanced economic competitiveness.

The UNIDO International Conference on Green Industry Asia and its associated Manila Declaration in September 2009 reported on the extent to which most countries in the region recognized and some were implementing policies aimed at making a transition to a resource efficient and low carbon manufacturing sector (UNIDO, 2009). The conference reinforced the targets for the region put forth in the 2005 Ministerial Conference on Environment and Development in Asia and the Pacific; these targets were for improved environmental

[1] An update and expansion of the book was published in 2010.

sustainability, environmental performance and environment as a driver and opportunity for economic growth and development. The 2009 Conference also stressed the need to promote long-term and ecologically sustainable development patterns by integrating environmental and development policies.

At this conference UNIDO launched its Green Industry Initiative that aims to enhance capacity in industrial support institutions to provide assistance to enterprises and entrepreneurs in all aspects relating to the greening of industry. A major thrust of the initiative is to support countries in their efforts to accelerate the decoupling of resource use (energy, water, raw materials and chemicals) and industrial output and to reduce industry's impact on the local and global environment.

At this Conference, UNIDO split its Green Industry Initiative into two major activities – greening of industry and green industry – a distinction that will be used to narrow the scope of the proposed initiative.

- *Greening of Industry* is a two-pronged endeavor. One prong is about improving the efficiency of materials and energy use in industrial production and the other prong is about reducing industry's impact on the local and global environments.
- *Green Industry* is the creation of new green industries to deliver environmental goods and services.

Building on the outcome of the first two Green Industry conferences (held respectively in Manila in 2009 and Tokyo in 2011), the third Green Industry Conference (China in 2013, focused on scaling-up and mainstreaming the Green Industry Initiative through a global, high-level, multi-stakeholder action partnership, known as the Green Industry Platform. The 2013 Conference reaffirmed the significance of the Green Industry Platform in promoting partnership and cooperation for concerted action on those central concerns. The Conference participants stressed the need for inter-sectoral cooperation, active partnership among stakeholders and the creation of a level playing field for all enterprises. Participants agreed on the importance of scaling up investments for green industry, as well as the replication of known good practices and monitoring towards green industry targets using appropriate indicators.

This paper, a proposed REGI initiative in Pakistan, would be the second UNIDO initiative in the region (the first being Vietnam) to cooperate with a national government to

formulate a follow-up initiative within the larger context of UNIDO's Green Industry Initiative for Sustainable Industrial Development (UNIDO, 2011). The larger context, as stated about, is a comprehensive and integrated strategy for resource and environmental management in the manufacturing sector. Within this context, this paper focuses on only one of the two prongs of greening industry, i.e., improving resource efficiency (initially energy) in the manufacturing sector because this prong is relatively underdeveloped in Pakistan compared to the one for reducing industry's environmental impact.[2] Still it must be acknowledged that even with the well articulated national legislation and institutional framework for industrial environmental management, there has been only a limited reduction of environmental pollutants. Over the years several studies have proposed changes in the framework to make it more effective, but few of these changes have been adopted (Annex A). Nor does the paper investigate the other major activity within UNIDO's Green Industry Initiative, i.e., the need to develop an environmental goods and service sector.

The paper consists of eight sections:

1. Introduction;
2. Energy use and efficiency potential in the industrial sector;
3. Legislative and institutional arrangement for promoting energy efficiency;
4. Donor programs that have initiated energy efficiency audits;
5. Overview of other country efforts to increase resource efficiency, essentially those efforts focused on decoupling energy use and industrial output;
6. Proposed program for a resource efficient greening of industry (REGI) initiative in Pakistan;
7. Next steps for implementing the initiative; and
8. Conclusions.

[2] Though there are several definitions of energy efficiency, each with its respective strengths and weaknesses, most reports as well as this one use a measure of energy intensity or its inverse, energy productivity.

2. ENERGY USE AND EFFICIENCY POTENTIAL IN THE INDUSTRIAL SECTOR[3]

2.1 INDUSTRY

Pakistan's manufacturing sector accounted for about 25% of GDP (with the textile sub-sector contributing the most, about 25% of Manufacturing Value Added (MVA)) in 2011 (UNIDO, 2013). Other significant manufacturing sub-sectors are chemicals and chemical products (14%), cement (8%), iron and steel (4%) and pulp and paper (3%).

Total industrial energy consumption amounted to 15.03 million tons of oil equivalents (TOE) in FY 2011 which was a decrease from 16.8 million TOE in FY 2008. (Ministry of Petroleum and Natural Resources, 2013) Consumption of natural gas by the industrial sector was 7.8 million TOE, of oil was 1.4 million TOE, of coal was 4.1 million TOE (consumed only in cement and brick industry) and of electricity 1.8 million TOE.

2.1.1 TEXTILE SUB-SECTOR

The textile sub-sector consists of approximately 520 mills located mainly in Punjab and Sindh provinces. It accounts for a 17% share in total industrial energy consumption (2.95 million TOE) and utilizes electricity (16%) and natural gas (82%) as its main energy sources. The remaining 2% is oil, which is utilized as a backup energy source to natural gas. It should be noted that 70% of the total electricity requirement of the textile sub-sector is met by natural gas-based 'captive' generation and the remainder is supplied by the power utilities. Most of the textile sub-sector in the country is privately-owned, and operates in a competitive local and international market environment. The GOP reports that there are no public subsidies provided for the energy used by the sub-sector; it procures fuel at market prices from local sources.

Due to escalating energy outages and rising energy costs, the textile sub-sector faces significant competitiveness challenges in local and international markets. Energy efficiency improvement is needed to help stimulate the future growth of Pakistan's textile sub-sector. Thermal energy savings potential in textile sub-sector could be between 11-22% and that of electricity between 4-7% (technically realizable savings). The total realizable energy savings potential (by FY2019) is estimated at 339,000 TOE (Table: 2.1).

[3] Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water and gas.

Table:2.1 Energy Consumption, Realizable Energy Savings and Required Investment							
Sub-sector	**Energy Consumption ('000 TOE)**				**Realizable EE Potential ('000 TOE)**	**Investment Required (USD million)**	**Payback Period (Yrs)**
	Fuels	**Electricity**	**Total FY2008**	**Total FY2019**			
Iron and Steel	610	215	825	1,276	21	25	1.1-1.8
Pulp and Paper	1,197	47	1,244	2,517	170	70	1.2-2
Textile	2,519	433	2,952	5,977	339	109	1.2-2.9
Cement and Kilns	5,852	0	5,852	11,933	476	309	1.9-2.8
Other Industry	4,929	988	5,917	9,999	977	1,755	0.9-2.9
TOTAL:	**15,107**	**1,683**	**16,790**	**31,702**	**1,983**	**2,268**	
Source: Own elaboration based on data in ADB TA-7060 Pakistan Sustainable Energy Efficiency Development Program (2009)							

2.1.2 OTHER SUB-SECTORS

In addition to textiles, iron and steel, pulp & paper and cement & kilns are significant energy using sub-sectors requiring support and guidance on energy efficiency.

The *iron and steel* sub-sector consists of about 650 steel mills of different sizes, with a total product output of 4.6 million tons. The annual demand for iron and steel products in Pakistan has been in the range of 5 million tonnes recently, resulting in a gap between demand and installed capacity that is met by imports. Of the installed capacity, the public sector accounts for 1.1 million tons of installed capacity, with the remainder in the private sector. The private sector steel industry consists primarily of small- and medium-scale production units (steel re-rolling), where the penetration of energy efficient technologies is relatively low. Induction furnaces installed in the private sector have an average specific electricity consumption of 650 kWh/ton. There appears to be scope for reducing this consumption by 8% to 600 kWh/ton, with a $8.8 million investment for the entire industry. Natural gas is mainly used in the re-rolling process that has an efficiency improvement potential of 20%.

The *pulp and paper* sub-sector consists of about 44 manufacturing units of various products and with capacities ranging from 20 to 120 tons per day. The paper sub-sector is mainly located in Punjab and Khyber Pakhtunkhwa provinces. About two-thirds of companies are operated at efficiency levels below international standards and benchmarks.

The *cement* sub-sector consists of 24 cement manufacturing units. Cement production has gradually increased from 8.89 million tons in 1990 to 44.77 million tons in 2013. As of 2013, the capacity utilization was about 75%.

The *brick manufacturing* sub-sector consists of approximately 11,000 brick kilns of which about 5,000 are located in rural areas at the periphery of major cities in Punjab province. The sub-sector employs the traditional Bull's Trench Kiln technology that uses coal and some undesirable fuels including hospital waste, old tyres, plastic waste etc. This sector is highly energy inefficient and is responsible for huge amounts of undesirable emissions. It is an informal and undocumented sector that employs around two million workers.

3. INSTITUTIONAL ARRANGEMENTS

In 1985, a detailed National Energy Conservation Plan was drawn up and in 1986 the National Energy Conservation Centre (ENERCON) was established to serve as the Government's focal implementing agency. In 1992, ENERCON prepared the Pakistan National Conservation Strategy and Plan of Action 1993-1998. ENERCON remains severely under-resourced; it has functioned mostly on project-based donor assistance and lost most of its key technical staff, professional facilities, business processes, and knowledge base over time. Moreover, it has not been able to commercialize energy efficiency activities effectively. It has been assigned to various ministries and until recently was under the Ministry of Environment, which was dissolved in 2011.

Presently, the National Energy Conservation Policy approved in 2006 provides broad guidelines for enhancing end-use efficiency in various energy consuming sectors of economy. To achieve the goals defined in these policies, the Government has adopted the *EE Sector Roadmap (2010-2019).*For the industry sector, the policy defines short, medium and long term measures for meeting overall policy objectives and goals.

The Planning Commission, which prepares strategic plans and policies, has a role in formulating policy, devising public sector efficiency programs, and approving and monitoring public investment projects. The role of the energy wing of the Planning Commission, the coordinating unit for government budget appropriations for energy projects, should be re-evaluated with regard to mainstreaming energy efficiency into integrated energy planning.

The National Productivity Organization (NPO) is an autonomous organization under the Ministry of Industries and Production that promotes productivity consciousness and quality initiatives in compliance with international best practices. Given the price hikes in fossil fuels and big gap in demand and supply, NPO initiated an energy efficiency program in 2008. The NPO works as a Liaison Office of Asian Productivity Organization for the promotion of "productivity & quality" in various sectors of the economy. NPO's programmes include training, benchmarking, energy efficiency and auditing and performance and quality awards. NPO is the main executing agency for the recently funded UNIDO Global Environment Facility project on renewable energy and energy efficiency.

What is missing in the current institutional arrangements is an apex ministry, such as the proposed Ministry of Energy, which would have both administrative and technical capacity and be responsible for formulating energy efficiency policies. It would set national and sector targets for improving energy efficiency, raise awareness about the benefits of energy efficiency among market players (industries, consultants, equipment suppliers and banks) and offer financing incentives and mechanisms. It would gather timely data working with other government units on industrial sub-sector specific energy consumption and efficiency that are essential for policy formulation. (Additional information about potential policies and programs can be found in the sources cited in Annex B.)

4. ENERGY EFFICIENCY AND CLEANER PRODUCTION PROGRAMS

The concept of energy efficiency and Cleaner Production (CP) have been introduced into Pakistan's industrial sub sectors like leather, textile processing, pulp and paper, sugar and oil and gas over the past fifteen years through the implementation of different CP initiatives. Some major initiatives are described in the following paragraphs.

NPO: The NPO with only GOP funding carried out the most extensive and solely focused program for industrial energy efficiency in the country between 2008 and 2013. It's Center for Energy and Environmental Management conducted energy audits for a fee in approximately 250 textile mills and 67 steel mills. The audits resulted in between 5 and 16% reductions in energy consumption at no or little cost to the participating mills.

Cleaner Production Centers: There are three CP centers in Pakistan—Cleaner Production Center Sialkot, Cleaner Production Institute (CPI) and National Cleaner Production Centre Foundation. Together they have completed approximately 300 cleaner production audits with a focus on textile mills and leather tanneries over the period 1998 to 2013. While the focus of the audits is on reduction of water and air pollutants, the audits identified many options for reducing energy consumption that participating plants implemented at considerable cost savings.

Promotion of Energy Efficient Boilers: The International Finance Corporation and CPI have started the first initiative for the promotion of energy efficient boilers in one industrial estate (20 progressive units) in Punjab.

Cleaner Technology Project for Textile Industry 2004-2007: The All Pakistan Textile Mills Association drew on CPI to provide CP services to almost 100 textile mills in Lahore, Karachi and Faisalabad.

Program for Industrial Sustainable Development -1: CPI worked with the Pakistan Pulp, Paper and Board Mills Association to implement cleaner technology measures, which among other things improved energy efficiency in the sub-sector.

Program for Industrial Sustainable Development -2: CPI provided cleaner technology advice to 125 mills in Lahore, Karachi and Faisalabad during 2007-2010. The project was extended to cover the period 2010-2013 and delivered cleaner technology advice on both

environment and energy to the textile, sugar and textile spinning sub-sectors. It also covered three industrial estates (Quaid-i-Azam, Sundar and Korangi) as models and provided project services to selected progressive industrial units. Besides providing traditional technical services in the areas of energy efficiency and CP, CPI advised the industrial estates about developmental and sustainability matters.

Sustainable and Cleaner Production in the Manufacturing Industries of Pakistan (2007-2013): Funded by the European Union and implemented by CPI, Switch Asia has been developed in response to the need for cleaner and more energy efficient industrial production in Asia. The program targets SMEs, which are important sources of employment and in the aggregate seriously impact the environment. The specific objectives are to develop a model for Sustainable Production through the implementation of a range of energy and resource efficiency initiatives in the textile and tannery sectors in Pakistan with the potential to adapt these initiatives to other sub-sectors (sugar, pulp and paper, steel rolling etc.)

Unfortunately, these programs are focused almost exclusively on supplying resource efficiency services and are failing to create sufficient demand for these services. More specifically:

- There are no significant donor-funded programs that are building institutional capacity to create a demand driven national program on resource efficiency (more specifically energy) for the manufacturing sector.
- The on-going donor projects for CP, energy and environmental management work with industry without any effort to coordinate and integrate their service delivery to industry participants.
- There appears to be insufficient effort to involve sub-sector associations in sub-sector wide sharing of resource efficiency information with all their members. In fact, many of the sub- sector associations are unaware of the productivity benefits to be gained from a resource efficiency program.
- Also there appears to be little if any effort to involve industrial park management authorities in initiatives to start resource efficiency or more limited energy efficiency programs for the plants located within their parks. Again, most of the industrial park

management authorities are unaware of the productivity benefits to be gained from a resource efficiency program. Moreover, most of these authorities appear not to be interested or concerned about how firms within the parks are dealing with the pollutants generated by their production processes.

- Most programs focused on energy efficiency are not building capacity to recognize the importance of reduced water and material use as one of the most cost-effective approaches for reducing energy use as well as pollutant generation.

5. RESOURCE EFFICIENT GREENING OF INDUSTRY PROGRAMS IN SEVEN ASIAN COUNTRIES[4]

This section describes resource efficient greening of industry programs in seven Asian countries – Peoples Republic of China, India, Indonesia, Japan, Malaysia, Thailand, and Vietnam. In addition to these country overviews, a summary description of energy efficiency programs in three countries (Brazil, China and India) can be found in Annex C.

5.1 PEOPLES REPUBLIC OF CHINA

From 1980 through 2001 energy intensity in China fell by 60 % even though China was the world's largest exporter of embodied energy in the form of manufactured products. However, from 2002 through 2005 there was no further improvement. In response, China's energy efficiency policy has again become very aggressive by including an efficiency component in its industrial structural adjustment program and launching two energy conservation and efficiency programs.

The 11th Five-Year Plan (FYP), 2006-2010, set an energy reduction target of 20% and a pollutant reduction target of 10% by 2010 against a 2005 baseline. Pollutant reduction targets included several water pollutants as well as sulfur dioxide, nitrogen oxides and particulate matter but not carbon dioxide (CO_2). It calls for closure of small plants and the phase-out of inefficient, outdated capacity in high energy-consumption industries, including electricity, iron and steel, electrolytic aluminum, ferroalloys, calcium carbide, coking, cement, coal, plate glass, pulp and paper, alcohol, mono-sodium glutamate and citric acid. Specific targets for each of these sub-sectors are outlined in the FYP. As a result, the National Development and Reform Commission reported the closure in 2007 of 47 million and 38 million tons of inefficient production capacity in the iron foundry and steel mill sub-sectors respectively and the China Cement Association reported the closure of 140 million tons of inefficient production in the cement sub-sector in the same year. (Zhou *et.al.* 2010).

While final data are not yet available, China likely fell short of meeting its 11th FYP energy intensity target of 20%, instead achieving in the range of 19.1%. There is no doubt, however, that much was learned though efforts to improve efficiency nationwide. Many changes were made to how such national targets are enforced at the local level, including the

[4] The information about country programs was compiled in 2008. The only updated information (2012-2013) is for China and Malaysia.

incorporation of compliance with energy intensity targets into the evaluation for local officials (Lewis, 2011).

The 12th FYP (2011-2015) builds directly on the 11th FYP energy intensity target and its associated programs, setting a new target to reduce energy intensity by an additional 16 % by 2015. While this may seem less ambitious than the 20 % reduction targeted in the 11th FYP, it likely represents a much more substantial challenge. It is likely that the largest and least efficient enterprises have already undertaken efficiency improvements, leaving smaller, more efficient plants to be targeted in this second round. (Lewis, 2011).

Notable progress towards achieving the 12FYP target has already been reported. In the last FYP, the government closed down many inefficient industries, and many industries retrofitted their factories to improve energy efficiency. Many people think that it is becoming more and more difficult to further reduce energy consumption beyond these early achievements. Despite these challenges, the new data shows a 2 % intensity reduction in the first year of 12^{th} FYP. This is considered significant progress when compared with the reduction made in the first year of 11^{th} FYP, which was only 1.8 %.

The Ten Key Projects program was important for reducing the energy intensity in GDP by 20% between 2005 and 2010. The most relevant projects for industry were renovation of coal-fired industrial boilers, district level combined heat and power and oil conservation and substitution (Price, 2010).

The Top-1000 Energy Consuming Enterprises program required the 1,000 highest energy consuming enterprises to improve their energy efficiency. These enterprises account for approximately 47% of total industrial sector energy consumption and 33% of total energy consumption in China. The Government provided guidance to the enterprises, calling on them to significantly reduce their energy intensity (energy use per unit of production) with the goal that energy intensity should reach the level of advanced domestic production and that some enterprises attain either international or industry-advanced levels of energy intensity. The implementation plan further stipulated that the enterprises within the Top 1000 should realize savings of 100 million tons coal equivalent between 2006 and 2010 from their expected 2010 energy consumption. The program involves signed energy conservation agreements with local governments and quarterly reporting on their energy consumption by fuel type to the national government. Even though the program was designed and implemented rapidly, it appears that

depending on the growth rate, it contributed to a 10 % to 25 % of the savings required to meet the 20% reduction goal set in the 11th FYP (Price, 2010).

Under preparation is a new "Top 10,000" program, which is modeled after the Top 1,000 program but adds an order of magnitude of companies to the mix. But as the number of plants grows, so do the challenges of collecting accurate data and enforcing targets. (Lewis, 2011).

Additional information about China's energy efficiency program can be found in Annex D.

5.2 INDIA

The Energy Conservation Act (2001) empowers the central government and in some instances state governments to take steps in various sectors to achieve an estimated 20% reduction in energy intensity.

In regard to industrial energy efficiency, the Bureau of Energy Efficiency is required to designate energy intensive industries, other establishments and commercial buildings as designated consumers and to establish and prescribe energy consumption norms and standards for designated consumers. The designated consumers in turn are required to designate or appoint a certified energy manager in charge of activities for the efficient use of energy and its conservation; get an energy audit conducted by an accredited energy auditor in a specific and timely manner; furnish information with regard to energy consumed and action taken on the recommendation of the accredited energy auditor to the designated agency; comply with energy consumption norms and standards, and if not done, to prepare and implement schemes for the efficient use of energy and its conservation.

Nine sub-sectors were identified as designated consumers which include thermal power, fertilizer, cement, iron and steel, chlor-alkali, aluminum, railroad production units and workshops, textile and pulp and paper. All plants in six of those sub-sectors using 30,000 or more metric tons of oil equivalents were designated consumers; for chlor-alkali the cut-off was 12,000 metric tons of oil equivalents, for aluminum it was 7,500 and for textiles it was 3,000. There are currently 714 designated consumers.

There is also a separate program for 25 Small and Medium Enterprise Clusters. The Bureau is working with designated state agencies to initiate diagnostic studies in the clusters and

preparing cluster specific energy efficiency manuals and other documents to enhance energy conservation in Small and Medium Enterprises (Ministry of Power, 2008; Bureau of Energy Efficiency, 2009).

5.3 INDONESIA

There is currently no national law or program that sets a specific target for decoupling energy use and industrial output, as there is in China and Thailand. However, more recent regulations (2006 and 2009) and the new Energy Act (2007) suggest that Indonesia is moving in the direction of setting specific decoupling targets.

Aware of the problems related to energy supply and utilization and the need for policy guidance, the Government through Presidential Regulation No 5/2006 formulates a National Policy on Energy. It aims at achieving energy elasticity less than 1 (relative decoupling) for the economy as a whole in 2025 and gaining an optimum energy resources mix in 2025.

The Energy Act No. 30 (2007) reinforces the Government's vision to guarantee national energy security through the establishment of appropriate national energy policies, proper instruments, law enforcement related to the national energy policy, use of environmentally sound energy sources and technologies and the establishment of the National Energy Council. The Energy Act puts an emphasis on significant energy conservation issues such as involving all parties in the process (national government, regional governments, business entities and communities) and recognizing the importance of incentives for energy consumers to conserve energy and of disincentives for those that fail to do so.

Government Regulation No. 70/2009 provides more guidance for implementation of the Energy Act. The provisions most relevant for industry are:

- The Government should implement energy conservation measures based on a five-year National Energy Conservation Master Plan;
- Energy conservation activities should involve all stakeholders including the national government, regional governments, business enterprises and society. Some of the partnership activities include free of charge energy audits (283 industries and buildings already undertaken between 2003 and 2009) and 160 audits targeted for 2010;

— On the demand side, mandatory energy management is required from energy consumers that use more than 6000 tons of oil equivalents (toe)/year. Concretely these consumers have to designate energy managers, develop an energy conservation program, perform periodic energy audits, implement energy audit recommendations and report yearly on energy conservation implementation to the Government;

5.4 JAPAN

In Japan's Keidanren Voluntary Action Plan on the Environment, which commits to stabilizing greenhouse gas emissions of Keidanren members at 1990 levels by 2010, numerical savings targets were set voluntarily by 38 sectors in 1997. The number of sectors has grown to 58, including 35 from the industrial and energy-converting sectors. Baseline data for 35 industries in the industrial and energy-converting sectors shows that their CO_2 emissions declined absolutely by 0.5% between 1990 and 2004.

A large part of the success of the Keidanren Voluntary Action Plan, which sets emissions or other related targets such as energy intensity, at the sector level and not by individual firms, is said to be based on distinctive features of Japanese industrial policies. First, Keidanren, the most prominent business association in Japan, played a major role in the formation of the plan. Second, there are clear goals based on a long-term national energy plan that includes policies on energy conservation, energy security and structural change of the economy. Third, the plan is not truly voluntary despite its name because of the possibility of regulation in case there is failure to achieve targets. (Wakabayashi and Sugiyama, 2007).

5.5 MALAYSIA

Only recently has Malaysia begin to build on the positive results of the completed GEF financed Malaysian Industrial Energy Efficiency Improvement Project (2000-2009), which demonstrated the potential for improving industrial energy efficiency. The Tenth Malaysia Plan (2011-2015) envisages intensifying energy efficiency initiatives through the implementation of various measures such as guidelines, standards for appliances, implementation of green technologies, incorporation of EE provisions in the building by-laws, promotion of energy efficient and high value added industries and the introduction of the National Energy Efficiency Master Plan (2011-2020), as well as the promotion of EE in industry, such as "increasing the use

of energy efficient machineries and equipment such as high efficiency motors, pumps and variable speed drive controls." The Plan's target is to reduce electricity consumption by 10% in the year 2020 (7.3 million tonnes of oil equivalent, TOE), compared to a 'business-as-usual' scenario.

The National Energy Efficiency Act is expected to be adopted in 2014 and will further foster the efforts by industry and other sectors to reduce energy consumption, not only of electricity but also thermal energy use. The Act would institute a legal and regulatory framework for efficiency and conservation, the establishment of a centralized agency for energy efficiency and the development of a funding mechanism including the establishment of a revolving energy efficiency fund (UNIDO, 2013b).

5.6 THAILAND

In the past 20 years (1990-2010), energy consumption in Thailand continuously increased at an annual average rate of 4.4%. At present, energy consumption is 2.3 times the amount it was in 1990; the growth rate has been in line with the average annual economic growth rate of 4.5%. In particular, energy consumption growth rates in the manufacturing industry and commercial building sectors are much higher than the GDP growth rate, i.e. 3.0 and 3.7 times respectively, compared with consumption in 1990 (Thailand, 2010).

In the next 20 years, if there is no energy conservation or energy efficiency improvement measures or no significant reform of the industrial structure and transportation system, energy demand under the business-as-usual scenario will increase from 71,000 ktoe/year at present, to 151,000 ktoe, or about 2.1 times the present amount, accounting for an annual average growth rate of 3.9%, under the assumption that the GDP will grow at an annual average rate of 4.2%. The demand in the industrial and commercial sectors will still increase at a higher rate than other sectors.

Thailand has formulated a 20 Year Energy Efficiency Development Plan (EEDP) (2011-30) with a target to reduce energy intensity by 25% in 2030, compared with that in 2005, or equivalent to reduction of final energy consumption by 20% in 2030, or about 30,000 thousand tons of crude oil equivalent. The economic sectors with priority for undertaking energy conservation are the transportation sector (13,400 ktoe in 2030) and the industrial sector (11,300 ktoe in 2030). Specifically:

- The EEDP is aimed at reducing energy elasticity (the percentage change in energy consumption to achieve 1% change in national GDP) from an average of 0.98 in the past 20 years to 0.7 in the next 20 years.
- Implementation in pursuance of the EEDP will result in cumulative energy savings at an average of 14,500 ktoe/year, which is worth 272 billion baht/year, and cumulative CO2 emission reductions at an average of 49 million tons/year.
- Both mandatory measures, via rules and regulations, and supportive/promotional measures will be introduced. Major mandatory measures include the enforcement of the Energy Conservation Promotion Act, B.E. 2535 (1992), as amended up to No. 2, B.E. 2550 (2007), the establishment of Minimum Energy Performance Standards (MEPS), and energy efficiency labeling.
- Emphasis will be placed on measures which will bring about market transformation and energy consumers' behavioral change, by enforcing energy efficiency labeling for equipment/appliances, buildings and vehicles so as to provide options for consumers.
- Large-scale energy businesses, e.g. those in the electricity, oil and natural gas industry, will be required to implement energy conservation promotion measures to encourage their customers to reduce energy use by a specified minimum standard (Energy Efficiency Resource Standards: EERS), instead of allowing such measures to be voluntarily undertaken as previously practiced.
- Assistance measures, both financial and technical, will be provided for SMEs, particularly the provision of funding via the Standard Offer Program and technical assistance via the Energy Efficiency Resource Standards.
- As the use of motor vehicles is projected to continuously increase in the future, this EEDP includes measures promoting the use of highly energy-efficient vehicles, e.g. mandatory energy labeling, enforcement of MEPS and tax measures.
- Responsibilities for energy conservation promotion will be the responsibility of all sectors of society. The private sector will become an important partner and greater roles will be entrusted to local administration organizations. In addition, government agencies must set a good example of energy conservation practices.

5.7 VIETNAM

The first law that focused on resource input management was the Law on Water Resources (1998). More recently Vietnam adopted the Law on Energy Conservation and Efficient Use (2010). These laws as well as other more generic laws, sub-laws and strategies appear to be sufficient to force a shift to a more resource efficient and low carbon manufacturing.

Unfortunately these laws, sub-laws and strategies have resulted in overlapping and vague mandates and weak (if any) coordination among the implementing ministries. More significantly these laws and sub-laws, plans and strategies are missing specific resource efficiency targets for the manufacturing sector and sub-sectors, programs to support the manufacturing sector achieve targets and programs to monitor progress in meeting specific targets.

More specifically:

- The National Target Plan on economical and efficient use of energy calls for a 3% to 5% reduction of total national energy consumption in the period 2006 to 2010 and 5% to 8% in the period 2011 to 2015. However, there are no specific targets for various sectors like manufacturing, transport, commercial building etc. Nor are there sector specific plans on how these sectors should go about achieving reductions.
- Even though the laws and sub-laws on environmental protection and water call for issuance of pollutant discharge and water use licenses, which would be the basis of a national inventory, these licenses have not been issued in sufficient number. Consequently there is no at source monitoring inventory of water and pollutant discharge. The only nationally available information on pollutant discharge is an engineering estimate based on pollutant coefficients and employment.
- There is not yet a national energy use inventory for the manufacturing sector. The Institute of Energy is in the process of surveying approximately 700 establishments. The data being collected are incomplete because of limited reporting and a focus on electricity consumption rather than total energy consumption. A review of the first 500 plant reports indicates that less than 200 were complete and that even a smaller number were reasonably accurate.
- The price of coal used for electricity generation is only 50% to 60% of the cost of coal production, resulting in a cost of electricity that is lower than most other countries in the

region. This subsidy largely explains why the price of electricity in Vietnam is only $0.051 kWh compared to $0.06 kWh in Indonesia and Malaysia and $0.067 kWh in Thailand. This low cost is eroding one of the major incentives for energy conservation. Recently the Government has increased the price of coal to near market rates and is considering a major increase in the price of electricity of almost 5% (UNIDO, 2010b).

5.8 SUMMARY

In summary those countries with established decoupling programs (China and Thailand) have been more successful in achieving relative decoupling in the long term, 1990–2008, and in the short term, 2006–2008 than three of the four countries in the process of initiating them (Table 5.1). The anomaly is India, which has been relatively successful in decoupling energy use and industrial output in the period 1990–2008 and in the short term, 2006–2008, but is just now initiating an explicit decoupling program. It was not possible to identify which factors, such as a shift away from energy intensive sub-sectors in the composition of MVA, which would explain the relative success in energy decoupling. In fact, the share of energy intensive sub-sectors in total MVA increased from 40% to 50% between 1990 and 2008.

Table 5.1: Decoupling Estimates for Seven Asian Countries

GROUP	Relative Decoupling Indicator[5]		Absolute Decoupling Indicator[6]	
	1990-2008	2006-2008	1990-2008	2006-2008
World	-19	6	31	7
Asia (Excl China)	-20	1	21	4
Japan (OECD)	-29	-9	-16	-12
China	-66	-4	170	24
India	-47	-6	63	6
Indonesia	2	13	178	23
Malaysia	-5	3	250	12
Thailand	-14	-7	179	2
Vietnam	5	8	609	35

Source: International Energy Agency (2010a, 2010b) for energy use and UNIDO (2010c) for MVA

[5] RDI = [(Energy Use 2008/MVA2008) - (Energy Use 1990/MVA1990)]/(Energy Use 1990/MVA 1990)
[6] ADI = (Energy Use 2008-Energy Use 1990)/Energy Use 1990

Those countries with established programs (China and Thailand) have common programmatic features which have contributed to, but certainly do not account for all, of the success in decoupling. These programmatic features are: (a) a quantitative target for decoupling of energy use and industrial output (a percentage reduction in energy use compared to the energy use associated with the business as usual scenario), (b) a government program that offers financial incentives (loans and tax reductions) and imposes specific auditing and reporting requirements, and probably most important (c) involvement of the manufacturing sub-sectors in designing and implementing targets as they apply to individual enterprises. (See Altenburg, 2010; UNIDO, 2011 and UNCTAD, 2011 for the importance of dialogue between the government and private sector.)

Four countries are in the process of starting industrial energy decoupling programs, all of which lack some or all of these essential programmatic features. In the case of India, there are no financial incentives directly provided by the government; the only incentive is a "perform and trade" exchange between individual plants. Nor is there evidence of industry involvement in program design or setting decoupling targets In the case of Indonesia, the proposed program does not set a quantitative decoupling target (s) for the manufacturing sector and sub-sectors nor does it include specific tax incentives or rebates for achieving energy efficiency measures. In the case of Vietnam, the proposed program fails to set a quantitative decoupling target for industry, offer financial incentives and involve the manufacturing sector. Only recently has Malaysia begun to incorporate the three essential features — quantitative targets, government regulatory and support features and manufacturing sector involvement (Luken and Piras, 2011).

6. PROPOSED PROGRAM FOR REGI INITIATIVE IN PAKISTAN

A national REGI initiative would consist of the following components -- a goal and associated rationale for moving towards decoupling resource use from industrial output in order to move towards a resource efficient and low carbon manufacturing sector; quantified sector and sub-sector targets for decoupling specific resource uses (energy, water, raw materials and chemicals) and industrial output, a generic approach for integrating sub-sector decoupling resource use targets into sector development plans, government programs to assist industry in meeting targets, information dissemination and a comprehensive monitoring and evaluation scheme. The proposed REGI initiative would complement current efforts by:

- Setting specific decoupling targets for each resource (energy, water, raw materials and chemicals) first for the manufacturing sector and then for several resource intensive manufacturing sub-sectors. Its implementation would initially focus on decoupling energy use and industrial output while recognizing the importance of decoupling material and water use;
- Focusing on the more resource use intensive plants in each sub-sector;
- Involving subs-sector business associations in setting sub-sector decoupling targets for resource use intensity and requiring them to enter into voluntary agreements to meet agreed upon targets;
- Requiring, where feasible, the use of new and renewable energy sources;
- Attempting, and of great importance for operational efficiency, to integrate all resource use and environmental compliance targets into long-term comprehensive operating permits for industrial enterprises.

6.1 RATIONALE FOR A REGI INITIATIVE

Three compelling reasons underpin the need for Pakistan to decouple energy use as well as other production inputs from industrial output -- to enhance the productivity of the industrial sector by reducing the cost of energy used in production processes; to improve energy security by reducing the need to import energy resources; and to reduce the generation of pollutants, both conventional pollutants such as particulate matter and sulfur dioxide, and of global pollutants

(specifically GHGs). There is sufficient evidence from global studies and from the Pakistani perspective that underlie these reasons:

Productivity*:* Recent research has focused on the benefits to be derived from energy efficiency especially from a macroeconomic perspective. Many empirical studies agree that energy efficiency generates positive outcomes such as higher output, competitiveness (Taylor et. al. 2008) and employment (IEA, 2009) as well as environmental improvement induced by lower energy bills (WEC, 2008) and sustainable production methods (World Bank, 2006). On-going research based on an econometric analysis using firm level data in 24 developing countries (including Pakistan) suggests a robust relationship between firm level productivity (or technological change) and energy efficiency (Cantore et. al., 2011).

Energy Security: From a global perspective, longer-term risks to energy security are also set to grow**.** With stronger global energy demand, all regions are faced with higher energy prices in the medium to long term in the absence of concomitant increases in supply-side investment or stronger policy action to curb demand growth in all countries. The increasing concentration of the world's remaining oil reserves in a small group of countries – notably Middle Eastern members of OPEC and Russia – will increase their market dominance and may put at risk the required rate of investment in production capacity. OPEC's global market share increases in all scenarios – most of all in the Reference and High Growth Scenarios. The greater the increase in the call on oil and gas from these regions, the more likely they will seek to extract a higher rent from their exports and to impose higher prices in the longer term by deferring investment and constraining production. Higher prices would be especially burdensome for developing countries still seeking to protect their consumers through subsidies (IEA, 2007).

Pakistan is a net importer of crude oil and refined products. Oil production in Pakistan has fluctuated between 55,000 to 70,000 barrels per day since the 1990s. The country produced 62,000 barrels per day of oil in 2012. Oil consumption has grown over time and averaged 440,000 barrels per day in 2012. Pakistan currently has six oil refineries with a total crude oil distillation capacity of 186,000 barrels per day which run mostly on imported crude oil (EIA, 2013).

Dry natural gas production has grown by more than 70 percent over the past decade from 809 billion cubic feet in 2002 to 1,383 billion cubic feet in 2011, all of which was domestically consumed. Despite the growth of natural gas production, the country's demand is still

constrained. Pakistan currently does not import natural gas because it lacks the infrastructure. The country plans to build a liquefied natural gas re-gasification plant to relieve some pressure from its growing demand, although development efforts to build a terminal have moved slowly. Implementing REGI initiatives will be a step towards enhanced energy security in Pakistan.

Environment: Many of the policies available to alleviate energy insecurity can also help to mitigate local pollution and climate change, and vice-versa**.** In many cases, those policies bring economic benefits too, by lowering energy costs that would increase productivity – a "triple-win" outcome. An integrated approach to policy formulation is, therefore, essential. The right mix of policies to address productivity enhancement, energy-security and climate concerns depends on the balance of costs and benefits, which vary among countries. The most cost-effective approach would involve market-based instruments, including those that place an explicit financial value on CO_2 emissions. Regulatory measures, such as standards and mandates, will also be needed, together with government support for long-term research, development and demonstration of new technologies.

The urgent need to tackle local air pollution in Pakistan would undoubtedly continue to provide the primary rationale for further efforts to stem the growth in greenhouse-gas emissions. In terms of air pollution load, sulfur dioxide (SO_2) and particulate matter 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) are clear priorities owing to their significant share of total air pollutants. But from a hazard standpoint, PM_{10}, and $PM_{2.5}$ are a slightly higher priority than SO_2 as the impacts of particulate pollution on respiratory illness, chronic bronchitis and asthmatics is particularly severe in urban and heavily industrialized areas.

Fossil–fuel carbon emissions in Pakistan are growing rapidly. They have increased from 18.7 million metric tons in 1990 to 44.05 million tons in 2008. They stem from the burning of fossil fuels and the manufacture of cement. Carbon emissions from cement production have increased over the same time period from 1.0 to 5.3 million metric tons, increasing its share of total carbon emissions from 5.4 % to 12.0 % (Marland et al, 2010).

The CO_2 emissions (metric tons per capita) in Pakistan were reported at 0.97 in 2008, an increase of 0.19 metric tons per capita from 2002 levels (World Bank, 2009).

6.2 QUANTIFIABLE OBJECTIVES FOR DECOUPLING

The concept of decoupling, as defined by the OECD (2002), refers to the relative growth rates of environmental pressure and the economic activity with which it is causally linked. Decoupling occurs when the growth rate of an environmentally relevant variable, energy use in this case, is less than the growth rate of the economically relevant variable, industrial output in this case, over the same period of time. For the most part, however, the fundamental concern is not the relative but the absolute change in the environmental variable, since decoupling could occur but yet not be sufficient to keep economic activity within the limits of environmental standards. If industrial output displays a positive growth, then 'absolute decoupling' is said to occur when the growth rate of an environmentally relevant variable is zero or negative; that is, pressure on the environment is either stable or falling. 'Relative decoupling' is said to occur when the growth rate of the environmentally relevant variable is positive but less than the growth rate of industrial output. For more information on decoupling refer to the links listed in Annex B.

Relative rather than absolute decoupling of energy use in the manufacturing sector is the only realistic goal for developing countries given that even developed countries have not been able to achieve absolute decoupling of energy use and industrial output (Castellanos and Luken, 2008). Comparable data on the relative decoupling of water and material use and industrial output are not available for either developed or developing countries.

The experience of Pakistan to date in the relative decoupling of energy and growth indicates it occurred over the period 1990 to 2011 (Table 6.1). Although there has been no absolute decoupling in the period 1990 to 2011, there has been relative decoupling between energy use and MVA and between energy use and gross domestic product (GDP). Energy use did not increase as much as MVA or GDP as well over two shorter time intervals. (It was not possible to construct a table for water and raw material given the absence of data).

Table 6.1: Decoupling Estimates for Pakistan

Economic Unit	Relative Decoupling			Absolute Decoupling		
	1990-2008	1990-2011	2005-2011	1990-2008	1990-2011	2005-2011
GDP	-29	-16	-4	67	70	7
MVA	-23	-26	-9	23	24	5

Source: **IEA (2013) and UNIDO (2013c)**

The REGI initiative should include energy, water and material efficiency (intensity) and conservation (total use reduced) targets for the manufacturing sector that would contribute to meeting the sector's share of the national objective for decoupling that has yet to be set by the GOP. If it is not possible to set targets for water and material efficiency, these could be put forward at a later time. However, the target setting process should not lose sight of the potential for energy conservation that could result from reducing wasteful water and materials use.

6.3 LONG-TERM AGREEMENTS ON RESOURCE EFFICIENCY FOR SUB-SECTORS

The proposed REGI initiative would consist of implementation plans for sub-sectors rather than for the manufacturing sector as a whole. It is too difficult to formulate a cost-effective and responsive action plan for the entire manufacturing sector as is the case for development plans, which also have been formulated for sub-sectors rather than for the entire manufacturing sector. Sub-sector action plans with an initial focus on energy efficiency and conservation and to the extent possible for water and materials would consist of the following components:

- Resource efficiency targets set for sub-sectors;
- Targets incorporated into established or revised sub-sector development strategies that reflect a consensus of state owned, foreign direct investment and domestically owned enterprises; and
- A written long-term agreement between industry associations and the government on how and when targets would be achieved.

6.3.1 INITIAL TARGET SPECIFICATION

Targets are normally a given percentage reduction from the baseline scenario for each sub-sector. The targets are not necessarily uniform for each sub-sector and would be based on sub-sector specific energy efficiency potential studies. These targets would be set on an established inventory of economically viable measures that could be implemented in each sub-sector as done in the Netherlands (Gerritis and Oudshott, 2003) or on the general technology configuration in the sub-sector and level of best performance by existing and new plants as done in China (Price, 2005). Interestingly, both the well considered Dutch target and the hastily formulated Chinese target were a 20% reduction from the business as usual scenario.

6.3.2 SUB-SECTOR TARGET MODIFIED AS NEEDED

The baseline scenario specified in sub-sector development strategies (business as usual) would be modified to show the least cost (alternatively most profitable) composition of existing and new plants that will be needed to meet the decoupling target for a sub-sector. The modified composition should be reviewed in the light of productivity, employment and environmental implications. If these implications are unacceptable, then the percentage reduction and how it is allocated among existing and new plants could be revised by the sub-sector working group that would consist of industry and government representatives. The consensus scenario would specify the long term production estimates and the social, energy use and environmental outcomes.

6.3.3 LONG-TERM AGREEMENT ON SUB-SECTOR TARGET

Long-term agreements, often called voluntary or negotiated agreements, are essentially a contract between the government and industry with commitments and time schedules on the part of all significant enterprises in a sub-sector (OECD, 2003). These agreements typically have a long-term outlook, covering a period of five to ten years, so that strategic resource-efficiency investments can be planned and implemented. A key element of these agreements is that they focus the attention of all actors on resource efficiency, conservation and pollutant reduction goals and often result in the exchange of information among participating companies (Price, 2005; Hu, 2007; Eichhorst and Bongardt, 2009).[7]

6.4 GOVERNMENT SUPPORT PROGRAMS

Establishing supportive and harmonized programs for participating enterprises is necessary before launching a sub-sector plan to improve energy efficiency. Such programs will include financial incentives, technical assistance, rewards and publicity for enterprises that reach targets and perhaps penalties for failure to achieve targets. Financial incentives for investing in energy efficiency technologies and measures could include targeted grants or subsidies, tax relief, loans for investments in energy efficiency and partial risk guarantees for loans made by banks. Financial disincentives could include differentiated electricity and other energy sources

[7] The drafting of voluntary agreements needs to be done carefully. For example, an initial review of the Danish voluntary agreement on industrial energy efficiency revealed that it was an administrative nightmare, resulting in huge compliance costs for the government. It was redesigned as a consequence. Then there is the problem of free-riders in sub-sector agreements. OECD studies show that voluntary agreements should be used within a suitable mix of policy instruments rather than on their own to meet particular outcomes.

based on levels of energy efficiency with the more inefficient plants bearing a higher price, elimination of tax rebates for exports of energy-intensive products and penalties.

6.5 INFORMATION DISSEMINATION

Internationally, information dissemination is an important component of target setting and other industrial energy efficiency programs. Technical information sources such as energy efficiency guidebooks, databases, software tools, and industry or technology-specific energy efficiency reports are available. One of the most relevant sources of information for Pakistan would be the reports being produced by the Asia Pacific Partnership on Clean Development and Climate Change.

6.6 MONITORING PROGRAM

International experience indicates that it is extremely important to establish effective monitoring guidelines at the beginning of an energy-efficiency program. Clear and transparent monitoring guidelines would specify what needs to be reported, when it would be reported, how it would be reported and to whom. Enough detail should be provided at the beginning of the program as to how enterprises' savings would be documented and the desired level of accuracy.

For example, the Top-1000 program in China requires all participating enterprises to report directly to the National Bureau of Statistics. There is a generic spreadsheet used by all enterprises to report via an on-line website their energy consumption by fuel type on a quarterly basis (should also include reporting on output). The monitoring program for the REGI initiative would be a similar comprehensive operating and reporting requirement.

7. NEXT STEPS

7.1 PHASE ONE (YEARS 1 AND 2)

- Set a timetable and identify responsibilities for issuing general guidance for formulation of a REGI initiative with its principal objective being the decoupling of energy use from industrial output. Draw on international expertise as needed, particularly that of China, the Netherlands and Japan.
- Initiate a survey of the top energy consuming enterprises. The survey could start with large electricity using enterprises, if the government maintains such a data base. However, it would need to be expanded to fuel use to have a complete picture of total energy consumption;
- Review procedures for data collection of water and pollutant discharge and raw material utilization with the aim of building a national database. Initiate a survey similar to the one being undertaken on energy utilization;
- Collect and analyze all cleaner production case studies (completed by Cleaner Production Centre in Sialkot, by Cleaner Production Institute in Lahore, Faisalabad, Multan & Karachi; and National Cleaner Production Centre-Foundation in Rawalpindi) to assess their usefulness in estimating the potential for improving energy/water/material use efficiency and benchmarking. Design a comprehensive resource use compliance monitoring and reporting requirement to complement the current requirement for an environmental compliance permit.

7.2 PHASE TWO (YEARS 3 AND 4)

- Set decoupling target for energy use and industrial output translated into energy use efficiency and total energy use targets for the manufacturing sector and more importantly for sub-sectors. If possible also set water and materials use efficiency and total resource use targets for the manufacturing sector and more importantly for sub-sectors.
- Establish two sub-sector working groups to agree upon sub-sector targets that take into account the social and environmental implications of their implementation.

- Provide national and international expertise on a cost sharing basis to the sub-sector associations and participating plants in the sub-sector on accurate measuring of energy use and on managerial and technological measures to improve energy efficiency
- Allocate enterprise specific energy/water/material efficiency and conservation targets.[8]

The most appropriate sub-sectors, based on fuel consumption are cement and textiles. Other potential sub-sectors are iron and steel and pulp and paper.

7.3 PHASE THREE (YEARS 5 AND 6)

- Launch a "lean and mean" energy/water/materials efficiency program for all resource intensive manufacturing sub-sectors, which would be integrated into national development plans;
- Issue energy efficiency targets for non-energy intensive sub-sectors as well as industrial boilers if needed at the completion of the International Finance Corporation project using existing best available technology guidelines.

[8] The sub-sector association would have to agree on a physical indicator for the sub-sector. The association could draw on the work of the International Energy Agency and an application of their proposal in India (Gielen and Taylor , 2008)

8. CONCLUSION

The GOP needs to take several actions to effectively implement the proposed REGI initiative. These include:

- Setting national numerical targets first for decoupling energy use from GDP and then within that target setting a target for industry. Of course there could also be targets for water and raw materials;
- Involving business (sub-sector) associations in setting targets and getting their commitments to meeting the targets for their largest enterprises;
- Incorporating targets into long range plans national development and sub-sector plans, which specify the mix of upgraded and new plants needed to optimize the industrial structure and to meet social and environmental goals;
- Finalizing a data base on resource use and if possible GHGs in order to monitor progress in meeting targets; and
- Designing a cross ministry/department comprehensive resource use and environmental compliance operating permits and associated reporting.

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ANNEX-A: REPORTS ON INDUSTRIAL ENVIRONMENTAL MANAGEMENT

United Nations Industrial Development Organization (UNIDO), Asian Development Bank (ADB), and The World Bank have prepared reports with in-depth analysis on industrial environmental management. These reports provide valuable findings and recommendations for industrial environmental management. The reports are indicated below for reference:

1. UNIDO 11-Dec-2000: NC/PAK/97/018: Industrial Policy and the Environment in Pakistan.
2. Hagler Bailly, Pakistan/ADB (2005): Pakistan Industrial Environmental Management – Project Ref: TA 3944-PAK
3. Luken, R. (2008) Industrial Environmental Regulation, 1997-2007: Reasons for the Failure of Existing Manufacturing Plants to Comply with National Environmental Quality Standards (NEQS) – The World Bank
4. Ernesto Sanchez-Triana, Leonard Ortolano, and Javaid Afzal, August 2012: Mainstreaming Environmental Sustainability in Pakistan's Industrial Sector – Report No: 72246 PK

ANNEX-B: UNIDO REPORTS ON INDUSTRIAL ENERGY EFFICIENCY

Policies & programmes aimed at decoupling are more covered in the background papers for the UNIDO Industrial Development Report 2011. The papers can be found at http://www.unido.org/en/resources/publications/publications-by-type/policy-advice/industrial-energy-efficiency.html.

Also there is a compilation of energy-related policy measures (implemented or planned) in an online database called Industrial Energy Efficiency Policy (IEEP) database. The temporary link to this data base is http://unido.olbaid.dk/.

ANNEX-C: BRAZIL, CHINA, INDIA AND BEYOND

"Financing Energy Efficiency" (Taylor et. al., 2008), reviews the reasons for the success and failure of a range of recent energy efficiency programs in developing countries and economies in transition. It also draws heavily on an intensive program to exchange ideas and lessons learned in energy efficiency projects in Brazil, China and India, undertaken during 2002-2006.

The report states that tapping more aggressively into the wealth of available, financially attractive energy-saving renovation projects requires mechanisms to develop and deliver large numbers of relatively small projects scattered among hundreds of thousands of industries and building complexes. The investment opportunities would result in operating cost-savings, as opposed to increased production, and are technically and logistically diverse. As such, they often do not compete well with other opportunities for using up-front capital, such as capacity expansion or penetrating new markets. If left unaddressed, problems of prevailing high transaction costs, perceptions of uncertain risks and unmet needs for financial intermediation or technical expertise mean that much of the potential energy savings will remain unimplemented. Institutional innovation is required to address these problems and put in place efficient ways of identifying, packaging and delivering bundles of energy saving projects.

ANNEX-D: ENERGY EFFICIENCY IMPROVEMENT POLICY AND PROGRAMS IN CHINA'S 12TH FYP (2011-15)

The 12th FYP (2011-2015) goes further than previous Plan on energy saving measures. It considers a policy to place an actual cap on total energy consumption to approximately 4 billion tons of coal equivalent (TCE) per year by 2015. For the medium term (2011-2015) the FYP sets development plans for seven strategic emerging industries. These "pillar industries" were identified to promote economic growth while de-carbonizing the economy, and include: ICT (including smart grids); biotechnology industry; new and renewable energy; electric vehicles; energy-saving and environmental protection equipment/industry; new materials. The main policies for industrial energy efficiency set by the 12the FYP include "Energy saving and Environmental Protection Industry Development Plan", which considers:

- Setting the energy intensity target to 16 per cent of the levels of 2005 by 2015;
- Sectoral performance standard: for the cement sector (in terms of energy consumed per unit of coal) and for the oil and chemical industries a 10% intensity reduction compared to the levels of 2010 by 2015;
- Carbon dioxide emission per unit of GDP to be reduced by 17 percent of 2010 levels by 2015;
- New legislation that will require an energy efficiency assessment and proof of Best Available Technologies (BAT), before the government approves to any Greenfield investments in fixed assets;
- Scale-up results with a "10,000 Enterprises" programme;
- Endorses a market approaches like energy service companies (ESCOs) that help to finance energy efficiency; and
- Based on the Ten Energy Conservation Programmes in the 11 FYP period, implementation of the transformation for the boiler and furnace, energy conservation on electrical system, energy system optimization, residual heat and pressure recovering utilization, petroleum saving and replacement, energy conservation on construction, green lighting and other projects will continue.

Amongst other programs China pledged in its communications under the Copenhagen Accords to reduce emissions intensity by 40-45 per cent by 2020 compared to 2005 levels and increase the share of non-fossil fuels in primary energy consumption to 15 per cent by 2020. China is currently undergoing a technology needs assessment funded by the GEF and WB (GEF ID 4188).

In addition to the central policies under the 12thFive Year Plan framework, the central Government has developed additional policies to emphasize the need to address energy efficiency issues. A State Council Framework Policy on accelerating the development of energy-saving and environmental protection industry was published on August 10, 2013.

The main goals of the new policy are centered on fostering the development of energy saving measures that promote energy conservation. The policy is detailed in selecting the policy measures as well as key energy conversation technologies. The key policy elements are in line with the proposed project and would provide the regulatory support required to ensure that the selected measurers will be adopted. The concept of energy system optimization is detailed out in the regulation.

The key aspects of the State Council framework policy on accelerating the development of energy-saving and environmental protection industry are as follows:

Policy Measures

It states that regulatory-driven policy incentives will be promoted, such as energy saving regulations and standards, including the strengthening of supervision and management.

Technologies

The policy emphasizes the need to promote key energy saving technologies for boilers, motors, heat transfer and cooling equipment, new energy vehicles and semiconductor technologies.

It provides detail on the specific technologies (hardware and knowledge). On those relevant to the proposed project, it indicates that (1) for boilers, energy efficiency may be achieved by expanding the manufacturing of high efficiency boilers but also by adopting a systems optimization approach (including measures such as automatic control, optimization, improved use of fuels, flue gas waste heat recovery, etc) and (2) for heat transfer and cooling

technology, more efficient equipment as well as heat integration/recovery approaches shall be promoted.

On-going projects

China Utility-Based Energy Efficiency Finance (CHUEE) Program

This WB/IFC (GEFID 2624, 2008-2012) led project has assisted national banks in providing loans to energy efficiency projects, as well as organizing and providing marketing and financing services to large energy consumers in all economic sectors. This project does not provide technical support to enterprises nor assesses standards issues. This project is listed to avoid duplication of actions: based on discussion with the IFC project team, the awareness of national banks on the financing of energy efficiency issues is high as a consequence of this and other similar interventions.

Energy Efficiency Financing

This GEF/World Bank project (GEF ID 2951, 2011-2015) focuses on the establishment of Energy Service Companies (ESCOs) but primarily on the fostering of large-scale energy efficiency loan programs in three Chinese national banks, to lend for projects in the $5-10 million range in heavy industries. This project is listed to avoid duplication of actions: which indicates that national banks have acquired the capacity to finance large energy efficiency investment projects.

The Energy Efficiency Promotion in Industry project

This ongoing GEF/World Bank project (GEF ID 4109, 2011-2015) aims to improve the technical and managerial capacities required to promote a rational use of energy in the key industrial sectors and has four main components: supporting policy development (but not focused on technical standards); capacity building for energy managers (focuses on energy managers but not on system optimization); demonstration of energy management measures; and dissemination of knowledge.

Establishment of Measurement and Verification System for Energy Efficiency in China

This GEF/World Bank project which is at PPG stage (GEF ID 4947, approved in June 2012), aims to establish MRV systems to control energy efficiency investment undertaken under the Ministry of Finance “Financial Reward Fund for the Energy-saving Technologies”. The project

will be centered on the capacity building to establish the quality infrastructure for MRV, but will not address steam or heat recovery systems in depth.

Promoting Energy Efficiency in Industrial Heat Systems and High Energy-Consuming (HEC) Equipment

The pipeline GEF/UNIDO project which is at advanced stage of development is to promote energy efficiency in “high energy consuming” special equipment through the development of technical regulations; the establishment of national laboratories; the training of national experts; and the demonstration of new technologies at enterprise level.

This project shall monitor the progress of the existing GEF projects, through the interaction with the national focal point and the implementing agencies to identify areas of collaboration.