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The perform, achieve and trade scheme in India: An effectiveness analysis

Divita Bhandari, Gireesh Shrimali*,[1]

Yale University, Stanford University, United States

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ABSTRACT

India's flagship scheme for energy efficiency is Perform, Achieve and Trade (PAT). Under PAT, obligated industries are required to achieve targets either by implementing energy efficient technologies or by purchasing energy efficiency certificates (ESCerts). We ask two questions: is PAT effective so far? Is PAT likely to be effective in future? We conclude the following: the targets are not strict enough to add energy efficiency activities beyond business-as-usual; long-term investment in energy efficiency may not happen; the PAT market may not form; many equity issues remain unaddressed; and, it is too early to assess transaction costs. Based on best practices, the policy implications are: set additional targets that account for rising energy costs; promote long-term investments via clear and consistent goals; create a functioning PAT market platform to ensure cost-effectiveness; reduce equity concerns via normalized targets and standardized auditing; and, keep transaction costs low.

1. Introduction

India has the third largest energy demand in the world [18]. Though the per capita energy consumption is lower than a third of the countries in the world there has been a simultaneous growth in the economy and population, resulting in a doubling of energy consumption since 1990 [31]. In this context, India faces three significant challenges in defining its energy policy: Energy Access, Energy Security and Climate Change. Energy efficiency is likely to play a major role in meeting these challenges.

Given that a significant portion of the total energy consumption – i.e., 45% in 2006-07 [8] happens in the industrial sector, energy efficiency measures within the industrial sector is an important aspect to achieve policy objectives. The Energy Conservation Act [19] identified energy intensive industries as designated consumers and provided them with a five-year time frame to: (1) establish the standards for energy consumption, (2) conduct mandatory energy audits through accredited auditors, (3) appoint plant-level designated energy managers, and (4) furnish information regarding the energy consumed and the actions taken to the designated agencies. Under the Act, the Bureau of Energy Efficiency (BEE) was established as the regulatory institution responsible for energy efficiency improvements.

In 2008, the National Action Plan on Climate Change (NAPCC) included the National Mission for Enhanced Energy Efficiency (NMEEE). Under the NMEEE, the Government of India has enacted a multi-pronged approach to achieve improvements in energy efficiency [26]:

1. Perform, Achieve and Trade (PAT) mechanism: A market based mechanism to enhance cost effectiveness of energy efficiency improvements within industrial plants. The goal of this scheme is to set energy efficiency targets and issue market tradable permits for certification of energy savings. This is similar to cap-and-trade schemes used in other contexts.
2. Market transformation for energy efficient appliances: a mechanism to shift consumers to energy efficient appliances through product labeling and awareness programs.
3. Financing platform for energy efficiency projects: a mechanism to help finance demand side management and energy efficient programs by capturing future energy savings.
4. Institutions: Strengthening of institutions such as the BEE and the state designated agencies (SDA) that are responsible for energy conservation, maintaining of energy databases and for accurate monitoring and verification of energy use through audits.

The overall goal of NMEEE is to achieve savings of 23 million metric tons of oil equivalent through an avoided capacity of 19,000 MW [39]. However, this raises the question: is NMEEE on target? And more importantly, will it be on target? In particular, what is the current and likely performance of BEE's flagship policy, PAT? How would its perfor-

Abbreviations: BEE, Bureau of Energy Efficiency; DCs, designated consumers; ESCerts, energy efficiency certificates; NAPCC, National Action Plan on Climate Change; NMEEE, National Mission for Enhanced Energy Efficiency; NPV, net present value; Performance, PAT, Achieve and Trade; SEC, specific energy consumption; SDA, state designated agencies; toe, ton of oil equivalent

* Corresponding author.
E-mail address: gireesh@stanford.edu (G. Shrimali).

[1] Gireesh is the Director of Climate Policy Initiative's India office; he is also a Fellow at the Steyer-Taylor Center for Energy Policy and Finance at Stanford University.

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mance relate to design and implementation? Based on the COP21 summit, additional goals of reducing the emissions intensity of its GDP by 33–35% by 2030 from its 2005 levels [57]. PAT is expected to be a key component to this decrease in energy consumption.

Stern [53] outlines three main objectives of international cap and trade schemes: effectiveness, efficiency, and equity. Based on these objectives, we have established three significant research questions that help evaluate the design and performance of PAT:

- Has the PAT scheme been *effective*?
- Has the PAT scheme been *cost effective*?
- Has the PAT scheme been fair – i.e., *equitable*?

The first research question explores the impact of the PAT scheme in driving energy efficiency improvements as well as the barriers to effectiveness. The second question assesses whether the improvements are being achieved at the lowest cost. And the third research question explores equity impacts. Our findings are supported by primary as well as secondary research and backed with quantitative data where available. We have also compared PAT with other cap and trade schemes to leverage best practices within the Indian institutional context.

2. Overview of the PAT scheme

There are a number of barriers impacting energy efficiency within the industrial sector in developing countries. These barriers include access to sufficient capital, uncertainty over the length of the payback period, hidden costs associated with energy efficiency investments, lack of information and split incentive issues [56].

In an effort to address the barriers to energy efficiency within the industrial sector, the Bureau of Energy Efficiency has implemented PAT. The goal is to create a transparent, flexible, and robust scheme to achieve energy efficiency measures within specific industrial sectors cost-effectively. The guiding principles for developing PAT are Simplicity, Accountability, Transparency, Predictability, Consistency and Adaptability [39].[2]

The PAT scheme involves identification of the highest energy consumers within each of the selected sectors. These entities are termed designated consumers (DCs). BEE would issue Energy Saving Certificates (ESCerts) to DCs based on respective savings. Each ESCert is equivalent to one ton of oil equivalent (toe). DCs that do not meet the targets will be required to either buy ESCerts to meet targets or pay penalties. The ESCerts will be tradable and bankable in a market.

2.1. Selection of sectors

For the first cycle of PAT, 478 designated consumers from eight industrial sectors have been assigned targets. These sectors include cement, iron and steel, chlor-alkali, aluminum, thermal power plants, pulp and paper, fertilizer and textiles. The second cycle of PAT will include 143 additional targets and include three additional sectors – Refineries, Railways and DISCOMs. The annual energy thresholds and total sector-wise energy savings are included in Table 1. Industries that are below these annual thresholds are not included within the PAT scheme. The expected savings of the scheme across all the sectors during the first cycle – i.e., 2012–2015 – is 6.68 million toe.

2.2. Baseline and target setting

Each DC is a specific facility, with its own assigned target. The main metric for evaluation is the gate-to-gate specific energy consumption (SEC).[3]

The gate-to-gate SEC (Eq. (1)) is specified as the ratio of net energy into the plant boundary to the total quantity of output exported from the plant boundary (Fig. 1). The boundary of the plant is defined to capture the entire net energy input to the boundary.

$$SEC = \frac{Energy\ \ Into\ \ Plant}{Product\ \ \ Output} \tag{1}$$

Energy input to the plant boundary includes Electricity, Solid fuel, Liquid fuel and Gaseous fuels. To standardize across fuel inputs, the calorific value of the respective fuel is converted to tons of oil equivalent. The SEC does not include energy consumed due to residential complex, mining operations, transportation, construction etc. Energy used from renewable sources is also not included.

The assignment of targets is done in a hierarchical fashion. First, the total PAT cycle targets are divided among sectors in proportion to their corresponding energy consumptions. For example, if a particular sector is 10% of the total energy consumption of the eight sectors, the targeted reduction is 10% of the total targeted savings, resulting in a sectoral savings target of .668 million toe.[4] The sectoral targets are further broken down into sub-sectoral targets based on the utilized processes. For example, in aluminum sector, this includes smelter and refinery sub sectors; for textiles, this includes processing/spinning/composite or fiber. The targets for each sub-sector are calculated in a similar manner to the targeted sector savings. Finally, within each sector, targets are calculated based on baseline plant level SECs.

The plant baseline SECs are estimated based on self-declared data submitted by DCs and approved by designated energy auditors. Estimation of the baselines are done based on data collected between April 2007 and March 2010. These values are expected to be further normalized and adjusted based on site specific characteristics; however, details of this process are not readily available.

The target for each facility is defined as a percentage reduction from the corresponding baseline. Facilities are benchmarked against the best performing plant within the sector. The best performing plant would receive the lowest target and others will be assigned with proportional values. Thus,

$$Plant\ Target\,(\%) = \frac{Plant\ SEC}{Best\ SEC} * X\% \tag{2}$$

where X% is the targeted SEC reduction of the best performing plant within the sub sector, and can be calculated by adding up all the plant-level targets under a certain category and equating the sum to the targeted sub sector saving, which has been calculated based on the sectoral and sub-sectoral energy consumptions.

$$\sum\left(\frac{Plant\ SEC}{Best\ SEC} * X\% * Total\ Energy\ Consumption\ of\ Plant\right) = Targeted\ Sub\ Sectoral\ Savings \tag{3}$$

Therefore,

$$X\% = \frac{Targeted\ Sub\ Sectoral\ Savings}{\sum\left(\frac{Plant\ SEC}{Best\ SEC} * Total\ Energy\ consumption\ of\ Plant\right)} \tag{4}$$

Overall, the less energy efficient DCs within each sector would have to achieve higher reductions than the most efficient DCs since the SEC of the best performing plant will be the lowest. The baseline SEC will be revised in the subsequent cycles and the targets are expected to get progressively more stringent [38].

2.3. Monitoring and verification of savings

During the compliance period, the DCs are required to submit annual reports called PAT assessment documents. The monitoring and

[2] Most of what follows within this section is from Ministry of Power [39].

[3] The SEC target is used for all the industrial sectors except for the power sector. For the power sector the targets are based on the operating efficiency and the design efficiency of the plant.

[4] These numbers are presented for illustrative purposes only.