

## **Emission Trading in India: A Study of Two Schemes**

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# **Emission Trading in India: A Study of Two Schemes**

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## **Extended Abstract**

The paper reviews two schemes in India that have some degree of resemblance with the market based emission trading mechanism like EU-ETS. The first scheme is an innovative emission trading scheme on an air pollutant namely respiratory solid particulate matter (RSPM) with serious potential health implication. The scheme has been piloted in industrial clusters of three polluting states in India (Gujarat, Maharashtra and Tamilnadu). Although the scheme is not on CO<sub>2</sub>, this happens to be the first of its kind emission trading system in a developing country that mimics the EU-ETS system. The scheme shifts away from the traditional command and control regulation where the industrial point sources have to comply with the norms set by the Central Pollution Control Board (CPCB) or else pay a high penalty. It instead sets a pollution target for an area based on ambient air quality standard and allocates permits to industrial point sources that would then be traded based on gains or shortfalls from compliance after verification. For setting the baseline and verification the scheme relies on a continuous emission monitoring system (CEMS) that provides real-time information on emission and resolves much of the problems that are otherwise prevalent with spot checking and also minimises the problem that potentially arises with suspicious or wrong reporting by third-party auditors. The second scheme known as Perform Achieve and Trade (PAT) scheme is a flagship programme of the Bureau of Energy Efficiency, Ministry of Power, Government of India, under the National Mission on Enhanced Energy Efficiency (NMEEE). The programme also resembles a cap and trade mechanism and involves trading in energy saving certificates between energy intensive industrial production units identified as designated consumers (DCs). Although the scheme does not involve any direct trading based on absolute or relative CO<sub>2</sub> emissions but the potential unit of energy saved (expressed in tonnes of oil equivalent) could easily be converted into CO<sub>2</sub> emission equivalent. The scheme has the potential to pave the way for creating a more holistic market for emission trading in India. The scheme also holds lot of promises in linking with the international carbon offsets market through adjustments and harmonisation in monitoring, reporting and verification (MRV). In the light of this, the paper also provides a review of the operation and institutional mechanism of the scheme and explores the potential in its linking with other international carbon offsetting schemes.

Keywords: emission trading, air pollution, energy efficiency

JEL codes: Q490, Q480, Q530, Q580

## ***Scheme 1: Emission Trading Scheme in India on Respiratory Solid Particulate Matter (RSPM)***

### **1.1 Introduction**

The high influxes of population to urban areas, change in consumption patterns and unplanned urban and industrial development have led to unabated increase in air pollution in urban metropolitan cities in India. The problem has been exacerbated due to inadequacy of pollution control measures, lack of proper enforcement of laws and regulations, increasing desertification, and decreasing vegetation cover<sup>1</sup>. As per an earlier conservative estimate of The Ministry of Environment and Forests (MoEF) air pollution contributed to nearly 40,351 premature deaths spread across 36 cities of India in 1995 itself. The total economic loss attributed to air pollution in these cities for the year was estimated as US\$1,310 million (Greenstone and Shah, 2013). Another new set of findings from Global Burden of Disease Report indicate that outdoor air pollution has reportedly become the fifth largest killer in India after high blood pressure, indoor air pollution, tobacco smoking, and poor nutrition,. The report says that about 620,000 premature deaths occur in India from air pollution-related diseases each year.<sup>2</sup>

The urban air quality database brought out by WHO in 2014 reaffirms that most Indian cities are becoming death traps because of high particulate matter (PM) levels due to air pollution. Furthermore, Indian cities have highest levels of PM10 and PM2.5 (particles with diameter of 10 microns and 2.5 microns) when compared to other cities. If one, however, considers National Ambient Air Quality Standards (NAAQS) as a benchmark to compare the air quality across Indian cities—then 60 cities would comply with the PM 2.5 standard and 21 cities would comply with PM10 standard (out of 124 Indian cities as considered in urban air quality database of WHO)<sup>3</sup>. This is owing to the

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<sup>1</sup>[http://cpcb.nic.in/upload/Newsletters/Newsletters\\_64\\_COVER,%20SOFT,%20BACK,%20EDITORIAL%20HAPs%20Newsletter.pdf](http://cpcb.nic.in/upload/Newsletters/Newsletters_64_COVER,%20SOFT,%20BACK,%20EDITORIAL%20HAPs%20Newsletter.pdf) (last accessed 9 February 2015)

<sup>2</sup> <http://www.downtoearth.org.in/content/air-pollution-killing-620000-indians-every-year-global-burden-disease-report> (last accessed 10 February 2015)

<sup>3</sup> <http://www.downtoearth.org.in/news/who-estimate-on-air-pollution-shows-indian-cities-are-death-traps-44283> (last accessed 10 February 2015)

fact that Indian NAAQS are three to four times lax compared to WHO guidelines. Indian NAAQS for PM10 is 60 µg/cum, and for PM2.5 it is 40 µg/cum, whereas the WHO guidelines for PM10 is 20 µg/cum and for PM2.5, it is 10 µg/cum. So one can easily gauge how unsafe it is to breathe even after meeting the national standards. Most large Indian cities violate NAAQS for RSPM (60 µg/m<sup>3</sup>)<sup>4</sup>.

While the potential spill-over of air pollution on human health is well recognized, regulating air pollution always remains a challenge especially because of a plethora of economic activities that create air pollution. These include, among others, transport, industry and electricity production, which, otherwise are crucial from the point of view of augmenting economic growth. Hence, the impact of stringent regulation using traditional command and control models could potentially have an adverse impact in terms of lowering living standards (Greenstone et al., 2011).

Indian environmental regulation has traditionally been based on command and control. Central Pollution Control Board (CPCB) usually has been setting strict guidance for industrial emissions. State Pollution Control Board enforces standards, required to be at least as stringent as central guidance. Figure 1 below shows how the traditional regulation based on command and control actually works. However, the enforcement and compliance in the traditional regulation system has largely remained weak. In some cases there had also been intervention by court system through public interest litigation (PIL) filed against pollution. Noted among the PILs that have been filed in the context of pollution is M.C. Mehta vs. Union of India where the Supreme Court of India held that air pollution in Delhi caused by vehicular emissions violates right to life under Article 21 of the Indian Constitution and directed all commercial vehicles operating in Delhi to switch to CNG fuel mode for safeguarding health of the people.<sup>5</sup> More recently in 9 February 2015, the Delhi High Court sought responses of the government, the city pollution panel and civic agencies of the national capital on the

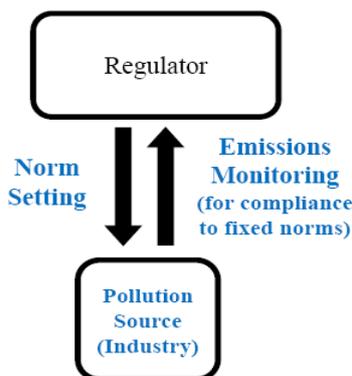
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<sup>4</sup> <http://www.downtoearth.org.in/content/who-estimate-air-pollution-shows-indian-cities-are-death-traps> (last accessed 10 February 2015)

<sup>5</sup> For more details on different PILs filed in the context of pollution see - [http://cpcb.nic.in/upload/Newsletters/Newsletters\\_17\\_2002.pdf](http://cpcb.nic.in/upload/Newsletters/Newsletters_17_2002.pdf) (last accessed 11 February 2015)

issue of air pollution here which it has taken up suo motu as a public interest litigation (PIL).<sup>6</sup>

**Figure 1: Traditional Command and Control**



## 1.2 Piloting the Innovative Market Mechanism

As difficulties have been encountered in the context of checking and abating air pollution through the usual enforcement methods, the Union Ministry of Environment and Forests (MoEF) has introduced a market-based mechanism in 2011 on a pilot basis to reduce air pollution. It is called the Emissions Trading Scheme (ETS). The proposed ETS meant for ‘particulate matter’ would be the first of its kind in the world. The ministry has initiated the pilot in industrial areas of three states—Gujarat, Maharashtra and Tamil Nadu—with the aim of improving overall ambient air quality. The scheme is in its nascent stage and the results of pilots would be used to determine its feasibility in other parts of the country.

Three states were chosen for the pilots because they have maximum number of industries and critically polluted areas. The states and the participant clusters are indicated below-

**-Gujarat** (Surat, Narol, Ahmedabad, Sachin Industrial Cluster)

**-Maharashtra** (Aurangabad, Jalna, Chandrapur, Domivali, Kolhapur)

**-Tamil Nadu** (Chennai Greater Metropolitan Area: Ambattur, Chennai, Marainalai, Sriperumpudur and Tiruvallur)

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<sup>6</sup> [http://articles.economictimes.indiatimes.com/2015-02-09/news/58967754\\_1\\_air-pollution-delhi-high-court-environment-pollution](http://articles.economictimes.indiatimes.com/2015-02-09/news/58967754_1_air-pollution-delhi-high-court-environment-pollution) (last accessed 11 February 2015)

A detailed questionnaire had been designed to gather information on the condition of pollution abatement equipment, the level of particulate concentration presently produced by industry and to estimate marginal abatement costs at the industry and cluster level. The pilot project was essentially a two-part exercise. The first part involved devising and testing of continuous emissions monitoring systems (CEMS), which would provide real time data on industrial pollution to regulators. The second part proposes using the data generated on the basis of CEMS as the basis for a market-based regulatory programme. For setting the cap, the pilot project would collect baseline data, compute the existing level of emissions and then set the cap at some percentage below that.

The concern with a spot-check design as it existed under a strict command and control regime is that - 1) it could not match the transparency and fairness of a system based on continuous monitoring; 2) it would not have the rigor to earn the confidence of market participants. As pollution based ETS requires adequate real time monitoring of total emissions which is acceptable to regulators, participating industries and public, the role of continuous emissions monitoring system (CEMS) becomes crucial in ensuring effective measurement, recording and standardised reporting of specified air emissions and other parameters. Installation of CEMS, however, might be expensive for industries, albeit monitoring is accurate for a range of pollutants. It can also be used in a number of industries such as power, steel, cement, chemical fertilisers and petrochemicals, pharmaceuticals, boilers and incinerators and paper. One issue that becomes crucial while implementing CEMS is the requirement of a common guideline with specification for calibration for CEMS type and results of different types of imported equipment to check for disparities and ensuring uniformity in results. In that context, the Tamil Nadu Pollution Control Board has started an initiative to develop and standardise a basic platform so that there are no disparities in the results (see CPCB, 2013 for detailed guideline on CEMS).

A collaborative study has also been carried out in the state of Gujarat to examine the truthfulness of auditors as there were concerns about third party audit especially because of the conflict of interest that arises as the pollution auditors are essentially paid by the firm hiring them (Greenstone and Shah, 2013). A two year experiment has been carried

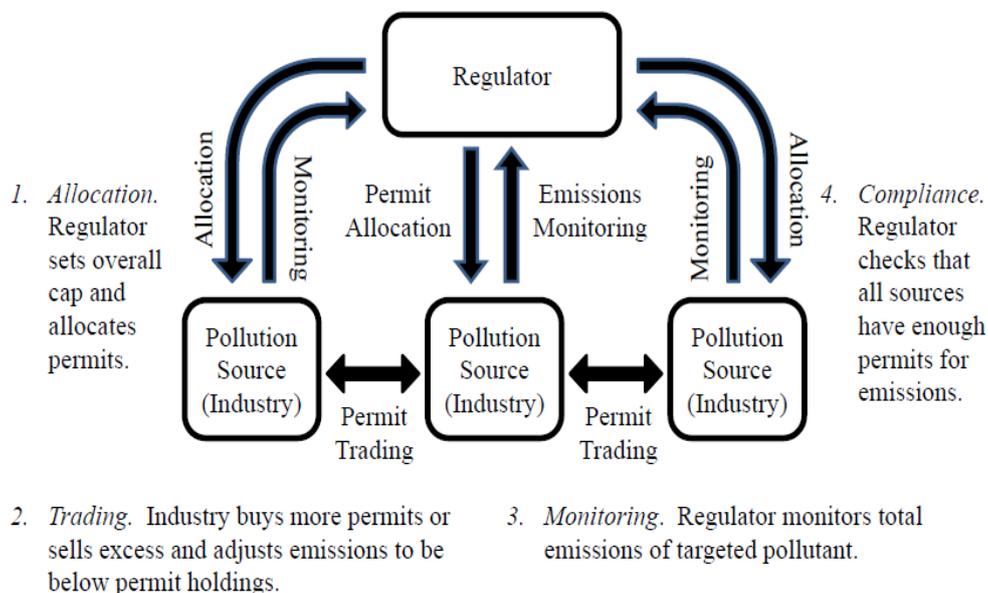
out by assigning select 233 out of 473 audit-eligible plants in two most populous cities of Gujarat namely Surat and Ahmedabad to audit treatments with an objective to curb such a conflict by altering the market structure for environmental audits of industrial plants and to incentivize accurate reporting on pollutants. The experiments led to three main findings. First, the status quo system based on spot checking through third party audit has been observed as largely corrupted with auditors systematically reporting plant emissions just below the standard, although true emissions were typically higher. Second, the treatment caused auditors to report more truthfully and substantially lowered the fraction of plants that were falsely reported as compliant with pollution standards. Third, treatment plants, in turn, reduced their pollution emissions. The result suggested that reformed incentives for third-party auditors could improve their reporting and make regulation more effective (Duflo et. al, 2013). The preliminary results from this evaluation were also shared with Gujarat Pollution Control Board (GPCB) officials and third-party auditors to which the auditors suggested that adopting parts of the modified audit programme permanently would improve the quality of work they are currently providing (Greenstone and Shah, 2013).

### **1.3 How the Scheme Works?**

Figure 2 shows how the emission trading system functions. The scheme allows the regulators—central and state pollution control boards—to set a cap on the aggregate level of pollution permitted in an industrial area, and then allow the industries to self-regulate to ensure that pollution does not exceed this cap. Industries that emit excess pollutants can buy permits from industries that would be overachieving targets in a similar manner as in the carbon trading system. Although regulator sets total emissions amount but does not decide what any particular source will emit. Industries face price for their emissions and can buy and sell permits to emit under the cap. Price of emissions makes pollution costly and gives incentive to cut back. Industries have the flexibility to design own compliance strategy either through abatement process and/or technology changes or through permit trading. Flexibility allows units with low cost of reductions to emit less and sell their right to emit to others, lowering overall compliance costs. Auctioning would be considered as the preferred method of allocation of permits to

show that the government is establishing a right to emissions and to send clear price signals to participating units from the very start of the scheme.

**Figure 2: Functioning of the emission trading system**



Source: Duflo et al (2010)

There is, however, one complication in linking NAAQS and ambient air quality to the cap is that the former refers to the total level of pollutants in an area, which is a function of all local sources (of which industry is a fraction and transport and others play a significant role) as well as more distant sources whose pollutants are transmitted through meteorological forces. Therefore, a simpler method is to rely on estimating how much industries covered by the pilot are currently contributing and then setting a target below that.

#### 1.4 Relevant Institution and Decision Process

The pilot emissions trading scheme involves collaboration amongst many parties.

- The scheme had been taken up under the authority of the Ministry of Environment & Forests (MoEF), Government of India.
- The Central Pollution Control Board (CPCB) advises on technical aspects of the scheme implementation.

- The respective State Pollution Control Boards (SPCBs) of Gujarat, Maharashtra and Tamil Nadu are responsible for implementing the scheme, both directly and indirectly, through private consulting firms with expertise in relevant technical and financial fields.
- J-PAL (Abdul Jameel Latif- Poverty Action Lab) South Asia at IFMR (Institute of Financial Management and Research) serves as independent advisor and evaluator for the scheme.

A governing council was also formed in MoEF to oversee the development and implementation of the scheme that would meet approximately three times per year during the first two years of the scheme (Duflo et al, 2010).

## ***Scheme 2: Perform, Achieve and Trade (PAT)***

### **2.1 Introduction**

India is a democratic country with varying endowment of resources and biodiversity that spreads across 29 states. With a population of over 1.2 billion of people India is unequivocally the most populous democracy in the world. The growing population coupled with the country's aspiration to reach a double digit growth in order to drive the lion's share of people above the poverty line has also been driving India's quintessential energy consumption. The lion's share of India's energy consumption is made up of fossil fuels and the country is also a net energy importer which comprises largely of crude oil (Government of India, 2014). The dependence on fossil fuels, on the one hand, accounts for rapidly growing CO<sub>2</sub> emission and on the other hand puts immense pressure on India's balance of payment. The latter problem has become especially critical with increasing speculation and volatility in the world oil markets in the recent years. Interestingly South Asia including India also happens to be on the receiving end when it comes to bearing the brunt of the repercussions of global warming with most of its coastal areas under constant threat of being submerged and the region as a whole being prone to erratic weather conditions and climate variation triggered by global warming (Ahmed and Supachalasai, 2014)

Table 1 based on simple Kaya Decomposition delineates the key factors that drive the growth of CO<sub>2</sub> emissions in India namely the population, per capita GDP, energy intensity of GDP and carbon intensity of energy (considering 1990 as a base year).

**Table 1: Decomposition of India's CO<sub>2</sub> emission**

<i>Index (reference year 1990 = 100)</i>	<b>1990</b>	<b>1995</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
CO <sub>2</sub> emissions	100	133	169	205	301	315	337
Population	100	110	120	130	139	141	142
GDP per capita (GDP at PPP#)	100	116	143	184	256	269	279
Energy intensity (TPES*/GDP)	100	95	84	72	64	63	63
Carbon intensity (CO <sub>2</sub> /TPES)	100	110	117	120	132	133	135

PPP stands for purchasing power parity; \* TPES stands for total Primary Energy Supply.  
Source: IEA (2014).

India's biggest challenge lies in decoupling the CO<sub>2</sub> emission from the its much needed rapid economic growth that is crucial for lifting the poor above poverty line and reducing the proneness to multifarious vulnerabilities. An appropriate way to address that challenge, as evinced by the Kaya decomposition, is by a combination of reduction in energy intensity of GDP coupled with reducing usage of carbon intensive fuel in the energy mix without compromising on the growth trajectory. In other words, this implies achieving the desired national growth objectives through a qualitative change in growth process by accounting for ecological sustainability. The qualitative change could be brought about by devising efficient and cost-effective strategies for energy efficiency through end user demand side management (DSM), changing the energy mix, deploying appropriate technologies for both adaptation and mitigation of greenhouse gases emissions and engineering new and innovative forms of market, regulatory and voluntary mechanisms to promote sustainable development (BEE, 2012).

Realizing the dire need of an ecologically sensitive and climate benign growth process, India Government came out with its flagship National Action Plan on Climate Change (NAPCC) released by the Hon'ble Prime Minister on 30th June, 2008. NAPCC outlines Eight National Missions, representing multi-pronged, long-term and integrated strategies for achieving key goals in the context of climate change. Figure 3 below indicates the eight missions.

The International Energy Agency (IEA) in its World Energy Outlook, 2010 delineated various options that are available to implement cumulative abatement of 1.8 Giga tonnes of CO<sub>2</sub> emission that would be necessary for India to reach a CO<sub>2</sub> concentration to 450 ppm (parts per million) from the Business as Usual Scenario (see Figure 4). This volume of abatement, as underscored by IEA, could be potentially achieved in India by implementing various options between 2010 to 2035, of which energy efficiency would account for 51 percent of the share in that abatement.

Furthermore energy efficiency is an inexpensive and a no-regret option that is easily scalable when compared to the development of large-scale power plants. Given the fact that it is crucial to treat each unit of energy saved and hence avoided generation on par with each unit of energy generated, encouraging industry and consumers to use energy

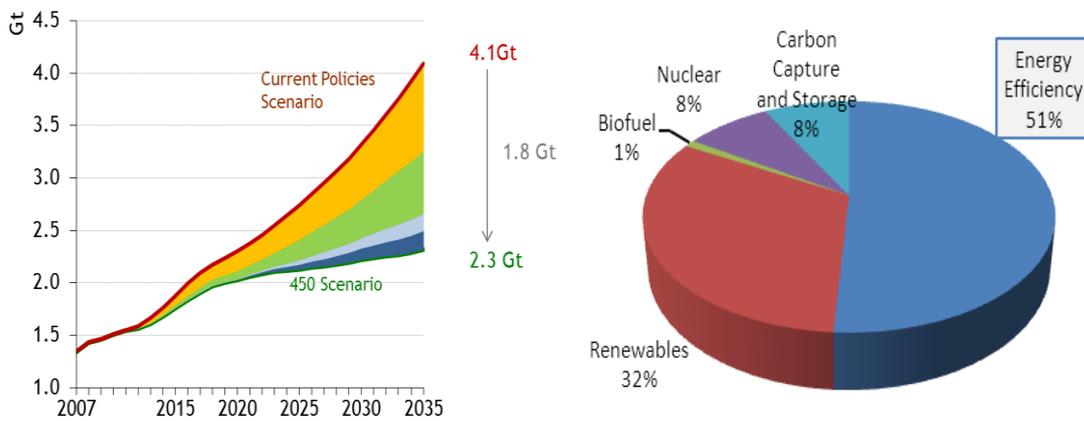
more efficiently ought to be regarded as the first policy choice in the path towards energy security and energy for all.

**Figure 3: Eight National Missions under the National Action Plan on Climate Change**



Source: BEE, 2012

**Figure 4: Cumulative CO2 emission abatement from current policy scenario to 450ppm scenario**



Source: IEA (2010)

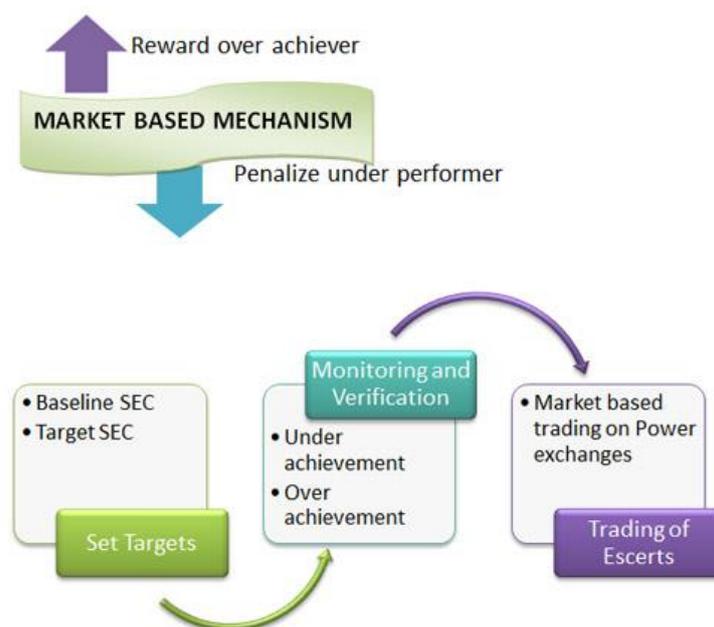
In view of the crucial role that energy efficiency could play in energy security and the future CO2 abatement, the National Mission for Enhanced Energy Efficiency (NMEEE), a key mission amongst the eight national missions of NAPCC, has been garnered to promote innovative policy and regulatory regimes, financing mechanisms, and business models that facilitates in creating and sustaining markets for energy efficiency with clear deliverables to be achieved in a transparent and time bound manner (BEE, 2012). The task of implementation of the mission has been entrusted on Bureau of Energy Efficiency under the aegis of Ministry of Power. The NMEEE comprises of four new initiatives which are:

- **Perform Achieve and Trade (PAT):** A market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, through certification of energy savings that could be traded.
- **Market Transformation for Energy Efficiency (MTEE):** Accelerating the shift to energy efficient appliances in designated sectors through innovative measures to make the products more affordable
- **Energy Efficiency Financing Platform (EEFP):** Creation of mechanisms that would help finance demand side management programmes in all sectors by capturing future energy savings.
- **Framework for Energy Efficient Economic Development (FEEED):** Developing fiscal instruments to promote energy efficiency

## **2.2 Understanding the Perform, Achieve and Trade (PAT) Scheme**

PAT scheme, in simple terms, is a market based instrument that mimics a cap and trade mechanism and is intended to enhance cost-effectiveness of improvement in energy efficiency in energy intensive large industries and facilities through issuance and trading on energy saving certificates (ESCerts) between over-performing and under-performing units in energy intensive industries, identified as designated energy consumers. The ESCerts will be traded on trading platform created in the two power exchanges namely Power Exchange Indian Limited (PXIL) and Indian Energy Exchange (IEX). Figure 5 below shows the mechanism diagrammatically.

**Figure 5: A snapshot of the mechanism of the PAT Scheme**



\*SEC stands for specific energy consumption

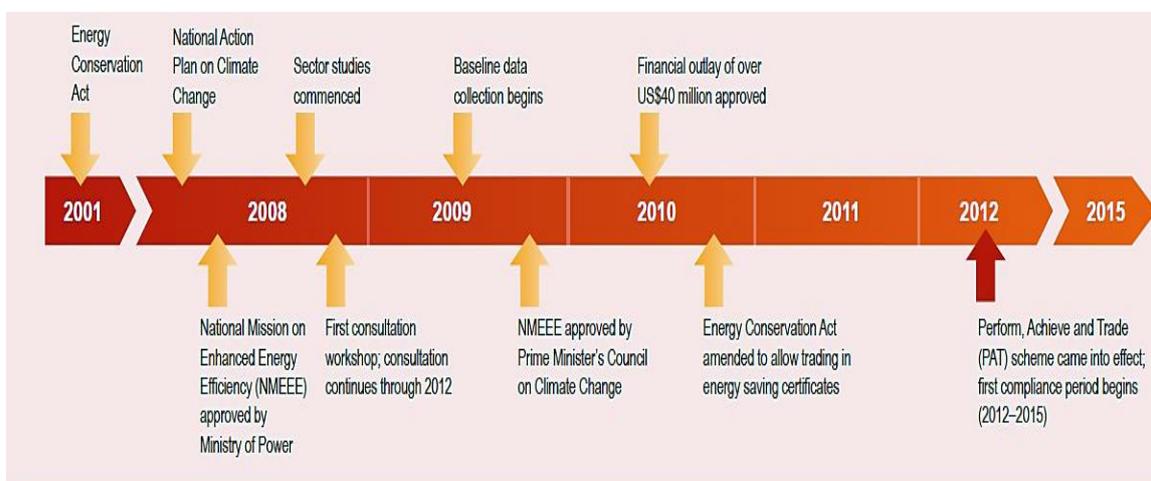
With the introduction of PAT scheme, India also turns out to be the first developing country to implement a market based mechanism that relies on trading of energy saving certificates. The programme would facilitate in scaling up energy efficiency in targeted industries while allowing for increased production and energy consumption to cater to the needs of the much needed growth (Singh, 2013).

### ***2.2.1 Evolution of the PAT Scheme***

The foundation of the PAT scheme lies in the Energy Conservation Act (ECA) of 2001. The ECA provides for the legal framework, institutional arrangement and a regulatory mechanism to initiate energy efficiency related services in the country. The ECA also led to creation of Bureau of Energy Efficiency (BEE) by Ministry of Power in 2002 as the institution to provide the national policy framework and direction for energy efficiency initiatives including advisory services. The stage-wise evolution of the PAT scheme since the inception of ECA is shown in Figure 6. The ECA empowers the Indian Government to single out energy intensive industries as Designated Consumers (DCs) and establish mandatory energy conservation or savings target for them. The Designated

Consumers, as notified under ECA, account for 25% of the national gross domestic product (GDP) and about 45% of commercial energy use in India. The list of DCs that had been identified in the schedule pertaining to ECA 2001 is given below in Table 2.

**Figure 6: Stage-wise Evolution of the PAT Scheme**



Source: Singh (2013)

**Table 2: Designated consumers in the schedule of Energy Conservation Act 2001**

S.N	Sector	S.N.	Sector
1	Aluminium	9	Chemicals
2	Fertilizers	10	Railways
3	Iron and Steel	11	Port Trust
4	Cement	12	Transport Sector (industries and services)
5	Pulp and paper	13	Petrochemicals, Gas Crackers, Naphtha Crackers and Petroleum Refineries
6	Chlor Alkali	14	Thermal Power Stations, hydro power stations, electricity transmission companies and distribution companies
7	Sugar	15	Commercial buildings or establishments
8	Textile		

Source: <http://powermin.nic.in/upload/pdf/ecact2001.pdf> (last accessed 10 December 2015)

Only 8 of the aforementioned identified sectors comprising of 478 DCs have been included in the first cycle of the PAT scheme that began from 2012 and will end in 2015 and the choice is driven by the magnitude of energy consumption, the energy intensity and large variation in energy consumption patterns across each of these eight sectors. The DCs considered together account for about 231 MMTOE (million metric tons of oil equivalent) of energy consumption annually as per 2007-08 data which is about 54% of the total energy consumed in the country (BEE, 2011). The minimum annual energy consumption and the distribution of designated consumers across 8 sectors are depicted in Table 3. In the second cycle of PAT Scheme post-2015, there may be a revision in the number of DCs as more sectors get included.

**Table3: Minimum annual energy consumption and number of DCs in select sectors**

Sector	Minimum annual energy consumption for the DC (tonnes of oil equivalent)	No. of DCs
Aluminium	7500	10
Cement	30000	85
Chlor-alkali	12000	22
Fertiliser	30000	29
Iron and steel	30000	67
Pulp and paper	30000	31
Textile	3000	90
Thermal power plant	30000	144
<b>Total</b>		<b>478</b>

Source: BEE (2012)

### **2.2.2 Target setting methodology**

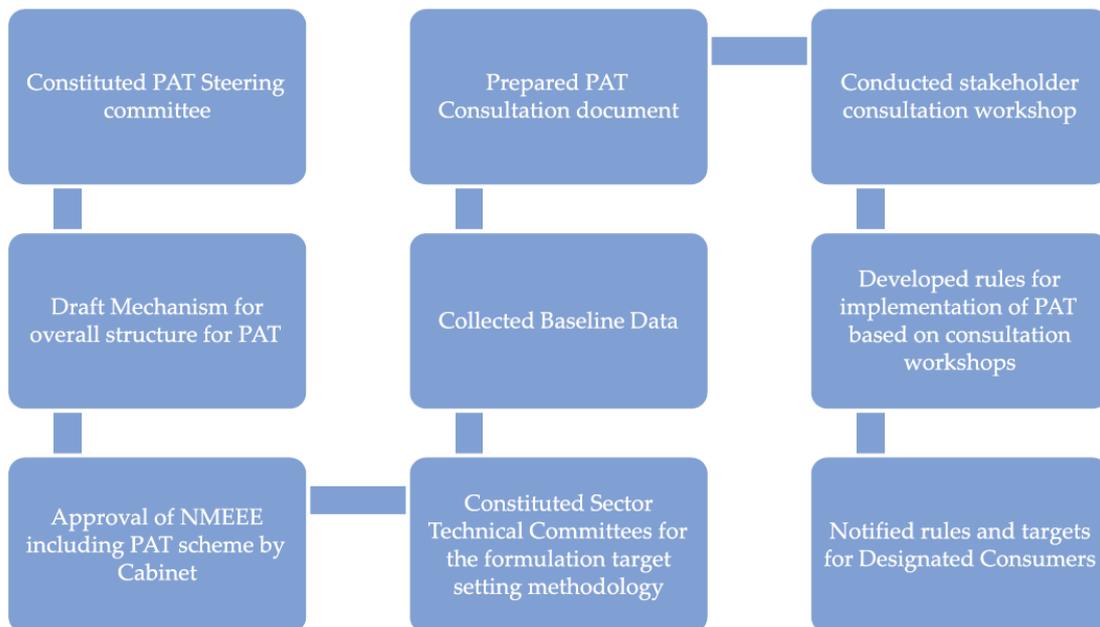
The background work towards creation of the PAT mechanism has been carried out by BEE. In the design phase BEE has consulted all the key stakeholders that include extensive discussion with the DCs through workshops besides sector and plant level meetings to solicit comments particularly on the following aspect:

- a) Methodology for establishing the baseline energy consumption

- b) Methodology for target setting for each sector
- c) The process of measurement and verification, in particular the verification agencies that need to be appointed by BEE for this purpose.
- d) The manner in which trading of the certificates can be encouraged, in particular instruments that could increase liquidity in the system.

The consultations were aimed at enhancing awareness and industry-readiness; placate concerns about the scheme’s objectives especially the concerns raised by industries that are sceptical. The complete step-wise implementation process that has been followed by BEE for the PAT scheme beginning from constituting a steering committee for PAT till notifying the rules and targets for DCs is shown in Figure 7. Besides BEE, the industry body of India namely Confederation of Indian Industry (CII) and Federation of Indian Chambers of Commerce and Industry (FICCI) also organised stakeholder consultation for their industry members.

**Figure 7: Steps towards Implementation of the PAT Scheme**



Source: BEE (2012)

### *Basis of fixing an energy consumption norm for DCs*

As per Section 14(g) of EC Act, 2001, the central government can stipulate energy usage norms for designated consumers. In the process of stipulating energy usage norms, sector-specific studies had been carried out by BEE. The studies depict wide variations in specific energy consumption (SEC) within an industrial sector and thus hints on the large energy-savings potential in a sector (see Table 4 for the bandwidth across various sectors).

The wide bandwidth also reflects on the dispersion in the energy-saving possibilities at the plant level (that could be attributed to variation in vintage, production capacity, raw material quality, and product-mix). In fact, the lower the SEC i.e. the higher the energy efficiency, the lower the energy-savings potential. The lack of homogeneity due to lack of uniformity in SEC within a sector makes it problematic to specify a single benchmark SEC for the sector as a whole, as the benchmark would obviously turn out to be high for older plants if it is set at the level of newer plants; on the other hand the newer plants will find it very easy to attain the benchmark if it is set at the level of older plants. Thus, it is more useful if the SEC improvement norm is set at the individual plant level. These SEC improvement targets would be contingent upon trend of energy consumption and energy-savings potential of the plants. In view of this, the energy efficiency improvement targets fixed in case of PAT are “unit or plant specific”. Each unit i.e. DC is mandated to reduce its SEC by a certain proportion or value (value of SEC is expressed in metric ton of oil equivalent per unit of the product), based on its baseline SEC within the sectoral bandwidth.

**Table 4: Variations in Specific Energy Consumption across sectors**

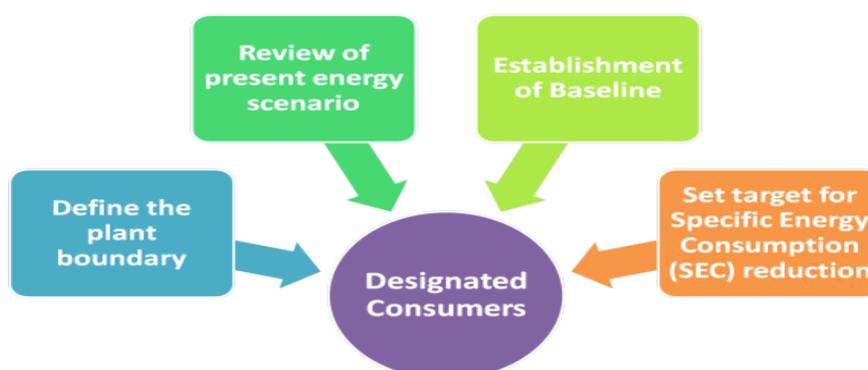
Sector	Range of SECs
Aluminium	15875-17083 kwh/T*(Smelter) 3.28-4.12 mkcal/T of Alumina (Refinery)
Cement	66-127 kwh/T of clinker (Thermal) 665-900 kcal/kg (Electrical)
Chlor-alkali	2300-2600 kwh/T of caustic soda
Fertiliser	5.86-9.11 Gcal/T of urea (Thermal)
Iron and steel	6.15-8.18 Gcal/T (Integrated Steel) 4.4-7.6 Gcal/T (Sponge Iron Thermal) 72-135 kwh/T (Sponge Iron Electrical)
Pulp and paper	25.3-121GJ/T
Textile	3000-16,100 kcal/kg (Thermal) 0.25-10 kwh/kg (Electrical)
Thermal power plant	2300-3400 kcal/kwh

Source: BEE (2011);

\*T stands for metric tonnes of oil equivalent

The step-wise approach to setting a target for SEC reduction (see Figure 8) involves: 1) defining the plant boundary; 2) reviewing the present energy scenario; and 3) setting the baseline and eventually setting the target for SEC reduction.

**Figure 8: Schematic Presentation of the Steps in Setting the Target of Energy Saving for DCs**

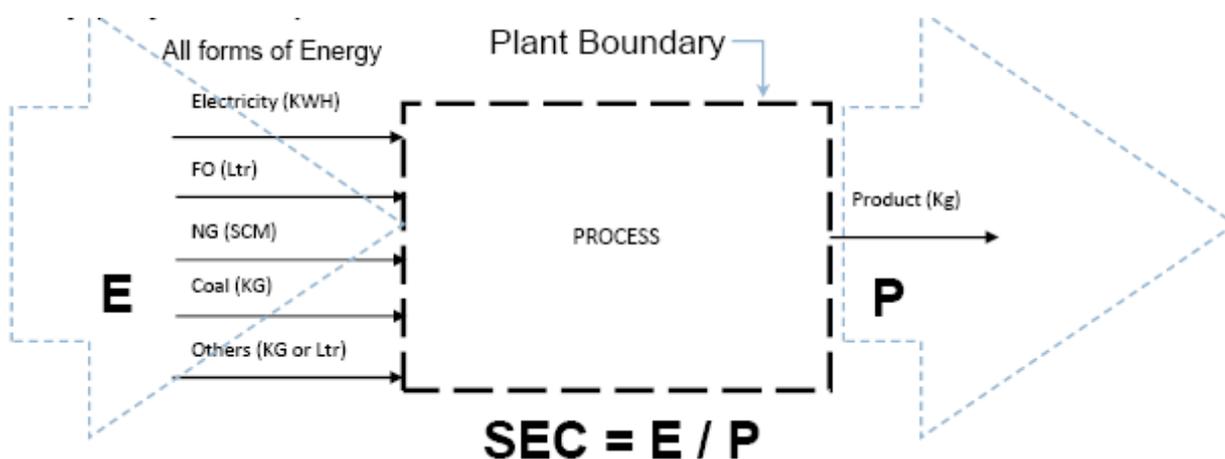


The plant boundary is selected in such a way that the total energy input and the above defined product output is fully captured and the SEC of an unit is calculated based on Gate-to-Gate concept (as shown in Figure 9 below) with the following formula:

Specific energy consumption (SEC) = net energy input into the designated consumers' boundary /total quantity of output exported from the designated consumers' boundary

While calculating the total energy input to the plant, all energy sources is converted into single unit i.e. toe (metric ton of oil equivalent) using standard engineering conversion formula. Energy used through renewable energy sources is not accounted for. Furthermore any energy consumption related to major construction work is also excluded as this energy does not go as an input in production.

**Figure 9: Designating the Plant Boundary and computing SEC**



Source: Diddi, 2011

The plant boundary consists of the entire plant excluding colony, residential complex and transportation system. In case of Iron & Steel, Aluminium and Cement sector mining operations are excluded from the plant boundary. The plant boundary so decided would be constant for the entire PAT cycle.

The base line SEC is calculated based on the submission of the details of production and energy consumption for 5 years by DCs from 2005-06 to 2009-10 through notified form. Along with that some other sector-specific information is also collected on the

process technology, process flow, raw material, product mix etc. The reported SEC through notified form is then normalised (usually for capacity utilisation or plant load factor). The base line SEC is eventually calculated by taking the average of normalized SEC from 2007-8 to 2009-10 and 2009-10 would be considered as base year. To avoid double counting in total energy consumption by designated sectors, thermal power sector is left out and considered separately as the power plant sector is also supplying electricity to other designated industrial sectors (Bhattacharya and Kapoor, 2012).

The target has been defined under the PAT mechanism as a percentage reduction of SEC from baseline value to that of target year and the target year for the first PAT cycle is 2014-15. The national energy saving targets under PAT cycle 1 is 6.686 million tonnes of oil equivalent apportioned first across 8 sectors in proportion to their relative energy use to ensure that the sectoral reduction is equal, in percentage terms, to the percentage of the energy consumption of all covered plants in a sector to the overall energy consumption of all covered plants. The sectoral targets are further disaggregated among the designated consumers (478 in the first PAT Cycle) after taking into account their historical energy consumption, sustainability of trading market and other related issues. The lowest percentage target is given to the best performing plant. Hence, if the best performing plant has X% target to reduce SEC, the other plants would be having (plant SEC/best SEC) times X% (see Figure 10 for an illustration of plant-level target setting for pulp and paper industry). The X can be numerically calculated keeping in view of total energy saving in a target year. If a sector has wide variations in process technology and raw material, then DCs would be grouped or clustered as per their similarities and the same methodology would be applied.

The absolute energy saving at the end of three years is estimated as:

$$P_{\text{base}} (\text{SEC}_{\text{base}} - \text{SEC}_{\text{target}})$$

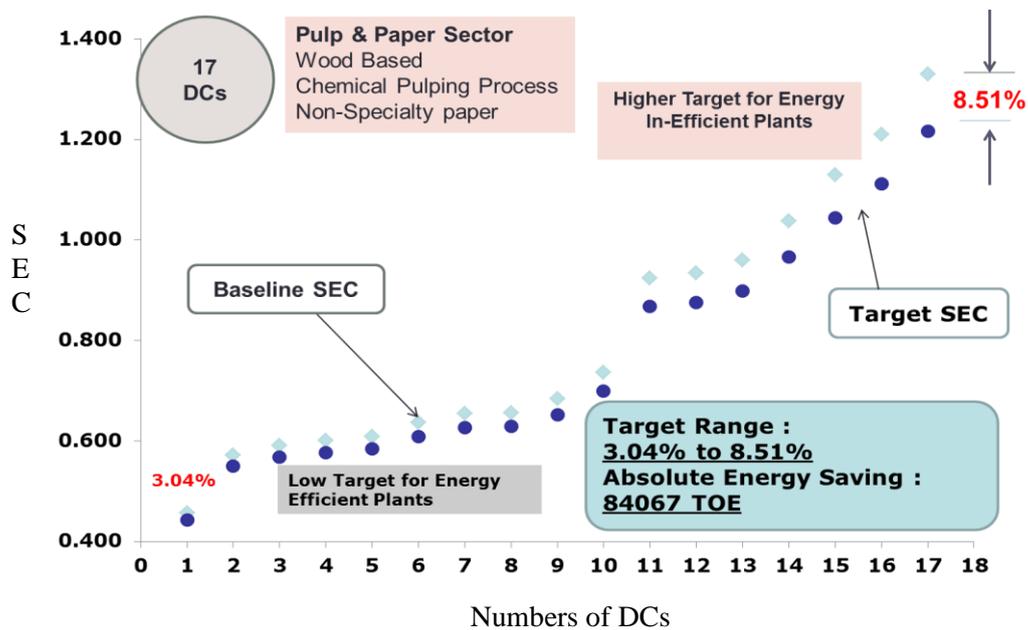
where  $P_{\text{base}}$  = Production quantity at the base year

The steps towards target setting and estimation of energy savings could thus be summarised as below:

1. Selecting the Baseline Year: 2009-10

2. Baseline Production ( $P_{base}$ ): Calculating Arithmetic Average of 2007-8, 2008-9 & 2009-10 from the reported data
3. Baseline CU% ( $CU_{base}$ ) : Avg. of 2007-8, 2008-9 & 2009-10 (CU stands for capacity utilization)
4. Normalization of SEC is done by incorporating the normalization factor based on capacity utilisation (if required)
5. Baseline SEC ( $SEC_{base}$ ) : Calculating Arithmetic Average of 2007-8, 2008-9 & 2009-10 from the normalised SEC data
6. Target SEC ( $SEC_{target}$ ): SEC as estimated in 2014-15 (with or without normalization)
7. Target : % reduction from  $SEC_{base}$
8. Estimation of energy savings

**Figure 10: Illustration of Plant Level Target Setting for Pulp and Paper Industry**



Source: Garnaik (2011)

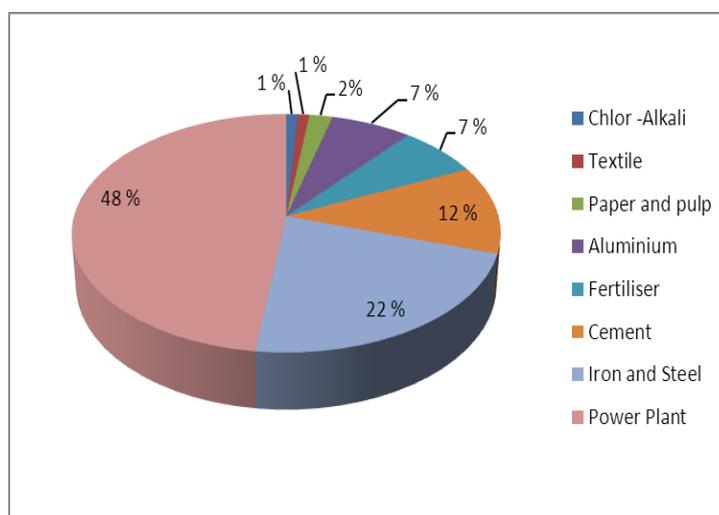
Table 5 indicates the reported energy consumption and energy saving target in PAT Cycle 1 and Figure 11 below indicates the national savings target under PAT Cycle 1 (in percentage). Table 6 further shows the distribution of state-wise target energy savings. The targeted energy saving for the states have been computed from the targeted energy savings of all the DCs for all the sectors of a particular state.

**Table 5: Reported Energy Consumption and Energy Saving Target in PAT Cycle 1**

S N	Sector	No. of Identified DCs in PAT Cycle 1	Reported Energy Consumption in PAT Cycle 1 (million toe)	Energy Saving Target under PAT Cycle-1 (million toe)
1	Aluminium	10	7.71	0.456
2	Chlor-Alkali	22	0.88	0.054
3	Textile	90	1.20	0.066
4	Pulp & Paper	31	2.09	0.119
5	Iron and Steel	67	25.32	1.486
6	Fertiliser	29	8.20	0.478
7	Cement	85	15.01	0.816
8	Thermal Power Plants	144	104.56	3.211
	Total	478	164.97	6.686

Source: Verma et. al (2013)

**Figure 11: National Energy Saving Target under PAT (in percentage)**



Source: BEE (2012)

### *Issuance of ESCerts*

An ESCert is an instrument that is issued by Ministry of Power/BEE for a one ton of oil equivalent of energy savings achieved by the designated consumer, over and above the target savings. The number of ESCerts which would be issued depends upon the quantum of energy saved at the target year. The process involved in issuing and promoting trading of ESCerts could be summarised as below:

- 1) Verification of the SEC of the DCs both in the baseline and target years by a BEE accredited verification agency known as Designated Energy Auditors (DEA) hired by DCs.
- 2) Issuance of ESCerts only to those DCs who exceed the target efficiency levels, that is who achieves in achieving lower SEC than the targeted SEC. The quantification of energy savings for issuance of targets would be based on the report provided by DEA
- 3) Trading the ESCerts by overachieving DCs with underachieving DCs (who failed to meet the target by undertaking appropriate measures). Each certificate will be unique tradable commodity and the trading can be carried out bilaterally between any two DCs (within or across the designated sectors) or on special platforms for their trading created in power exchanges namely Indian Energy Exchange (IEX) and Power Exchange of India (PXIL). First ESCerts is supposed to be issued after completion of one financial year in 2013-14.
- 4) Ensuring compliance and organizing reconciliation of ESCerts will be undertaken by BEE in association with the two Power Exchanges.

**Table 6: Target Energy Saving and Number of Identified DCs in Different States**

States	Number of identified DCs	Target Energy Savings (in ton of oil equivalent)
Andhra Pradesh	39	370789
Assam	7	83177
Bihar	3	47473
Chattisgarh	38	641897
Delhi	4	62937
Goa	5	14387
Gujarat	54	592781
Haryana	7	269734
Jharkhand	11	521098
Karnataka	20	223964
Kerala	9	14685
Madhya Pradesh	24	500453
Maharashtra	45	790354
Orissa	28	541192
Puducherry	2	1146
Punjab	22	337123
Rajasthan	58	358656
Tamil Nadu	41	395365
Tripura	3	7050
Uttar Pradesh	27	395225
Uttarakhand	2	7090
West Bengal	17	472740
Himachal Pradesh	10	29044
Meghalaya	2	6035

Source: Verma et al (2013)

For sectors (other than thermal power sector):

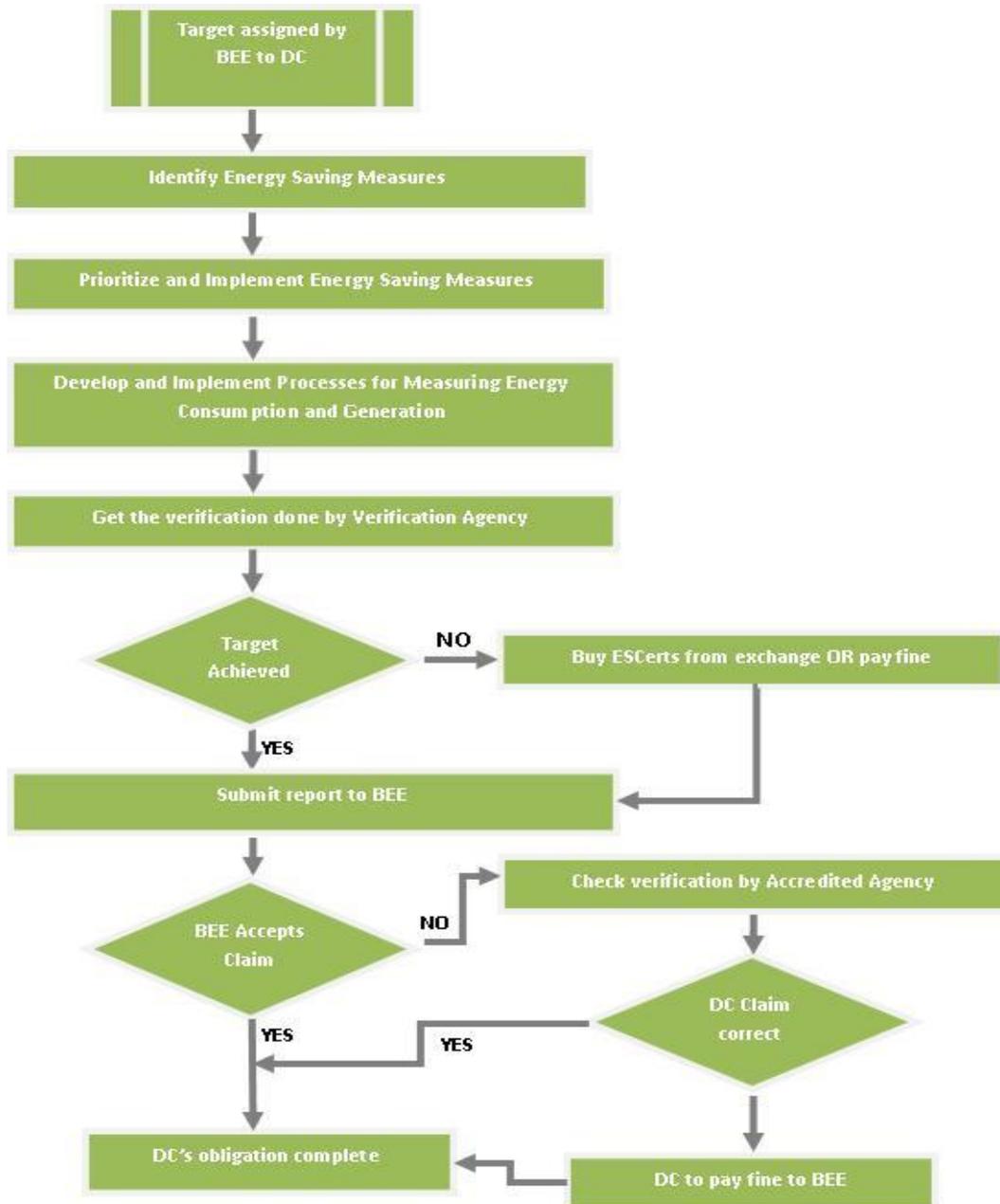
Number of ESCerts that would be issued = (SEC notified for target year- SEC achieved in target year) × (production in baseline year).

For thermal power plant sector (Kumar and Aggarwala, 2013):

Number of ESCerts that would be issued = {(heat rate notified for target year- heat rate achieved in target year) × production in baseline year in million kWh}/10

The entire process could be represented schematically as in Figure 12.

**Figure 12: A Simplified Schematic Representation of the Process towards Issuance of ESCerts**

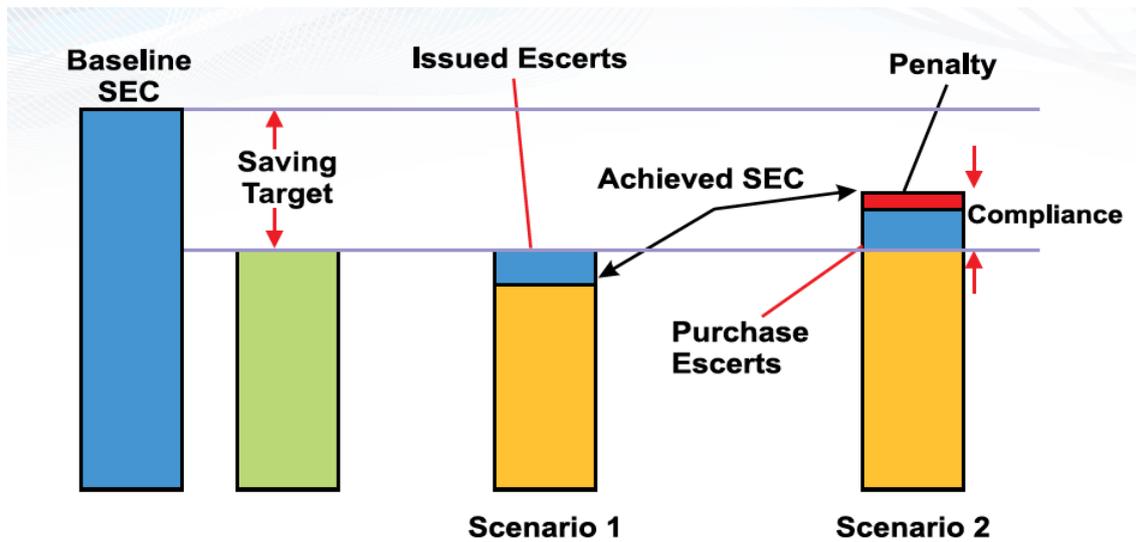


DCs who would fail to achieve the target by the time frame would be imposed a fine or penalty for the non-compliance as per the provision of the EC Act. The financial penalty for non-compliance is linked to the degree of non-compliance, so that

underperformers can buy certificates for some amount and pay a penalty for the rest. The proposed penalty is equal to the (fixed amount = Rs 10 lakh) + [(Target saving) × (% Actual unachieved) × (Current Price of 1 tonne of oil equivalent)] The diagrammatic illustration of the working of ESCerts trading is given in Figure 13.

The diagrammatic illustration of the working of ESCerts trading is given in Figure 13.

**Figure 13: Diagrammatic Representation of Targets, Compliance, ESCerts and Penalty**



Source: BEE (2012)

The calculation can be illustrated by an example:

SEC in baseline: 10 toe/unit of production (tonnes of oil equivalent per unit of production)

Baseline Production: 10000 units

Target: 4% reduction in SEC

SEC at the end of 2014-15: 9.6 toe/unit of production

For ESCerts or Penalty:

- Reduction requirement: 4000 toe
- Case1 (Achieved SEC = 9.8): -2000 toe (Penalty)
- Case2 (Achieved SEC = 9.4): +2000 toe (ESCerts)

In case of compliance (say up to 80%) by purchase of ESCerts (equivalent to 1600 mtoe)

Monetary Value of ESCerts (A) =  $1600 \times (X)$  INR (depending on the price of 1 tonne of crude oil which is assumed here as X)

Compliance for the remaining Rest 20% by Paying Penalty for 400 MTOE (Calculated)

Upfront penalty 1000000 INR (As per the Energy Conservation Act)

Non-compliance Penalty  $400 X$  INR

Total Penalty Value (B)

$(1000000+400 X)$  INR

Total Monetary Implications to DC=  $(A + B)$  INR

\*INR: Indian rupee

As indicated above, the Energy Savings Certificates (ESCert) will be traded on special trading platforms to be created in the two power exchanges (IEX and PXIL). The exchanges are also supposed to maintain data on traded prices, traded volumes, and trends. Transfer agents or depositories shall hold the ESCert in electronic form and provide client services in relation to ESCert. The lifetime of ESCert potentially affects its price. Thus, shorter compliance period and hence life time certificates tend to increase the transaction cost and may potentially distort market prices because the market will tend to respond to short term forces of demand and supply (Bhattacharyya, 2012) . The BEE has therefore allowed the option to a DC who has been issued the ESCert during the current PAT cycle to use it for the purpose of banking until the next PAT compliance cycle and the ESCert issued in the first compliance period shall remain valid till the completion of the following compliance period (Ministry of Power, 2012) This would also facilitate in building investor confidence and market stability (BEE, 2011). In case the market has surplus ESCert there could be a possibility of auctions/ buy-back of ESCert to ensure price stability. Apart from this there is a provision of getting advanced ESCert in between two PAT cycles and at the end of each financial year, however the targets assigned to them will also be revised accordingly (Verma et. al, 2013).

### 2.3 Computing Potential CO2 Abatement

An important issue that deserves mention at this point is how one can translate this energy savings into abated CO2 emission. For each DCs, CO2 emission reduction with respect to apportioned targeted total savings in terms of SEC can be calculated and the same method can be applied for the whole sector by relying on sectoral apportionment based on share of relative energy consumption across sector (thermal power sector is considered separately). By adding the CO2 emission reductions of the different sectors covered under the PAT scheme, the total CO2 emission reduction can be calculated. The formula that can be used for calculating CO2 emission from reducing the usage of a fuel is given as below:

$$\text{CO2 emission reduced (tonnes of CO2)} = \text{Avoided energy purchase} \times \text{Emission factors}$$

For grid based electricity the emission factor could be obtained from Central Electricity Authority (CEA) and for other fuels it could be obtained from IPCC emission factor database. Table 7 shows the emission factor values that could be used. It needs to be emphasised at this point that the emission factors are expressed in different units and needs to be converted to a uniform unit

**Table 7: Fuels and emission factors**

<b>Fuels</b>	<b>Emission factors</b>
Coal (gCO2/MJ)	92.5
Lignite (gCO2/MJ)	102.5
Gas (gCO2/MJ)	49.4
Oil (gCO2/MJ)	71.9
Diesel (gCO2/MJ)	69.1
Naptha (gCO2/MJ)	66
NEWNE Grid (tCO2/MWh)	0.83
South Grid (tCO2/MWh)	0.75

Source: Verma et. al (2013)

For grid emission factor the value is different for the North, Eastern, Western and North Eastern (NEWNE) Grid and southern grid, because the locations of DCs are different and across the nation so the different emission factors value has been considered.

## **2.4 Institutional Structure for PAT Mechanism**

In the institutional design for PAT, the role of scheme administrator and regulator is being executed by the Bureau of Energy Efficiency (BEE) (which has been constituted under the provision of the Energy Conservation Act, 2001) and the Central Electricity Regulatory Commission (CERC), apex body in matters related to regulations governing the electricity sector, respectively. CERC provides the umbrella regulations for governing the functioning of PAT Mechanism. BEE acts in its capacity to set the energy efficiency targets, publish protocols and procedures for implementation of the PAT Mechanism. BEE also undertakes the accreditation and empanelment of Designated Energy Auditors (DEA). The DEA are independent entities, accredited by BEE, who are responsible for carrying out monitoring, verification, and reporting of energy efficiency projects undertaken by Designated Consumers under the PAT Mechanism.

The Designated Consumers (DCs) would have the obligations to fulfill the annual energy savings targets and the total compliance targets. For this purpose, they either can undertake energy efficiency initiatives or can engage in Obligations and/or ESCerts Trading. The DCs would be responsible annually for monitoring and reporting their energy efficiency status to the BEE and ESCerts will be awarded to DC only if the energy savings in the particular year exceed the annual savings target.

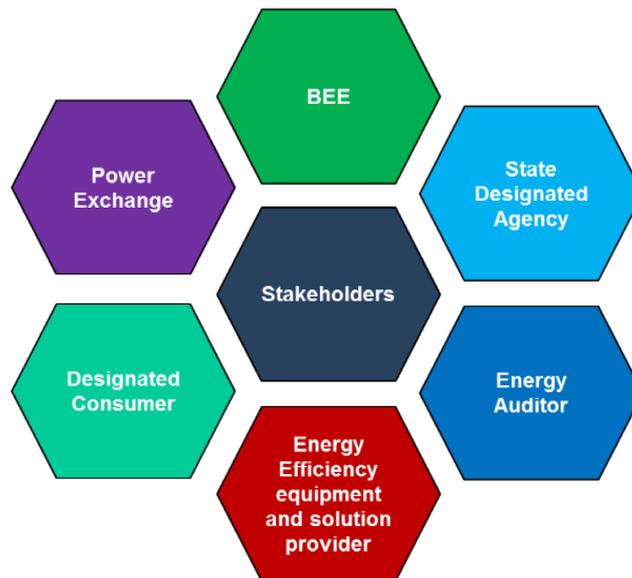
BEE can initiate compliance checks against any DC at any point of time preferably upon submission of annual monitoring report. BEE will recommend the DEA for the compliance check and in case of compliance checks; the Designated Consumers would be responsible for communication and cooperation with the DEA and for suitable compensation of the DEA for its services.

The existing power Exchanges namely Power Exchange India Limited (PXIL) and Indian Energy Exchange (IEX) will provide a neutral electronic platform to all designated consumers for trading Obligation and ESCerts in a fair manner without any information asymmetry. Both PXIL and IEX will have interface with BEE and EESL (Energy Efficiency Service Limited), Banks and Clearing and Settlement system to enable seamless transactions of the tradable instruments.

In case of non-compliance the State Designated Agencies (SDA) as constituted in accordance with the Energy Conservation Act, 2001 will act as the body responsible for adjudicating matters related to penalizing the Designated Consumers for noncompliance. Market Makers, Brokerage, Consulting firms, Financial Institutions, Financiers would have their own roles to play as the entire mechanism attains greater depth and liquidity in due course of time, wherein these entities would help the market to stabilize and sustain in the longer run.

Figure 14 below indicates the stakeholders in the PAT Scheme.

**Figure 14: Key Stakeholders in the PAT Scheme**



Source: Tata Strategic Management Group (2014)

### **2.5 Measurement & Verification under PAT Scheme: A Snapshot**

As defined earlier, the baseline SEC would be estimated based on the reported data of DCs through the mandatory reporting system of annual energy consumption and quantity produced. As it is a self-declared data, this would form the basis of establishing baseline SEC. As the baseline SEC is on gate-to-gate basis, there is no such measurement involved in any sub-system or sub-process of the plant.

After submission of Form 1 containing reported data on annual energy consumption and Form A as performance assessment document, the Designated Consumer has to hire

an accredited energy auditor, from the list of BEE empanelled accredited energy auditors<sup>7</sup> for the verification of these forms.

Accredited energy auditor (AEA/DEA) will verify Form 1 and Form A by conducting baseline energy audit in the DCs. The baseline energy audit conducted by the DEA is aimed at knowing the energy performance of various key equipments, energy balance, energy saving potential, various energy conservation options implemented in the plant etc.

DEA shall submit certificate of verification through Form B to BEE within 3 months from the last day of the financial year. This process is mandatory after the last financial of the cycle, whereas designated consumer can submit these documents after verification in the voluntary phase for issuance of ESCerts. A positive recommendation shall be submitted only if the proposed project activity complies with all the requirements stipulated under the PAT scheme. The verification by DEA of project documentation provided by the project DC shall be based upon both quantitative and qualitative information on SEC. Quantitative information comprises the reported numbers in the monitoring report submitted to the DEA. Qualitative information comprises information on internal management controls, calculation procedures, and procedures for transfer, frequency of SEC reports, and review and internal audit of calculations and data. In addition to reviewing the monitoring documentation, the DEA shall confirm that the project DC has complied with requests, if any, made during validation. The verification report submitted by DEA in form B further goes through an independent review and ex-post determination by BEE in a year of the energy consumption norms and standards achieved in year out of three year compliance period. This known as 'check verification' and this is also done through AEA.

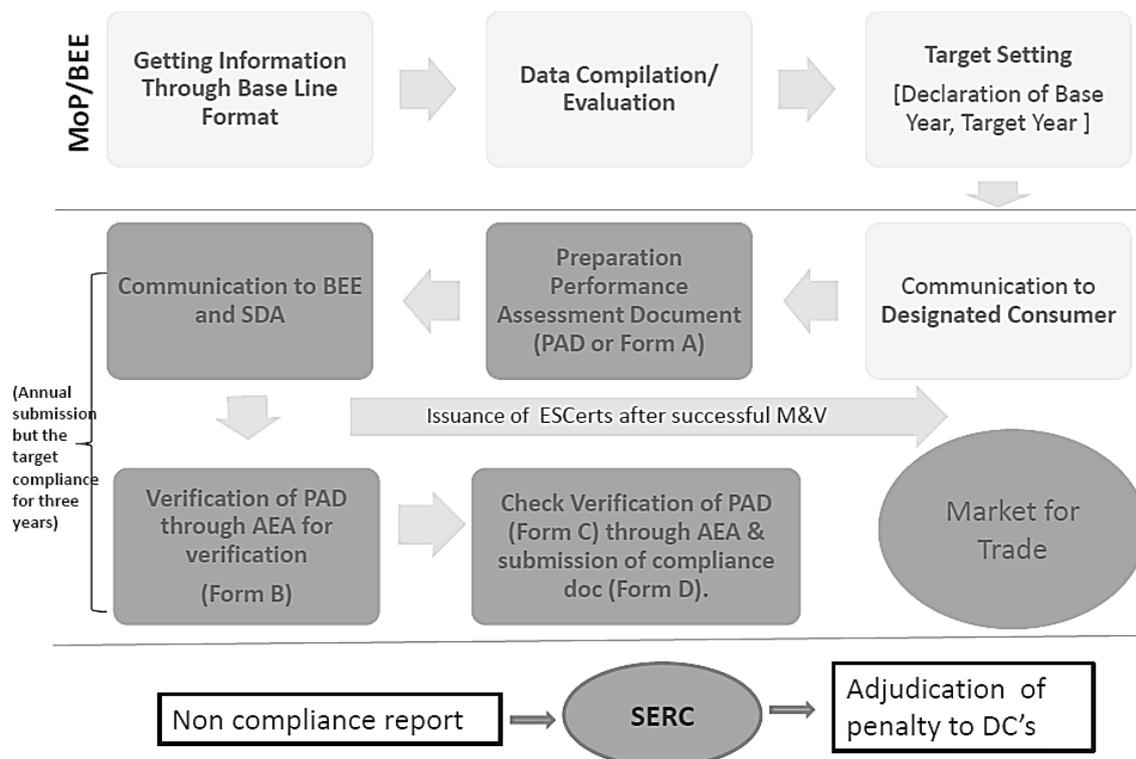
There would not be any M&V during the intermediate years i.e. between 2012 & 2015. However, each DC would be required to submit the annual energy consumption

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<sup>7</sup> Accreditation of DEAs is undertaken by BEE under appropriate rules/ regulations in this regard. The designated energy auditor shall be a legal entity and that it can function legally, enter into contracts, make decisions independently, and may be sued for failure to perform as agreed in the contract. DEA will have appropriate legal and financial liabilities for all its actions under the PAT scheme and such liabilities will be an integral part of the accreditation.

through the ‘Form-1’ to BEE. Apart from this, one to two energy audits by ‘Accredited energy auditors’ will be conducted by DCs as per the provision of EC Act, 2001. These would form a basis of M&V system in the target year. The entire scheme of M & V involved in the PAT activity could be schematically represented in Figure 15.

**Figure 15: PAT Activity and M&V Flowchart**



Source: BEE (2012)

## 2.6 PAT: Current Status

As reported by Reconnect energy<sup>8</sup> based on a press release by BEE, there has been satisfactory progress in the PAT scheme and the Bureau of Energy Efficiency (BEE) appears to have actively taken the scheme forward. The first PAT cycle (2012-15) is going to end in March 2015. The online PAT Net platform providing the foundation for

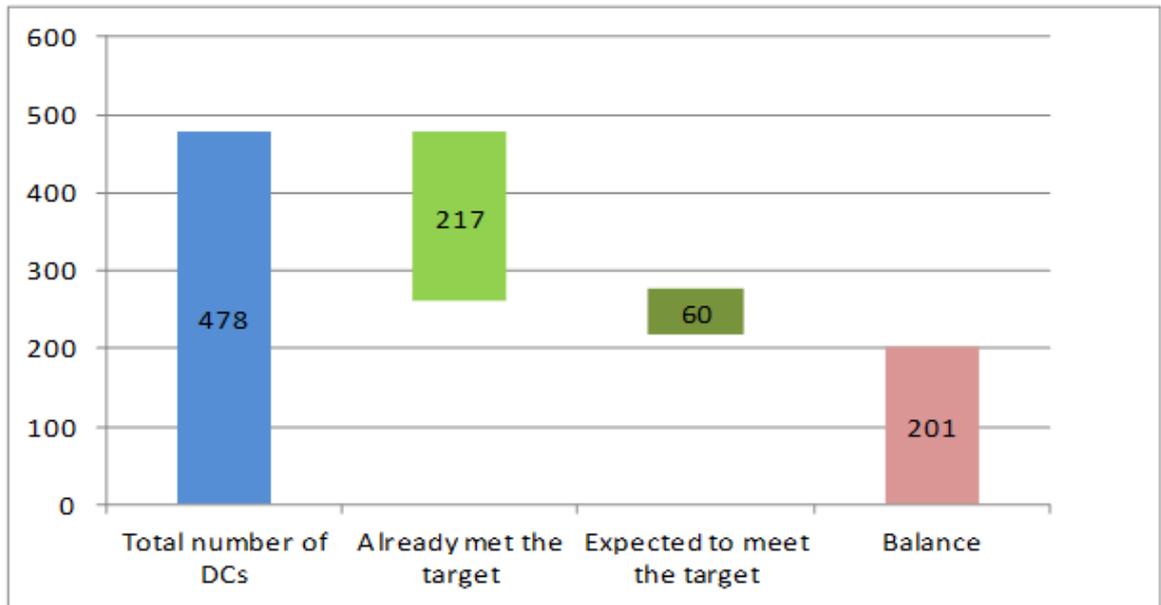
<sup>8</sup> This section draws heavily on- <http://reconnectenergy.com/blog/2015/01/preliminary-analysis-of-pat-scheme/> (accessed January 14, 2015)

carrying out trading in ESCerts is at its final stage and consultants have been invited to review the framework for ESCerts trading.

The final verification of the energy saving done is due followed by issuance of ESCerts. The final verification and certification will be done by Accredited Energy Auditors (AEA). After the verification, ESCerts will be issued.

From Figure 16 based on the recent press release, one can make out that demand is likely to be seen in the first cycle. However, given that 50% of the DCs are yet to meet the target, it would be worthwhile and interesting to watch the first round of ESCerts market as the scheme is still in a nascent stage.

**Figure 16: The status of PAT**



Source: Based on a press release by BEE dtd 24.11.12- Annual (unverified) reporting by the designated consumers at the end of the year 2013-14

The price of an ESCert will also attract the market which is variable in nature and depends upon the market price of coal, gas & crude oil. The price of an ESCerts determined by BEE for the year 2011-12 was Rs.10, 154.

## **2.7 PAT and Potential of Linking with International Carbon Markets**

PAT mechanism has been set in place with the objective of improving industrial energy efficiency in India. Given the potential benefit that India could derive from the scheme in terms of energy security and cost curtailment or saving, the Government is committed to implementing the proposed Mandatory Energy Efficiency PAT scheme irrespective of any international climate change agreement (CII, 2011). Thus, the Specific Energy Consumption (SEC) reduction targets under the PAT mechanism neither create any international obligations nor are they directly intended to put any overall cap on energy consumption.

The PAT mechanism also has a carbon emission reduction potential as a co-benefit of the targeting of energy savings and calculations with respect to its potential in terms of carbon abatement has been already illustrated in the previous section. Such energy saving and concomitant emission reduction would be possible if the country has increased access to capital and clean-technology. In that context, offset-based finance like CDM provides a link between projects in developing countries and compliance-based trading schemes, as there is no direct relationship otherwise between the provision of funds and the underlying emission reduction performance.

The earlier research (Janardhanan and Srivastava, 2012) in understanding the potential in linking the PAT mechanism with international offsets suggests that some modifications in the rules and regulations of the PAT scheme may make it institutionally compatible with CDM or bilateral offset mechanisms.

### ***2.7.1 PAT: Synergy with CDM market***

PAT has the potential to reduce around 98 million tonnes of CO<sub>2</sub> per year (Garnaik, 2011). This potential could be exploited to finance the PAT scheme by exploiting the carbon offsets market. Although the institutional mechanism for data collection, monitoring and verification and reporting are in place, there are some grey areas that need to be addressed before linking PAT to international carbon offsets.

The foremost among the challenges is addressing the criterion of ‘additionality’ in approval of CDM projects i.e. whether the emission reduction that would happen (in

case a project or Programme of Activities gets approved as a CDM project) is additional to what is stipulated by the legal and regulatory framework. There could be a serious problem here in terms of demonstrating additionality in case of PAT because the emission reduction is simply a co-benefit of a nationally determined target for SEC reduction and in that sense it is not additional.

Additionally, the monitoring, reporting and verification (MRV) framework under PAT, as mentioned before, is not directly geared towards reducing CO<sub>2</sub> emission, hence additional information and data needs to be collected on that count. Albeit not an impossible task, such extension or inclusion would be clearly contingent upon government's willingness and approval.

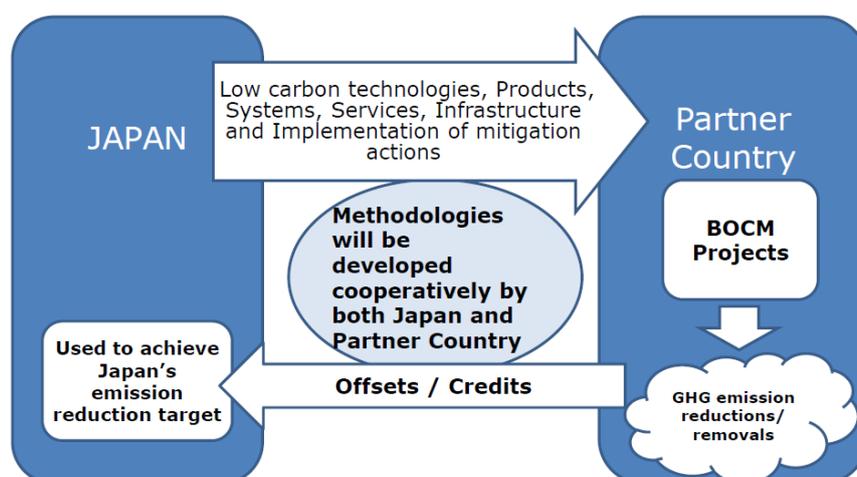
The problem may get compounded when it comes to question of accessing data. Currently the data and information on SECs of DCs are available to DCs, DEA (Designated Energy Auditor), SDA (State Designated Authority) only through login requirement whereas the CDM project design documents (PDDs) are open access material and easily available on the designated website of UNFCCC. In case of PAT, the DEAs that are involved in verifying or check-verifying are accredited by BEE whereas the validating agency in case of CDM known as Designated Operational Entity (DOE) are recognised by CDM Executive board through a different mechanism. Thus a synergy has to be drawn in the processes so as to make PAT scheme eligible for offsets under CDM.

It may also be too problematic to attempt an ex-ante allocation (crediting in advance of the scheme on the basis of forecast energy efficiency improvement pertaining to PAT scheme). The problem might be serious if there is over-allocation of CERs. Unless there is harmonisation between the PAT Cycle and the issuance of CERs through an ex-post crediting after say a PAT cycle is completed, the problem cannot be resolved.

### 2.7.2 PAT: Synergy with bilateral offsets

Among the various proposals for new market mechanisms that have been deliberated upon, Bilateral Offset Credit Mechanism (BOCM) has been considered as an option to facilitate the linking of PAT with international carbon offsets. The proposal on BOCM had been submitted to UNFCCC by the Government of Japan in February, 2011. The primary differentiator of BOCM, as underscored by the Government of Japan, is that the scheme would make faster diffusion of low carbon technology products and services possible as compared to CDM which has not observed any significant technology transfer (Das, 2011). The functioning of the BOCM is shown in Figure 17

**Figure 17: Bilateral Offset Credit Mechanism**



Source:

[http://pub.iges.or.jp/modules/envirolib/upload/4167/attach/IGES\\_Ninomiya\\_Asian\\_Carbon\\_Forum\\_Bangkok.pdf](http://pub.iges.or.jp/modules/envirolib/upload/4167/attach/IGES_Ninomiya_Asian_Carbon_Forum_Bangkok.pdf) (last accessed January 15, 2014)

As per the Japanese proposal, Japan would support projects in developing countries that involve installation of low carbon technologies or involving low carbon products and services. This would enable the host countries to reduce emissions and the emission reduction would be counted under Japan's emission reduction pledges. The computation involved in balancing support on the technology and finance front with flow of offsets would be contingent upon the mutually developed and agreed methodologies.

PAT scheme is focussed on targeted SEC reduction through reduced consumption of fossil fuels and electricity within the designated boundary. The reduced consumption

and hence avoided production of fossil fuels could be translated to actual or avoided emission reduction by using relevant emission coefficients of fuel (as illustrated before). Hence, the compliance with the targeted energy saving norms and concomitant emission reduction would require additional investment and installation of state of the art technologies. This is where BOCM has the potential to contribute as a market mechanism when it comes to both finance and technology. However, attempt to link the two schemes would face methodology and policy related challenges besides the issue of policy and political willingness to go for such linking at the first instance.

The primary methodological challenge would be to synergise the notion of offsets as proposed in BOCM with that of emission reduction through targeted SEC reduction and whether the institutional mechanism and the methodology to determine the latter would be in synergy with what BOCM proposes as an institution mechanism for verification of offsets. As the PAT mechanism has not been originally designed as an international offset mechanism the institutional architecture is ideally suited to measure and address domestic energy saving targets and may not necessarily hold good in its usual form when ESCerts are used as instruments of international offsets. Additionally there exist no components in the methodology especially in MRV mechanism pertaining to PAT scheme that could make it compatible with MRV pertaining to BOCM or any other international emission trading scheme, for that matter (IGES, 2012).

Furthermore, calculation of the offsets ought to be over and above the overall energy saving targets that the PAT mechanism intends to achieve. Hence ESCerts would first have to be accepted as meeting domestic energy saving objectives under National Mission for Enhanced Energy Efficiency (NMEEE) and then as offsets under BOCM. That essentially opens the room for double counting, as ESCerts are counted twice – first, in meeting India’s domestic energy saving targets and second, accounted for in meeting Japan’s or for that matter any other developed country’s emission reduction in such bilateral offsets. Questions may not arise if PAT is completely delinked from India’s international pledges to reduce emissions but with the Lima COP meeting emphasising on firming up intended nationally determined contribution (INDCs)<sup>91011</sup>

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<sup>9</sup><http://www.iaea.com/blogosphere/the-lima-call-to-action-and-the-role-of-national-pledges> (last accessed January 15, 2015)

India may well be inclined to count ESCerts towards meeting its domestic emission reduction pledges. In that case such linking could be thrown open to question.

Another critical issue that has been deliberated widely is whether BOCM would be equally acceptable at the level of international climate negotiations as well as in a host country with equal credibility as CDM (IGES, 2012). In absence of clarity on that, the basic purpose of BOCM to provide flexibility to Japan in addressing its emission reduction pledges at lower costs would come to grief.

## **2.8 Conclusion**

The biggest challenge that a country like India faces is decoupling its economic growth from the concomitant growth in CO<sub>2</sub> emission. An avenue to improve the growth process without compromising on environmental quality and without augmenting the spillover on global warming is through enhancement of energy efficiency. In fact energy efficiency is considered as a least costly and no-regret option when it comes to mitigating the impact on global warming. India's National Action plan on Climate Change (NAPCC) has a key component focusing on energy efficiency known as the National Mission for Enhanced Energy Efficiency (NMEEE). Under the umbrella of NMEEE, PAT has been introduced as a market based mechanism to enhance industrial energy efficiency across energy intensive industrial sectors. Considered in terms of CO<sub>2</sub> emission, PAT has the potential to reduce 98 million tonnes of CO<sub>2</sub> annually (Garnaik, 2011). In the first cycle ranging from 2012 to 2015, PAT has the target energy saving potential of 6.68 million tonnes of oil equivalent spread across 8 highly energy intensive industries and in the second cycle there would be both widening and deepening of the scheme with more energy-intensive sectors (listed under the Energy Conservation Act 2001) to be brought under the scheme. The mechanism involves target savings in terms of Specific Energy Consumption (SECs) set across the level of unit or plant known as designated consumer and involves issuance of

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<sup>10</sup> [http://www.business-standard.com/article/current-affairs/javadekar-warns-against-doing-away-with-interests-of-poor-at-lima-climate-talks-114121000140\\_1.html](http://www.business-standard.com/article/current-affairs/javadekar-warns-against-doing-away-with-interests-of-poor-at-lima-climate-talks-114121000140_1.html) (last accessed January 15, 2015)

<sup>11</sup> <http://mitigationpartnership.net/intended-nationally-determined-contributions-indcs> (last accessed January 15, 2015)

energy saving certificates (ESCCerts) for those who exceed the targeted savings. These ESCerts could be traded either bilaterally by an over-achieving DC with an under-achieving DC or could be bought by the under-achiever from power trading exchanges (IEX and PXIL) that would be the depository of the certificates in electronic form. The mechanism mimics a cap and trade mechanism but does not involve any absolute emission reduction, albeit the unit of energy saving certificate in terms of tonnes of oil equivalent could be equated to avoided unit of energy consumption and hence avoided production. Currently, no such equivalence or fungibility exists between a unit of emission reduction and a unit of energy saving certificate but it is not difficult to bring out such equivalence. An illustration has also been given in this paper on how one can compute the potential emission reduction.

Market-based mechanisms have their inherent advantages as compared to command and control, fiscal measures or other regulatory approaches for GHG mitigation such as technology or performance standards and feed-in tariffs. The key advantages lie in their ability to attain an emissions goal in a cost-effective manner and simultaneously providing incentives for innovation and technology transfer. Beyond the benefits in terms of cost-saving, these mechanisms also act as a potential source of revenue for the governments. However there are certain grey areas that deserve due attention. These include: i) technical readiness, including coverage, monitoring and verification and establishing registries; ii) policy readiness, including setting clear goals, choosing appropriate instruments and distributing benefits; and iii) institutional and legal readiness, including establishing responsibility for collection of data, issuance of allowances or certificates or credits, and handling legal compliance issues (Aasrud, Baron and Karousakis, 2010).

It is in these grey areas that coordination and harmonisation might be necessary when it comes to integrating and linking any two market mechanisms with potential for generating carbon offsets. The paper has delved into a discussion of some of these challenges of linking the ESCert based PAT scheme with CDM and with bilateral offsets proposed by the Japanese Government. The PAT scheme is in its first cycle and

is just beginning to trade in ESCerts.<sup>12</sup> Once the trading is successfully completed in the first cycle without many hiccups it would be possible to throw better light in terms of fungibility of ESCerts with other instruments relating to carbon offsets and hence comment on the future of such linking.

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<sup>12</sup> As of November 2015, the roles and responsibilities of the entities involved and ESCerts exchange regulation have been finalized and the PATNet portal that will record trading and other activities involving ESCerts have been upgraded ( for more details see- <http://knowledgeplatform.in/wp-content/uploads/2015/11/Presentation-on-ESCert-Trading.pdf>, last accessed on 08 January 2016)

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