The PAT Scheme: Analysis, Insights and Way Forward

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pwc

SHAKTI
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FOUNDATION

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Abbreviations

AEA	Accredited Energy Auditor
AEA Firm	Accredited Energy Auditor Firm
AEEE	Alliance for Energy Efficiency Economy
AMAI	Alkali Manufacturers' Association of India
AMR meters	Automatic Meter Reading
APC	Auxiliary Power Consumption
APDRP	Accelerated Power Development and Reforms Programme
AT&C losses	Aggregate Technical & Commercial losses
ata	Unit of Absolute Pressure
BEE	Bureau of Energy Efficiency
BREDA	Bihar Renewable Energy Development Agency
BRPL	Bongaigaon Refinery & Petrochemicals Limited, An IOCL Refinery
BTU	British Thermal Units
CCAs	Climate Change Agreements
CDM	Clean Development Mechanism
CDSL	Central Depository Services (India) Limited
CEA	Central Electricity Authority
CEO	Chief Executive Officer
CERC	Central Electricity Regulatory Commission
CHT	Center for High Technology
CII	Confederation of Indian Industry
CITI	Confederation of Indian Textile Industry
CMA	Cement Manufacturers Association
CPCL	Chennai Petroleum Corporation Limited (an IOCL group company)
CPP	Captive Power Plant
CV	Calorific Value
DC	Designated Consumer
DISCOM	Distribution Company
DRI	Direct Reduced Iron
DSM	Demand Side Management
EA	Energy Auditor
EC Act 2001	Energy Conservation Act, 2001
ECBC	Energy Conservation Building Code
EE & ES	Energy Efficiency and Energy Services (EU Directives on EE & ES)
EEFP	Energy efficiency financing platform
EESL	Energy Efficiency Services Limited
EII	Energy Intensity Index
EM	Energy Manager
ES Certs	Energy Saving Certificates
EU	European Union
EU ETS	European Union's Emmission Trading System
FAI	Fertilizer Association of India
FAQ	Frequently Asked Questions
FEEED	Framework for energy efficient economic development
FICCI	Federation of Indian Chambers of Commerce and Industry
FMCG	Fast Moving Consumer Goods
GAIL	Gas Authority of India Ltd.
GCV	Gross Calorific Value
GEDA	Gujarat Energy Development Agency
GiZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GJ	Giga Joules
GTKM	Gross Ton Kilometers
HAREDA	Haryana Energy Development Agency
HMEL	HPCL-Mittal Energy Limited (HMEL), a joint venture between Hindustan Petroleum Corporation Limited (HPCL) and Mittal Energy Investment Pte Ltd, Singapore
HPL	Haldia Petrochemicals Limited
HVDS	High Voltage Distribution System
IA	Industry Association

IEX	Indian Energy Exchange
IOCL	Indian Oil Corporation Limited
IPMA	Indian Paper Manufacturers Association
IPPAI	Independent Power Producers Associations of India
ISMA	Indian Sugar Mills Association
kWh	Kilo Watt-hours
M&V	Measurement and Verification
MBN	A unit of Specific Energy Consumption for Petroleum Refineries (same as MBTU/Bbl/NRGF)
MBTU/Bbl/NRGF	A unit of Specific Energy Consumption for Petroleum Refineries (Thousand BTU per Barrel per Energy Factor)
MMTPA	Million Metric Tons Per Annum
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
MRPL	Mangalore Refinery & Petrochemicals Limited, A subsidiary of ONGC
MRV	Measurement, Reporting and Verification
MTEE	Market transformation for energy efficiency
MTOE	Metric Tonnes of Oil Equivalent
MWh	Mega Watt-hours
NDPL	North Delhi Power Limited (Now known as Tata Power Delhi Distribution Limited [TPDDL] - a joint venture between Tata Power and the Government of NCT of Delhi)
NIC	National Informatics Center
NITRA	Northern India Textile Research Association
NLDC	National Load Dispatch Center
NMEEE	National Mission for Enhanced Energy Efficiency
NPC	National Productivity Council
NSDL	National Securities Depository Limited
OPC	Ordinary Portland Cement
PAD	Performance Assessment Document
PAT	Perform Achieve and Trade
PCRA	Petroleum Conservation Research Association
PEDA	Punjab Energy Development Agency
POSOCO	Power System Operation Corporation Limited
PPC	Portland Pozzolana Cement
PXIL	Power Exchange India Limited
R&D	Research & Development
R-APDRP	Restructured Accelerated Power Development and Reforms Programme
RDSO	Research Designs and Standards Organisation, Indian Railways
REC	Renewable Energy Certificates
RIL	Reliance India Ltd.
RREC	Rajasthan Renewable Energy Corporation
SCADA	Supervisory Control And Data Acquisition system
SDA	State Designated Agency
SEBI	Securities and Exchange Board of India
SEC	Specific Energy Consumption
SERC	State Electricity Regulatory Commission
SHR	Station Heat Rate
SIMA	Sponge Iron Manufacturers Association
SITRA	South India Textile Research Association
SMS	Steel Melting Shop
SSEF	Shakti Sustainable Energy Foundation
SSP	Single Super Phosphate
TCD	Tons (of Sugarcane) Crushed per Day
tCO2	Tonnes of Carbon Dioxide
TERI	The Energy and Resources Institute
TFO	Two-for-One Twisting (Textile Machinery)
TOE	Tonnes of Oil Equivalent
TPP	Thermal Power Plant
TSP	Triple Super Phosphate
UK EEC	United Kingdom – European Economic Community
WHR	Waste Heat Recovery

Table of contents

Acknowledgement

At the outset, PricewaterhouseCoopers Pvt. Ltd. would like to thank Shakti Sustainable Energy Foundation for providing us the opportunity to undertake the interesting and challenging assignment on “The PAT scheme: Analysis, Insights and Way Forward”. The conclusions of this study are expected to support the foundation that is active on the areas to strengthen the energy security of India by aiding design and implementation of policies that support energy efficiency and renewable energy.

PricewaterhouseCoopers Pvt. Ltd. places on record its sincere gratitude to the Bureau of Energy Efficiency for their support and cooperation at various levels in this project. We hope this report would be of assistance to the scheme implementer in fine tuning the policies and strategies within the framework of PAT scheme and the Energy Conservation Act, 2001 and will thus assist them in their primary objective of reducing energy intensity of the Indian economy.

We would also like to acknowledge the support of industry associations, state designated agencies, energy regulatory commissions, energy exchanges, EESL, and think tanks who have provided valuable inputs and information at various stages throughout the conduct of the study.

Last but not the least; we acknowledge the contributions from various experts, members of industry and industry associations representing different DC sectors. The interactions and deliberations with all members during the study were very useful and helped us gain an appreciation of the sector specific aspects and concerns relevant to PAT.

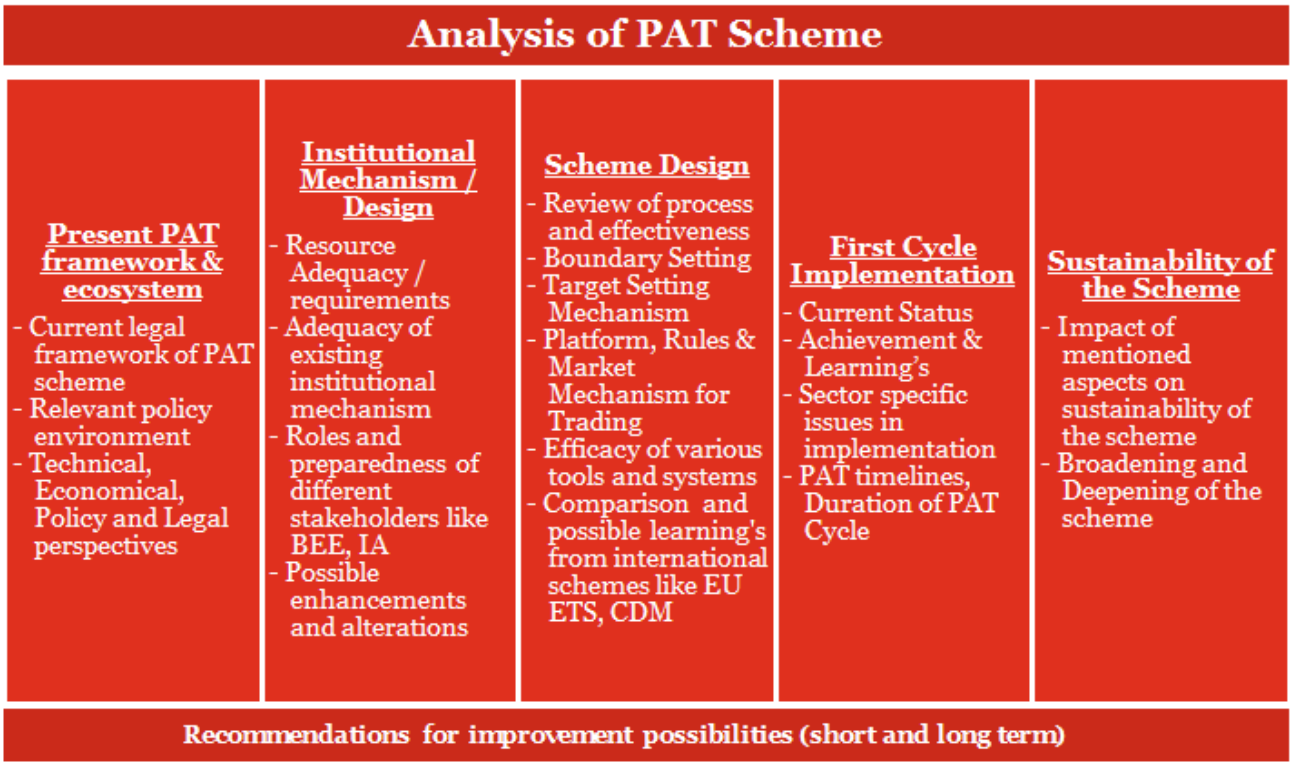
All in all, the assignment has been a rich and rewarding experience for PwC, and this would not have been possible without the unstinted support that we received from stakeholders whom we approached during the course of our study.

Executive Summary

Perform Achieve and Trade (PAT) is an innovative policy mandated, market based mechanism launched in 2012, designed to accelerate energy savings in energy intensive and large industries by incentivizing energy savings. Overachievement above the assigned targets will result in tradable ES Certs, whereas under-achievers have to comply by purchase of ES certs or by paying a penalty.

The scheme is likely to save about 6 to 7 million TOE (tons of oil equivalent) of energy, and the co-benefit would be a reduction of about 25 million Tons of CO2 equivalent. Considering the cost of 1 TOE to be Rs. 10,154 as notified by BEE in 2011-12, the cost of energy saved amounts to rupees 6782 Crores.

This study is aimed at carrying out analysis of the PAT Scheme which has been rolled out for eight selected sectors during March 2012. The scope of the study includes an assessment of performance of the scheme in the present cycle and learnings therefrom with a view to provide constructive feedback, observations and recommendations that may be of assistance to strengthen the scheme performance in future cycles. The studies have been carried out in consultation with SSEF, BEE and other stakeholders. The various aspects covered in the analysis under the project are as follows:



PAT framework and Ecosystem

The existing legal frameworks including the EC Act, various subsequent rules and regulations and the PAT rules, 2012 collectively put in place a robust legal framework. The framework clearly defines stakeholder roles, mechanisms to prevent and manage role conflicts and conflict of interest, and thus lays a good foundation for a sound institutional mechanism and scheme design. Some of the new regulations or amendments required include predominantly those related to the trading mechanism. Apart from trading rules that are yet to be framed, following amendments might be required:

- An amendment in Power Market Regulations might be required to enable the trading of ES Certs to be carried out at the power exchanges. A mention of ES Certs as a tradable instrument will be needed.
- Contracts related to trading of instruments in power exchanges will need to mention a single unit of measurement for purpose of quantification of units traded. Given that the CERC's present legal mandate would be over matters relating to electrical energy, the power exchanges are unclear on the units to be adopted, for the purposes of contracts related to trading. In case of any insistence on using MWh as the unit based on CERCs legal mandate, it might be appropriate to clarify the same either in Power Market Regulations or the PAT Rules through an amendment.

Institutional Mechanism design

Different stakeholders relevant to PAT scheme and their broad roles and relationships are depicted below:

<table>
<tr><th></th><th>Operational Mechanism</th><th>Compliance Enforcement</th><th>Trading Mechanism</th></tr>
<tr><td rowspan="3">Regulators, Adjudicators, Quasi-Judicial and Judicial Institutions</td><td colspan="3">Bureau of Energy Efficiency (BEE)</td></tr>
<tr><td></td><td>Supreme Court
Appellate Tribunal</td><td rowspan="2">CERC</td></tr>
<tr><td></td><td>SERCs and Adjudicating Officers</td></tr>
<tr><td rowspan="2">Agencies authorized and responsible to interact with DCs</td><td colspan="2">SDA and Inspecting Officers</td><td>Power Exchanges</td></tr>
<tr><td colspan="2">Accredited Energy Auditors (AEAs)</td><td>Depository</td></tr>
<tr><td rowspan="2">Designated Consumers (DCs) and associated Interest groups</td><td colspan="3">Designated Consumers (DCs) and EA/EM at DCs</td></tr>
<tr><td colspan="3">Industry Associations (National and Sector Specific)</td></tr>
<tr><td rowspan="2">Agencies that may provide Services to DCs and other stakeholders</td><td>ESCOs</td><td>Legal Experts</td><td>Traders</td></tr>
<tr><td colspan="2">Sector-wise Process Experts</td><td>Market Makers</td></tr>
</table>

The PAT institutional mechanism is elaborate and well designed. There is clarity in role assignments of various stakeholders. The design of institutional mechanism becomes crucial in ensuring effective enforcement of compliance including an objective and impartial measurement and verification exercise. This is a key parameter for the success of such policy mandated target oriented schemes. These critical requirements have been carefully addressed in the design of PAT institutional mechanism. Conflict of interest and independence issues are well thought out and provided for.

Selection of various stakeholder organizations for the various roles has been done in keeping with the strengths and existing profile of these organizations. One relatively weak link in the chain are the SDAs wherein a primarily regulatory role has been assigned to these organizations, a majority of whom have been traditionally involved in promotional roles or service oriented roles. Thus the resource requirements and amount of training and development needed is relatively high at the SDAs. There are also some role assignments like that of the depository of ES Certs which are yet to be made.

Overall the institutional mechanism design as well as role assignments are robust and capable of inspiring confidence among the stakeholders by comprehensive coverage and treatment. The need of the hour is to disseminate the provisions made and develop elaborate working guidelines on roles, independence procedures etc. to supplement the existing institutional framework. This will go a long way in clearing any apprehensions, and instilling confidence in the framework that is put in place with utmost care and due diligence.

Observations and Recommendations

Based on insights gathered during our desk research and stakeholder consultations, following are some observations and recommendations on the various aspects of institutional mechanism design:

Roles and Responsibilities	Some aspects of the role of SDA as laid out in various PAT rules call for better clarity. Detailed guidance will need to be provided on nature of scrutiny, action to be taken by SDA and comments that SDA is expected to give based on the data received from DCs in Form 1, Form 2, and Form 3, as well as the Performance Assessment Document (Form A)
	Effective enforcement is a key enabler for policy mandated schemes like PAT, and SDA is the key institution to ensure enforcement. Once the SDA is empowered through a clear mandate, adequate resources and training, it also becomes important to adequately incentivize effective enforcement by fostering an environment that rewards and glorifies performance.
Addressing Potential Role conflicts	Since the AEA firm for verification is appointed by the DC, the possibility of check verification can act as an effective deterrent to any potential influence that the DC can exert on the AEA firm. It will be important for BEE and SDAs to commission a good number of check verifications (say at least 10%) in the initial cycles so as to maintain an effective deterrent.
	The check verification will also provide an effective feedback to the SDAs on the compliance scenario so that SDA can accordingly increase or maintain the inspection and review activity at their end
	It will also be important to ensure that the documented systems related to independence of AEAs as prescribed in PAT rules are implemented and practiced by the AEA firms. Detailed guidance documentation for such systems and controls to be implemented by the AEA firms also needs to evolve during early PAT cycles. Without such guidelines and controls, it will not be possible to monitor and maintain independence requirements.
	There are provisions for independence of AEA firms conducting verification and check verification. However, the rules presently seem to be silent on whether an AEA can conduct mandatory energy audit in a DC where he is employed. This might be construed as conflict of interest situation and may need to be addressed by appropriate provisions since the DC's SEC reduction targets for the next cycle will be decided based on the potential indicated in the energy audit report.
Resource adequacy and requirements	Short term contractual positions do not inspire loyalty and commitment to organizational goals, and is hence not a good option for regulatory and technical support functions at SDAs. Appointment of technically qualified staff for longer terms would be a desirable option.
	Some SDAs also envisage the necessity of qualified staff at District level. In times to come as the PAT scheme expands through broadening and deepening, this requirement will increase.

Resource adequacy and requirements	Inspecting officers are to be appointed by SDAs from among the existing officers of the state govt. not below the grade of deputy secretary, and should possess qualifications specified for accredited energy auditors. Given that energy efficiency is still an emerging area of focus for most SDA or state governments. Such a cadre will need to be developed and strengthened over subsequent PAT cycles.
	Development of the necessary technical competence and regulatory capacity in SDAs may be a relatively long drawn and evolutionary process. An alternative to quickly put in place the necessary competencies may be to hire competent agencies to perform or to support SDAs in this role. Agencies may be hired for a fixed period say 3 years. The effectiveness of the bid process management will be crucial for hiring of the right skillsets. Support from BEE to the SDAs on this front will be desirable.
	The pool of 150 accredited energy auditors is generally felt to be adequate for the requirements of verification audits of 478 DCs. However, resource adequacy in this context will also depend on the number of AEA firms that will be empanelled by BEE, and the number of AEAs that will be associated with these empanelled firms.
	For PAT cycle 2, since both mandatory energy audits and verifications are to be conducted, and the number of DCs is also expected to be close to 800 more AEAs might need to be accredited.
	It is high time that the depositories are identified and related processes set-up. Leveraging the infrastructure at NSDL or CDSL is now a difficult option with a recent SEBI directive that bars these national depositories from providing registry services for anything other than stock. Thus NSDL or CDSL cannot be involved unless there is some resolution and SEBI is explained about the national importance of this scheme.
	A bid process might need to be initiated by BEE to set up an independent registry and there will be interested parties. Data security, integrity and availability concerns, data mirroring at two servers at different physical locations etc. will need to be considered in setting up the independent registry. Volume of certificates envisaged is small and an independent entity may not be able to commercially sustain the costs and overhead of maintaining the depository services and platform unless there is some grant or support.
	It is a general perception among SERCs that any Scheme related activity requiring their involvement shall commence at a relatively distant future (at least not before one year of publication of this report) and the activities shall be necessarily triggered by respective State Designated Agency (SDA). As a result, the SERCs perceive no proactive role-play in the overall scheme implementation. Once the compliance process starts SERCs will need to employ empanel or hire necessary expertise and resources according to DCs' mix in the state. Creation of such dedicated pool of resources shall take time at SERC's end, and it is, therefore, recommended that timely guidance be provided to SERCs to address this requirement.

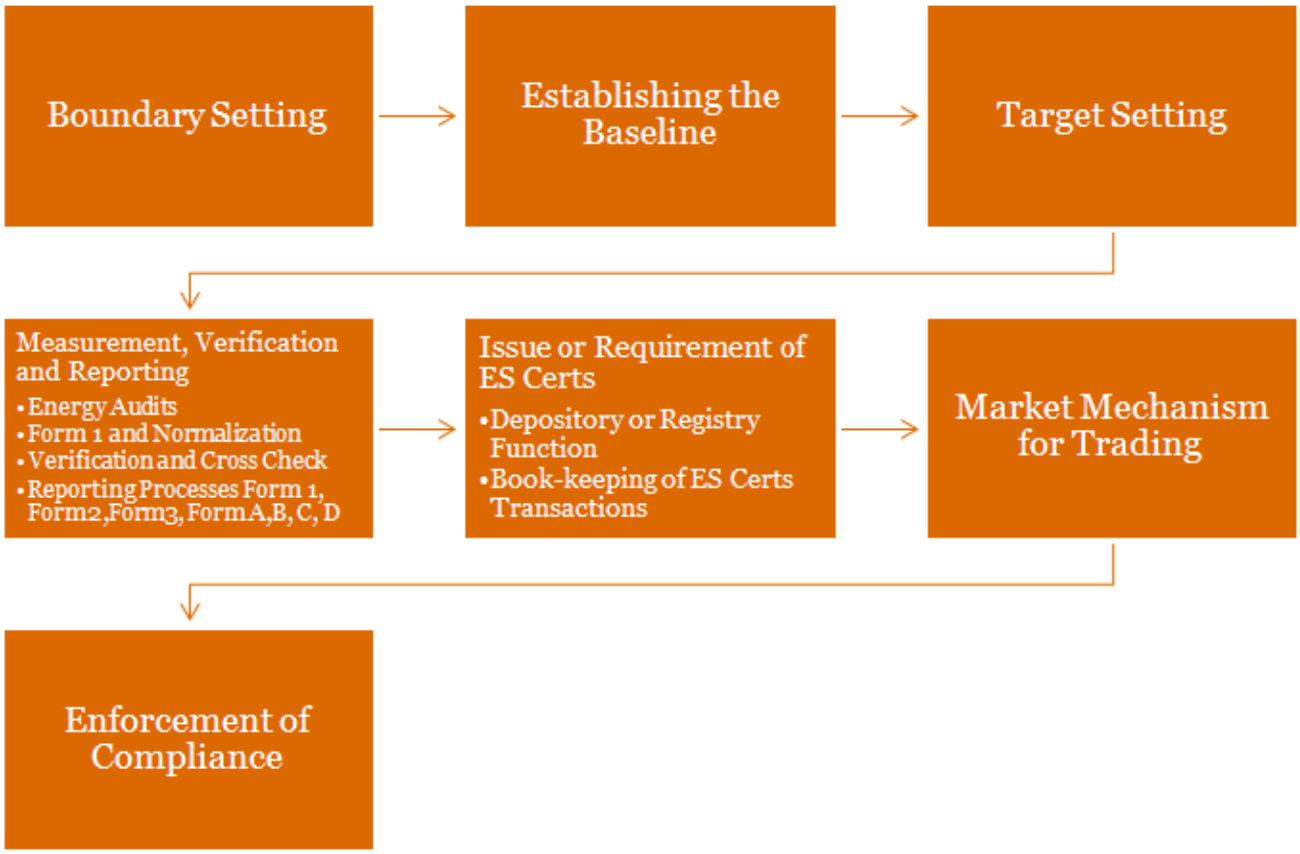
Training and Development Needs for DCs	The DC's commitment to energy efficiency and to achievement of PAT targets is crucial and is secured to an extent through the PAT mechanism of incentives and penalties. However a sustained interest and commitment towards PAT can only be facilitated by providing an enabling environment for energy efficiency to the DCs. We enlist below some of the specific suggestions that came up during our various interactions with stakeholders:
	Facilitating better access to efficient technologies for the sector, through technology roadmaps and compendiums, along with cost benefit analysis. This will be increasingly more relevant in subsequent cycles where more advanced technology might be needed to meet targets and interventions will be more technology based. However this should be done while respecting proprietary R&D and process expertise that might exist at DCs.
	Facilitating experience exchange among the DCs of a sector, setting up software platforms like e-networking for frequent experience exchange. A formal institutional arrangement will be needed.
	Evolving guidance documents and resources on Energy Management Systems, including robust metering and sub-metering systems, systematic approach to baseline and reporting period measurements, recording and reporting of results etc. While these systems are broadly prescribed under various PAT rules there still are many confusions among the DCs with respect to these
	Providing clear guidelines on measurement and verification, normalization techniques to ensure that savings are recognized under varying conditions of influencing variables, resolving ambiguity within DCs on application of calculation methods, formulae, etc.
	FAQs that highlight answers to simple questions related to the PAT process to address any confusion among the DCs on the PAT process
	DCs are approaching SDAs with specific queries and SDAs do not always have the answers at this point in time. A helpdesk either centrally at BEE or at state level with SDAs can be useful to provide quick resolutions to DCs on specific queries relating to PAT
Training and Development Needs for SDAs	There is an obvious need for extensive training and capacity building among SDA personnel, including those being newly inducted. Aspects on which capacity building is required include clarity on roles, detailed step-by-step guidance on various tasks and scenarios under PAT, guidance on points to be considered during review of Form A and other reports being received from DCs etc.
	Further to the notified PAT rules, there is also a corresponding need to equip the SDAs with lucid and comprehensive guidance documents and tool-kits on the PAT processes which can be used for day-to-day reference. BEE can undertake to develop such guide or manual and widely disseminate the same among SDAs.
Training and Development Needs for AEAs	It is crucial for Accredited Energy Auditors to have good level of understanding of process dynamics in order to contribute meaningfully towards significant enhancement in energy efficiency in an industry. Agencies with sound process and engineering backgrounds like PDIL and EIL may be promoted to take active interest in the energy audit space.

Training and Development Needs for AEAs	Orientation sessions for energy auditors to equip them with the requisite knowledge on process aspects of a sector will be very helpful.
	A pool of process experts may be identified in each sector. The role of process experts may be either to offer their expert services to audit teams during the audit, or alternatively to train the accredited energy auditors and teams in the process aspects.
	Secondly, there is a need to appraise AEAs on the roles and requirements specific to PAT scheme. This includes sector wise normalization and M&V considerations. There are also specific independence requirements associated with Verification and Check verification activities.
Training and Development Needs for SERCs	While SERCs are generally aware of their role under PAT there are some doubts on the aspects like collection of penalties. SERCs also seemed to be unaware of The Energy Conservation (Manner of Holding Inquiry) Rules, 2009. A consultative approach to iron out the differences in understanding of respective as well as each other's' roles among the institutions involved in calculation, adjudication, imposition, compliance and collection of penalties is required.
	Additionally a lucid and comprehensive communication from BEE to all SERCs to clarify common doubts specific to role of SERCs, manner of conducting enquiry, provisions in the EC Act for appeals, collection of penalties, etc. will be helpful.
Training and Development Needs for all stakeholders	There is a significant requirement of training and capacity building of key stakeholders in PAT, especially DCs, Accredited Energy Auditors (AEA) and SDAs, in order to achieve the underlying objectives of PAT Scheme. The new Form-1, Normalization Factors and M&V guidelines due to be notified will also bring along additional training and capacity building needs.
	Considering the scale and extend of training and development activities needed it is recommended to compliment BEE's efforts with external support from consultants and experts. Such support can be employed for training to AEAs for all the sectors, trainings for SDA personnel etc.

PAT Scheme Design

The PAT Scheme is a unique policy instrument and stands out from the pool of several ongoing initiatives across the globe targeted at emissions reduction. The uniqueness of the scheme lies in the overall objective of improving the ***efficiency*** of the production process to achieve the ultimate target of energy savings. This approach towards energy saving is a major digression from emission reduction directives followed in several developed and developing economies which, in general, aim at reduction in absolute number of emission/(fuel) consumption units. Thus, the reduction in energy consumption once achieved through PAT will be far more realistic (pointing towards a more efficient and less energy intensive economy) than those reported through other methodologies where absolute reduction of emission units may be influenced by commercial and/or political factors.

The design of PAT scheme can be understood along the lines of the following broad topics:



Observations and Recommendations

Based on insights gathered during our desk research and stakeholder consultations, following are some observations and recommendations on the various aspects of scheme design:

Identifying sectors with potential for inclusion in future PAT cycles.	Similar to the model is adopted by China in their top 10,000 programme, a common threshold (say 30,000 toe) can be considered and any unit crossing that energy consumption threshold can be defined as DC if it belongs to a sector or sub-sector that is presently not included under PAT. This will obligate a large no. of industries to submit annual energy returns and undertake mandatory energy audits through AEAs. Targets need not be assigned to these industries under PAT. While the units will benefit from the energy audits, and inculcate a habit of energy monitoring and filing energy returns, the baseline data thus generated will be useful in identifying sectors with potential for inclusion in future PAT cycles.
Establishment of new baseline for next cycle	Rule 14, PAT Rules, 2012 'Energy consumption norms and standards achieved by the DC on the completion of the target year, as mentioned in the compliance report in Form-'D' shall be the baseline for establishment of new plant specific energy consumption norms and standards for next cycle'. The rule however, is silent on the effect on baseline energy consumption for the next cycle in case a negative opinion is recorded during check verification for a DC and the target compliance status as mentioned in Form D stands invalidated.

An extension of the gate-to-gate approach	The gate-to-gate approach is easy to comprehend, and appropriate for initial PAT cycles. As the scheme matures in future cycles, sub-metering or additional measurement boundaries around specific processes or activities within a DC should be encouraged. Process level sub-metering in DCs will help to evolve process level benchmarks that are applicable across the sector. Making process or activity level SEC data available has advantages in better understanding of process or area wise energy consumption, effective identification of energy saving opportunities and also in measurement and verification.
Target setting methodology for new DCs in future cycles	Where a designated consumer is newly included in future cycles and has NOT completed mandatory energy audit, PAT rules provide for that DC's SEC reduction target to be set on the basis of average rate of reduction in SEC across all the DC sectors' in the last three years, with the optional provision of further tightening to a few percentage points. The prescribed method seems to be generic and may result in targets that are not realistic for some of the new DCs. Where the new DC belongs to an existing DC sector, it would be a better approach to allocate the targets based on the average rate of reduction in SEC during the last three years, for that particular DC sector and sub-sector to which the units belongs. If the new DC belongs to a sector included by widening of PAT scheme, it would be best to decide the targets based on knowledge gathered through a preliminary study of the sector. When BEE will conduct sector wise preliminary studies for widening, it will be useful to orient these preliminary studies so as to capture the knowledge required for target setting exercise. (eg. Sector and sub-sector wise historic rate of reduction of SEC).
Some Observations on PAT rules related to Measurement/ Monitoring, Reporting and Verification (MRV)	The time period provided for submission of Form A is within 3 months of close of each year in target period. This deadline of 3 months is expected to be short considering the elaborate procedure for MRV which will need to be followed. This is all the more so during the first cycle, since DCs will have very limited amount of time to get verification done by AEA firms as per the M&V and normalization processes yet to be notified. Various timelines for activities or milestones are clearly laid out in PAT rules. However, there could be better clarity on consequences of not meeting these deadlines for any of the stakeholders involved. There is a need for detailed guidelines on the nature of comments that SDA is expected to give on Form A and Form B. Data to be sought and verified by SDAs will also need to evolve in the form of additional guidelines, operating manual etc. which may as well be subsequently referenced in the PAT rules. Detailed Reporting Formats including Records to be kept by DCs, Data to be verified by AEAs etc. will also need to evolve sector wise, based on the M&V guidelines that will be notified along with the normalization factors.

Safeguarding proprietary technical information at DCs	While most energy efficiency projects do not involve proprietary technical information, process related interventions may be of this nature. Any enforcement on DCs for sharing such proprietary information may not be welcome. Regulators and enforcement agencies like BEE, SDAs and adjudicating officers must take cognizance of this sensitivity.
	The scheme design including information to be provided in Form 2, Form 3 etc. do not mandate the provision of proprietary technical details on how process efficiency was achieved. However, the AEA appointed by the DC (or appointed by BEE for check verification) might at times need access to such process related technical details while verifying and certifying the energy savings achieved. Safeguards like non-disclosure agreements with AEA might need to be put in place in such occasional cases where proprietary information is involved.
Identifying / Establishing Depository for ES Certs	On the trading rules, IEX is already working with BEE and we are given to understand that this will not be a bottleneck in complying first cycle timelines. The exchanges are well prepared but the bottleneck may be at the power market regulations and also the identification / establishment of depository.
	A recent SEBI directive bars NSDL and CDSL from providing registry services for anything other than stock. This will need to be addressed if NSDL or CDSL have to be involved. It is possible to set up an independent registry. Possible options would include among others, NIC, either of the two power exchanges, EESL etc. A bid process might need to be initiated by BEE for this. Data security, integrity and availability concerns, data mirroring at two servers at different physical locations etc. will need to be considered in setting up the independent registry. It was felt that the volume of certificates envisaged is small and an independent entity may not be able to commercially sustain the costs and overhead of maintaining the depository services and platform unless there is some grant or support.
Floor and Forbearance prices for ES Certs	Notification of Trading Rules shall provide requisite clarity and basis for operational aspects for Exchanges and Depositories. While some aspects are already addressed in PAT rules, 2012, some areas that may be addressed through trading rules were discussed along with relevant stakeholder opinions
	Establishing a floor price for ES Certs may not be a good idea. Floor price was introduced in REC as a means to facilitate investment decisions in Renewable Energy projects. However, this might not be required in case of ES Certs. As for the ceiling price, a natural ceiling does exist in case of ES Certs (Value of applicable Penalty)

Early Price Signals to promote trading	IEX highlighted the need of setting up mechanisms to provide early price signals of ES Certs. Once the MRV systems related to Form 1 and normalization are fully established and stable, a shortened period for mandatory disclosure (say quarterly energy returns) will be helpful to provide some signals to the market. The resulting SEC trends can be provided as market signals to promote more frequent trading activity. This shall provide incentive for sellers to sell early and buyers to buy early. IEX feels that an annual position paper, issued by BEE on the status of achievement of targets by various players can be helpful to promote speculation. This position paper can be made available to interested entities at a price.
Trading Frequency	A frequency like monthly will be good for early price discovery, and the frequency may also be increased towards the close of compliance cycle (i.e. around July to Oct). Double sided closed auction will be a good method for price discovery. This has been used in case of REC trading.
Supply and Demand of ES Certs – A Scenario	Experts opine that likely under-achiever DCs constitute a share of around 2.7 million TOE from the overall 6.7 million TOE PAT target from first cycle implementation. Assuming a scenario of 20% shortfall in these DCs where targets are less likely to be met, the number of ES Certs required by these DCs at the end of first cycle will be 0.54 million, which translates to around 45,000 ES Certs per month if the transactions were to happen at a monthly frequency, spread over a span of one year. Above is only a scenario building exercise and not in any way a prediction of the supply and demand scenario at the end of the first cycle.
Banking of ES Certs	It is generally felt that the first cycle supply of ES certs might far exceed the demand. Hence banking from first cycle to second may need to be moderated to prevent over-flooding of ES Certs from first cycle thus vitiating the second cycle. Over the longer term (i.e. in subsequent cycles once the market has stabilized), banking can offer benefits in terms of building investor confidence and promoting market liquidity and price stability. However a restricted lifetime (say up to 1 additional cycle – as provided for in present PAT rules) will be desirable to prevent undue hoarding of certificates where there is expectation of price increase.
Fungibility of ES Certs with other national and international schemes	With PAT cycle one expected to generate surplus supply of ES certs and REC scheme already experiencing surplus supply there is no immediate need to consider the fungibility between PAT and REC schemes. A similar case can be made for the international schemes.

Penalties under EC Act	Clause 1A, section 26 of the EC Act, provides for a penalty not exceeding rupees 10 lakhs for non-compliance of the PAT targets (energy consumption norms and standards). In case of continuing failure, an additional penalty is to be imposed, not less than the price of every MTOE of energy that is in excess of the prescribed norms. It is unclear how 'continuing failure' is defined in the case of PAT. It would therefore be in order if this is adequately clarified in subsequent rules or amendments thereof.
Are penalties adequate to drive compliance?	Based on study of a randomly selected sample of DCs, it was felt that while the penalties may not be excessively high, they should certainly be significant enough to motivate efforts for compliance. As expected, the penalties for complete non-compliance runs into hundreds of crores for the business groups in the more energy intensive sectors like TPP, Cement, Aluminium, Iron & Steel etc., whereas it is relatively lower for less energy intensive sectors like Textile, Pulp & Paper, and Chloe-Alkali. For some of the more efficient units among these sectors with lower energy intensity, the penalties may not be very significant.
Are penalties adequate to encourage trading?	The penalties are generally adequate to encourage trading under most circumstances, provided they continue to act as an effective driver for compliance behaviour in the first place. It is important to re-iterate here that role of SDAs will be important in enforcement of penalties. In case of weak enforcement the trading will never pick up and the mechanism will see limited success as in the case of REC trading.

Sustainability of the PAT Scheme

Having evolved through complex challenges in developing efficiency metrics and normalization parameters, the first cycle thus far has resulted in development of a unique framework oriented towards rewarding demonstrated energy efficiency in large industries.

The scheme will now require continuously reviewing and consolidating on its intrinsic mechanisms for sector coverage, threshold and target setting mechanism, trading rules, shelf life of ES Certs, ensuring compliance and enforcement of the EC Act provisions etc. At the same time, such schemes are essentially required to demonstrate adaptability to changes in economic and political scenario.

Globally, the initiatives on emission reduction have been demonstrating this trend and evolving to a more mature, robust and inclusive stage after several phases of learning-by-doing approach, thereby carrying forward the learning and best practices from one phase to the next and shedding of redundant and counter-productive practices. The EU ETS mechanism, currently in its third phase (2013 – 2020) has evolved into more wide-based, market-driven, and robust mechanism as compared to the two earlier phases.

Most of the experiences like those related to the verification, trading and enforcement aspects from the first cycle are yet to come. The learnings from the first cycle can best be consolidated on during the second cycle if the focus is retained on the existing sectors. While it would be important to actively pursue the deepening activity for the second cycle, the broadening activity may best be relegated to subsequent cycles.

However, having said that the extent of preparatory effort that goes into inclusion of a new sector as DC is significant. This includes preliminary studies to ascertain energy efficiency potential, consultations with relevant ministries, re-orienting the scheme framework where needed (eg. to address issues like definition of bagasse as energy) etc. Thus it is the right time now for BEE to identify and prioritize possible industry sectors for broadening of scheme coverage beyond PAT cycle 2, and start specific consultations and studies for inclusion of the prioritized sectors in subsequent cycles.

Also, targets should ideally be assigned after one full cycle of defining the sector as DC, so as to allow for mandatory audits, collection of baseline data, identifying the normalization factors and formulae etc.

Observations and Recommendations

Based on insights gathered during our desk research and stakeholder consultations, following are some observations and recommendations on the various aspects of institutional mechanism design:

Deepening the coverage of PAT

Deepening the coverage of PAT – Existing Sectors	TPP is the largest contributor both in terms of energy consumption and energy saving targets for PAT cycle 1. Several complexities need to be carefully considered in deciding the strategy for deepening and target setting for the TPP sector in PAT cycle 2. These include the growth rate and associated challenges of fully including all new TPPs that fall within the threshold, a threshold value that is already quite low and the implications of maintaining or increasing it, inter-linkages of the PAT targets with new CERC norms on gross SHR etc. Further, while a deepening study is commissioned for other critical sectors, there is none for the TPP sector. Thus a specific and detailed consideration on power plants will be in order.
	Significant deepening potential is expected in the Iron and Steel sector, with Ferro alloys as a new sub-sector within Iron and Steel that may contribute significantly. The deepening study commissioned by BEE will examine the effect on coverage by reducing the threshold to 20,000 TOE from 30,000 TOE.
	96% of the total energy consumption covered in PAT cycle 1 comes from only 4 sectors – Power, Cement, Fertilizer and Steel. These sectors with the exception of Fertilizers are also expected to offer the most deepening potential in terms of total energy consumption and energy saving potential covered.
	For textiles, there is a large no. of units where the energy consumption and therefore the saving potential are not so high. Presently the threshold at 3000 TOE is the lowest among the PAT sectors. The sector is expected to offer moderate deepening potential even without further reduction in threshold.
	The sector would presently comprise of around 500 to 600 units in total. However a large majority of these would be too small to contribute significantly to the energy consumption and saving. The sector is expected to offer moderate deepening potential, and the study commissioned by BEE will examine the effect on coverage by reducing the threshold to 20,000 TOE from 30,000 TOE.

Deepening the coverage of PAT – Railways	Among the presently notified DCs within Railways, the factories are the most amenable to the existing PAT framework, and hence should be a starting point for inclusion into the scheme. Traction sub-stations are the least amenable to the present PAT framework and their inclusion as DCs might need to be reviewed.
	Railways are a unique sector among the target sectors of PAT scheme in terms of institutional framework as well as processes at its manufacturing units and entities like loco sheds and workshops. A detailed scoping study for assessing the existing preparedness as well as to develop benchmarking guidelines for Railways is felt as an important pre-cursor to inclusion of the sector in mainstream PAT activities.
	Traction understandably forms the major chunk of the energy consumption within railways, with 82% of the electricity consumption and 98% of the diesel consumption being attributed to traction. Aligning with the existing system for data collection and SEC metric that the zonal railways might have for traction might be an option for inclusion of traction within the PAT framework.

Deepening the coverage of PAT – Railways	However, realization and conversion of existing energy savings potential (especially traction) within railway through policy intervention may require application of PAT scheme design in more innovative manner. At the same time, necessary timeframe needs to be considered to account for organizational framework complexities in areas of procurement of goods and services (from outside existing Railways supply chain), funding of identified energy efficiency projects, validation process, etc. that may arise during the course of PAT implementation.
	Railways, as a group of distinct but interrelated entities, is a vast organization spanning across the national geography. The number of entities within Indian Railway systems and their mutual interdependence as well as administrative control makes it one of the more complex organizational frameworks to reckon with as compared to other target sectors in PAT.
	The point of initial consultation with railways must be the railway ministry or railway board. This top down approach will facilitate the decision making and allow access to important operational data and information from a central location to support the development of the appropriate mechanism. RDSO is also currently involved in the task of developing the systems within railways necessary for PAT and hence becomes a point of consultation.

The remaining sectors from among the 15 energy intensive sectors listed in the schedule to EC Act, become a natural priority while considering the widening of PAT scheme.

A listing of some of these potential sectors for broadening with a rough estimate of the sector wise annual energy consumption is provided below:

Sector	Approx. Annual Energy Consumption (million TOE)*	Remarks*
Petroleum	20.000	22 Petroleum Refineries
Transmission & Distribution	18.130	About 26 Transmission Utilities and 50 Distribution Utilities in 22 States
Sugar	4.455	There are 99 Plants with capacity above 5,000 TCD. These have annual energy consumption between 45,000 TOE to 90,000 TOE
Petro-Chemicals	2.850	Threshold value of 30,000 TOE represents 35% of the petrochemical sector accounting for over 85% of energy consumed
Glass	1.182	7 Major Plants manufacturing Float and Container Glass consume 0.78 million TOE
Ceramics	0.564	36 Plants consuming between 5,000 TOE to 50,000 TOE
Distillery	0.630	99 Major distilleries consuming 0.39 million TOE
Automobile Manufacturing	0.410	24 Major Plants consuming 0.34 million TOE
Zinc	0.288	4 Major DCs consuming 12,500 TOE to 1,75,000 TOE
Chemicals	0.270	Includes 4 sub-sectors viz. Carbon Black, Calcium Carbide, Titanium Dioxide, and Methanol. There are 14 Major Plants consuming 0.235 million TOE
Copper	0.123	5 Major Plants. Largest 3 plants consume around 13,000 TOE to 51,000 TOE
Vegetable oil Refineries	0.120	

*Note: Energy Consumption is a rough estimate based on existing studies. These are calculated from production figures based on an average SEC for the sector and sub-sector.

Broadening the coverage of PAT

Criteria for selection of DC sectors

Criteria for selection of DC sectors for inclusion in future cycles of PAT need to be carefully evolved. Some of these criteria can be:

- Annual Energy Consumption in Sector
- Number of Major Units or Potential DCs and range of annual energy consumption of these units
- Existing Energy Efficiency Potential in the units
- Clarity of Product and Sub-sector definitions in sectors where multiplicity of products exist
- Extent of Complexity in defining Efficiency Metric, Normalization, Measurement and Verification
- Amenability of the sector to the PAT institutional framework
- Amenability of the sector to the PAT scheme design
- Growth rate or stagnancy in the sector

Potential for Broadening – Energy Intensive Sectors covered in the Schedule to EC Act	Petroleum seems to be one sector which is easily a candidate for inclusion in future cycles of PAT, since the refineries are large energy consumers and the specific energy consumption metrics and the parameters influencing efficiency or SEC are already well defined. In the 1990's the sector underwent various efforts towards integration of the various products manufactured. However, this is still an area where further improvements are possible, resulting in energy efficiency improvements. Another major cause of inefficiency is related to operating efficiency of the captive power plants. This could be an area of immediate focus as far as energy efficiency is concerned. The refineries in India are operating at an average energy intensity of about 70 to 80 MBTU/Bbl/NRGF, whereas the best performers among these are operating at 61 to 62 MBTU/Bbl/NRGF. For Transmission and Distribution sector, the baseline energy consumption, data collection process and infrastructure, and benchmarks etc. are already in place. Information is available circle wise with the APDRP secretariat. PAT can provide a parallel process through which the efforts can be complimented and the success of APDRP can be provided with a further policy push through the PAT process. There is a need for consultations between BEE and Ministry of Power on how to include Transcoms and Discoms. A detailed and focused study on the sector will be helpful to assess the energy efficiency potential and the SEC metric, the amenability of the sector for inclusion under PAT, possible interlinkages and data collaboration with APDRP etc.
Potential for Broadening – Energy Intensive Sectors covered in the Schedule to EC Act	Sugar is an energy intensive sector and sugar mills need to go for higher efficiency co-generation systems. There will be energy saving potential in both the co-generation and process areas. MNRE has been promoting bagasse based co-generation through policy interventions including capital and interest subsidies, tax benefits and preferential tariff guidelines. However there are various legal and political complexities. Bagasse being recognized as renewable energy by MNRE, the captive energy consumption might not qualify as energy under PAT rules, 2012. While most of the energy used in sugar mills comes from bagasse, not all mills have co-generation systems or export power. While co-operative sugar mills may be relatively less efficient, imposition of penalties might be a challenge if they fail to achieve targets or comply with requirements. In light of the complexities, detailed consideration and consultations are required to address the possibility of including sugar as a sector within the PAT framework. Most of the units in the Petrochemicals sector would be large integrated complexes producing other products as well. It would be appropriate to have separate benchmarking levels for integrated and other units. The multiplicity of products and hence complexities in defining Efficiency Metric, Normalization, Measurement and Verification etc. are expected to be high. The automobile manufacturing sector is moderately energy intensive and has competent resources as well as a systems orientation that will help in development, tracking, measurement and verification of efficiency metrics. However the sector has lot of variability in energy consumption depending on the extent of processes outsourced. For the Buildings sector a feasibility study to assess the energy saving potential and

	compare it with other existing PAT sectors would be a good first step. Specific sub-sectors amenable to the PAT framework need to be identified. Hotels and Hospitals may be a good starting point. Data centres are also fairly large consumers and would usually have all necessary monitoring arrangements.
Potential for Broadening – Energy Intensive Sectors not covered in the Schedule to EC Act	While not covered in the schedule to EC Act, sectors like Glass, Ceramics, and even Copper and Zinc seem to have good overall amenability to the PAT frame work based on energy intensity of the sector, annual energy consumption of individual plants, energy saving potential and other factors.

1. Introduction

1.1. About PAT Scheme

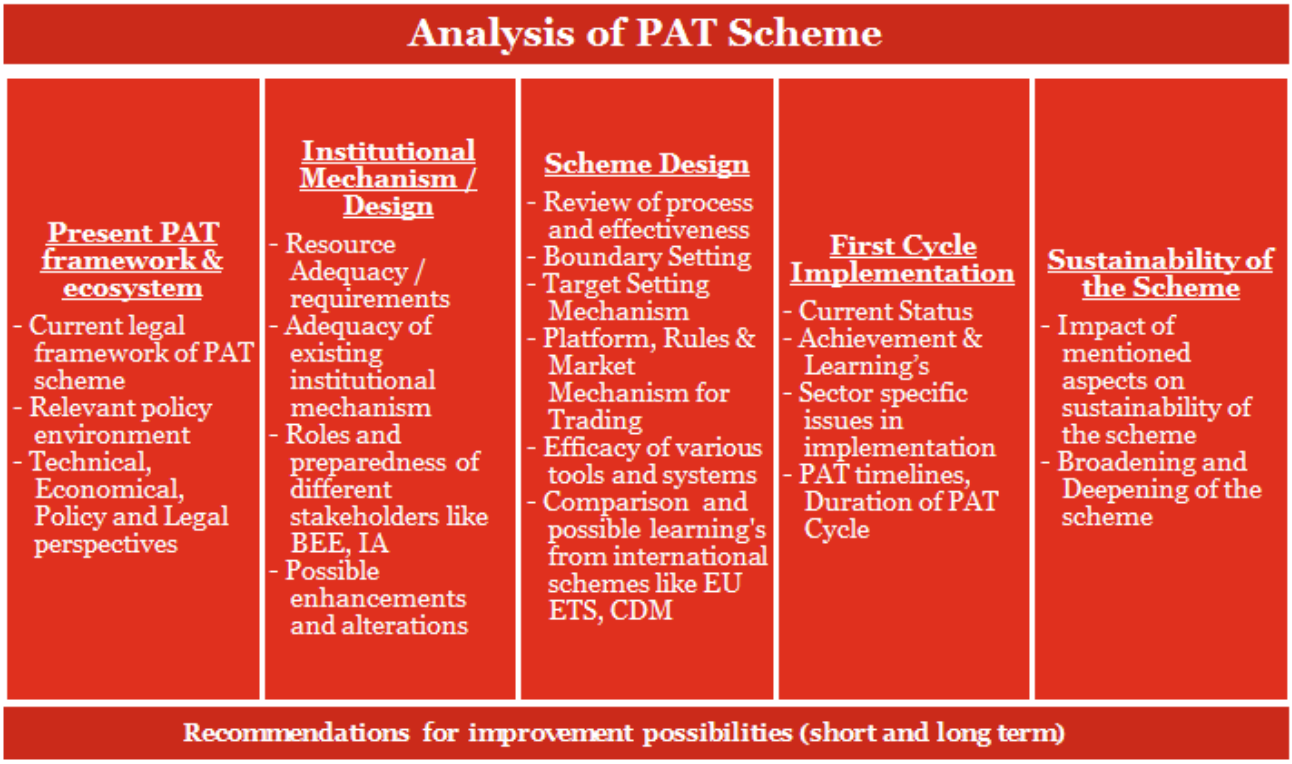
Perform Achieve and Trade (PAT) is an innovative policy mandated, market based mechanism launched in 2012, designed to accelerate energy savings in energy intensive and large industries by incentivizing energy savings. Overachievement above the assigned targets will result in tradable ES Certs, whereas under-achievers have to comply by purchase of ES certs or by paying a penalty.

The scheme is likely to save about 6 to 7 million TOE (tons of oil equivalent) of energy, and the co-benefit would be a reduction of about 25 million Tons of CO_2 equivalent. Considering the cost of 1 TOE to be Rs. 10,154 as notified by BEE in 2011-12, the cost of energy saved amounts to rupees 6782 Crores.

1.2. Analysis of PAT Scheme - About the study

1.2.1. Study Objectives and Areas Covered

The study is aimed at carrying out analysis of the PAT Scheme which has been rolled out for the selected eight sectors during March 2012. The project also includes assessment of performance of the scheme in the present cycle and further providing recommendations for future. The studies have been carried out in consultation with SSEF, BEE and other stakeholders. The various aspects to be covered in the analysis under the project are as shown below:

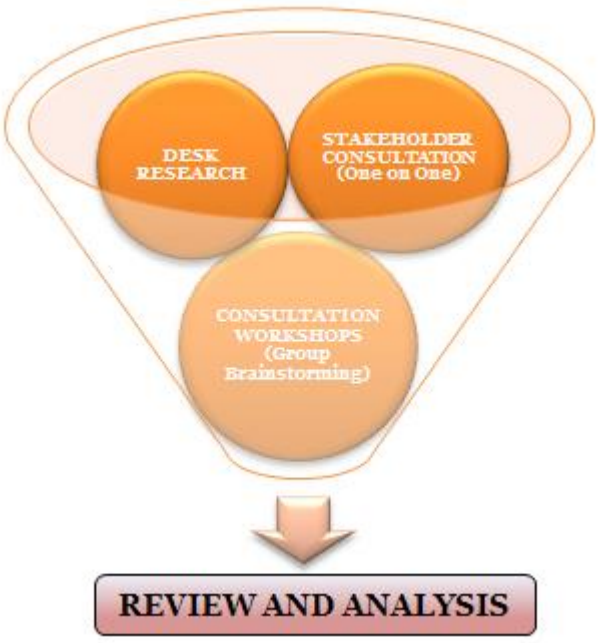


The analysis of PAT Scheme has been carried out broadly in line with the various features stated above. The insights gathered from the elaborate desk research and stakeholder consultations have been condensed and presented as conclusions and recommendations for future improvement in the scheme. An attempt has been made to provide constructive inputs to programme implementers for enhancing the effectiveness of the scheme in present as well as future cycles.

The outcomes of the review and analysis include appropriateness of the present framework of PAT Scheme, possible improvements in the institutional mechanism, need for enhancement in the present resources, recommendations for fine-tuning roles, enhancing preparedness of different stakeholders, and suggestions to improve the scheme design.

Further, an attempt has been made to capture the thoughts that have evolved through stakeholder consultations, towards Sustainability of the Scheme. Aspects studied include the Broadening or Horizontal Expansion of the scheme with respect to sectors. Possibility of such expansion of coverage under the scheme has been explored through desk research and stakeholder consultations among the remainder of the 15 sectors identified initially under EC Act 2001 as well as amongst other energy intensive sectors like Petroleum, Glass, Sugar, etc. We have also analyzed coverage of the industries within the presently designated sectors with existing energy consumption thresholds for DCs. The deepening or vertical expansion possibilities within the sectors presently under PAT scheme has been explored.

1.2.2. Our Methodology



A three-pronged approach was adopted so as to ensure sound coverage of the identified topics, and inclusion of views from a broad section of relevant stakeholders in the review and analysis. A combination of desk research, one-to-one interactions with key stakeholders, and group consultations through round tables was employed. The project team undertook detailed desk research based on Govt. Notifications and publications on the PAT scheme, International carbon trading and other similar market based schemes, publication on international policy experience etc. This provided a sound basis for facilitating discussions with stakeholders during the subsequent meetings, interviews and round tables.

1.2.2.1. Stakeholders covered

Stakeholders were identified to ensure appropriate coverage of all interest groups. Coverage includes industry, industry associations, state designated agencies, energy regulatory commissions, energy exchanges, and various think tanks. Key decision makers and authorities at stakeholders like BEE, EESL, SDAs, SERCs, CERC, IEX, Industry Associations like FICCI, some designated consumers and think thanks like TERI, AEEE, and PCRA were contacted. A limited number of stakeholders were strategically identified across various industry sectors that are presently DCs, those that included in the early list of 15 Energy Intensive Industries, and some others. To gain an appreciation of the sector specific aspects and concerns, some of the sector specific Institutions and Industry Associations with membership base constituting designated consumers were contacted. These included:

- Sponge Iron Manufacturers Association (SIMA)
- Cement Manufacturers' Association (CMA)

- Fertiliser Association of India (FAI)
- Indian Paper Manufacturers Association (IPMA)
- Northern India Textile Research Association (NITRA)
- Alkali Manufacturers' Association of India (AMAI)
- Central Electricity Authority (CEA)
- Independent Power Producers Association of India (IPPAI)

1.2.2.2. Stakeholder Consultation Activities

1.2.2.2.1. One-to-One Consultations

The PAT Scheme has various stakeholders ranging from policy decision makers to authorities entrusted with demanding and reviewing data from designated consumers, the designated consumers themselves, trading exchanges, and regulators under the purview of this Scheme. It is imperative to capture their valuable perspective and incorporate their views and opinions into the study.

Our approach for the study included interviews and consultation with the identified stakeholders. The interviews were loosely structured discussions so as to allow free and un-obstructed flow of thoughts and opinions. It included non-intrusive use of agenda points, presenting of facts and analysis from our on-going desk studies, consultations and reviews, so as to provoke thought, and ensure content-rich discussions. A sample questionnaire for Industry Associations of the selected sectors is attached as Appendix A.2

1.2.2.2.2. Round Tables for Group Consultations

The inputs from progressive stakeholder consultations have fed into and form an important part of our critical review and analysis. While some aspects are well analyzed through one-on-one interactions with stakeholders, brainstorming and debates among the various stakeholders can bring in further clarity and whole new perspectives. Hence, as the analysis progressed and matured it was thought appropriate to share some of the views on a broader platform and invite concerns and suggestions.

Two round tables were organized for group consultations each at an appropriate stage in the analysis. The theme for the first round table was to bring out the learnings in the ongoing cycle of the PAT scheme, whereas the second round table focused on the future cycles and on using the learnings from PAT cycle 1 to effect improvements in the future cycles.

2. Present PAT framework and Ecosystem

2.1. Overview of PAT framework and Ecosystem

2.1.1. Genesis of PAT Scheme

The National Mission for Enhanced Energy Efficiency (NMEEE) is one of the eight missions under National action plan on climate change (NAPCC) of Government of India (GoI), released by the Prime Minister of India on 30 June 2008 with the objective of promoting innovative policy and regulatory regimes, financing mechanisms, and business models which not only create, but also sustain, markets for energy efficiency in a transparent manner with clear deliverables to be achieved in a time bound manner. The implementation plan of NMEEE seeks to upscale the efforts to create the market for energy efficiency with potential of about Rs 74,000 crore.

The Ministry of Power (MoP) and BEE were entrusted with the task of preparing the implementation plan for the national mission for enhanced energy efficiency (NMEEE). NMEEE ushers in the following four initiatives, in addition to the policies and programmes for energy efficiency being implemented by BEE. These initiatives are:

1. Perform, Achieve, and Trade (PAT), a market-based mechanism to make improvements in energy efficiency in energy-intensive large industries and facilities more cost-effective by certification of energy savings that could be traded

2. Market transformation for energy efficiency (MTEE) by accelerating the shift to energy-efficient appliances in designated sectors through innovative measures that make the products more affordable

3. Energy efficiency financing platform (EEFP), a mechanism to finance DSM programmes in all sectors by capturing future energy savings

4. Framework for energy efficient economic development (FEEED), or developing fiscal instruments to promote energy efficiency

PAT scheme is the flagship scheme of NMEEE and is designed to facilitate the Designated Consumers to not only achieve their legal obligations under the Energy Conservation Act, 2001, but also to provide them with necessary market based incentives to overachieve the targets set for them.

2.1.2. Current Legal & Policy Framework

Energy Conservation Act, 2001 empowers BEE to put in place the policies, rules and regulations to improve energy efficiency in energy intensive industries. The genesis of the PAT mechanism flows out of the provision of the Energy Conservation Act, 2001. Provisions for energy efficiency improvement targets in energy efficiency are set under section 14, in a manner that reflects fuel usage and the economic effort involved.

The EC Act 2001 has been amended from time to time and supplemented by rules and regulations to put in place the necessary mechanisms throughout the evolution of the PAT scheme. Some of the important regulations and amendments are:

Rules / Regulations / Amendments	Purpose
Rules 2007	Defining the form and manner for submission of report (Form 1) on the status of energy consumption by Designated Consumers
Rules 2008	Defining Processes and timelines associated with submission of Form 1, Form 2, and Form 3 by Designated Consumers Form 1 - Status of energy consumption by Designated Consumers Form 2 - Details of action taken on recommendations of accredited energy auditor for improving energy efficiency Form 3 - Details of energy efficiency improvement measures implemented, investment made, savings in energy achieved and progress made in the implementation of other recommendations
Regulations 2010	Manner And Intervals Of Time For Conduct Of Energy Audit
Amendments, May 2010	Amendments to provide for trading of ES Certs
Rules 2012 (PAT Rules)	Detailed Rules of operation of PAT Scheme

Some of the other important notifications relating directly or indirectly to the PAT scheme and their significance are tabulated below:

Notification Date / Year	Purpose
8th December 2006	Notification of Rules to prescribe minimum qualification for energy managers designated or appointed under Section 14, clause (l) of the EC Act
19th March 2007	Notification of Designated Consumer Sectors, and Energy Consumption Thresholds for Designated Consumers within each of the sectors The notification also provides the GCVs of common fuels and the conversion factor for conversion of energy from kcal to toe
Rules 2009	Describes the Manner of holding Inquiry by an Adjudicating Officer The respective State Commission, shall appoint any of its members as an Adjudicating Officer as per Section 27 of EC Act
Rules 2010	The Energy Conservation (Inspection) Rules Allows for the State Designated Agency (SDA) to appoint an Inspecting Officer from amongst the officers of the State Government not below the rank of the Deputy Secretary. The SDA may direct and authorize the Inspecting Officer to carry out inspection at the premises of the Designated Consumers, for confirming the compliance to Rules 2007, Rules 2008, Appointment of Energy Manager etc.
Regulations 2010	Certification Procedures for Energy Managers
Regulations 2010	Qualifications for accredited energy auditors and maintenance of their list

30th March 2012	Notification of Energy Consumption Norms and Standards for the 478 Designated Consumers under PAT cycle 1
27th May 2014	Notification mandating DCs to get Energy Audit done by Accredited Energy Auditor in accordance with Regulations 2010 (Manner and Intervals of Time of conduct of Energy Audit)

There are also some CEA recommendations and CERC regulations which are relevant to PAT scheme for the Power Plant sector and Trading of ES Certs. These are listed as follows:

Rules / Regulations	Purpose
Power Market Regulations, 2010	Regulations related to trading of Electricity through various types of contracts including new contracts linked with electricity generated from renewable sources, e.g. Renewable Energy Certificates (REC), transacted on Power Exchange. An amendment might be required to include the contracts linked with energy conservation i.e. ES Certs
CEA Recommendations on Operational Norms of Thermal Power Stations	CEA Recommendations typically become the basis for regulators (CERC and SERCs) who specify operational norms for parameters like gross station heat rate and auxiliary power consumption in their power tariff regulations. CEA recommendations for 2009-14 and 2014-19 are relevant for the first PAT cycle.
Power Tariff Regulations	Five year power tariff regulations specified by the regulators (CERC and SERCs) These regulations include operational norms like gross station heat rate and auxiliary power consumption, which hold relevance for the TPP sector under PAT scheme, since PAT targets are based on net SHR reduction. Net SHR is influenced by gross SHR and APC Power tariff regulations for 2009-14 and 2014-19 are relevant for the first PAT cycle.

2.1.3. Industry Sectors and Designated Consumers Included under PAT cycle 1

The Schedule to the EC Act initially identified following 15 energy intensive sectors: aluminum, fertilizers, iron and steel, cement, pulp and paper, chlor - alkali, sugar, textiles, chemicals, railways, port trust, transport, petrochemicals, power and commercial buildings or establishments.

Out of these, the Ministry of Power (MoP) has notified in March, 2007, industrial units and other establishments consuming energy more than defined thresholds in 9 industrial sectors namely Thermal Power Plants, Fertilizer, Cement, Pulp and Paper, Textiles, Chlor-Alkali, Iron & Steel, Aluminum and Railways as Designated Consumers (DCs).

Of these 9 notified sectors, the first cycle of PAT includes 8 sectors except Railways. The following table gives details of different sectors of Designated Consumers, the respective threshold for energy consumption, energy saving targets, and number of DCs in different sectors for PAT cycle 1.

Sector	Minimum annual energy consumption for the DC (tonnes of oil equivalent)	No. of DCs	Energy Saving Targets under PAT Cycle-1 (million toe)
Thermal Power Plant	30,000	144	3.211
Iron and Steel	30,000	67	1.486
Cement	30,000	85	0.816
Fertilizer	30,000	29	0.478
Aluminum	7,500	10	0.456
Pulp and Paper	30,000	31	0.119
Textile	3,000	90	0.066
Chlor-Alkali	12,000	22	0.054
Total		**478**	**6.686**

2.1.4. PAT Cycle 1

Bureau of Energy Efficiency, Ministry of Power has notified the Energy Conservation Rules 2012 (PAT rules)[1] on 30th March 2012

Energy Consumptions Norms and Standards for the 478 Designated Consumers have also been notified on 30th March 2012. Target is specified individually for each of the DC's in terms of a Specific Energy Consumption (SEC) in TOE per Ton of Product. (TOE = Tons of Oil Equivalent)

FY 2008-09 to FY 2010-11 is specified as the Baseline Period. SEC (in TOE/Ton) for this period is the Baseline SEC. The target period for the first cycle is FY 2012-13 to FY 2014-15. FY 2014-15 is the assessment year. DC's have to get their compliance with energy consumption norms and standards verified by the end of the Assessment Year.

The methods for calculation of the entitlement or requirement of energy saving certificates for a Designated Consumer are detailed in the PAT rules 2012.

Some of the essential and specific arrangements that are being put in place in order to completely operationalize the mechanisms under the PAT framework include:

Mechanism for Monitoring and Verification: Normalization factors and sector wise revised Form 1, Metering / Measurement, Verification and Reporting protocols. These are in an advanced stage of finalization and are presently being disseminated by BEE through sector specific workshop across the country.

Mechanism for Trading of ES Certs: Amendments in power market regulations for inclusion of ES Certs as a tradable commodity, Identification of Depositories, and notification of operational rules for functioning of Depositories, Notification of Trading Rules.

The details regarding these aspects are provided in the chapter on scheme design.

[1] PAT rules and targets are available for download on BEE website: http://www.beeindia.in/content.php?page=schemes/schemes.php?id=8

2.2. Stakeholder consultation and literature review

2.2.1. Technical Perspectives, Complexities and Challenges

PAT is a very unique policy mandated market based scheme among the various similar international experiences cited. The features that set the scheme apart include the fact that the targets are allocated individually to each separate designated consumer, and that the mechanism truly seeks to encourage efficiency by setting targets on specific energy consumption rather than absolute energy consumption targets.

This unique approach also brings along its share of complexities and challenges, in terms of dealing with multiple products, varying process conditions, varying raw material quality etc. and related issues of normalization, Measurement & Verification aspects in determining Specific Energy Consumption of designated consumers. These complexities and challenges are essentially of a technical nature. The Bureau of energy efficiency has worked with various sector-specific technical committees to develop elaborate and sector-specific data collection formats (Form 1), normalization factors and M&V guidelines. Overall, it is an excellent effort by policy makers and implementers to resolve the underlying complexities and develop a robust and unique efficiency based market mechanism.

2.2.1.1. Importance of Enforcement

As is the case with similar policy mandated target based mechanisms like REC, the importance of a sound Enforcement Mechanism cannot be over-emphasized. Enforcement of compliance includes the role of SDAs in inspection and recommending penalties, role of SERCs to Adjudicate and impose penalties, role of Appellate Tribunal to effectively address grievances etc.

When the target achievement or non-achievement is decided, because of the huge financial implications of such decisions, there are bound to be some DCs who would approach the adjudicating authority. This situation will also arise when the numbers of ES Certs awarded to DCs on exceeding the target are not satisfactory for DCs and they expect higher number due to difference between the energy consumption levels which are determined by Accredited Energy Auditors (AEAs) and the DCs themselves.

2.2.2. Economic Perspectives, Incremental cost of generating an ES Cert

Section 14 clause (e) of the EC Act spells out certain considerations in specifying designated consumers from among the energy intensive industries defined in the schedule to the Act. These include intensity or quantity of energy consumed, amount of investment required to achieve energy efficiency, capacity of industry to invest, and availability of the energy efficient technology relevant to the industry sector.

The incremental cost of achieving further energy savings or the incremental cost of the ES cert will tend to increase as the scheme matures and existing DCs have experienced 2 or more cycles of progressively more stringent SEC reduction targets, Once the incremental cost of generating an ES cert exceeds the direct cost benefits available to the DC due to the reduced energy intensity, the value of ES cert earned and traded becomes an important additional incentive for energy efficiency investment. Thus influencing the market dynamics to ensure a good market value of ES Cert becomes pertinent in the long run.

Various constraints in resources / infrastructure and maintenance issues beyond the direct control of the industry make energy efficiency that much more difficult to achieve. For instance, energy loss due to unplanned shutdowns, interruptions in power supply etc. prevent the achievement of benchmarked energy performance. Further there may be issues related to availability of the appropriately trained manpower, infrastructure facilities like timely transport of critical supplies and raw material (resulting in part load operations), variation or unreliability in quality or composition of raw material, fuel and other critical supplies etc. all affect the ability of a unit to improve the energy performance.

While in the short run, these are treated as inevitable or unavoidable influencing parameters and energy performance is normalized to isolate the effects of some of these measures, in the long run the extent to which improved support is available in infrastructural facilities to industries like Power, Transport, and Water etc. will make further improvements in energy performance feasible and thus allow for more stringent targets, and lower incremental cost of generating the ES certs.

2.2.3. Legal Perspectives, Need for new regulations or amendments

While there is a robust legal and policy framework in place, some of the aspects relating to ES Certs trading mechanisms are yet to be put in place. Apart from trading rules that need to be defined, following are some of the requirements.

2.2.3.1. ES Certs as a tradable commodity, Power Market Regulations

The operations of trading exchanges are governed by the Power Market Regulations notified by CERC in January 2010. The power market regulations primarily deal with trading of electric power which is typically expressed in MWh or million units (MUs).

Recommendation 1:

Specialized instruments like Renewable Energy Certificates (REC) have been specifically mentioned in the Power Market Regulations, thus enabling for trading in these instruments linked with electricity generated from renewable sources.

Similarly, an amendment to the Power Market Regulations might be required to enable the trading of ES Certs to be carried out at the power exchanges.

2.2.3.2. Unit of ES Certs – TOE or MWh?

While establishing ES Certs as a tradable commodity at power exchanges will only require a simple amendment to the Power Market Regulations, the units in which value of ES Certs will be accounted becomes important for the power exchanges. The contracts at a power exchange clearly define the commodity to be traded including the units in which it is to be measured. PAT rules 2012 and other PAT related documentation mentions metric tons of oil equivalent (MTOE) as the unit of measurement of ES Certs. It is proposed to recognize 1 ES Cert as equivalent to 1 MTOE. A central govt. notification in March 2007 clearly defines the conversion between TOE and MWh.

Recommendation 2:

Given that the CERC's legal mandate would be over matters relating to electrical energy, the power exchanges are unclear on the units to be adopted, for the purposes of contracts related to trading. Thus in case of any insistence on using MWh as the unit based on CERCs legal mandate, it might be appropriate to clarify the same either in Power Market Regulations or the PAT Rules through an amendment.

2.2.4. Policy Perspectives influencing Scheme uptake

The initial targets in PAT scheme are not very stringent. As such there is a possibility for most industries to achieve their respective targets, resulting in a situation of excess of supply over demand of ES cert. Such a situation can effectively be dealt with by policy interventions to augment the purchase obligations for ES certs through innovative means other than underachiever DCs alone.

2.2.4.1. Fungibility of ES Certs with other schemes

PAT consultation document, 2011 released by BEE mentions that Fungibility of PAT scheme with REC mechanism was being discussed. Conversion factor relevant for such Fungibility can be based on the conversion factors already defined in the Gazzette notification by central government dtd. March 2007. Thus one TOE being equal to 11.628 MWh approx., one ES Cert can be considered equal to as many RECs.

Fungibility of the scheme with other domestic and international schemes will be influenced by the performance metric used in the two schemes. Emissions trading schemes to date have adopted a tCO_2 as the standardized metric. In order to trade, conversion calculations are made to translate the energy saving into tonnes of carbon dioxide (tCO_2) or vice versa. Performance metrics for some schemes are listed below:

Scheme	Performance Metric
White certificate scheme (UK EEC)	fuel standardized, lifetime discounted kWh
White certificate scheme (Italy)	kWh primary energy saved
White certificate scheme (France)	kWh lifetime discounted of avoided final energy consumption (as per EU Directive on EE & ES)
CCAs	Energy or carbon metric per unit of output - eg. GJ/tonne or GJ/m2 of product

Observation 1:

Fungibility is generally useful where the surplus supply from one scheme can cater to the surplus demand in the other scheme and vice versa. Thus, with PAT cycle one expected to generate surplus supply of ES certs and REC scheme already experiencing surplus supply there is no immediate need to consider the fungibility between PAT and REC schemes. A similar case can be made for the international schemes since most of the schemes have either a stable supply demand scenario or are dealing with excess supply issues.

However as a policy tool to improve trading volumes, fungibility with national and international schemes may turn out to be more useful as the scheme matures.

2.3. Conclusion and Recommendations

The section on 'Overview of PAT framework and Ecosystem' presented the current legal and policy framework of PAT and the subsequent section on 'Stakeholder Consultation and Literature Review' presented thoughts and view-points relevant to technical, economic, legal and policy perspectives on the PAT framework based on our desk research and stakeholder consultations.

This section endeavors to summarize, conclusions and recommendations relevant to the broad level legal an policy framework of PAT based on findings in the above two sections.

2.3.1. Overall conclusion on legal and policy framework of PAT

The existing legal frameworks including the EC Act, various subsequent rules and regulations and the PAT rules, 2012 collectively put in place a robust legal framework. The framework clearly defines stakeholder roles, mechanisms to prevent and manage role conflicts and conflict of interest, and thus lays a good foundation for a sound institutional mechanism and scheme design. Some of the new regulations or amendments required include predominantly those related to the trading mechanism.

2.3.2. Observations and Recommendations

Compiled below is a summary of the Observations and Recommendations that were framed in the previous sections. The respective observations and recommendations are presented along with the commentary on stakeholder consultations and literature review, so as to maintain the flow of the topics being discussed.

The casual reader will find it convenient and intuitive to read through the section on stakeholder consultations and literature review, gathering in the process the insights shared through the observations and recommendations. Readers interested in observations or recommendations specific to a particular context can use the summary below to point to the relevant section of their interest.

Reference	Context	Section No.	Page No.
Recommendation 1	Amendments in Power Market Regulations	2.2.3.1	33
Recommendation 2	Units and denomination of ES Certs	2.2.3.2	33
Observation 1	Fungibility of ES Certs with other national and international schemes	2.2.4.1	34

3. Institutional Mechanism

3.1. Overview of Institutional Mechanism

This section presents a bird's eye-view of the current institutional mechanism design of PAT.

3.1.1. Stakeholders under PAT

Different stakeholders relevant to PAT scheme and their broad roles and relationships are depicted below:

<table>
<tr><th></th><th>Operational Mechanism</th><th>Compliance Enforcement</th><th>Trading Mechanism</th></tr>
<tr><td rowspan="3">Regulators, Adjudicators, Quasi-Judicial and Judicial Institutions</td><td colspan="3">Bureau of Energy Efficiency (BEE)</td></tr>
<tr><td></td><td>Supreme Court
Appellate Tribunal</td><td rowspan="2">CERC</td></tr>
<tr><td></td><td>SERCs and Adjudicating Officers</td></tr>
<tr><td rowspan="2">Agencies authorized and responsible to interact with DCs</td><td colspan="2">SDA and Inspecting Officers</td><td>Power Exchanges</td></tr>
<tr><td colspan="2">Accredited Energy Auditors (AEAs) / AEA Firms</td><td>Depository</td></tr>
<tr><td rowspan="2">Designated Consumers (DCs) and associated Interest groups</td><td colspan="3">Designated Consumers (DCs) and EA/EM at DCs</td></tr>
<tr><td colspan="3">Industry Associations (National and Sector Specific)</td></tr>
<tr><td rowspan="2">Agencies that may provide Services to DCs and other stakeholders</td><td>ESCOs</td><td>Legal Experts</td><td>Traders</td></tr>
<tr><td colspan="2">Sector-wise Process Experts</td><td>Market Makers</td></tr>
</table>

In the next section we look at the roles of the key stakeholders and their status of preparedness including resource availability are requirements, availability of relevant expertise, capacity building needs etc.

3.2. Stakeholder consultation and literature review

This section presents thoughts and view-points relevant to the institutional mechanism design of PAT, resulting from a combination of desk research, one-to-one interactions with key stakeholders, and group consultations through round tables.

The view-points and insights are framed into relevant observations and recommendations that are presented in this section so as to maintain the flow of the topics being discussed. These are subsequently summarized in the next section 'Conclusion and recommendations'.

3.2.1.1. Designated Consumers (DCs)

Rule 15, under PAT Rules, 2012 accurately sums up the obligations of designated consumers under PAT:

- Take all necessary measures including Implement EE measures suggested by AEAs and other best practice applicable in industry sector to achieve optimum use of energy in their plant
- Get the work of verification done through accredited energy auditor firms

- Furnish full and complete data, provide documents and other facilities required by AEA firms for Verification and Check Verification

DCs are also mandated since 2007 to appoint an energy manager who is qualified by BEE as a certified energy auditor or certified energy manager. The responsibility for all key activities under PAT scheme rests with the energy manager and his team and ultimately with the CEO of the unit. The resource adequacy and requirements at DCs related to PAT thus begins with the energy cell or energy manager and his team, and extends throughout the organization, including the R&D area and process areas up to operator and technician level. Aspects related to resource adequacy are discussed in the next section on EM/EAs within DCs.

Recommendation 1:

The DC's commitment to energy efficiency and to achievement of PAT targets is crucial and is secured to an extent through the PAT mechanism of incentives and penalties. However a sustained interest and commitment towards PAT can only be facilitated by providing an enabling environment for energy efficiency to the DCs.

Creation of enabling environment for DCs will include extensive facilitation and training activities. We enlist below some of the specific suggestions that came up during our various interactions with stakeholders:

- Facilitating better access to efficient technologies for the sector, through technology roadmaps and compendiums, along with cost benefit analysis. This will be increasingly more relevant in subsequent cycles where more advanced technology might be needed to meet the PAT 2 targets and interventions will be more technology based. However this should be done while respecting proprietary R&D and process expertise that might exist at DCs.
- Facilitating experience exchange among the DCs of a sector, setting up software platforms for frequent experience exchange
- Evolving guidance documents and resources on Energy Management Systems, including robust metering and sub-metering systems, systematic approach to baseline and reporting period measurements, recording and reporting of results tec. While these systems are broadly prescribed under various PAT rules there still are many confusions among the DCs with respect to these
- Providing clear guidelines on measurement and verification, normalization techniques to ensure that savings are recognized under varying conditions of influencing variables, resolving ambiguity within DCs on application of calculation methods, formulae, etc.
- FAQs that highlight answers to simple questions related to the PAT process to address any confusion among the DCs on the PAT process
- DCs are approaching SDAs with specific queries and SDAs do not always have the answers at this point in time. A helpdesk either centrally at BEE or at state level with SDAs can be useful to provide quick resolutions to DCs on specific queries relating to PAT

It will be important adopt a flexible approach and address issues as they occur providing timely resolutions to DCs and other stakeholders

Relevant International Experience:

China's Top 1000 and Top 10,000 programmes provide extensive support to the participating industries. Provisions for robust energy management systems where developed, disseminated and mandated. These included standards GB/T 23331 (requirements for Energy Management Systems – similar to ISO 50,001) and GB/T 17166 (General principle of energy audit on industrial and commercial enterprise) and elaborate guidance on these standards.

3.2.1.2. Certified Energy Managers and Auditors at Designated Consumers (DCs)

Resource adequacy and requirements

DCs presently have either in-house energy cells or energy managers or some also have outsourced the function of energy manager, while retaining managerial control. Larger DCs have in-house capacity while smaller DCs presently show a mixed trend. For instance in textile sector many of the smaller processing units have opted to hire external agencies rather than maintaining in-house capacity for energy management.

With a pool of more than 10,000 energy managers and energy auditors certified through BEE, there is no dearth of qualified manpower available to the DCs. A large number of these energy auditors and managers are already employed in various industries including DCs. While not all of these would be in positions that require or allow them to contribute to energy management, all sectors are generally self -sufficient in respect of availability of qualified resources for energy management. The requirement for practicing certified energy managers and auditor can be expected to rise exponentially as the compliance activities under PAT pick up and more sectors and DCs are added in progressive cycles. At the same time more energy auditors and managers are being certified every year to meet these needs.

Training Needs

The energy auditor community currently consists of two groups – the first providing service to DCs, and second employed in DCs. Training needs are different for both groups. Also, training needs of practicing energy auditors vary largely, ranging from basics for energy efficiency to international benchmarks and best practices, practical case studies etc.

Apart from these training needs, extensive and focussed training on Form 1 templates, M&V and Reporting Obligations is missing till now. Such training will be crucial to equip the qualified workforce for requirements specific to PAT scheme. BEE is presently conducting a series of sector specific workshops which will cater towards this requirement. However such focussed training will need to be administered on a much wider scale to ensure coverage of the energy auditor community.

3.2.1.3. State Designated Agencies (SDAs) and Inspecting Officers

Role of SDAs under PAT

In the presently notified PAT rules, SDAs are entrusted with a crucial role in enforcement of compliance. This includes reviewing and commenting on the appropriateness of the various reports received from DC, advising BEE on need or appropriateness of conducting check verification, and triggering penalty proceedings against non-compliant DCs.

The energy conservation (Inspection) Rules, 2010 also empower SDAs to appoint as many inspecting officers as required (requirements may vary from state to state based on the number of DCs and DC Sectors in the state among other factors). With a view to ensuring compliance, Inspecting officers are empowered through SDAs to visit the premises of the DCs as and when required and to consult with or seek necessary information from AEAs and DCs and to report on the compliance of various provisions under the EC Act.

Recommendation 2:

However, many aspects of the role of SDA as laid out in various PAT rules call for better clarity and detailed guidelines. For instance as per Rules 2008 the DCs are required to submit Form 1, Form 2, and Form 3, verified by the accredited energy auditor, to the SDA. However, there is little further clarity on nature of scrutiny and action to be taken by SDA based on the data received. While the rules clearly specify the timelines there is a need for detailed guidelines on the nature of comments that SDA is expected to give on the data received from DCs in Form 1, Form 2, and Form 3, as well as Performance Assessment Document (Form A).

Some of the SDAs have also opined that the degree of empowerment of SDAs is not commensurate with the roles specified for them. For instance SDA should have a greater say in the appointment of AEA firms for verification and check verification.

SDAs did a survey in cycle 1 to identify the DCs, the list was passed on to BEE who verified and subsequently finalized the list. The process will be similar in PAT cycle two. The results of the present deepening study commissioned by BEE will ultimately go to SDA for validation. However, an expectation from SDA is that they should also independently identify and inform BEE about new DCs in their respective states. This has been a practice in PAT cycle one also.

Resource Adequacy and Requirements

All of the SDA agencies are primarily engaged in other core functions like RE development activities, supply of electricity etc. which is very different from the regulatory and facilitating role in energy efficiency as SDAs. Hence these agencies have very little staff dedicated to the regulatory and promotional role of SDA in energy efficiency. There is inadequate assignment of resources and infrastructure in the SDAs at present.

The current manpower requirement at SDAs related to PAT will vary depending on the no. of DCs and DC sectors existing in the respective state. Some of the states with maximum no. of DCs include Gujarat with around 61 DCs, Rajasthan with around 58, and Maharashtra with around 48 DCs respectively. Some states have as few as 5 to 8 DCs.

In the 12th five year plan, provisions have been kept for empowering the SDAs by deploying additional manpower, and the process for sanctioning such resources is currently underway. For instance a dedicated cell is being established within Rajasthan Renewable Energy Corporation (RREC) to execute its EE related mandate[2].

Recommendation 3:

Short term contractual positions do not inspire loyalty and commitment to organizational goals, and is hence not a good option for regulatory and technical support functions. Appointment of technically qualified staff for longer terms would be a desirable option.

Some SDAs also envisage the necessity of qualified staff at District level. In times to come as the PAT scheme expands through broadening and deepening, this requirement will increase.

Observation 1:

Inspecting officers are to be appointed from among the existing officers of the state govt. not below the grade of deputy secretary, and should possess qualifications specified for accredited energy auditors. However, it is unclear whether officers of the state governments with prescribed qualification would initially exist in required numbers, given that energy efficiency is still an emerging area of focus for most SDA or state governments. Such a cadre might need to be developed over several subsequent PAT cycles.

[2] Interview with RREC

Recommendation 4:

One opinion is that development of the necessary capacity in SDAs will be a long drawn and evolutionary process. Hence an alternative to quickly put in place the necessary competencies may be to hire competent agencies to perform the role assigned to SDAs or to support SDAs to perform this role[3]. Agencies may be hired for a fixed period say 3 years.

This route is being planned by some SDAs like Tripura State Electricity Corporation (TSECL) Bihar Renewable Energy Development Agency (BREDA) etc. However, the effectiveness of the bid process management will be crucial for hiring of the right skillsets. Support from BEE to the SDAs for on this front will be desirable.

The extent of state machinery employed to enforce the provision under the Environment (Protection) Act should provide an indication of resource requirement at SDAs to fruitfully implement all the provisions of the EC Act in times to come[4].

Training Needs

It is generally acknowledged that the necessary competencies are not presently available with SDAs. There is limited capacity and knowledge resource among existing officers towards addressing scheme related issues that may arise.

Based on the PAT rules notified, SDAs are a key point of contact and liaison for the DCs within their respective states. Currently, SDAs are not equipped to adequately address queries of DCs, with the result that except for submission of energy returns (Form 1), DCs prefer to liaise directly with BEE for all their dealings and queries under PAT. Further the understanding at different SDAs may differ and DCs enquiring with different SDAs may receive different views.

Recommendation 5:

There is an obvious need for extensive training and capacity building among SDA personnel, including those being newly inducted. Aspects on which capacity building is required include clarity on roles, detailed step-by-step guidance on various tasks and scenarios under PAT, guidance on points to be considered during review of Form A and other reports being received from DCs etc.

Support from outside consultants to compliment BEE's efforts on training to SDAs including personnel who are now being newly inducted at SDAs would be desirable, considering the extent of the task.

Recommendation 6:

There is also a corresponding need to equip the SDAs with lucid and comprehensive guidance documents and tool-kits on the PAT processes which can be used for day-to-day reference. Further to the notified rules, there are no resources at the disposal of the SDAs to clarify their roles and responsibilities. Some SDAs also pointed out that they do not yet have password access to the online PATnet platform, where DCs are supposed to upload their energy returns. BEE can undertake to develop such guide or manual and widely disseminate the same among SDAs.

[3] Interview with FICCI
[4] Interview with FICCI

Learnings from National and International Experience

In China's Top 1000 and subsequent Top 10,000 programmes, the achievement of the energy-saving targets is a part of the provincial government evaluation system. Responsible government offices are evaluated annually on whether or not the targets under their jurisdiction have been achieved. Incentives and disincentives are built in through annual rewards and honorary titles or exclusion from these rewards, thus creating an environment where performers are rewarded.

Recommendation 7:

Effective enforcement is a key enabler for policy mandated schemes like PAT. Any slackness or deficiency in effective enforcement is bound to have a significant negative impact on the effectiveness of the scheme, as was the experience in the case of REC mechanism. It is therefore important to first empower the SDA through a clear mandate, adequate resources and training, and then to adequately incentivize effective enforcement by fostering an environment that rewards and glorifies performance.

3.2.1.4. Accredited Energy Auditors (AEAs)

Role of AEAs under PAT

As per PAT rules, there are two types of roles to be played by the Accredited Energy Auditor (AEA)

1. Initially an accredited energy auditor (say AEA - Energy Audit) will be engaged by the DC for conducting energy audit and working with the energy manager and energy cell of the DC for recommending energy conservation options. This AEA will also review the Form 1, Form 2, and Form 3 for the previous years for the DCs.

2. Once the DC has implemented energy conservation projects and achieved energy savings, the DC appoints a second Accredited Energy Auditor Firm (say AEA - Verification) for verification and certification of the achieved savings

An important Distinction between 'AEA' and 'AEA Firm':

AEA	***AEA Firm***
An individual, accredited as per the process laid out in the Regulations, 2010, (Qualifications for Accredited Energy Auditors and Maintenance of their List) as notified on 31st March, 2010 in the Gazette of India as per provisions of the EC Act.	*A Firm, Company or legal entity satisfying the criteria laid out in Rule 9 of PAT Rules, 2012 and empanelled by BEE for conducting Verification and Check Verification*
AEA who is not associated with an AEA Firm is not authorized to conduct verification or check verification at DCs. However, AEA is authorised to conduct Mandatory Energy Audit at DCs.	*Authorised to conduct both Mandatory Energy Audits and Verification or Check Verification at DC*
Independence requirements do not apply to an AEA who is not associated with an AEA firm.	*AEA Firm is required to ensure independence with the DCs where they conduct verification and check verification as per Rule 10 of PAT rules, 2012*
BEE presently has a list of 150 AEAs posted in their website.	*BEE is presently in the process of empanelling AEA firms*

One of the important requirements for effectiveness of energy audits is incorporation of process expertise in addition to specialist knowledge of AEAs. The responsibility of engaging experts lies with the Accredited

Energy Auditor (Firm) as per Rule 10, of PAT Rules 2012. Thus it is ultimately up to DCs (who are to hire the AEAs and AEA firms) to ensure that adequate process expertise is available with the selected AEA.

Further, one more level of verification is provided through provision for check-verification by an AEA Firm (say AEA – Check Verification) appointed by BEE in consultation with SDA. BEE may commission check verifications of its own accord, or on receipt of a complaint within certain timelines.

Recommendation 8:

Since the AEA firm for verification is appointed by the DC, the possibility of check verification can act as an effective deterrent to any potential influence that the DC can exert on the AEA firm (AEA – verification). To maintain a significant random possibility of occurrence of check verification, it will be important for BEE and SDAs to commission a good number of check verifications (say at least 10%) in the initial cycles.

The check verification will also provide an effective feedback to the SDAs on the compliance scenario so that SDA can accordingly increase or maintain the inspection and review activity at their end.

Various levels of process expertise (sector specific) as well as prior experience with specific sectors, and processes may make an AEA most effective in handling specific types of energy efficiency assessments and verifications. Thus categorization / scope definition in terms of sector expertise of AEAs as well as rating of AEA firms similar to ratings system in place for ESCOs may be a possibility as the scheme matures[5].

Accountability and Independence of AEA Firm during verification and check verification

Process of assigning the authority (empanelment) as Accredited Energy Auditor Firms in charge of verification or check verification will be crucial. There are chances of industries trying to influence their independent opinion. Two provisions become crucial in this context – first for implementing systems to ensure the independence of AEA firms thus avoiding all conflicts of interest situations, and second for holding the AEA firm accountable in case check verification indicates a liability of the AEA firm.

Rule 10, under PAT Rules 2012 require AEA firms to implement documented systems including due diligence in selection of team members, contractual obligations with team members for maintaining independence with the DC etc. The independence requirements also bar an AEA firm from conducting verification at a DC if the AEA has been employed with the DC or has conducted energy audit at the DC for previous four years.

Recommendation 9:

It will also be important to ensure that the documented systems related to independence of AEAs as prescribed in PAT rules are implemented and practiced by the AEA firms. It might be best to require that necessary documented systems be put in place prior to empanelment of the AEA. This might however not be feasible in the first cycle since the timely enlistment of AEA firms is an immediate priority.

In any case, it will be important to ensure that the prescribed systems are implemented and practiced by AEA firms. The detailed guidance documentation for systems and controls to be implemented by the AEA firms also needs to evolve as during early PAT cycles. Without such guidelines are controls, it will not be possible to monitor and maintain independence requirements.

In case check verification indicates a liability of the AEA firm conducting verification for any deficiency, inconsistence, error or misrepresentation, punitive action includes permanent de-empanelment of the AEA firm. This seems to be an adequate deterrent, and like any other checks and balances, its effectiveness will depend on the efficiency of its enforcement.

[5] Discussions with stakeholders during National Workshop (Nov. 2014)conducted to disseminate findings of this study

Observation 2:

While the independence criteria are applicable to the AEA firm conducting the verification and check verification, the same is understandably not the case for the AEA conducting energy audit.

The rules do presently seem to be silent on whether an AEA can conduct mandatory energy audit in a DC where he is employed. This might be construed as conflict of interest situation and may need to be addressed by appropriate provisions since the DC's SEC reduction targets will be decided based on the potential indicated in the energy audit report.

Resource Adequacy and Requirements

The time required to conduct mandatory energy audit and verification audit will also influence the number of AEAs and AEA firms needed. While a thorough audit may take up to 3 months, most audits can be completed in 4 to 6 weeks. With standardization of the requirements, the time may reduce to around 4 weeks[6]. Software support for measurement and data collection would be helpful to reduce time required for audits.

Observation 3:

The pool of 150 accredited energy auditors was generally felt to be adequate for the requirements of verification audits of 478 DCs. However, resource adequacy in this context will also depend on the number of AEA firms that will be empanelled by BEE, and the number of AEAs that will be associated with these empanelled firms.

The empanelment process for AEA firms for verification and check verification has now commenced. Some of the AEAs among the list of 150 may not actually be available for conducting the energy audits and verification.

Observation 4:

For PAT cycle 2, since both mandatory energy audits and verifications are to be conducted, and the number of DCs is also expected to be close to 800 we might need more AEAs to be accredited.

Training Needs

Apart from general expertise in energy efficiency, it is crucial for Accredited Energy Auditors to have good level of understanding of process dynamics in order to contribute meaningfully towards significant enhancement in energy efficiency in an industry. This is true with all DC sectors, and more so with an industry sector like Fertilizers, that is already conscious of their energy consumption patterns and is operating at reasonably good levels of energy intensity compared to global average benchmarks[7].

Observation 5:

A good level of understanding of process dynamics among AEAs can be facilitated by introducing agencies with sound process and engineering backgrounds like Projects & Development India Limited (PDIL) and Engineers India Limited (EIL) to take active interest in the energy audit space. However efforts to get such agencies involved have not yet fructified8.

Orientation sessions for energy auditors to equip them with the requisite knowledge on process aspects of a sector will be very helpful.

[6] Discussions in Round Table 2
[7] Interview with FAI
[8] Interview with FAI

Observation 6:

Secondly, there is a need to appraise AEAs on the roles and requirements specific to PAT scheme. While Manner and Conduct of Energy Audit Regulations, 2010 and PAT Rules, 2012 are in place, the AEAs will need clarifications on some aspects. This includes sector wise normalization and M&V considerations. There are also specific independence requirements associated with Verification and Check verification activities. BEE is planning workshops to address some of these requirements of AEAs.

3.2.1.5. Sector-wise Process Experts

The process energy consumption in sectors like iron and steel, cement and textile typically accounts for the major share of energy consumption with utilities consuming a relatively lower share. However, energy auditors often tend to be more focused on the utility side.

DCs and industry associations representing various sectors have strongly emphasized the need for process expertise of the respective sector among energy auditors, without which limited value is perceived in the interventions that auditors will be capable of identifying.

Recommendation 10:

A pool of process experts may be identified in each sector. The role of process experts may be either to offer their expert services to audit teams during the audit, or alternatively to train the accredited energy auditors and teams in the process aspects.

Various industry associations representing the DC sectors have unanimously acknowledged the importance and utility of orientation sessions for energy auditors to equip them with the requisite knowledge on process aspects.

3.2.1.6. Central Electricity Regulatory Commission (CERC)

CERC is the nodal body for regulation of tariff of centrally owned power generating utilities, inter-state power generation and transmission functions, power trading and several other regulatory and advisory activities related to competition, efficiency and economy in the activities of the power sector. In context of PAT, CERC serves two distinct functions – primarily, CERC is the regulatory body for trading of ES Certs and second, CERC provides regulations for tariff setting of centrally owned thermal power plants.

Recently, a joint committee has been formed with representation from CERC and BEE to formulate the rules and regulations regarding trading and need of trading infrastructure like exchanges, registries, etc. The committee shall pave the way for inclusion of ES Certs as a trade-able entity over various designated exchanges.

It is felt that unlike the case of REC mechanism for renewable energy, the regulatory function related to trading of ES Certs shall require understanding of more complex situations emanating from different industrial sectors and production processes9.

[9] Interview with CERC

3.2.1.7. Central Registry or Depository

The need of establishment/identification of a depository of ES Certs was emphasized during stakeholder interactions[10]. The book-keeping function of all the ES certs will be done electronically by Depositories. Functions of the depository include holding of ES Certs, tracking of the transactions of ES Certs made between various DCs and book-keeping of the resulting balance of ES Certs with each DC. The transaction fee charged by the Depository will be a source to meet their costs.

Recommendation 11:

It is high time that the depositories are identified and processes set-up. One of the best options would be to rope in POSOCO (NLDC) as has been done in the case of REC trading mechanism. Another option would be to use the existing infrastructure of the two National Depositories, National Securities Depository Limited (NSDL) and Central Depository Services (India) Limited (CDSL). The third alternative would be to develop an independent depository.

It was felt that NSDL and CDSL usually handle several million accounts and ES Certs trading might prove to be of less interest for these depositories, given the small volume of accounts and certificates[11]. More importantly, a recent SEBI directive which bars NSDL and CDSL from providing registry services for anything other than stock. As per this SEBI notification they cannot now hold gold certificates and the like. ES Certs also would fall in the same category, and per say NSDL and CDSL would be barred from registering these on their platform unless there is some resolution and SEBI is explained about the national importance of this scheme. This will need to be addressed if NSDL or CDSL have to be involved[12].

Recommendation 12:

It is possible to set up an independent registry. Possible options would include among others, NIC, either of the two power exchanges, EESL etc. In case of private players, it would be safe to opt for multiple depositories so as to ensure quality and continuity of service.

A bid process might need to be initiated by BEE or the central govt. and there will be interested parties. Data security, integrity and availability concerns, data mirroring at two servers at different physical locations etc. will need to be considered in setting up the independent registry.

It was felt that the volume of certificates envisaged is small and an independent entity may not be able to commercially sustain the costs and overhead of maintaining the depository services and platform unless there is some grant or support[13].

3.2.1.8. Trading Exchanges

As per the institutional mechanism put in place, the Energy Savings Certificates (ESCerts) will be traded on special trading platforms to be created in power trading exchanges. The two CERC approved power exchanges that presently exist in India are IEX and PXIL. Number of exchanges is same as in EU ETS which trade up to approximately 3 billion units of emissions. Thus resource adequacy is not expected to be an issue with the trading exchanges.

[10] Interviews with BEE, CERC and IEX
[11] Interviews with IEX
[12] Interviews with IEX and thoughts expressed in round tables
[13] Discussions with IEX and other stakeholders during round tables

3.2.1.9. State Electricity Regulatory Commissions (SERCs)

Role of SERCs under PAT

State Electricity Regulatory Commissions (SERCs) are an important link in the institutional mechanism laid out in the Act for implementation of the Scheme. Chapter VIII, Section 26 - 29 of the Act provide for the role of SERCs in areas of ensuring compliance by way of penalties and adjudication as *"…the State Commission shall appoint any of its members to be an adjudicating officer for holding an inquiry in such manner as may be prescribed by the Central Government,.."*.

The primary policy instrument defining the mandate of SERCs is the Electricity Act, 2003 for regulation of various public/private activities in areas of electricity generation, transmission and distribution. The EC Act brings-in additional mandate for SERCs in such areas which are outside their present sphere of activities, for example, various industrial sectors covered under the scheme.

The SERCs are aware of their inclusion in the implementing mechanism of the Scheme.

There exists a general perception among SERCs that definition of their role in ensuring compliance carries a certain degree of ambiguity. The understanding of respective roles in the Scheme varies from only adjudication, to adjudication and enforcing compliance, and further on to collection of penalties and mechanism thereof. It was also felt that PAT rules notified do not offer clarity on which agency / body will be entrusted with the money collected[14].

SERCs are mandated to appoint any of the respective members to be an adjudicating officer for holding an inquiry in such a manner as may be prescribed by the Central Government. The SERCs have mostly appointed Member – Technical (or equivalent thereof) as adjudicating officer, however, are unaware of any prescribed manner from the Central Government for holding any inquiry that may arise[15]. If such guidelines are not elaborate, there can be inconsistencies between the manners adopted by different state commissions.

Recommendation 13:

While SERCs are generally aware of their role under PAT there are some doubts on the aspects like collection of penalties. SERCs also seemed to be unaware of The Energy Conservation (Manner of Holding Inquiry) Rules, 2009. A consultative approach to iron out the differences in understanding of respective as well as each other's' roles among the institutions involved in calculation, adjudication, imposition, compliance and collection of penalties is required.

Recommendation 14:

Additionally a lucid and comprehensive communication from BEE to all SERCs to clarify common doubts specific to role of SERCs, manner of conducting enquiry, provisions in the EC Act for appeals, collection of penalties, etc. will be helpful.

Resource Adequacy and Requirements

SERCs are currently adopting a wait-and-watch approach towards estimating the resource requirement for undertaking activities relating to the Scheme, primarily keeping in view the variation in understanding the width of activity spectrum. Principal observations from consultations on resource adequacy, preparedness etc. with SERCs are provided below.

[14] Interviews with RERC
[15] Interviews with RERC and GERC

SERCs find that there is no fundamental for predicting the number of cases that may come up for adjudication before the adjudicating officer, and the nature/complexity of such cases as well. In such a scenario, the number as well as requisite skill set of additional man-power resources cannot be determined at this stage.

SERCs generally believe that existing infrastructure (office set-up, etc.) shall suffice for the additional mandate to be shared by them under the Scheme.

Additional skilled manpower will be required, or external opinion may need to be sought from technical subject matter experts by SERCs to evaluate the adjudication cases where industrial processes/workflows relating to determination of specific energy consumption (reduction) and application of suitable Normalization Factors are involved.

Recommendation 15:

It is a general perception among SERCs that any activity requiring their involvement in Scheme related activities shall commence at a relatively distant future (at least not before one year of publication of this report) and the activities shall be necessarily triggered by respective State Designated Agency (SDA). As a result, the SERCs perceive no proactive role-play in the overall scheme implementation. Creation of special PAT cells within SERCs, equipped with necessary human resources according to DCs' mix in the state, shall be required once the compliance process starts down the time. However, creation of such dedicated pool of resources shall take time at SERC's end, and it is, therefore, recommended that additional resources be deployed at SERCs to address this requirement.

3.2.1.10. Appellate Tribunal

Section 30 and 31A of EC Act **empowers** the **Appellate Tribunal established under** section 110 of the **Electricity Act, 2003** to act as Appellate Tribunal for the energy conservation act also, and hear appeals against the orders of the adjudicating officer or the Central Government or the State Government or any other authority under the EC Act. Procedure and powers of Appellate Tribunal shall be as they apply to the discharge of its function under the Electricity Act, 2003.

3.2.1.11. Legal Experts

Legal experts have been consulted by BEE in formulation of the PAT related provisions.

Further, Section 44 of EC Act stipulates that a person preferring an appeal to the Appellate Tribunal may either appear in person or take the assistance of a legal practitioner or an accredited energy auditor of his choice. Similarly, the Central Government or the State Government may authorize one or more legal practitioners or any of its officers to act as presenting officers with respect to any appeal before the Appellate Tribunal.

3.2.1.12. Roles and preparedness of other stakeholders

Among the agencies providing services to DCs, role of ESCOs and process consultants capable of designing, engineering and implementing energy efficiency solutions in the utilities and sector specific process areas will be important. EESL is gearing up for playing the role of solution provider and ESCO to the various industry sectors[16].

The role of a market maker is to augment the liquidity of the market by purchasing at lower prices during surplus demand conditions to sell later during surplus supply conditions at a higher price. Considering the

[16] Interview with EESL

general expectation of a scenario of surplus supply of ES Certs towards the end of the first cycle, the role of a market maker becomes very relevant. However, trading rules are yet to be notified and it remains to be seen how the policy framework evolves to facilitate such a role. EESL possesses the required capacity to play the role of market maker. However, EESL is presently adopting a wait and watch approach, and taking up such a role shall depend on clear provisions regarding the same in policy framework[17].

Traders if allowed to operate within the policy framework for trading of ES Certs, can improve the liquidity of the market to an extent since the smaller DCs who may not have in-house capacity for trading can utilize the services of the traders. Traders will be active only after both buyers and sellers are there and the market is an active market. Such traders related to the REC market and are keenly observing developments on the ES Certs trading front.

Legal experts will play an important advisory role to regulators, DCs and SDAs. Their role is most significant in the context of appeals to the appellate tribunal. Both the appealing party and the Central Government or the State Government may take the assistance of legal practitioners in presenting the case before the appellate tribunal.

Recommendation 16:

There is a significant requirement of training and capacity building of key stakeholders in PAT, especially DCs, Accredited Energy Auditors (AEA) and SDAs, in order to achieve the underlying objectives of PAT Scheme. The new Form-1, Normalization Factors and M&V guidelines due to be notified will also bring along additional training and capacity building needs.

Desirability of outside consultant support to compliment BEE's efforts on training to AEAs for all the sectors, trainings for SDA personnel who are now being newly inducted etc.

[17] Discussions with EESL at round tables

3.3. Conclusion and recommendations

The section on 'Overview of Institutional Mechanism' briefly presented the current institutional mechanism design of PAT along with roles and responsibilities of few key stakeholders. The subsequent section on 'Stakeholder Consultation and Literature Review' presented thoughts and view-points relevant to the institutional mechanism based on our desk research and stakeholder consultations. Roles, resource adequacy and requirements and training needs were discussed for various stakeholders.

This section presents, conclusions and recommendations relevant to the institutional mechanism of PAT based on findings in the above two sections.

3.3.1. Overall conclusion on effectiveness of PAT institutional mechanism

The PAT institutional mechanism is elaborate and well designed. There is clarity in role assignments of various stakeholders. The design of institutional mechanism becomes crucial in ensuring effective enforcement of compliance including an objective and impartial measurement and verification exercise. This is a key parameter for the success of such policy mandated target oriented schemes. These critical requirements have been carefully addressed in the design of PAT institutional mechanism. Conflict of interest and independence issues are very well thought out and provided for.

Selection of various stakeholder organizations for the various roles has been done in keeping with the strengths and existing profile of these organizations. One weak link are the SDAs wherein a primarily regulatory role has been assigned to these organizations, a majority of whom have been traditionally involved in promotional role or service oriented role. Thus the resource requirements and amount of training and development needed is relatively high at the SDAs. There are also some role assignments like that of the depository of ES Certs which are yet to be made.

Overall the institutional mechanism design as well as role assignments are robust and capable of inspiring confidence among the stakeholders by comprehensive coverage and treatment. The need of the hour is to disseminate the provisions made and develop elaborate working guidelines on roles, independence procedures etc. to supplement the existing institutional framework. This will go a long way in clearing any apprehensions, and instilling confidence in the framework that is put in place with utmost care and due diligence.

3.3.2. Observations and Conclusions

Compiled below is a summary of the Observations and Recommendations that were framed in the previous sections. The respective observations and recommendations are presented along with the commentary on stakeholder consultations and literature review, so as to maintain the flow of the topics being discussed.

The casual reader will find it convenient and intuitive to read through the section on stakeholder consultations and literature review, gathering in the process the insights shared through the observations and recommendations. Readers interested in observations or recommendations specific to a particular context can use the summary below to point to the relevant section of their interest.

Reference	Context	Section No.	Page No.
Designated Consumers (DCs)			
Training and Development Needs			
Recommendation 1	Providing an Enabling environment for energy efficiency to DCs	3.2.1.1	37
State Designated Agencies (SDAs)			
Roles and Responsibilities			
Recommendation 2	Some aspects of the role of SDA as laid out in various PAT rules	3.2.1.3	39

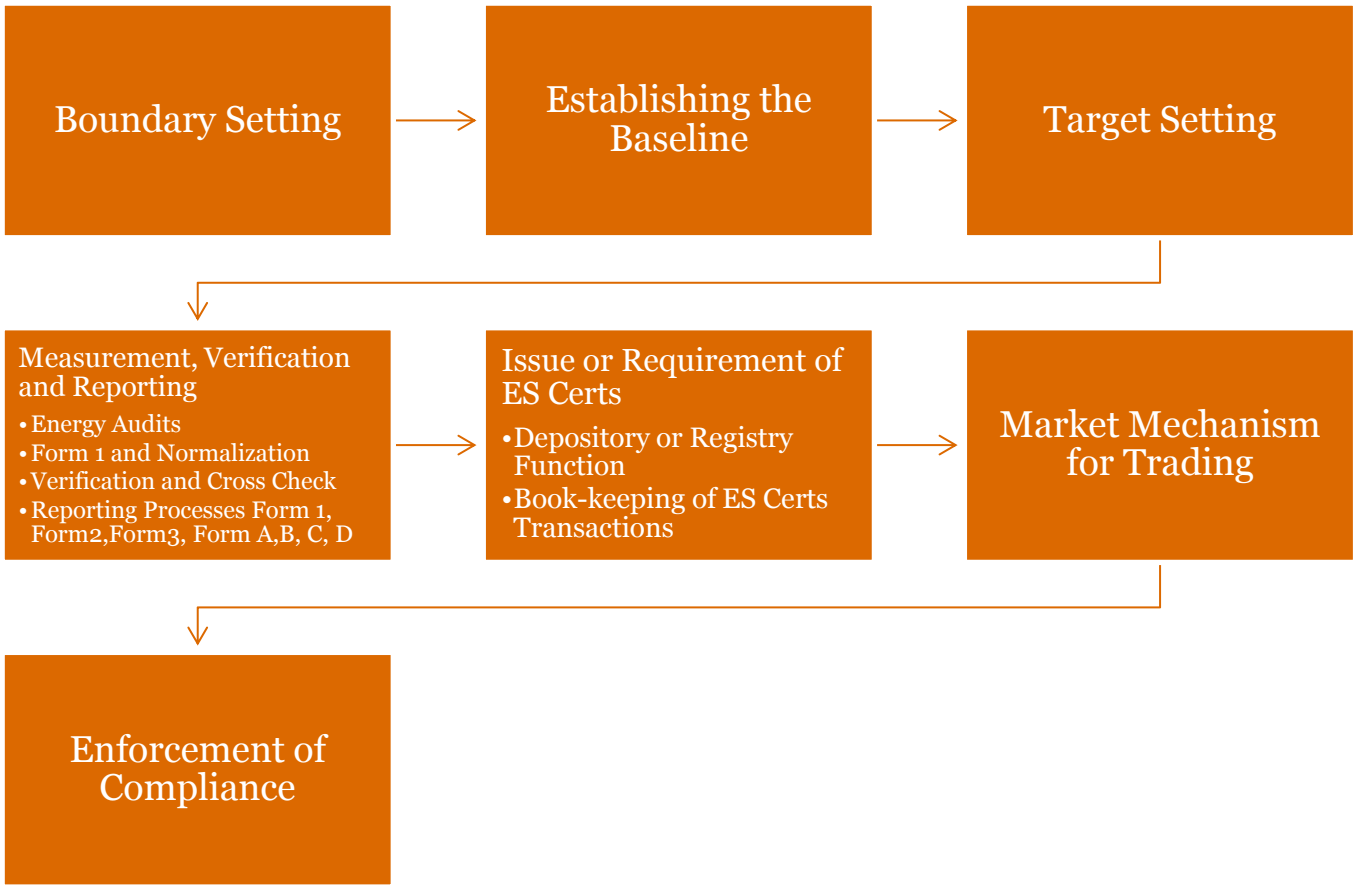
Reference	Context	Section No.	Page No.
	call for better clarity		
Resource adequacy and requirements			
Recommendation 3	Short term contractual positions at SDAs do not inspire loyalty and commitment to organizational goals. Appointment of technically qualified staff for longer terms would be a desirable option.	3.2.1.3	39
Observation 1	A strong cadre of Inspecting officers at SDAs needs to be developed over subsequent PAT cycles	3.2.1.3	39
Recommendation 4	An alternative to quickly put in place the necessary competencies may be to hire competent agencies to perform the role assigned to SDAs or to support SDAs to perform this role	3.2.1.3	40
Training and Development Needs			
Recommendation 5	Need for extensive training and capacity building among SDA personnel, including those being newly inducted	3.2.1.3	40
Recommendation 6	Need to equip the SDAs with lucid and comprehensive guidance documents and tool-kits on the PAT processes	3.2.1.3	40
Recommendation 7	Fostering an environment that rewards and glorifies performance at SDAs	3.2.1.3	41
Accredited Energy Auditors (AEAs)			
Roles and Responsibilities, Addressing Potential Role conflicts			
Recommendation 8	At least 10% check verifications in the initial cycles so as to maintain an effective deterrent and provide feedback to SDA on the compliance scenario	3.2.1.4	42
Recommendation 9	Documented systems related to independence of AEAs	3.2.1.4	42
Observation 2	Can AEA conduct mandatory energy audit in a DC where he is employed?	3.2.1.4	43
Resource adequacy and requirements			
Observation 3	Pool of 150 accredited energy auditors is generally felt to be adequate for the requirements of first cycle	3.2.1.4	43
Observation 4	For PAT cycle 2, more AEAs might need to be accredited	3.2.1.4	43
Training and Development Needs			
Observation 5	Accredited Energy Auditors to have good level of understanding of process dynamics of respective industry sectors	3.2.1.4	43
Observation 6	Need to appraise AEAs on the roles and requirements specific to PAT scheme.	3.2.1.4	44
Sector wise Process Experts			
Recommendation 10	A pool of process experts either to offer their expert services to audit teams, train the accredited energy auditors in the process aspects	3.2.1.5	44
Central Registry or Depository			
Recommendation 11	Options for setting up a depository for ES Certs	3.2.1.7	45
Recommendation 12	Considerations for setting up an independent registry	3.2.1.7	45
State Electricity Regulatory Commissions (SERCs)			
Role of SERCs under PAT			
Recommendation 13	A consultative approach to iron out the differences in understanding of roles among stakeholders responsible for calculation, adjudication, imposition, compliance and collection of penalties	3.2.1.9	46
Recommendation 14	Lucid and comprehensive communication from BEE to all SERCs	3.2.1.9	46
Resource adequacy and requirements			
Recommendation 15	Resource requirements at SERCs	3.2.1.9	47
Training and Development Needs for all stakeholders			
Recommendation 16	Significant requirement of training and capacity building of key stakeholders in PAT	3.2.1.12	48

4. PAT Scheme design

4.1. Overview of PAT Scheme design

This section presents the current scheme design of PAT scheme as notified under the EC Act and the various subsequent rules and regulations from time to time.

The design of PAT scheme can be understood along the lines of the following broad topics:



We have reviewed the existing scheme design for each of these broad topics and present in Appendix A.1 a synopsis of each of these aspects of the scheme design as it presently exists.

4.2. Stakeholder consultation and literature review

This section endeavors to present thoughts and view-points relevant to the scheme design of PAT, resulting from a combination of desk research, one-to-one interactions with key stakeholders, and group consultations through round tables.

The view-points and insights are framed into relevant observations and recommendations that are presented in this section so as to maintain the flow of the topics being discussed. These are subsequently summarized in the next section '4.3 Conclusion and recommendations'.

4.2.1. Selection of Sectors and DCs, Boundary Setting

4.2.1.1. Scheme Boundary: Sectors and DCs covered under PAT

Deciding the scheme boundary or the number of DCs included under PAT is closely related to the target setting mechanism. We saw that the PAT scheme adopts sector-wise energy consumption thresholds, which has strategic advantages for the target setting mechanism and can also lead to sector and process level benchmarks as the PAT scheme matures.

The alternative approach is of setting a common threshold across all sectors. This model is adopted by China in their top 10,000 programme. A common energy consumption threshold is considered for industries (10,000 tons of coal equivalent) and any unit crossing that energy consumption threshold is included in the scheme. Apart from industries, a separate common threshold (5,000 tce per year) is defined for large transport enterprises, public buildings, hotels and commercial enterprises.

As BEE points out, this is workable as long as we restrict ourselves to defining DCs and mandating that they should get energy audits done. However where target setting is involved, in a PAT kind of set-up, this approach becomes very difficult. Ultimately PAT targets are unit specific, but these targets are set based on the understanding of how the sector behaves, and how performances of units within the sector compare broadly. Setting the targets for individual units that exceed a prescribed energy consumption threshold will be very costly and time consuming in the absence of a sector level knowledge base.

Recommendation 1:

However, this can be a useful mechanism if employed for industry units in all sectors that are not presently included under PAT. A common threshold (say 30,000 toe) can be considered and any unit crossing that energy consumption threshold can be defined as DC if it belongs to a sector or sub-sector that is presently not included under PAT. This will obligate a large no. of industries to submit annual energy returns and undertake mandatory energy audits through AEAs. Targets need not be assigned to these industries under PAT.

While the units will benefit from the energy audits, and inculcate a habit of energy monitoring and filing energy returns, the baseline data thus generated will be useful in identifying sectors with potential for inclusion in future PAT cycles.

4.2.1.2. Boundary setting for DC: Gate-to-Gate Approach

The PAT scheme adopts the Gate-to-Gate approach for demarcation of SEC measurement boundary for the designated consumers. All activities that are carried out inside of the Gate-to-Gate premises of the DC are included for SEC measurement.

Again the Gate-to-Gate approach for boundary setting does not work very well unless DC produces a single product[18]. In case of multiple products, complexities are encountered in accounting for energy consumed in each product. Normalization of various grades of product to a single product becomes a complex exercise.

Recommendation 2:

The gate-to-gate approach is easy to comprehend, and appropriate for initial PAT cycles. Once the scheme matures, this can be further refined in future cycles to define additional measurement boundaries around the specific processes or activities within a DC. This will provide a boost to process level sub-metering in DCs and will help to converge to comparable benchmarks for different plants by making process or activity level SEC data available. This has advantages in better understanding of process or area wise energy consumption, effective identification of energy saving opportunities and also in measurement & verification.

[18] Interview with FAI

Exclusion from SEC calculations, of certain types of energy like energy consumed in colonies, captively generated renewable energy not connected to grid etc. is also mentioned in the PAT rules 2012. This exclusion of off-grid renewable energy sources from SEC calculation means that addition of such captive off-grid renewable generation capacity is encouraged under PAT and can be one of the SEC reduction measures that a DC can undertake. However grid connected renewable energy like wind is not given the same treatment, even though the usage is purely captive. This is a common scenario, where wind farms are typically located at favorable geographies, and the power generated for captive use is wheeled through the existing transmission grid. This is presently treated as conventional energy and is not excluded from SEC calculations for PAT. One of the questions raised by some stakeholders relates to why such a scenario cannot be encouraged under PAT[19].

4.2.1.3. Duration of PAT cycle

Presently the duration of one PAT cycle is 3 years. Thus DCs have to plan for and achieve the energy conservation measures within the 3 year cycle. While shorter cycle durations would have provided better market signals for trading it would have provided very little time for industries to plan and implement energy efficiency measures.

There are examples of some Japanese schemes where there was a substantial (about 12%) reduction target given to large industries like petroleum refineries in a considerably longer cycle time of about 10 years[20]. In this case longer cycle times probably offered adequate time for industries to plan and implement complex energy efficiency improvement projects. Thus implementation of projects involving complex technical changes and/or capital intensive projects with longer gestation periods became possible.

While this might be an advantage, longer cycle times are not prevalent in various similar international schemes. Except for some complex technical changes and capital intensive or long gestation projects, most energy efficiency interventions are feasible in a cycle time of three years.

4.2.2. Target Setting Mechanism

4.2.2.1. Establishment of New Baseline for existing DCs – approach adopted in future cycles

Rule 14, PAT Rules, 2012 'Energy consumption norms and standards achieved by the DC on the completion of the target year, as mentioned in the compliance report in Form-'D' shall be the baseline for establishment of new plant specific energy consumption norms and standards for next cycle'.

Observation 1:
The rule however, is silent on the effect on baseline energy consumption for the next cycle in case a negative opinion is recorded during check verification for a DC and the target compliance status as mentioned in Form D stands invalidated.

4.2.2.2. Establishment of Target Energy Consumption norms and standards– approach adopted in future cycles

The PAT cycle 2 target setting will be based on the energy audit results submitted by DCs in Form 2 and Form 3. The energy audit has been made mandatory for DCs and we will have the results latest by December 2015, when the 18 month deadline for conduct of audits will be completed. This will form the basis for cycle 2 target setting. Decisions will have to be taken on need to further tighten or tweak the targets from the possible savings reported in form 2 and form 3.

[19] Discussion with stakeholders during National Workshop (Nov 2014) held to disseminate findings of this study
[20] Interview with FICCI

According to the PAT rules 2012, in case the energy audit of a designated consumer has NOT been completed the SEC reduction target of that DC to be set on the basis of average rate of reduction in SEC across all the DC sectors' in the last three years. There is also a provision of further tightening the target to a few percentage points above the average rate of reduction. Where the DC is new, the prescribed method seems to be generic and may result in targets that are not realistic for some of the new DCs.

Recommendation 3:

Where the new DC belongs to an existing DC sector, it would be a better approach to allocate the targets to new units based on the average rate of reduction in SEC during the last three years, for that particular DC sector and sub-sector to which the units belongs. If the new DC belongs to railways or a new DC sector that is added as a result of widening of PAT scheme in subsequent cycles, it would be best to base the targets on knowledge gathered through a preliminary study of the sector.

Preliminary studies would also be required to be conducted by BEE in arriving at the possible sectors for widening. It will be useful to orient these preliminary studies so as to capture the knowledge (eg. Sector and sub-sector wise historic rate of reduction of SEC) which can be a basis for the target setting exercise.

4.2.2.3. Establishment of Target Energy Consumption norms and standards– alternative approaches for future cycles

Another alternative approach, observed in some international experiences[21] is a process based approach to target setting. Here the targets are based on the known efficiency or performance benchmarks of various processes within an industry. The scheme targets are based on the process rather than for individual industry. The targets for each industry are then deduced based on the process level targets and combination of various processes in an industry.

This approach has some inherent advantages like evolving process level benchmarks that are applicable across the sector. It also fosters process level sub-metering and tracking of energy performance at individual process level, which has advantages in better understanding of process or area wise energy consumption, effective identification of energy saving opportunities and also in measurement and verification. The existing DC based approach to target setting under PAT is capable of evolving into the process based approach as the scheme matures, and successive energy audits result in a database of process level energy consumption in various sectors.

4.2.3. Measurement, Reporting and Verification (MRV)

4.2.3.1. MRV processes and timelines, PAT Rules

Details from our intensive desk research on MRV processes, timelines, and relevant PAT Rules are presented in the appendix 'A.1 Synopsis of PAT Scheme Design'. Observations from our desk review and some insights from stakeholder consultations are listed below:

Observation 2:

The time period provided for submission of Form A is within 3 months of close of each year in target period. This deadline of 3 months is expected to be short considering the elaborate procedure for MRV which will need to be followed. This is all the more so during the first cycle, since DCs will have very limited amount of time to get verification done by AEA firms as per the M&V and normalization processes yet to be notified.

[21] EU-ETS: Cap setting mechanism operates with an elaborate sub-categorization of products within various industry sectors. This allows product level benchmarks to be defined. Industry level allowances are then arrived at based on the product level benchmarks.

Observation 3:

Various timelines for activities or milestones are clearly laid out in PAT rules. For instance, a timeline of 1 month and 10 days is provided to issue ES-certs to DC's, from last date of submission of Forms A & B by DCs (timeline for SDA -15 days, for BEE -10 days & for central government -15 days). *However, there could be better clarity on consequences of not meeting these deadlines for any of the stakeholders involved.*

Observation 4:

While the rules clearly specify the timelines there is a need for detailed guidelines on the nature of comments that SDA is expected to give on Form A and Form B. Data to be sought and verified by SDAs will also need to evolve in the form of additional guidelines, operating manual etc. for the SDA, which may as well be subsequently referenced in the PAT rules.

Detailed Reporting Formats including Records to be kept by DCs, Data to be verified by AEAs etc. will also need to evolve sector wise, based on the M&V guidelines that will be notified along with the normalization factors.

It was felt that while the DCs would welcome the PAT scheme with it targets as well as the market based mechanism for incentivizing achievers and would readily comply with any measurement and verification requirements to establish savings achieved, the details on implemented measures may be proprietary information which the DCs would not like to share. Any enforcement on DCs for sharing such proprietary information may not be welcome[22].

Recommendation 4:

Regulators and enforcement agencies like BEE, SDAs and adjudicating officers must take cognizance of this sensitivity and be equipped to deal with this effectively. While most energy efficiency projects do not involve proprietary technical information, process related interventions may be of this nature. The scheme design including information to be provided in Form 2, Form 3 etc. do not mandate the provision of proprietary technical details on how process efficiency was achieved. However, the AEA appointed by the DC (or appointed by BEE for check verification) might at times need access to such process related technical details while verifying and certifying the energy savings achieved. Safeguards like non-disclosure agreements with AEA might need to be put in place in such occasional cases where proprietary information is involved.

4.2.3.2. Normalization and related aspects

Regulators and other stakeholders alike acknowledge varying levels of complexities within target sectors and the uniqueness of each target sector. Developing the normalization factors has been a challenging process and one that afforded immense learnings. The process is almost complete with the participation of DCs through the technical committees and the normalization factors will be notified sometime soon. The new Normalization Factors shall take into account various issues faced by DCs which have an impact on determination of SEC, for example, quality of fuel, quality of raw material, availability of fuel, forced shutdown, etc. and shall adequately address the specific needs of each sector[23].

Apart from the normalization factors, detailed Measurement & Verification guidelines are also being developed. These include guidelines on records and metering arrangements, records to be kept by DCs etc.

[22] Interview with industry sector expert in Chlor Alkali Sector
[23] Interview with GiZ, and discussions during round tables

4.2.4. Market Mechanism for Trading, Trading Platform and Rules

4.2.4.1. Trading platform and Trading Rules for ES Certs

Process for development of Trading Rules is underway and BEE is working closely with IEX for this[24]. Recently, a joint committee has been formed with representation from CERC and BEE to oversee the formulation of trading rules and address requirement related to trading infrastructure like exchanges, registries, etc. The committee shall pave the way for inclusion of ES Certs as a trade-able entity at designated exchanges.

Notification of Trading Rules shall provide requisite clarity and basis for operational aspects for Exchanges and Depositories. Some of the areas that may be addressed through trading rules are presented below, along with the opinions collected during stakeholder interactions:

- **Central Depository and its functions**
- **Transactions in the certificates**
  - Transacted in any of the power exchanges, in accordance with the rules and byelaws of such Power Exchange (prior approval of the CERC on the rules and byelaws including Price Discovery mechanism)
  - **Traders** – only DCs are authorized to trade the ES certs on power exchanges? – Whether to allow traders? – If traders are allowed then the volume of market transactions may get a boost since the smaller DCs who may not have in-house capacity for trading can utilize the services of the traders. Traders will be active only after both buyers and sellers are there and the market is an active market.
  - Dealt only through the Power Exchange or other routes to be allowed? Should traders be allowed to re-sell? – Re-selling by traders can be a second route other than the exchange platform. It would be best to restrict trading only through exchange platform initially. The re-selling route may give rise to manipulative behaviour like hoarding by traders to push up demand. This can be an option in the longer term if market eventually stabilizes in terms of pricing and volumes.
- While Validity and extinction of Certificates are covered under PAT rules 2012, any moderation of certificate value while banking to the next cycle may be considered
- **Pricing of ES Certs**
  - Price will be as discovered in the Power Exchange.
  - Whether a Floor Price and Ceiling Price will be required; and mechanism for establishing these prices.
  - Floor and Forbearance prices for ES Certs

Recommendation 5:

Establishing a floor price for ES Certs may not be a good idea. Floor price was introduced in REC as a means to facilitate investment decisions in Renewable Energy projects. However, this might not be required in case of ES Certs. REC sellers are now ready to sell below floor price in REC, but they are not able to, thus hindering liquidity to that extent[25]. Such situations will be avoided by doing away with the floor price. Then market makers can come in to buy from sellers at very low prices as well.

As for the ceiling price, a natural ceiling does exist in case of ES Certs (Value of applicable Penalty).

- **Fees and charges**

[24] Interview with BEE
[25] Interviews with IEX, and discussions in round tables

- Commercials can be evolved by the exchanges and depository themselves or through BEE/CERC – BEE/CERC may like to cap the charge levied (both minimum and maximum)
- Fees and charges may include One time registration fee and charges, Annual fee and charges, Transaction fee and charges for issue of certificate, Charges for dealing in the certificate
- Manner of collection and utilization of the fees and charges
- Whether Exchanges to charge on Volume Basis or Value Basis?[26] – if on Value Basis then exchanges may try to push up the ES certs prices – but in case of ES certs there is a natural ceiling (Penalty value)

4.2.4.2. Early Price Signals and ES Certs Trading Frequency

Trading volume and trading frequency are closely related. Ideal trading frequency will depend on the spread of trading volume of ES certs over time. Trading sessions should be scheduled at intervals that allow for accumulation of ES Certs in sufficient numbers (thousands or so). For the first PAT cycle, trading volumes will start appearing only at end of final year of PAT cycle.

IEX highlighted the need of setting up mechanisms to provide early price signals of ES Certs. Considering purely from a trading perspective, a 3 year compliance cycle is quite long and does not encourage regular trading activity. There has to be some incentive or motivation for DCs to buy each year without waiting till end of compliance period.

Recommendation 6:

Once the MRV systems related to Form 1 and normalization are fully established and stable, a shortened period for mandatory disclosure (say quarterly energy returns) will be helpful to provide some signals to the market. The resulting SEC trends can be provided as market signals to promote more frequent trading activity. This shall provide incentive for sellers to sell early and buyers to buy early. IEX feels that an annual position paper, issued by BEE on the status of achievement of targets by various players can be helpful to promote speculation. This position paper can be made available to interested entities at a price.

Recommendation 7:

Double sided closed bid auction* will be a good method for price discovery. This has been used in case of REC trading.

***Note:** A double sided auction is a process of buying and selling goods when potential buyers submit their bids and potential sellers simultaneously submit their ask prices to an auctioneer, and then an auctioneer chooses some price p that clears the market: all the sellers who asked less than p sell and all buyers who bid more than p buy at this price p. (source: Wikipedia)*

In a closed bid auction the buyers and sellers submit sealed bids i.e. the bids are not publicly disclosed. The buyers and sellers do not know each other or the values of bids made by others.

The CERC has mandated that a double-sided closed bid auction with a uniform price solution be utilized as the price discovery mechanism for REC trading contracts within IEX and PXIL.

[26] Interview with IEX

Recommendation 8:

Provided mechanisms for early price signals are in place and on an optimistic note, Monthly or Quarterly trading sessions seem to be preferable given that REC is also following this frequency. A frequency like monthly will be good for early price discovery[27], and the frequency may also be increased towards the close of compliance cycle (i.e. around July to Oct).

4.2.4.3. Supply and Demand Scenario of ES Certs

In our discussions with BEE, industry stakeholders and power exchanges it was generally felt that majority of DCs are likely to achieve their respective SEC reduction targets in the first cycle. The demand for ES Certs will thus be low, and there is a reasonable possibility of supply far exceeding the demand. Power exchanges mention that while few DCs have approached them to enquire about ES Certs, those DCs who are talking about ES certs are talking in good volumes. A similar situation is there in recent REC trading sessions where the demand for solar RECs was only 0.5% of the supply and the demand for non-solar RECs was about 1.5% of supply.

The major players who have the maximum targets to achieve as a sector include Thermal Power Plants, Iron & Steel, Cement, Fertilizer and Aluminum. The level of achievement, over-achievement or under-achievement in these sectors will actually decide the demand and supply scenario that will emerge at the end of the first cycle.

Observation 5:

Experts opine that the possibility of under-achievement in the first cycle may lie with approximately 22 thermal power plants (mainly state owned / public sector Power Generating companies) and at some Integrated Steel Plants[28]. Such likely under-achiever DCs constitute a share of around 2.7 million TOE from the overall 6.7 million TOE PAT target from first cycle implementation.

Assuming a hypothetical scenario of 20% shortfall in these DCs where targets are less likely to be met, the number of ES Certs required by these DCs at the end of first cycle will be 0.54 million, which translates to around 45,000 ES Certs per month if the transactions were to happen at a monthly frequency, spread over a span of one year.

Important Disclaimer: *It is important to clarify here that the above is only a hypothetical scenario building exercise and NOT in any way a prediction or forecast of the supply and demand scenario at the end of the first cycle.*

4.2.4.4. Banking of ES Certs and its implication

The PAT rules 2012 specifically permits sell-side banking of ES Certs from the current cycle until the next compliance cycle. A DC who has been issued the energy savings certificates during the current cycle may use them for the purpose of banking until the next compliance cycle.

Recommendation 9:

It is generally felt that the first cycle supply of ES certs might far exceed the demand. A similar situation is there in recent REC trading sessions where the demand for solar RECs was only 0.5% of the supply and the demand for non-solar RECs was about 1.5% of supply. In case of excess supply of ES Certs in the first cycle, the sell-side banking provision might provide temporary perception of relief to the DCs in possession of the ES Certs (as they can sell in next cycle). However the potential of banked ES Certs to distort second cycle will

[27] Discussion with IEX during Round Tables
[28] Discussions with GiZ and industry stakeholders during round tables

need to be kept in mind. Hence banking from first cycle to second may need to be moderated to prevent over-flooding of ES Certs from first cycle thus vitiating the second cycle[29].

International experience also suggests that banking is not considered beneficial during the introductory phase of the scheme, since this phase is characterized by over-supply and low demand. It was not possible to bank allowances from phase 1 of EU ETS into phase 2. This prevented the over-allocation and low prices during phase 1 from affecting the integrity of phase 2.

Buy-side banking would have been even more detrimental to the liquidity of ES Cert market in the first cycle, since this would allow those with obligation to carry forward their obligation till the next cycle. Even a market maker, if in place, shall buy only when they are sure of being able to sell the ES Certs in subsequent cycles. PAT Rules, 2012 prudently avoids buy-side banking.

Recommendation 10:

Over the longer term (i.e. in subsequent cycles once the market has stabilized), banking can offer benefits in terms of building investor confidence and promoting market liquidity and price stability. However a restricted lifetime (say up to 1 additional cycle – as provided for in present PAT rules) will be desirable to prevent undue hoarding of certificates where there is expectation of price increase.

4.2.4.5. Are penalties adequate to encourage trading?

Section 'Penalty for Non-compliance' under 'Appendix A. Synopsis of PAT Scheme Design' - 'Compliance and Enforcement' describes the penalties applicable for non-compliance to targets notified under PAT scheme.

Recommendation 11:

Clause 1A, section 26 of the EC Act, provides for a penalty not exceeding rupees 10 lakhs for non-compliance of the PAT targets (energy consumption norms and standards). In case of continuing failure, an additional penalty is to be imposed, not less than the price of every MTOE of energy that is in excess of the prescribed norms. It is unclear in the EC Act as to how 'continuing failure' is defined in the context of PAT.

It would therefore be in order if this is adequately clarified in subsequent rules or amendments thereof.

However the following discussion assumes that both the penalty of Rs. 10 lakh as well as the additional penalty of 'not less than the price of every MTOE of energy that is in excess of the prescribed norms' will be levied for DCs not fully meeting the prescribed SEC targets. In case a DC has purchased ES Certs to meet part of its obligation, the DC will have to pay penalty for meeting the balance part of its obligation.

Ideally the penalty for non-compliance should be substantially high as compared to the market price for purchase of ES certs so that DCs actually prefer the trading route for compliance and penalties are not seen as an easy alternative to buying of ES Certs. In case of supply of ES Certs far exceeding the demand as is generally expected for the first cycle, the market price of ES Certs are expected to be much lower compared to the natural ceiling imposed by Penalty value. In such a case the penalty for non-compliance will be adequate to encourage trading.

However, in future cycles, if the demand significantly exceeds supply and the market price of certificates is close to the natural ceiling imposed by Penalty value, the situation changes. In such a case the penalty for non-compliance is no longer substantially high as compared to the market price for purchase of ES certs. Under this situation, if DCs choose to pay the penalty, this also works to reduce the demand of ES certs to that extent, and hence the situation may correct itself.

[29] Interview and Discussion with IEX, during round tables

The above analysis has been validated with an excel model which uses notified data of energy consumption baseline and targets for the DCs, to calculate penalties in case of non-compliance to varying degrees.

Observation 6:

Thus the penalties are generally adequate to encourage trading under most circumstances, provided they continue to act as an effective driver for compliance behaviour in the first place. It is important to re-iterate here that role of SDAs will be important in enforcement of penalties. In case of weak enforcement the trading will never pick up and the mechanism will see limited success as in the case of REC trading.

4.2.5. Compliance and Enforcement

4.2.5.1. Are Penalties under PAT adequate to encourage compliance?

We have studied the amount of penalties applicable in case of various industries being unable to comply with their prescribed energy consumption norms and standards to varying degrees. The study was done to understand the extent of monetary implications of the existing penalty provisions, on the non-compliant designated consumers.

Penalties have been calculated for a randomly selected sample of DCs belonging to specific business groups. These calculations assume the extreme case where the DCs completely disregard or fail to comply with the entire quantum of their energy consumption reduction target. To gauge the extent of monetary implication, these penalties are compared with the 3 year profit of the DCs. (Three year profits are arrived at by tripling the declared profit of the DCs for FY 13-14, ie the middle year of the 3 year PAT cycle). The results are as follows:

Sector	Business Group	No. of DCs	Penalty* (Crore Rs.)	Penalty as percentage of 3 year profit
Thermal Power Plant	Business Group 1	22	303.9	1.00
Cement	Business Group 2	11	151.8	2.95
Cement	Business Group 3	11	100.3	2.69
Aluminum	Business Group 4	5	178.6	3.17
Aluminum	Business Group 5	2	135.9	4.93
Iron & Steel	Business Group 6	3	109.9	2.08
Fertilizer	Business Group 7	5	15.0	0.69
†**Fertilizer**	Business Group 8†	5	275.0	260.00
Chlor-Alkali	Business Group 9	1	6.5	5.57
Chlor-Alkali	Business Group 10	3	7.4	1.43
Textile	Business Group 11	5	7.1	1.12
Textile	Business Group 12	2	1.9	1.56
Pulp & Paper	Business Group 13	1	6.3	0.60
Pulp & Paper	Business Group 14	2	7.5	3.86

***Note: Penalty calculations assume the extreme case where the DCs completely disregard or fail to comply with the entire quantum of their energy consumption reduction target.**

†**Note: Business Group 8 in fertilizer sector has exceptionally higher energy saving target as compared to Business Group 7 because 3 out of 5 plants in business group 8 were operating on LSHS/FO as feedstock, and hence had considerably higher SEC. These plants have recently changed its Feedstock from LSHS/FO to Natural Gas, and can thus be expected to be close to achieving their targets.**

Important Disclaimer: *It is important to clarify here that the above is only a hypothetical scenario building exercise and NOT in any way a prediction or forecast of the likelihood or extent of any DC achieving or not achieving their respective targets.*

Observation 7:

As can be observed from the above, the penalties applicable for the studied business groups for complete non-compliance of their PAT target ranges from 0.69% to 5.57% of the their respective 3 year profits. *While these penalties may not be excessively high, they should certainly be significant enough to motivate efforts for compliance.*

As expected, it can be observed that the penalties for complete non-compliance runs into hundreds of crores for the business groups in the more energy intensive sectors like TPP, Cement, Aluminum, Iron & Steel etc., whereas it is relatively lower for less energy intensive sectors like Textile, Pulp & Paper, and Chlor-Alkali. For some of the more efficient units among these sectors with lower energy intensity, the penalties may not be very significant.

4.3. Conclusion and recommendations

The section on 'Overview of PAT Scheme design' presented the current scheme design of PAT and the subsequent section on 'Stakeholder Consultation and Literature Review' presented thoughts and view-points relevant to this scheme design based on our desk research and stakeholder consultations.

This section endeavors to summarize, conclusions and recommendations relevant to the scheme design of PAT based on findings in the above two sections.

4.3.1. Overall conclusion on effectiveness of scheme design

The PAT Scheme is a unique policy instrument and stands out from the pool of several ongoing initiatives across the globe targeted at emissions reduction. The uniqueness of the scheme lies in the overall objective aimed at improving the ***efficiency*** of the production process to achieve the ultimate target of energy savings. This approach towards energy saving is a major digression from emission reduction directives followed in several developed and developing economies which, in general, aim at reduction in absolute number of emission/(fuel) consumption units. Thus, the reduction in energy consumption once achieved through PAT will be far more realistic (pointing towards a more efficient and less energy intensive economy) than those reported through other methodologies where absolute reduction of emission units may be influenced by commercial and/or political factors.

4.3.2. Observations and Recommendations

Compiled below is a summary of the Observations and Recommendations that were framed in the previous sections. The respective observations and recommendations are presented along with the commentary on stakeholder consultations and literature review, so as to maintain the flow of the topics being discussed.

The casual reader will find it convenient and intuitive to read through the section on stakeholder consultations and literature review, gathering in the process the insights shared through the observations and recommendations. Readers interested in observations or recommendations specific to a particular context can use the summary below to point to the relevant section of their interest.

5. PAT Cycle 1 – Status and Learnings

5.1. Overview of PAT Cycle 1

This section presents the current status of implementation of the first cycle of PAT scheme.

5.1.1. Evolution of PAT and Current status of implementation

5.1.1.1. Evolution of PAT

The evolution of the first PAT cycle thus far has been an immense learning experience, and also wrought with many challenges in the baseline establishment, target setting and above all the issue of normalization and sector wise design of format for DC to submit annual energy returns (Form 1).

Bureau of Energy Efficiency prudently adopted a gradual approach to enforcement of provisions. The initial phase saw support through external consultancy firms to assist various DCs in filling the Annual Energy Returns (Form 1) mandated as per the EC Act. The exercise collected data while simultaneously informing industries about the return filing mechanism and format, encouraging and inculcating the culture of Energy Return filing.

For the 672 industries initially identified, BEE in a landmark exercise with EESL as the implementing agency got Baseline energy audits conducted. In addition to the review and verification of energy consumption data being provided by the DCs to BEE for the last 3 years, the proposed baseline audit, included a detailed scope encompassing complete Process Mapping of the assigned Units, Energy balance of the entire plant and Identification of the energy conservation potential.

This mammoth exercise, highlighted various complexities in identifying and finalizing the baseline specific energy consumption which included need for complex normalization procedures in case of units manufacturing multiple or dissimilar products.

Post completion of the baseline exercise, Energy Consumptions Norms and Standards for the 478 Designated Consumers have also been notified on 30th March 2012. Target is specified individually for each of the DC's in terms of a Specific Energy Consumption (SEC) in TOE per Ton of Product. (TOE = Tons of Oil Equivalent).

FY 2008-09 to FY 2010-11 is specified as the Baseline Period. SEC (in TOE/Ton) for this period is the Baseline SEC. The target period for the first cycle is FY 2012-13 to FY 2014-15. FY 2014-15 is the assessment year, by which period, DCs have to comply with energy consumption norms and standards.

5.1.1.1. Current status of implementation

The need for sector-wise normalization factors highlighted during the baseline audits has later evolved into a crucial exercise. The exercise involved intensive consultations with sector experts and DCs from each of the 8 DC sectors through the sector wise technical committees and sub-committees. BEE is presently in an advanced stage of finalization of the normalization factors, as well as sector wise revised Form 1 formats, and is presently disseminating the same through sector specific workshops across the country.

The normalization factors, as well as sector wise revised Form 1 formats are likely to be notified sometime soon after the necessary approvals.

Some other aspects related to the ES Certs trading mechanism like amendments in power market regulations for inclusion of ES Certs as a tradable commodity, identification of Depositories, notification of operational rules for functioning of Depositories, and notification of trading rules are also at different stages of completion.

Observation 1:

It is felt that DCs across sectors are now generally compliant with the requirement to appoint energy managers responsible for the energy management function and all PAT related activities. Thus certified energy managers and auditors employed by DCs are emerging as an important stakeholder group, responsible for implementing PAT related activities within DCs.

DCs presently have either in-house energy cells or energy managers or some also have outsourced the function of energy manager, while retaining managerial control. Larger DCs have in-house capacity while smaller DCs presently show a mixed trend. For instance in textile sector many of the smaller processing units have opted to hire external agencies rather than maintaining in-house capacity for energy management.

The process of accreditation of energy auditors has been undertaken by BEE and a list of 150 AEAs are presently posted on BEE website.

A notification has been issued by Central government in consultation with BEE on 27 May 2014, mandating all existing designated consumers to get the first mandatory energy audit conducted by AEAs before December 2015.

Increased thrust in Policy circles expected to be seen with 1st PAT Cycle nearing closure and preparations for 2nd Cycle of PAT already commenced.

5.2. Stakeholder consultation and literature review

This section endeavors to present thoughts and view-points relevant to the first PAT cycle and sector specific issues in implementation, resulting from a combination of desk research, one-to-one interactions with key stakeholders, and group consultations through round tables.

Target Setting Process

The PAT target setting process was done by dividing the national target among the sectors and then among industries on pro-rata basis depending upon their energy consumption as outlined in the PAT consultation document by BEE. It is unclear whether the SEC determined in the baseline audits were subsequently considered in the target setting process[30].

Submission of Energy Returns and Action Plans by DCs

Energy returns are now being filed regularly by most DCs with very few exceptions[31]. SDAs are regularly receiving Form1 each year from the DCs. Few state and centrally owned TPPs have apparently not been very regular in submitting energy returns (Form 1) to SDAs. It was also felt that the data being generated had limited utility till the new normalization factors and form 1 formats are released. Some of the data required as per the new normalization factors might not be available within the old form 1 submissions. As soon as new sector wise form 1 formats are formally notified, there are plans to mandate an interim submission of the annual energy returns in the new formats. This will provide the first indications of the actual SEC reduction trends at various DCs.

As per rule 5 under PAT rules 2012, DCs were to submit the Action Plans for achieving their respective SEC reduction targets for the first cycle, within 3 months of notification of targets (i.e. by June 2012). The sector wise receipt of Action Plans from DCs has been almost 100% for most sectors. Actions plans indicate that most

[30] Interview with FICCI
[31] Interviews with BEE, SDAs

DCs are likely to achieve the targets. However the first indications of the extent of actual achievement vis-a-vis the claims will start appearing only with:

1) Receipt of Form 3 from DCs, verified by the AEA after mandatory energy audits have been undertaken by DCs
2) Receipt of energy returns from DCs in the new Form 1 formats with normalization calculations (this will be post notification of the new sector wise Form 1 formats)

Have DCs already achieved their targets?

There is a general feel that the first cycle targets are not very stringent and can be achieved by most DCs. Apart from this there are understandably not many claims from DCs on the achievement of targets. DCs are still not sure about the normalization factors and corresponding formulae used.

Concerns over the notification of normalization factors have been expressed by DCs from time to time during meetings between SDA and DCs[32]. Some SDAs have reported that DCs who have taken action towards achievement of notified energy saving targets have sought guidance on how to move further.

Capacity Building Needs

There is a need for capacity building among the whole institutional structure at BEE and SDAs, at the DCs, AEAs and empanelled AEA firms (for verification). Their capacity building is very vital. Therefore there is a need to have regular meetings or contacts by other means with the DCs and AEAs. There is limited or no interaction of SDAs with the DCs presently, other than collection of Form 1.

SDAs have proposed to BEE to conduct 2 workshops in a year for DCs wherein Sr. Management and Energy Manager from the DCs will be invited to attend[33]. The purpose of the workshops will be to inform DCs on the various technologies and options available for achieving the target under PAT. This will help to facilitate the DCs in achievement of the targets.

There is a need for clarity among DCs as to their notification. All those industries who exceed the energy consumption threshold will automatically be a DC and should file annual energy returns. Similarly confusion exists regarding the mandatory energy audit and the verification audits, which are totally different things. DCs and SDAs have also felt the need for experience exchange workshops with at least bi-annual frequency to understand what energy savings measures are being adopted by other industries in their sector.

Capacity building at SDA is also important. SDA is the first point of contact for DCs and are the first to receive the forms. They have to act on information received within time deadlines as mentioned in PAT rules 2012.

AEAs have also been pointing out the need for a national workshop to clarify their roles. This will be important since target setting under PAT cycle 2 will depend on the energy audit results. While Manner and Conduct of Energy Audit Regulations, 2010 is in place, the AEAs still need certain clarifications on some aspects. BEE might plan to conduct the national workshop in Delhi for AEAs.

BEE has started conducting awareness workshops of the DCs and AEAs in the cement sector. Four workshops are already conducted in Ahmedabad, Bangalore, Udaipur and Chennai.

[32] Interview with RREC
[33] Interview with PEDA

Recommendation 1:

BEE is presently in an advanced stage of finalization of the normalization factors, as well as sector wise revised Form 1 formats, and is presently disseminating the same through sector specific workshops across the country. The normalization factors, as well as sector wise revised Form 1 formats are likely to be notified sometime soon after the necessary approvals. Once notified, a need for an even wider scale of dissemination is anticipated since DCs will have to act immediately in filling up the revised formats and submitting the energy returns, conducting verification audits etc. Various queries will need to be addressed as they arise. Thus a need for clear instructions on sources of data to be reported by DC, explanations on calculation formulae used in Form 1 (excel sheets) etc. BEE may require to commission external consultants and experts, considering the volume of training and support that may be needed.

5.2.1. Sector Specific Issues in Implementation

5.2.1.1. Cement

About 99% of the cement plants in India are now using the more energy efficient Dry-process for manufacture of cement.

Sometimes the selection of processes is limited by the Raw Material and other external factors. Energy consumption is affected by whether the Limestone available is hard or soft. In some cases, the raw material itself is wet, and there is no option but to adopt the less efficient wet-process for cement manufacture. Hence conversion of 100% of plants to dry-process is not possible.

Cement industry in India operates at good levels of efficiency compared to world averages. Many of the cement plants employ the latest and most efficient technologies and best practices. However potential for energy efficiency does exist.

Normalization Factors

Normalization is an important area concerning the PAT implementation. Factors important for the Cement industry are Product Mix (eg. OPC / PPC), Power Mix (eg. Different grades of Coal, CPP/Grid), Capacity Utilization, Fly Ash content etc. Capacity Utilization is an important parameter.

Forced shut-down and related Energy loss due to the Hot-Cold-Hot cycling is an important factor affecting energy consumption and SEC in DCs.

Availability of coal is also a factor, and has been declining. The decline is made up with lignite, pet-coke etc. There is a combined effect of coal and raw material quality of the process energy consumption. i.e. some of the better quality of raw material can sustain the bad coal.

Waste Heat Recovery (WHR) Technology

Observation 2:

Waste Heat Recovery (WHR) Technology is an important energy efficiency measure, and is becoming more cost effective. For instance 5 years back, the technology costs around Rs. 15 Cr. / MW, whereas the cost now has come down to 8 to 10 Cr. / MW, thus improving the RoI. However, the RoI is still not at a very encouraging level. Presently only few cement plants are employing this technology, while there is potential in many more plants. The technology needs to be encouraged[34].

[34] Interview with CMA

5.2.1.2. Chlor-Alkali

22 out of the 31 Chlor-Alkali plants in the country are presently covered in the PAT scheme. Of these 22, presently about 20 plants are in operation, and about 2 plants have been shut down.

Observation 3:

Electrolysis is the main energy consuming process, wherein 100% of Indian Chlor-Alkali plants have already adopted the most efficient membrane technology. Some of the plants which were operating on Mercury Cell technology for electrolysis at the time of notification of PAT targets have now converted to membrane technology[35].

Thus the major saving area is already tapped by the industry, leaving lesser room for further substantial reduction in SEC in future PAT cycles.

Most efficient membrane cell units consume 2100 units/Ton of Caustic whereas the least efficient would consume about 2400 to 2500 units/Ton of Caustic. Thus there is some limited scope for further optimization[36]. Some potential exists for further improvement in energy efficiency is the Captive Power Plants. There are 8 Units with CPP and the rest are without CPP among the Chlor Alkali units under PAT[37].

Observation 4:

Oxygen Depolarized Cathode Technology is a newly emerging technology with around 30% energy saving potential compared to the present membrane technology for electrolysis in Chlor-Alkali sector. However this is presently in the R&D stage, and not yet deployed in manufacturing scale. Also, the Oxygen feed will be a very costly input, making this technology costly to operate[38].

In the membrane technology for electrolysis, the life of the membrane is presently about 4 years, with a continuous decrease in the energy efficiency throughout its useful life. Likewise, the life of the electrode coating is about 8 years, with a drop in its efficiency as the coating ages.

The normalization factors being considered for normalization of baseline and target SECs in Chlor Alkali sector includes the following two factors:

- Power Mix (i.e. Percentage of Electricity drawn from Grid and CPP)
- A annual factor of 60 Units / Ton of Caustic is considered to account for the decrease in efficiency of the membrane and electrode coating

5.2.1.3. Fertilizers

Observation 5:

In manufacture of fertilizers, 70 to 75% of the operating cost is cost of energy. This is the key driver for systematic efforts in bringing down the process SEC.

There have been systematic efforts since long both nationally and internationally in reducing the energy intensity. Ammonia production is one of the key processes in fertilizer sector. The weighted average of entire ammonia production in the country was reduced from 52.22 GJ per ton of ammonia to in 1987-88 to 36.74 GJ

[35] Interview with AMAI
[36] Interview with Sector Experts
[37] Interview with AMAI
[38] Interview with AMAI

per ton of ammonia in 2009-10[39]. Further projections by FAI indicate systematic plans to reduce energy intensity to 31.67 GJ per ton of ammonia by 2030 and to 30.17 GJ per ton of ammonia by 2050[40].

Observation 6:

The policy environment in India presently is not favorable for new investments in fertilizers. There has been no addition to capacity since 1999 in India. Six plants have closed down since 2011. However, the sector has good energy saving potential in the longer term (by 2050) due to systematic R&D efforts in the process side.

The target setting methodology followed under first cycle of PAT apportions the overall PAT target on pro-rata basis according to the energy consumption of each DC sector and sub-sector within PAT. Manufacturing of fertilizers uses energy as feedstock, and is hence energy intensive. This approach of pro-rata apportioning penalizes energy intensive sectors, like Fertilizers, operating with best efficiencies judging by global benchmarks, since such sectors got a higher share of the targets based on their energy intensity, while they were already operating at best efficiencies and had relatively lower potential for efficiency improvement[41].

Observation 7:

Most units running on Naphtha have either converted or are converting to Gas as feedstock. The few units which convert to Gas post the notification of target will be able to benefit from the PAT incentive (ES Certs) in addition to the SEC reduction achieved. However there is acute shortage of Gas as of today.

Like in other sectors measurement and verification and Normalization factors are crucial. Relevant normalization parameters being considered, includes the effect on energy consumption due to forced shutdowns and cold-start-ups beyond the control of DCs[42].

Fertilizer sector offers more scope in identification of energy conservation measures in process side as compared to the utilities side, since the feed itself is energy. A pool of process experts may be identified in each sector[43].

5.2.1.4. Iron and Steel

Energy Efficiency Potential

Observation 8:

There seems to be good scope for energy performance improvements in the Iron and Steel plants in India. The energy consumption for Indian Iron and Steel plants is 6.5 G Cal/ton liquid steel while the world average is about 4.5 G Cal / ton of liquid steel.

Few of the plants in India have energy consumption as high as 7.5 GCal/ ton of liquid steel. *However, such comparisons need to be carefully considered in the light of the various influencing parameters like raw material composition etc.*

Form 1 and Normalization Factors

The present Form 1 is not organized based on the terminology that is being used in Iron and Steel Industry, and hence is often not properly understood. The technical sub-committee representing Sponge Iron DCs, have

[39] Interview with FAI
[40] Energy efficiency and Ammonia Production in Indian Ammonia Plants – Dr. S. Nand and Manish Goswami, FAI
[41] Interview with FAI
[42] Discussion by GiZ in round tables
[43] Interview with FAI

provided their inputs for the same[44]. The new Form 1 submitted for approval is divided into 5 sections including Direct Reduced Iron (DRI), Steel Melting Shops (SMS), Rolling, CPP etc. in line with the operations typically found in a sponge iron manufacturing unit.

The sector faces high level of variation in the raw material composition. The SEC is dependent on the type of raw material being used for the process. Use of superior quality raw material will result in better SEC. But it depends on the availability of the raw material. It may so happen that at a particular period of time the best quality raw material is not available. This makes raw material composition an important factor for normalization.

The PAT processes like notification of new Form 1 and normalization factors is taking considerable time which is also resulting in lack of clarity and impatience to some extent among industries that are required to meet SEC targets within stipulated deadlines.

5.2.1.5. Textile Sector

While 96% of the overall PAT target is contributed by Power, Cement, Iron & Steel and Fertilizer sectors, the most complexity occurs in Textile and Paper sectors in terms of SEC determination due to diversity of processes.

Complexities in Normalization due to diversity in products and processes

Normalization is a major challenge due to diversity of processes in textile sector. There are many variations like lean and busy period and process variations depending on the season, festivities, market demand etc. Further, different processes and stages of value addition will have different SECs based on the processes characteristics.

Spinning is relatively better in terms of uniformity of process and hence ease of normalization while Processing sub-sector within textile has very little uniformity.

However even in case of spinning there are complexities like conversion of counts, and speed correction factor among others. The various yarn counts that are manufactured based on market demand has a direct bearing on energy consumption. Hence to arrive at a common SEC for all yarn produced; all counts of yarn are usually converted to 40's count.

Count conversion formulae are defined by SITRA. Speed correction factor is an important factor in these formulae. All DCs are working with different conversion formulae based on their machine (ring frame) characteristics, product manufactured etc. Further, yarn manufactured through Open End spinning technology cannot be converted to 40's count. It is usually converted to 10's count.

Typically in a spinning mill, processing remains common till the ring frame (basic yarn production stage). Further processes like doubling, twisting (TFO), yarn conditioning etc. are applied based on product grade and quality as per the market demand. Equivalent product conversion for all processes beyond the ring frame is now being considered.

Observation 9:
The most complexity occurs in Textile and Paper sectors in terms of SEC determination due to diversity of products and processes.

[44] Interview with SIMA

SEC is higher in Modern Mills

It is generally expected that increased automation improves productivity and brings down the SEC. However the experience in textile sector has been contrary to this, since the main purpose of automation here is cut down on manual labour input which is a very significant component of the cost of production.

Observation 10:

Contrary to popular belief, SEC is higher in the more modern mills due to introduction of various process automation measures that reduce the human intervention[45]. Examples include pneumatic auto doffers, link coners, modern open end spinning machines (Vortex) etc.

Sub-Grouping within textile sector

The difference between highest and lowest relative SEC across textile DCs is around 10 times. Hence sub-categorization will be helpful to reduce complexity. Normalization issues are simplified to an extent through sub-groupings, since there is better uniformity of product and processes within sub-groups.

Presently the textile sector includes 4 groups sub-groups viz. Fiber, Spinning, Composite, and Processing. To deal with the diversity in textile sector, BEE along with the expert sub-committees are considering the feasibility of further sub-categorization. Such sub-categorization is based on several parameters like twisted and non-twisted yarn, CPP and Non-CPP units etc.

Form1 design

The new Form 1 format should capture the data on Process wise energy consumption. Industry presently does not have sub-metering to the extent required to enable such data collection. Sub-metering should be encouraged and developed.

Process knowledge among AEAs

Sector specific process knowledge should be a point of consideration in Accreditation of Energy Auditors. Process side energy consumption accounts for more than 60% of energy consumption in textile industries. Measures suggested after audits should focus on process improvement and not just on utilities side.

Process knowledge can be brought in through associations like CITI (Confederation of Indian Textile Industry) 15 trade associations operate under the umbrella of CITI in the country, covering all the sub-sectors of Textile.

5.2.1.6. Thermal Power Plants (TPP)

Thermal power plant sector is the largest energy consumer among the presently notified PAT sectors, with 144 designated consumers and total reported energy consumption of 104 million TOE. The energy savings target notified to DCs in the TPP sector under PAT cycle 1 is 3.2 million TOE, amounting to 48% of the total national energy saving targets notified among all 478 DCs in 8 sectors.

Out of the 144 TPPs covered under PAT cycle 1, 97 are coal / lignite based, 40 are gas based and the remaining 7 are diesel based power plants.

Further these power plants are either centrally owned, state owned or private. The TPPs supplying to a single state are regulated by the SERCs whereas the centrally owned, NTPC and other TPPs supplying to more than one state are regulated by the CERC.

[45] Interview with NITRA

Target Setting

The TPP sector has witnessed one of the most robust target setting methodologies during the first cycle. The targets are set based on the Net Station Heat Rate (Net SHR) so as to account for both the Gross SHR and the Auxiliary Power Consumption (APC).

Targets are assigned based on the difference between the actual Net SHR and design Net SHR, with a higher deviation from the design net heat rate qualifying for a higher percentage of SHR reduction target. Thus some of the modern TPPs operating very close to design net heat rate have not received any further SHR reduction targets. This level of analysis has not been possible in other sectors so that DCs in no other sector have received zero targets.

The PAT targets for TPPs are apart from the norms specified by CERC or SERCs based on CEA recommendations. These norms are specified on Gross SHR. Gross Station Heat Rate (SHR) of generation units (of various capacity and vintage) plays an important role in determination of tariff allowed for any typical power generation utility.

PAT targets thus should be either at par or more stringent than the norms prescribed by regulatory commissions.

Impact of PAT Targets on Tariff Setting

Observation 11:

Under current regulations, capital expansion activities by TPPs qualify for tariff revisions if admitted by the regulator. Up-front expenditure incurred by utilities on implementation of energy efficient technologies can be taken as part of capital expansion activities under the current regulations in case utilities pass on the benefits in cost savings from energy efficiency to its consumers. However, in case when utilities decide against passing the benefits to consumers (by reduction in tariff), the upfront expenditure towards energy efficient technologies needs to be meted out from generated savings.

In the longer run, however, the consumers may want that the benefits of reduced SHR be passed on to them.

CERC has not yet been approached for any such cases as yet. It has therefore been decided that such cases will initially be dealt with on a case to case basis as and when they arise, rather than formulating formal norms upfront, to address such requests[46].

5.3. Conclusion and recommendations

The section on 'Overview of PAT Cycle 1' presented the current status of implementation and of PAT cycle 1 and the subsequent section on 'Stakeholder Consultation and Literature Review' presented thoughts and view-points relevant to PAT cycle 1 including sector specific aspects based on our desk research and stakeholder consultations.

This section endeavors to present, conclusions and recommendations relevant to the PAT cycle 1 based on findings in the above two sections.

5.3.1. Overall conclusion on PAT Cycle 1 implementation till date

The first cycle has witnessed an excellent effort by policy makers and participating stakeholders to uncover and resolve the underlying complexities and develop a robust and unique efficiency based market mechanism. The

[46] Interview with CERC

journey thus far has largely been a 'learn by doing' phase, and there is immense progress in terms of the learnings gathered.

Normalization and verification have indeed been a big challenge. The efforts in the first cycle have provided invaluable learnings and a robust process has now being put in place that is unique to the PAT scheme in India. This has been possible through the thorough consultations with the experts and industry stakeholders and any minor tweaking that still remains will be sorted out as we progress in the scheme implementation. Some of the final components like depository and trading rules must also now be put in place in a timely manner.

The outcome of first cycle implementation shall not be limited only to achievement of unit and sector specific targets, but shall rather go a long way to create significant awareness about PAT Scheme and energy conservation among stakeholders.

5.3.2. Observations and Recommendations

Compiled below is a summary of the Observations and Recommendations from the previous sections. The respective observations and recommendations are presented along with the commentary on stakeholder consultations and literature review, so as to maintain the flow of the topics being discussed.

The casual reader will find it convenient and intuitive to read through the section on stakeholder consultations and literature review, gathering in the process the insights shared through the observations and recommendations. Readers interested in observations or recommendations specific to a particular context can use the summary below to point to the relevant section of their interest.

Reference	Context	Section No.	Page No.
Observation 1	Certified Energy Managers and Auditors employed by DCs are emerging as an important stakeholder group	5.1.1.1	64
Recommendation 1	Capacity building needs for all stakeholders for PAT cycle 1	5.2	66
Observation 2	Waste Heat Recovery (WHR) Technology is an important energy efficiency measure, especially for Cement and other sectors and is becoming more cost effective.	5.2.1.1	66
Observation 3	100% of Indian Chlor-Alkali plants have already adopted the most efficient membrane technology	5.2.1.2	67
Observation 4	Oxygen Depolarized Cathode Technology is a newly emerging technology with around 30% energy saving potential in Chlor-Alkali sector	5.2.1.2	67
Observation 5	In manufacture of fertilizers, 70 to 75% of the operating cost is cost of energy	5.2.1.3	67
Observation 6	Present policy environment in India presently is not favorable for new investments in fertilizers. However, the sector has good energy saving potential in the longer term (by 2050)	5.2.1.3	68
Observation 7	Most units running on Naphtha have either converted or are converting to Gas as feedstock. However, there is acute shortage of Gas as of today.	5.2.1.3	68
Observation 8	There seems to be good scope for energy performance improvements in the Iron and Steel plants in India	5.2.1.4	68
Observation 9	The most complexity occurs in Textile and Paper sectors in terms of SEC determination due to diversity of products and processes	5.2.1.5	69
Observation 10	Contrary to popular belief, SEC is higher in Modern Textile Mills	5.2.1.5	70
Observation 11	Impact of PAT targets on tariff setting	5.2.1.6	71

6. Sustainability of the Scheme

We are now in the final year of the first cycle of PAT scheme (2012 - 2015). This is an apt juncture in the evolution of the scheme to take stock of the learnings and begin a timely preparatory analysis to plan for the way forward in future cycles including deepening and widening of the scheme. This chapter examines the sustainability and strengthening of the Scheme in future cycles.

In the previous chapters we have examined in detail the legal and policy framework, institutional mechanism, and scheme design. We also examined the aspects of scheme implementation in PAT cycle 1. Here we will consider how learnings from each of the above aspects can positively influence the sustained operation of the scheme.

6.1. Sustainability of PAT Scheme - An Overview

Expansion of the PAT scheme in future cycles is envisaged to further extend the coverage enabling more number of industries and industry sectors to benefit from the energy savings and related incentives and thus sustaining and strengthening the scheme performance.

Scheme expansion is envisaged through the twin routes of deepening and broadening. Deepening of the scheme involves reducing the energy consumption threshold defined for designated consumers in various existing PAT sectors, thus including more number of industries from existing sectors under PAT. Broadening of the scheme on the other hand, involves inclusion of more DC sectors under PAT.

This section presents the current scheme design of PAT scheme as notified under the EC Act and the various subsequent rules and regulations from time to time.

6.1.1. Deepening the coverage under PAT

BEE has already commenced preparatory activities for Deepening of the PAT scheme in PAT cycle 2. A detailed study on potential for deepening has been commissioned by BEE for Iron and Steel, Textile, Pulp & Paper and Cement sectors.

Railways is one of the nine sectors that were notified as designated consumers through the Gazette notification dtd. 12 March 2007 by the central government. The DCs notified include 13 traction sub-stations (TSS), 16 diesel loco-sheds in railway zones, all six production units (factories) and all workshops having annual energy consumption of 30,000 MTOE and above[47].

As DCs in the sector are already notified Railways is being considered for coverage in PAT cycle 2 as part of the Deepening activity. Initially, BEE plans to include only the production facilities and workshops. Indian Railways have internally initiated preliminary preparation and thought process to develop metrics and data collection systems required for inclusion under PAT.

6.1.2. Broadening the coverage under PAT

Activities by BEE for broadening the PAT scheme are at a relatively nascent stage as of now, the focus being more on wrapping up the balance activities under PAT cycle 1, and preparatory activities for deepening. The natural area of focus while considering sectors for inclusion in future cycles scheme are the remaining sectors from among the list of 15 energy intensive industries mentioned in the schedule to the EC Act.

[47] Source: The Gazette of India, Part II, sec – 3, sub-sec (ii) dated March 19, 2007

Energy intensive sectors not thus far covered under PAT, from among the 15 sectors identified initially under EC Act 2001 are Sugar; Chemicals; Port Trust; Transport Sector (Industries and Services); Petrochemical, Gas Crackers, Naphtha Crackers and Petroleum Refineries; Thermal power stations, hydel power stations, electricity transmission companies and distribution companies; and Commercial buildings or establishments

6.2. Stakeholder consultation and literature review

This section endeavors to present thoughts and view-points relevant to the sustained performance and strengthening of PAT scheme in future cycles including deepening and broadening of the scheme, resulting from a combination of desk research, one-to-one interactions with key stakeholders, and group consultations through round tables.

6.2.1. Deepening the coverage under PAT

Each of the 8 existing DC sectors has witnessed growth during recent times and there are new units in these sectors which already consume energy above the current PAT threshold. These automatically get included in PAT cycle 2 without any change in existing energy consumption threshold prescribed for DCs. Some SDAs have also corroborated this view based on their experience in respective states and confirmed the possibly of adding new DCs without reducing the threshold in their states[48]. Further there is the question of whether the thresholds need to be reduced so as to include more units, and to what extent.

A relevant and useful study that attempts to answer these questions for some of the PAT sectors like Iron and Steel, Paper, Textiles, Fertilizers, Chlor-Alkali etc. has been conducted by CSTEP[49] with support from Shakti Foundation.

Existing studies on deepening have been a useful first step. BEE has also commissioned a thorough field based deepening study for Iron and Steel, Textile, Pulp & Paper and Cement sectors. In consultation with the various industry associations and experts BEE felt that Paper and Steel are the two sectors where there is potential for expanding coverage by tweaking the threshold. Therefore the deepening study commissioned by BEE will estimate coverage by reducing threshold limit for 2 sectors (Pulp & Paper and Iron & Steel) from 30,000 TOE to 20,000 TOE. Situation in Textile sector would be similar but the size of units would be smaller and hence may not be worth the effort to include more units by reducing the threshold.

Many of the sectors are also seeing a growth and are thus expected to contribute to more new DCs during PAT cycle 2 even without a tweaking of the threshold. The thermal power plant sector is expected to witness a 60 to 70 percent growth by March 2015 – when the baseline SEC for PAT cycle 2 will be frozen. Similarly there is growth expected in Cement and Steel sectors also. This poses a challenge in terms of the baseline data collection and target setting for deepening.

Opinions from stakeholder consultations and desk research for deepening potential in some of the sectors are presented below:

6.2.1.1. Chlor Alkali

There are 22 Chlor-Alkali units included under PAT cycle 1. Existing studies point to 7 additional plants that can potentially be included under the ambit of the scheme, 4 of which may be already consuming more than the present threshold of 12,000 TOE. Experts seemed to be broadly in agreement with the findings. AMAI was aware of about three new units which will qualify for inclusion in PAT cycle 2 based on their energy consumption[50].

[48] Discussion with GEDA during round table
[49] CSTEP report can be accessed at http://shaktifoundation.in/Sector.asp?mnu=work_energy_Industry&id=9&inid=180
[50] Interview with AMAI and Chlor-Alkali Sector Experts

The new units are already using the energy efficient Membrane technology and hence there would be limited energy saving potential in the process side in these units.

6.2.1.2. Fertilizer

India is the second largest producer of fertilizers with a total production of 38.6 million Tons of fertilizers. Both Nitrogenous and Phosphatic fertilizers are manufactured, while we depend entirely on exports for Potassic fertilizers (mainly potassium chloride). Urea is the major Nitrogenous fertilizer and accounts for over 83% of the ammonia produced.

There are 67 fertilizer units covered under PAT cycle 1. These produce Urea as the main product, and represent almost all of the energy intensive units existing in fertilizer sector. There are several other units manufacturing Phosphate Fertilizers (TSP and SSP), which do not use energy as feedstock, and hence their SECs would be significantly lower than the existing DCs. These units would therefore likely be much below the current energy thresholds[51].

The actual no. of DCs that might be added with the existing threshold would not be more than 2 or 3[52]. These are Urea Plants that were not operating earlier and have probably started operations now.

6.2.1.3. Iron and Steel

There are 67 DCs notified under PAT cycle 1. Existing studies indicate possibility of inclusion of as many as 225 new units without increasing the threshold, and a further possibility of adding 37 units by reducing the threshold to 20,000 TOE from 30,000 TOE.

Sectors experts have opined that the estimate of about 225 new units consuming energy beyond or close to the current threshold might be true, and that this needs to be confirmed with more data from the units.

Observation 1:

Thus significant deepening potential is expected in the Iron and Steel sector. It was also mentioned that Ferro-alloys is a sub-sector under Iron and Steel that has not yet been covered under PAT. This could be contributing to several units[53]. The deepening study commissioned by BEE will examine the effect on coverage by reducing the threshold to 20,000 TOE from 30,000 TOE.

6.2.1.4. Power Plants

Installed capacity of Thermal Power Plants was around 105000 MW at the time baseline assessment was made for PAT cycle 1, whereas last year TPP installed capacity would be crossing 145000 MW. The sector is expected to witness a 60 to 70 percent growth by 31 March 2015 – the point in time when the baseline SEC for PAT cycle 2 will be frozen.

Thus there are a large no. of new power plants that would be added. However these plants may be operating at a relatively low plant load factor. The threshold for power plants in PAT is quite low and even a 15 MW plant would be covered. Even though some of the power plants are operating on part load, their energy consumption would be quite high and would easily cross the current threshold. Based on these insights, it was felt that power plants might turn out to be a sector where the threshold might actually need to be increased instead of

[51] Interview with FAI
[52] Discussion with FAI during round tables
[53] Interview with SIMA

decreasing. Decreasing the threshold is not desirable whereas increasing the threshold will require detailed consideration.

Another aspect to be considered during target setting is alignment of the PAT cycle 2 targets with the new CERCs norms on Heat Rate announced for 2014 to 2019. The PAT target should be either be at par or more stringent than the CERC norms. The target heat rate under PAT cannot be more than the CERC norms.

Recommendation 1:

TPP is the largest contributor both in terms of energy consumption and energy saving targets for PAT cycle 1. Several complexities need to be carefully considered in deciding the strategy for deepening and target setting for the TPP sector in PAT cycle 2. These include the growth rate and associated challenges of fully including all new TPPs that fall within the threshold, a threshold value that is already quite low and the implications of maintaining or increasing it, inter-linkages of the PAT targets with new CERC norms on gross SHR etc. Further, while a deepening study is commissioned for other critical sectors, there is none for the TPP sector. Thus a specific and detailed consideration on power plants will be in order.

6.2.1.5. Pulp and Paper

Observation 2:

Pulp and Paper sector includes 31 units in PAT cycle 1. The sector would presently comprise of around 500 to 600 units in total. However a large majority of these would be too small to contribute significantly to the energy consumption and saving. The sector is expected to offer moderate deepening potential.

The possibility of inclusion of more units by reducing the threshold to 20,000 TOE is being examined under the study commissioned by BEE.

The total no of IPMA members which covers most of the large paper manufacturers have remained almost constant during past few years. However some of the medium sized units (not under IPMA membership) might have expanded and hence may now be falling within the energy consumption threshold[54]. Existing studies cite around 15 additional units that are likely to cross the present PAT threshold.

6.2.1.6. Textile

PAT cycle 1 includes 91 DCs from Textile sector, whereas the total no. of textile units would be more than 500. It was felt that more units may be eligible to be covered with no decrease or a very small decrease in the threshold[55]. For instance, some of the units not covered under PAT cycle 1 include Alps Textile Industries, the spinning unit with largest no. of spindles in north India and Jayshree Textiles, one of the largest units for worsted spinning.

There are no Weaving Units (having only weaving process) included with the present threshold of 3000 mtoe. Further, Garment manufacturing is also completely excluded with the present threshold. However, these exclusions might be justified since the units are not very energy intensive.

Observation 3:

There are a large no. of units where the energy consumption and therefore the saving potential is not so high. The threshold may therefore not need to be further decreased. Presently the threshold at 3000 TOE is the lowest among the PAT sectors. The sector is expected to offer moderate deepening potential even without

[54] Consultation with IPMA during round tables
[55] Interview with NITRA

further reduction in threshold. Studies cite about 74 new units that are likely to fall within the current threshold.

One analysis under the deepening exercise already initiated by BEE is about where the potential lies. For example, whether 50 units in the textile sector would consume energy equal to 5 units in steel, where should the efforts be focused?[56]

Observation 4:

This is also important in the context that 96% of the total energy consumption covered in PAT cycle 1 comes from only 4 sectors – Power, Cement, Fertilizer and Steel. These sectors with the exception of Fertilizers are also expected to offer the most deepening potential in terms of total energy consumption and energy saving potential covered.

6.2.1.7. Deepening – Inclusion of Railways under PAT

DCs within railways have already been notified in 2007, which includes specifically identified manufacturing units, diesel locosheds, and traction substations. Workshops above a threshold of 30,000 MTOE are also included. These DCs are now being considered for inclusion in future PAT cycles. Irrespective of inclusion in PAT scheme, these notified DCs within railways will now have to get the mandatory energy audits conducted by accredited energy auditor, as per the notification for mandatory energy audits dtd. 27 May 2014.

Railways have initiated its own internal assessment of potential areas within its systems for implementation of PAT activities. This assessment is being done with the help of RDSO. On the basis of such analysis of existing gaps in information relating to energy accounting and efficiency, Railways would look forward to enter the further implementation cycles in a phased manner, starting with 2 – 3 factories which can be selected on the basis of existing preparedness as well as product mix[57].

Note: *Railways as a sector has not received any targets under PAT cycle 1. Thus it might seem logical to refer to the inclusion of Railways under subsequent PAT cycles as 'Broadening' of the PAT scheme. However, DCs within the sector were already notified in 2007. Hence allocation of targets to DCs under PAT or adding new DCs or altering the threshold of existing DCs of Railways sector under PAT has of-late been referred to as 'Deepening of PAT' among the policy circles. We have aligned to this nomenclature in this report.*

Railway Factories and Workshops

Railway factories and workshops are manufacturing and service units respectively where the output is quantified in terms of number of units of locomotives, coaches, engineering components, etc. produced or serviced in a particular entity. In this scenario, the overall production output depends on the mix of number of units of different types (for example, locos produced/repaired of each type of WAP 4, WAP 7, etc.). Further, each factory outsources certain steps in production process of coaches, locos, etc, to varying degrees which leads to increased complexities in energy accounting for a particular unit of output[58]. In case of workshops, which primarily carry out the maintenance and repair work of old and damaged locos and coaches, the degree of effort and energy consumption is directly proportional to degree of damage to be repaired or maintenance required to the inward loco/coach.

[56] Discussion by GiZ during round table
[57] Interview with RDSO
[58] Interviews with Railway Board - Electrical Engineering Dept., and RDSO

The existing PAT framework, with its gate-to-gate measurement boundary and single metric to define the SEC, struggles to accommodate this scenario where highly variable degree of outsourcing as well as variations in production process are observed. While factories are relatively more amenable to the present framework, the challenge is much more pronounced in case of workshops where the output may need to be redefined in terms of the extent of repair or maintenance work carried out instead of the number of units of locomotives, coaches, engineering components, etc.

Recommendation 2:

Railways are a unique sector among the target sectors of PAT scheme in terms of institutional framework as well as processes at its manufacturing units and entities like loco sheds and workshops. A detailed scoping study for assessing the existing preparedness as well as to develop benchmarking guidelines for Railways is felt as an important pre-cursor to inclusion of the sector in mainstream PAT activities.

Traction Sub-stations

Traction sub-stations transmit electrical power to locomotives and thus, operate over a large geographical region. Also, energy consumption at a given traction sub-station depends heavily on the railway traffic operating through that particular region. Hence, it is difficult to align traction sub-station operation with PAT schematics of gate to gate energy consumption and state-wise jurisdiction on DCs.

Further, inclusion of traction sub-stations as a designated consumer might not be able to fully account for energy consumed in traction. Traction substations are points through with the electrical energy is transmitted and not consumed. Therefore the treatment would have to be similar to a transmission utility (ie the goal or metric could only be oriented to minimize the transmission losses rather than the traction energy consumption).

Recommendation 3:

Among the presently notified DCs within Railways, the factories are the most amenable to the existing PAT framework, and hence should be a starting point for inclusion into the scheme. Traction sub-stations are the least amenable to the present PAT framework and their inclusion as DCs might need to be reviewed.

Traction

Observation 5:

Traction understandably forms the major chunk of the energy consumption within railways, with 82% of the electricity consumption and 98% of the diesel consumption being attributed to traction[59]. There are some significant energy saving possibilities especially with electric traction like regenerative braking.

Traction is the transport based sub-sector within railways, i.e. the boundary within which energy is consumed (the locomotive or train) is mobile and not stationary at one location. It continues to remain an important concern whether this is amenable to the PAT kind of framework or not. Another school of thought is to address energy efficiency in railways (traction) and other transport based sectors like airlines, buslines etc. from a technology perspective rather than from a performance perspective as adopted in the PAT scheme.

At the same time, Railways promise huge potential for energy conservation by programmatic intervention at train level. There are existing studies about specific energy consumption with train as a unit. SEC could be measured as toe/ton.km, and ton.km is a data that is regularly gathered by railways and published in their year

[59] Energy Consumption and Energy Intensity of Indian Railways in 2005-06 (http://www.irfca.org/docs/stats/stats-energy-ir.html)

book. Over past several years, penetration of energy efficient technology based locomotives and trains have increased in Railways. At present, about 400 – 500 electrical locos are based on energy efficient technology (3-phase traction with provisions of regenerative breaking, etc.) out of estimated 4,000 electric locos in operation. Alteration in PAT scheme towards coverage of trains as a unit can provide a much needed policy thrust in largely untapped potential in this area.

However considering train as a unit will be difficult in a framework like PAT. With 8000 odd locomotives (diesel and electric) data collection, recording and third party verification will be difficult. Further, capacity utilization and associated variations in specific energy consumption also becomes issue.

Another option might be to align with the existing system for data collection that the zonal railways have for traction. The regional and zonal railways may have implemented some metrics or energy performance indicators defined both for traction and non-traction facilities. For traction some of the zonal railways presently track energy consumption per 1000 Gross Ton Kilometers. For electric traction, the metric used for SEC measurement is kWh / 1000 GTKM and for diesel traction, the corresponding metric of Specific Fuel Consumption (SFC) measurement is Liters / 1000 GTKM[60].

Recommendation 4:

Traction understandably forms the major chunk of the energy consumption within railways, with 82% of the electricity consumption and 98% of the diesel consumption being attributed to traction. Aligning with the existing system for data collection and SEC metric that the zonal railways might have for traction might be an option for inclusion of traction within the PAT framework.

Recommendation 5:

However, realization and conversion of existing energy savings potential (especially traction) within railway through policy intervention may require application of PAT scheme design in more innovative manner. At the same time, necessary timeframe needs to be considered to account for organizational framework complexities in areas of procurement of goods and services (from outside existing Railways supply chain), funding of identified energy efficiency projects, validation process, etc. that may arise during the course of PAT implementation.

Railways, as a group of distinct but interrelated entities, is a vast organization spanning across the national geography. The number of entities within Indian Railway systems and their mutual interdependence as well as administrative control makes it one of the more complex organizational frameworks to reckon with as compared to other target sectors in PAT.

Recommendation 6:

The point of initial consultation with railways must be the railway ministry or railway board. This top down approach will facilitate the decision making and allow access to important operational data and information from a central location to support the development of the appropriate mechanism. RDSO is also currently involved in the task of developing the systems within railways necessary for PAT and hence becomes a point of consultation.

6.2.2. Broadening the coverage under PAT

Observation 6:

Since there are 15 energy intensive sectors listed in the schedule to EC Act, the ones that are left out become a natural priority while considering the broadening of PAT scheme.

[60] Railways Energy Consumption and SEC data for Zonal Railways from BEE EC Awards

Apart from this there are existing studies on potential for inclusion of some of the other energy intensive sectors like Glass, Ceramics, Copper and Zinc. Insights gathered from stakeholder consultations and desk research, are presented in this section.

BEE is planning to initiate preparatory studies to assess potential sectors for inclusion in future cycles. The initial considerations might be from among the 15 energy intensive industries in the schedule to EC act. However, based on our interactions, preparations for commissioning such studies might not happen very soon. Inclusion of any new sector as part of broadening of the scheme in PAT cycle 2 will require the studies to be commissioned early, considering that PAT cycle 2 targets are expected to be notified in April 2016.

Recommendation 7:

- Criteria for selection of DC sectors for inclusion in future cycles of PAT need to be carefully evolved. Some of these criteria can be:
  - Annual Energy Consumption in Sector
  - Number of Major Units or Potential DCs and range of annual energy consumption of these units
  - Existing Energy Efficiency Potential in the units
  - Clarity of Product and Sub-sector definitions in sectors where multiplicity of products exist
  - Extent of Complexity in defining Efficiency Metric, Normalization, Measurement and Verification
  - Amenability of the sector to the PAT institutional framework
  - Amenability of the sector to the PAT scheme design
  - Growth rate or stagnancy in the sector

A listing of some of these potential sectors for broadening with a rough estimate of the sector wise annual energy consumption is provided below:

Sector	Approx. Annual Energy Consumption (million TOE)*	Remarks*
Petroleum	20.000	22 Petroleum Refineries
Transmission & Distribution	18.130	About 26 Transmission Utilities and 50 Distribution Utilities in 22 States
Sugar	4.455	There are 99 Plants with capacity above 5,000 TCD. These have annual energy consumption between 45,000 TOE to 90,000 TOE
Petro-Chemicals	2.850	Threshold value of 30,000 TOE represents 35% of the petrochemical sector accounting for over 85% of energy consumed
Glass	1.182	7 Major Plants manufacturing Float and Container Glass consume 0.78 million TOE
Ceramics	0.564	36 Plants consuming between 5,000 TOE to 50,000 TOE
Distillery	0.630	99 Major distilleries consuming 0.39 million TOE
Automobile Manufacturing	0.410	24 Major Plants consuming 0.34 million TOE
Zinc	0.288	4 Major Plants consuming 12,500 TOE to 1,75,000 TOE
Chemicals	0.270	Includes 4 sub-sectors viz. Carbon Black, Calcium Carbide, Titanium Dioxide, and Methanol. There are 14 Major Plants consuming 0.235 million TOE
Copper	0.123	5 Major Plants. Largest 3 plants consume around 13,000 TOE to 51,000 TOE
Vegetable oil Refineries	0.120	

*Note: Energy Consumption in these various sectors are a rough estimate based on existing studies. These are calculated from production figures based on an average SEC for the sector and sub-sector.

6.2.2.1. Petroleum Refineries

Observation 7:

Petroleum seems to be one sector which is easily a candidate for inclusion in future cycles of PAT, since the refineries are large energy consumers and the specific energy consumption metrics and the parameters influencing efficiency or SEC are already well defined.

At present, domestic refining capacity in India stands at 215.066 MMTPA[61]. The sector is also set to grow with further capacity expansions and new refineries, taking the total capacity to 307.366 MMTPA by the end of 12th plan period. The present capacity utilization of the refineries is close to 100%, except CPCL Nagapattam and HMEL Bhatinda whose figures are around 55%.

At present, there are a total of 22 refineries in India - 17 in the public sector, 3 in the private sector and 2 are joint ventures. Even though the count of refineries in private sector is just 3, however they constitute 37 % of total capacity share.

Energy Consumption and Specific Energy Consumption

In India, the energy performance of refineries is expressed in terms of specific energy consumption, measured in million British Thermal Units (BTU) per barrel per Energy Factor (MBTU/BBL/NRGF). This unit, commonly referred to as MBN, and developed by the Centre for High Technology (CHT) provides a basis for comparing energy performance of refineries of different configurations[62].

The term barrel used in MBN refers to barrel of crude oil. Thus SEC in refineries is measured against the throughput of crude oil processed by the refinery instead of the refinery output. Refineries typically use a number of processes to refine crude oil into a range of final products such as gasoline, diesel, naphtha, LPG, fuel oil, asphalt etc. Even in a refinery with relatively less complexity, there is no single major product as output from the refinery. Hence it is difficult to quantify energy consumption in a refinery in terms of its output.

The complexities of each refinery are different, based on the type of crude they receive and several other factors. These factors are taken into account when the energy factor (NRGF) is developed. The SEC or MBN of the refinery is influenced a number of factors, key among which are Percentage Capacity utilization, Density of Crude, Sulphur content in crude and Composite NRGF of the entire refinery.

However the energy factors developed for the public sector and private sector companies are different and these cannot be compared among each other. Public sector refineries use MBN whereas Reliance refineries employ the Shell Benchmark and Energy Intensity Index, or EII.

Each of the refineries may continue to use their own methodology or units for measurements and they can be assigned targets to improve upon their own previous performance. This is in line with the present philosophy for target and compliance in PAT. The development and deployment of these indices are a complex and costly affair. Therefore it might be best to go by the indices that refineries maintain and then set targets to improve upon their existing specific energy consumption.

Considering the range of 60 to 70 MBTU/Bbl/NRGF for the refineries operating in India today, an average NRGF of 9.0, the total crude throughput of 211.42 million tons in the Indian petroleum sector for 2011-12 translates to about 20 to 23 million TOE.

[61] Ministry of Petroleum and Natural Gas
[62] E&Y Report supported by SSEF - Developing methodology for baseline energy consumption for petroleum refinery subsector

Potential for Energy Efficiency

As per past studies, Indian Petroleum refineries are globally the best in class in terms of energy performance in the key energy consuming area which is the Furnaces63. Among the major concerns of the petroleum refining industry, is the acute shortage in availability of gas. An alternative is being developed in the form of Coal Based Methane.

Observation 8:

In the 1990's the sector underwent various efforts towards integration of the various products manufactured. However, this is still an area where further improvements are possible, resulting in energy efficiency improvements. Another major cause of inefficiency is related to operating efficiency of the captive power plants. This could be an area of immediate focus as far as energy efficiency is concerned.

The refineries in India are operating at an average energy intensity of about 70 to 80 MBTU/Bbl/NRGF, whereas the best performers among these are operating at 61 to 62 MBTU/Bbl/NRGF.

6.2.2.2. Transmission and Distribution

The schedule to EC Act includes Transcoms and Discoms which is an energy intensive sector in terms of the transmission, distribution and other losses. These include losses in transmission between sources of supply and points of distribution and in the distribution to consumers, including theft.

The annual power transmission and distribution losses in India were 210,852 MWh as of 2010[64], which translates to around 18 million TOE. Average Aggregate Technical & Commercial (AT&C) losses for were 27% during 2010-11. The loss data for Transcoms and Discoms are reported in the ARR submitted to regulators annually.

Amenability to the PAT framework

Recommendation 8:

Under APDRP and R-APDRP a massive programme for demonstrable and sustained loss reduction at DISCOMs is already in place. Establishment of reliable and automated systems for sustained collection of accurate base line data, and the adoption of Information Technology in the areas of energy accounting are focus areas of the programme. Thus the baseline, data collection process and infrastructure, and benchmarks etc. are already in place. Information is available circle wise with the APDRP secretariat.

PAT can provide a parallel process through which the efforts can be complimented and the success of APDRP can be provided with a further policy push through the PAT process.

There is a need for consultations with Ministry of Power on how to include Transcoms and Discoms.

Potential for Energy Efficiency

High technical losses in the system are primarily due to inadequate investments over the years for system improvement works, resulting in unplanned extensions of the distribution lines, overloading of the system elements like transformers and conductors, and lack of adequate reactive power support.

The commercial losses are mainly due to low metering efficiency, theft & pilferages. This may be eliminated by improving metering efficiency, proper energy accounting & auditing and improved billing & collection efficiency. Fixing of accountability of the personnel may help considerably in reduction of AT&C loss.

[63] Interview with CHT
[64] International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp)

Among possible energy efficiency measures in the sector would be HVDS, SCADA, Electronic Metering, AMR meters etc. Some private sector Discoms like NDPL already have a track record of relatively lower losses. NDPL presently operates at about 9 to 11% AT & C losses.

Recommendation 9:

A detailed and focused study on the sector will be helpful to assess the energy efficiency potential and the SEC metric, the amenability of the sector for inclusion under PAT, possible interlinkages and data sharing with APDRP etc.

6.2.2.3. Petrochemicals

A petrochemical plant is a chemical plant that will use a petroleum based feedstock, such as LPG or other products from a petroleum refinery to produce a chemical product, such as plastics. Basic petrochemicals fall in two major categories – Olefins and Aromatics. In India, the major petrochemical products comprise synthetic fibres, polymers, elastomers, synthetic detergent intermediates and performance plastics.

The 11 major petrochemical complexes in India include RIL complexes in Vadodara, Hazira, Dahej, Patalganga, Nagothane, and Jamnagar; HPL, Haldia; GAIL, Pata; IOCL, Panipat; BRPL, Bongaigaon, Assam; and MRPL, Mangalore.

Energy Consumption and Energy Intensity (SEC)[65]

The gross primary energy consumption for the sector is estimated to be 120 million GJ or 2.85 million TOE during 2011-12. The three major petrochemical products Propylene, Ethylene and Benzene account for 75% of the total energy consumption. Production of Propylene and Ethylene consumes maximum energy amounting to almost 63% of the cumulative energy consumption for the entire sector.

An analysis of secondary data on energy consumption for petrochemical sector indicates the following:

- 43% of the petrochemical sector accounts for over 90% of the energy consumed
- Threshold value of 30,000 TOE represents 35% of the petrochemical sector accounting for over 85% of energy consumed
- Threshold value of 12,000 TOE represents 54% of the petrochemical sector accounting for over 95% of energy consumed

The energy consumption data for above analysis is based on actual production data and the design/benchmark specific energy consumption for specific petrochemical products.

Observation 9:

While most of the units manufacturing these petro-chemical products would be large integrated complexes producing other products as well, it would be appropriate to have separate benchmarking levels for integrated and other units. The multiplicity of products and hence complexities in defining Efficiency Metric, Normalization, Measurement and Verification etc. are expected to be high.

6.2.2.4. Sugar

Sugar mills typically operate with bagasse as the primary fuel for captive energy generation. While there is access to bagasse produced as a by-product, the cost of generating power with bagasse as fuel is no longer very

[65] Delloitte Report supported by SSEF - Developing baseline SEC in Petrochemicals Industry in India

cheap since market price of bagasse is presently about Rs. 2000 a ton. Bagasse finds process application in paper mills and thus would not sell cheap.

Most Sugar mills operating in India are either privately owned or Co-operative mills. There are a few publicly owned mills also. Out of more than 500 sugar mills operating in India, about 99 sugar mills have installed capacities of 5000 TCD and above[66]. The average capacity utilization of the sugar factories in India during 2010-11 was about 92%.

Energy Consumption and Energy Intensity (SEC) [67]

The specific power consumption of sugar mills is typically evaluated based on power consumption per tonnes of cane crushed. The typical SEC will be in the range of about 26 to 32 kWh/tonne of cane.

The estimated annual energy consumption of sugar mills above 5000 TCD capacity vary between 45,000 toe per year to 90,000 toe per year. These mills thus have a high potential for coverage under PAT from an energy intensity point of view.

A threshold limit of 30,000 toe as minimum annual energy consumption per plant will bring in more than 50% of existing mills within the ambit of PAT.

Potential for Energy Efficiency

Both, energy consumed within sugar mills as well as power generation and export from sugar mills might offer potential for energy efficiency interventions. A large number of these units are adopting cogeneration route to meet their overall energy requirements. The adoption of technology in sugar mills has been fast and many mills are going for up to 110 ata boilers. The high pressure systems offer greater energy efficiency.

Observation 10:

Sugar is an energy intensive sector and sugar mills need to go for higher efficiency co-generation systems. There will be energy saving potential in both the co-generation and process areas. MNRE has been promoting bagasse based co-generation through policy interventions including capital and interest subsidies, tax benefits and preferential tariff guidelines.

Consultations with ISMA and National Federation of Co-Operative Sugar Factories[68], and industries indicated a readiness to go for sugar mills above 5000 TCD, wherein any energy efficiency measure could easily be integrated. There exists a significant energy saving potential of about 20% in many sugar industries.

Amenability to Measurement and Verification

For a framework like PAT it becomes important to determine with accuracy the calorific value of bagasse. The extent of drying or extraction of juice from sugar cane will affect the calorific value of the resulting bagasse, and hence there should be a mechanism to accurately define the CV. However this might not be a major issue, and an appropriate mechanism can be developed. It will also be instructive to examine any existing guidelines for GCV and heat rate to be considered in case of bagasse contained in CERC regulations for renewables.

[66] TERI Report supported by SSEF - Widening the coverage of PAT scheme, Sector Manual, Sugar Sector
[67] TERI Report supported by SSEF - Widening the coverage of PAT scheme, Sector Manual, Sugar Sector
[68] Consultations referenced in TERI study, and discussion with TERI during round tables

Political and Legal Aspects

Observation 11:

Bagasse might not be energy as defined in PAT rules, 2012 – only fossil fuels count as energy (Renewable energy sources not connected to grid, not to be considered in calculating net energy input to the plant). Bagasse being recognized as renewable energy by MNRE. Since most of the energy in sugar mills came from bagasse, the legal problem of defining bagasse as energy becomes significant.

While the private sugar mills are technology conscious and efficient, the co-operative sugar mills are not so conscious and may not be as efficient. Imposition of penalties might be a bigger challenge in the co-operative mills if they fail to achieve targets or comply with requirements.

In light of the complexities, more detailed consideration is required to see how sugar as a sector could be addressed within the PAT framework.

6.2.2.5. Automobile Manufacturing

Manufacture of automobiles is covered in the schedule to EC Act and the sector is moderately energy intensive. 24 large units are identified, with an estimated total annual energy consumption of 0.34 million TOE[69]. This sector being covered in the EC awards, BEE already has some data on the performance indicators and benchmarks etc.

Observation 12:

The automobile manufacturing sector is moderately energy intensive and has competent resources as well as a systems orientation that will help in development, tracking, measurement and verification of efficiency metrics.

However the sector has lot of variability in energy consumption depending on the extent of processes outsourced.

6.2.2.6. Chemicals

Two of the sectors under the ministry of chemicals and fertilizers, alkali chemicals (as chlor-alkali) and fertilizers have already been included under the first cycle of PAT. The balance of the chemicals sector includes four energy intensive sub-sectors carbon black, calcium carbide, titanium dioxide and methanol. Estimated total annual energy consumption of the four sub-sectors is 0.27 million TOE[70]. These four sub-sector include 14 large units with moderate energy saving potential and may be eventually included in PAT.

6.2.2.7. Buildings

Buildings sector is included in the schedule to the EC act. Putting in place an energy consumption threshold is one way to include buildings as DCs. 100 kW is the present threshold for inclusion of buildings in ECBC. Similarly a threshold for PAT may be considered.

[69] CII Report supported by SSEF - Widening the coverage of PAT scheme, Indian Automobile Industry
[70] CII Report supported by SSEF - Widening the coverage of PAT scheme, Indian Chemical Industry

Observation 13:

For the Buildings sector a feasibility study to assess the energy saving potential and compare it with other existing PAT sectors would be a good first step. Hotels and Hospitals may be a good starting point. Data centres are also fairly large consumers and would usually have all necessary monitoring arrangements.

ECBC as it is defined presently is for new buildings. Once a new building is constructed to comply with all ECBC requirements, it becomes an existing building, and the continued energy performance of the building can as well be covered under PAT.

Amenability to Measurement and Verification

Systems for energy performance measurements, record keeping etc. are in place in the large industries in other sectors, and when we consider buildings we should also ensure that similar systems are in place for buildings prior to being included as DCs.

Since commercial buildings like large malls etc. would have multiple tenants / owners, existence of a central metering location from which you can get the energy data becomes important. Data on energy consumed through generator backup should also be recorded and easily available.

A related issue is the treatment or approach to be adopted when multiple tenants / owners within a large building individually cross the energy consumption threshold. The question of whether to treat them as separate DCs or treat the large building as a single DC becomes significant.

6.2.2.8. Other Sectors

While the sectors in schedule to the EC act can be a more immediate priority where they readily fit into the PAT framework, there are relevant studies conducted on suitability of other sectors for inclusion under PAT. The annual energy consumption figures quoted below are from various studies supported by SSEF[71].

- In case of Glass Sector there are around 7 major energy consuming units with annual energy consumption ranging from 24,000 TOE to 3,78,000 TOE. These are mostly plants manufacturing float glass and container glass.
- Ceramics Sector includes around 36 major plants with an annual energy consumption ranging from 5,000 TOE to 50,000 TOE. Among these a few units (about six units) have annual energy consumption in the range of 30,000 TOE to 50,000 TOE.
- There are about 96 major Distilleries with annual energy consumption above 3,000 TOE. These account for a total annual energy consumption of 0.39 million TOE including about 40% energy input from renewable energy sources like baggase, and bio-fuel.
- In case of Copper and Zinc, there are few but large and energy intensive units. Three out of the five major Copper plants have annual energy consumption in the range of 13,000 to 51,000 TOE. There are four large Zinc plants with annual energy consumption ranging from 12,500 TOE to 1,75,000 TOE.
- There are about 4 to 5 Vegetable oil refineries with annual energy consumption ranging from 5,000 to 25,000 TOE.
- While Mining is not presently included in the schedule, ministry of coal is said to have opined that it can be considered for inclusion.

[71] Studies can be accessed at http://shaktifoundation.in/Sector.asp?mnu=work_energy_Industry&id=9&inid=170

- Studies have also been conducted for Diary and Beverages (Non-alcoholic where the energy consumption and saving potential is found to be relatively low.
- FMCGs are large in number and may include some big energy consumers. Manufacture of FMCGs can be relatively less energy intensive, similar to some engineering industries. Another problem would be that there are several tiers of FMCG manufacturers and the decision on where to draw the boundary would need careful consideration. Comparison and benchmarking also becomes difficult.

Observation 14:

While not covered in the schedule to EC Act, sectors like Glass, Ceramics, and even Copper and Zinc seem to have good overall amenability to the PAT frame work based on energy intensity of the sector, annual energy consumption of individual plants, energy saving potential and other factors.

6.2.3. Some other aspects relevant to Scheme Sustainability

Here we discuss few considerations on various aspects of scheme design and institutional mechanism, and their impact on the long term sustainable operation of the PAT scheme.

Target setting mechanism for new DCs

Prescribed method for target setting in case of DCs being newly included in PAT, is an area that calls for tweaking of the approach so as to provide a fair onboarding experience for the DCs. The present approach of allocating targets based on average rate of SEC reduction across DC sectors may result in unrealistic targets for the first cycle for some of the new DCs. Using average rate of SEC reduction for a particular DC sector and sub-sector as the basis for target setting can avoid possible anomalies arising from generalizing across all DC sectors.

While baseline SEC and production data are an essential pre-requisite for setting targets, average rate of SEC reduction for a particular DC sector and sub-sector may or may not be available at the time of target setting. Availability of this data during target setting can be ensured by the following routes:

1) Preliminary studies would be required to be conducted by BEE in arriving at the possible sectors for widening. It will be useful to orient the preliminary studies conducted for broadening, so as to capture the knowledge essential for the target setting exercise. This may include:
   - Sector and sub-sector wise historic rate of reduction of SEC
   - Sector and sub-sector wise energy saving potential, both short-term and long term

   While such knowledge will be eventually consolidated through energy audits and energy returns filed in progressive cycles, it will be important to ensure that first cycle targets do not leave a bad taste.
2) Targets can be assigned after one full cycle of defining the sector as DC, so as to allow for mandatory audits, collection of baseline data, identifying the normalization factors and formulae etc.
3) It would be interesting to explore the possibility of defining a common energy consumption threshold (say 30,000 toe) irrespective of sectors, and mandating energy audits. Identification and inclusion of sectors in future cycles can then be based on baseline data thus generated.

Consultative process for Normalization

Normalization and verification have indeed been a big challenge. The efforts in the first cycle have provided invaluable learnings and a robust process has now been put in place that is unique to the PAT scheme in India. This has been possible through the thorough consultations with the experts and industry associations etc. and any minor tweaking that still remains will be sorted out as we progress in the scheme implementation.

Continued efforts to sustain and foster the robustness of the consultative process, by engaging the new and existing DCs as well as sector experts will be crucial in maintaining the effectiveness of the normalization process.

Trading mechanism

Once the trading mechanism matures, options like encouraging speculation by providing market signals, and other mechanisms for encouraging early realization of the ES Certs by DCs will be important.

It was felt that some kind of differentiated value or denomination for ES Certs generated in progressive cycles certificates may need to be considered as the scheme evolves. For instance, Identifying and realizing the potential in both the new and the old power plants will be more time, effort and cost intensive.

Institutional Mechanism – Developing the regulatory cadre and capacity building at SDAs for enforcement, Strengthening the cadre of Accredited Energy Auditors

Inspecting officers are required to be state govt. officials with adequate seniority and exposure to regulatory affairs. Such a cadre might need to be developed over several subsequent PAT cycles.

Further the importance of a strong cadre of AEA with knowledge in energy efficiency and management as well as specialization in process areas of specific sectors has been unanimously acknowledged by stakeholders. Such cadre of AEAs in adequate numbers to cater to the PAT requirements will also need to be developed over several subsequent cycles.

6.3. Conclusion and recommendations

The above presented thoughts and view-points relevant to this sustainability of the PAT scheme including potential for deepening and broadening based on desk research and stakeholder consultations.

This section presents some conclusions and recommendations relevant to the scheme design of PAT based on findings in the above two sections.

6.3.1. Overall conclusion on sustainability of PAT scheme

Having evolved through complex challenges in developing efficiency metrics and normalization parameters, the first cycle thus far has resulted in development of a unique framework oriented towards rewarding demonstrated energy efficiency in large industries.

The scheme will now require continuously reviewing and consolidating on its intrinsic mechanisms for sector coverage, threshold and target setting mechanism, trading rules, shelf life of ES Certs, ensuring compliance and enforcement of the EC Act provisions etc. At the same time, such schemes are essentially required to demonstrate adaptability to changes in economic and political scenario.

Globally, the initiatives on emission reduction have been demonstrating this trend and evolving to a more mature, robust and inclusive stage after several phases of learning-by-doing approach, thereby carrying forward the learning and best practices from one phase to the next and shedding of redundant and counter-productive practices. The EU ETS mechanism, currently in its third phase (2013 – 2020) has evolved into more wide-based, market-driven, and robust mechanism as compared to the two earlier phases.

Most of the experiences like those related to the verification, trading and enforcement aspects from the first cycle are yet to come. The learnings from the first cycle can best be consolidated on during the second cycle if the focus is retained on the existing sectors. While it would be important to actively pursue the deepening activity for the second cycle, the broadening activity may best be relegated to subsequent cycles.

However, having said that the extent of preparatory effort that goes into inclusion of a new sector as DC is significant. This includes preliminary studies to ascertain energy efficiency potential, consultations with relevant ministries, re-orienting the scheme framework where needed (eg. to address issues like definition of bagasse as energy) etc. Thus it is the right time now for BEE to identify and prioritize possible industry sectors for broadening of scheme coverage beyond PAT cycle 2, and start specific consultations and studies for inclusion of the prioritized sectors in subsequent cycles.

Also, targets should ideally be assigned after one full cycle of defining the sector as DC, so as to allow for mandatory audits, collection of baseline data, identifying the normalization factors and formulae etc.

6.3.2. Observations and Conclusions

Compiled below is a summary of the Observations and Recommendations that were framed in the previous sections. The respective observations and recommendations are presented along with the commentary on stakeholder consultations and literature review, so as to maintain the flow of the topics being discussed.

The casual reader will find it convenient and intuitive to read through the section on stakeholder consultations and literature review, gathering in the process the insights shared through the observations and recommendations. Readers interested in observations or recommendations specific to a particular context can use the summary below to point to the relevant section of their interest.

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Appendices

A.1. Synopsis of PAT Scheme Design

A.1.1. Selection of Sectors and DCs, Boundary Setting

A.1.1.1. Scheme Boundary: Sectors and DCs covered under PAT

Deciding the scheme boundary or the number of DCs included under PAT is closely related to the target setting mechanism. Possible approaches include setting sector-wise energy consumption thresholds or setting a common energy consumption threshold across sectors.

The PAT scheme adopts a sector based approach to defining the scheme boundary. The first cycle includes eight energy intensive sectors like Thermal Power Plants, Iron & Steel, Cement, Fertilizers etc. Each sector is assigned a threshold energy consumption level and DCs consuming energy equal to or above this threshold are included under PAT scheme. This approach has strategically important implications for the target setting mechanism. Knowledge about the sector, its technologies and vintages, average SEC levels across the sector etc., gathered through progressive cycles helps in establishing targets in a more scientific, meaningful and economical way for the DCs in the sector. This approach can also lead to sector and process level benchmarks as the PAT scheme matures. By identifying and including the most energy intensive sectors, and then covering the most energy intensive industries in the identified sectors, this approach can ensure coverage of the vast majority of energy intensive industries.

The relative merits and demerits of the alternative approach of setting a common threshold across all sectors are also examined under the section on stakeholder consultation and literature review.

A.1.1.2. Boundary setting for DC: Gate-to-Gate Approach

PAT scheme relies on specific energy consumption targets which the designated consumers should achieve and exceed through energy saving measures. This calls for measurement of energy consumption and production. Thus it is important to define the measurement boundary within which to account for the energy consuming processes of a DC. The PAT scheme adopts the Gate-to-Gate approach for demarcation of SEC measurement boundary for the designated consumers. Under this approach, all activities that are carried out inside of the Gate-to-Gate premises of the DC are included for SEC measurement.

Some of the exceptions include activities not related to production like energy consumed in the colony attached to the plant, temporary or major construction work, and for outside transportation system. An important exception is that of energy consumed through renewable energy sources not connected to the grid. Thus off-grid renewable energy projects can be effectively used to reduce the DC's SEC level, and are thus encouraged under PAT.

A.1.2. Target Setting Mechanism

The PAT scheme adopts an individual industry based approach for target setting. Targets are set individually for each designated consumer.

A.1.2.1. Establishment of Baseline Energy Consumption

An important step in setting the SEC target for designated consumers is to establish the baseline energy consumption. The targeted reduction in SEC is applied to the baseline SEC values to arrive at the target SEC values under PAT. Baseline SEC values for each of the 478 DCs in PAT cycle 1 have been notified along with their SEC targets.

In the first cycle, the specific energy consumption, production, and capacity utilisation, in the baseline year are calculated by taking the average of the previous three years. For subsequent cycles, the provisions of rule 14 under PAT rules, 2012 shall apply:

Rule 14, PAT Rules, 2012 – Establishment of new baseline for next cycle

'Energy consumption norms and standards achieved by the DC on the completion of the target year, as mentioned in the compliance report in Form-'D' shall be the baseline for establishment of new plant specific energy consumption norms and standards for next cycle'.

The rule however, is silent on the effect on baseline energy consumption for the next cycle in case a negative opinion is recorded during check verification for a DC and the target compliance status as mentioned in Form D stands invalidated.

A.1.2.2. Establishment of Target Energy Consumption norms and standards

The first PAT cycle adopted a top-down approach to target setting. The national target of 10 million TOE energy consumption reduction was apportioned on a pro-rata basis among the eight sectors based on the energy consumption of the sector. This pro-rata apportioning was also adopted further down to sub-sectors within a sector (eg. Spinning and Weaving, Processing, and Composite sub-sectors within Textiles sector, Integrated Steel Plants, and Sponge Iron sub-sectors within Iron and Steel sector etc.). Further apportioning of the targets down to DCs within the sector or sub-sector was done on the basis of relative SEC of the DC within a sector or sub-sector. This ensured that within a sector or sub-sector, the DC received a target proportional to their baseline SEC levels. DCs with the highest SEC levels received proportionately higher targets.

There were opinions that this approach of pro-rata apportioning penalizes energy intensive sectors, like Fertilizers, operating with best efficiencies, since such sectors got a higher share of the targets based on their energy intensity, while they were already operating at best efficiencies and had relatively lower potential for efficiency improvement[72].

Pro-rata apportioning of targets based on energy consumption was also practiced for sub-categories within a sector (eg. textile sector - Spinning, Composite, Processing, and Fibre)[73]. It was felt that a better approach would have been apportionment on the basis of energy intensity (i.e. SEC) since the energy intensity varies widely among these sub-categories.

The target setting process for the second PAT cycle onwards was modified vide rule 3 of the PAT rules, 2012. The modified arrangement has provision for deciding the SEC reduction target based on the potential identified and reported in the mandatory energy audits through Form 2 and Form 3, under rules 2008. However, in case the energy audit of a designated consumer has NOT been completed the PAT rules provide for that DC's SEC reduction target to be set on the basis of average rate of reduction in SEC across all the DC sectors' in the last three years. There is also a provision of further tightening the target to a few percentage points above the average rate of reduction. In brief the provisions are as below:

Rule 3, PAT Rules, 2012 – Target setting methodology for next cycle

- If Energy Audit at DC is Completed (as per 4 and 5 of Regulations, 2010)
    - Based on timely submission of Form 2 and Form 3 under Rules 2008;
- If Energy Audit at DC is NOT Completed
    - average rate of reduction in SEC in last three years across all the DC sectors'
    - reducing the SEC a few percentage points above the average rate of reduction

[72] Interview with FAI
[73] Interview with NITRA

This effectively defines the target based on scientifically determined potential existing at each DC where the energy audit has been done. Where the DC is new, the method used seems to be generic and may result in targets that are not realistic for some of the new DCs. We will analyze this further in the section on stakeholder consultation and literature review.

A.1.3. Measurement, Reporting and Verification (MRV)

Establishing performance against pre-defined targets is of paramount importance to any target oriented scheme or activity. The PAT scheme lays out an elaborate mechanism for measurement, reporting and verification, through various rules and regulations notified from time to time.

Various influencing variables like capacity utilization, raw material quality, fuel quality etc. significantly affect the specific energy consumption (SEC) performance of a designated consumer. Thus another crucial aspect relating to MRV is Normalization of the measured energy consumption, production or SEC parameters to account for changes in these influencing parameters.

We will consider in detail the present status of PAT scheme design with respect to both these aspects.

A.1.3.1. MRV processes and timelines, PAT Rules

We have made a detailed review of the PAT related MRV processes as notified under various rules and regulations from time to time. These MRV processes can be categorized as follows:

Measurement and Reporting Processes	
Measurement / Monitoring	**Reporting**
Status of Energy Consumption by DC	Self-reporting by DC (**Form 1**, Rules 2007) With verification by AEA (**Form 1**, Rules 2008)
Action Plan to achieve SEC target under PAT	Self-reporting by DC (data similar to Form 2)
Mandatory Energy Audit by AEA (Regulations 2010)	
Action Plan on recommendations of AEA	Reporting by DC along with verification by AEA (**Form 2**, Rules 2008 and Regulations 2010)
Progress Report on implementation of recommendations	Reporting by DC along with verification by AEA (**Form 3**, Rules 2008 and Regulations 2010)
Assessment of SEC Performance Assessment against target	Reporting by DC along with verification by AEA Performance Assessment Document (**PAD – Form A**)
Status of Compliance	Self-reporting by DC (**Form D**, PAT Rules 2012)
Verification Processes	
Verification	**Reporting**
Verification of Performance by AEA	Reporting by AEA (**Form B**, PAT Rules 2012)
Check Verification by AEA	Reporting by AEA (**Form C**, PAT Rules 2012)

These MRV processes mentioned above along with the responsibility, timelines, and a reference to the relevant Rule / Regulation are outlined in the following two process charts.

- Process Chart for PAT Related Processes

- Process Chart for Check Verification under PAT

Mandatory Energy Audits by AEA at DCs: Regulations 2010 stipulate that every designated consumer shall have its first energy audit conducted, by an accredited energy auditor within 18 months of the notification issued by the Central Government under clause (i) of section 14 of the EC Act. Accordingly, the notification has been issued by Central government in consultation with BEE on 27 May 2014. Thus all existing designated consumers have to get the first mandatory energy audit conducted by AEA before December 2015.

Empanelment of AEA Firms for Verification and Check Verification: While BEE now maintains a list of Accredited Energy Auditors (AEAs) the Verification and Check Verification is to be done through AEA firms/companies. BEE has now invited applications for empanelment of firms / companies or other legal entities which fulfil the eligibility criteria for carrying our verification and check verification activities at the DCs.

- The **eligibility criteria** of such AEA firms are **detailed in rule 9 of the PAT Rules, 2012**.
- Empanelment procedure as specified in rule 9 of PAT rules, 2012 shall be followed, including scrutiny of applications by an empanelment advisory committee formed by BEE, award of certification of empanelment to selected firms/companies/entities, maintaining a list of the panel of eligible AEA firms and display of the same in BEE website.
- **Obligations** for AEA as **specified under rule 10, PAT Rules, 2012** shall be **applicable for** the **empanelled AEA Firms**.

As part of the measurement verification and reporting (MRV) processes, **Rule 11 of PAT rules 2012** provides **detailed formulae** to calculate the **entitlement or requirement of Energy Savings Certificates at DCs**. These calculations will be verified by the Accredited Energy Auditor conducting verification at DC's premises and submitted by the DC to SDA and BEE as part of the performance assessment document (Form A)

Process Chart for PAT Related Processes

Process	Responsibilities	Authenticated by	Timeline	Mandatory / Optional	Reference
Details of Energy Consumption & SEC (Form 1)	DC's to submit to SDA, and BEE	EM, Chief Executive, or his nominee authorized for the purpose	Within 3 months of close of Financial Year	Mandatory	*Rules, 2007*
Action plan for achieving target	DC's to submit to SDA, with a copy to BEE		*Within 3 months of notification of target (i.e.. by June 2012)*	Mandatory	*PAT Rules, 2012; Rule 5*
Energy Audits	All DC's to get audits conducted by an AEA	EM, AEA	First Audit, within 18 months of central govt. notification Subsequent audits within 3 yrs. of submission of previous Audit Report i.e. Once in every PAT cycle (3 years)	Mandatory	Regulations, 2010; Regulation 3
Verified details of Energy Consumption & SEC (Form 1)	DC's to submit details verified by AEA to SDA	EM, AEA	Within 3 months of submission of Energy Audit Report	Mandatory	Rules, 2008
Details of Action taken on recommendations of AEA (Form 2)	DC's to submit to SDA	EM, AEA	Within 3 months of submission of Energy Audit Report	Mandatory	Rules, 2008
Achievement and Status of EE measures (Form 3)	DC's to submit to SDA	EM, AEA	Every Year, Within 3 months of close of respective year	Mandatory	Rules, 2008
Performance Assessment Document (Form A)	DC's to submit to SDA, with a copy to BEE	EM?	Within 3 months of close of each year in target period	Optional for first and second year, Mandatory for Final year of Target period	PAT Rules, 2012; Rule 6
Verification (Form B - Cert. of Verification)	Conducted by AEA	AEA	To be submitted along with Form A	Optional for first and second year, Mandatory for Final year of Target period	PAT Rules, 2012; Rule 6

Comment on Form A (if any)	SDA to submit to BEE		Within 15 days of last date of submission of Form A	Comments to be submitted if any	PAT Rules 2012; Rule 8 Sub-rule 11
Issue (or requirement) of Energy Savings Cert.	BEE to send recommendation to central govt. (ES Certs not exceeding 80% of the entitlement in a year other than the target year)		Within 10 days of last date of submission of Form A by SDA.	Mandatory	PAT Rules 2012; Rule 11
-do- (ES certs issued will be valid till end of compliance period of the next PAT cycle)	Central Govt. to issue ES cert. to DC.	A central depository of ES Certs to be created	Within 15 days from the date of receipt of recommendation from BEE	Mandatory	PAT Rules 2012; Rule 12 EC Act Section 14A
Status of Compliance (Form D)	DC to submit to SDA and BEE	EM	Within 5 months from the last date of submission of Form A	Mandatory	PAT Rules 2012; Rule 13
Check Verification (by AEA other than the AEA who performed the verification function)	To be initiated by BEE i) On its own or ii) On receipt of complaint		Within 1 year from the date of submission of compliance report or 6 months from issue of ES certs. whichever is later	Initiated by BEE on case to case basis	PAT Rules 2012; Rule 8 Sub-rule 1

Acronyms

BEE – Bureau of Energy Efficiency
SDA – State Designated Agency
DC – Designated Consumer
AEA – Accredited Energy Auditor. Appointed by the respective DC for carrying out Energy Audit and certifying form 1 and form 2 data as per Regulations 2010

AEA (Verification) - Accredited Energy Auditor appointed by the respective DC for carrying out verification of energy consumption norms and standards achieved by DC. AEA (Verification) will be different from the AEA doing energy audit at a DC.

AEA (Check Verification) – Accredited Energy Auditor. Will be appointed by BEE for check verification at the respective DC. AEA (Check Verification) will be different than the AEA (Verification) for the same DC
ES cert – Energy Saving Certificate

Process Chart for Check Verification Process under PAT

Process and Responsibilities	Authenticated by	Timeline	Mandatory / Optional	Reference
Check Verification (by AEA other than the AEA who performed the verification function) To be initiated by BEE i) On its own or ii) On receipt of complaint		Within 1 year from the date of submission of compliance report or 6 months from issue of ES certs. whichever is later	Initiated by BEE on case to case basis	PAT Rules 2012; Rule 8 Sub-rule 1
BEE to issue notice to DC and AEA (Verification) with a copy to SDA			Initiated by BEE on case to case basis	PAT Rules 2012; Rule 8 Sub-rule 2
DC and AEA (Verification) to reply to notice by BEE i) Stand by compliance report ii) Accept inconsistency / misrep and give detailed explanation	EM (at DC) and AEA (Verification)	Within 10 working days from the date of receipt of notice	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 2
BEE to decide to undertake or not undertake review, in consultation with SDA, and record its decision in writing BEE to appoint AEA (Check Verification) for review If BEE decides not to undertake the review, same to be informed in writing to DC, concerned AEA, and complainant (if any)		Within 10 working days from the date of receipt of comments	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 2
• Process shall involve both doc review and on-site visit • If AEA (Check Verification) decides that on-site verification is not possible or appropriate, he shall record the reasons in writing • Review of Quantitative and Qualitative information	AEA (Check Verification)		Mandatory	PAT Rules 2012; Rule 8 Sub-rule 4
DC to furnish full and complete data, necessary documents, other facilities required by AEA (Check Verification)		During check verification process	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 5
In case of negative opinion: AEA (Check Verification) shall also record: Effect of opinion on energy consumption norms and stds, effect on issue or Purchase of ES Certs, liability of AEA (Verification),	AEA (Check Verification)	During check verification process	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 7
In case of negative opinion: quantum of unfair /undue gain shall be calculated with regard to - Amount payable by DC (due to unfair gain) plus 25% MTOE (unfair gain) identified by Check Verification	AEA (Check Verification)	During check verification process	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 10

Cost of Check Verification				
AEA (Check Verification) shall provide report in Form C to BEE and SDA	AEA (Check Verification)		Mandatory	PAT Rules 2012; Rule 8 Sub-rule 9
SDA may furnish comments (if not furnished, it will be presumed that SDA has no comments)		Within 10 days of the receipt of Report in Form C	Comments to be furnished if any	PAT Rules 2012; Rule 8 Sub-rule 11
BEE to issue show cause notice to DC and AEA (Verification)		After expiry of 10 days of the receipt of Report in Form C	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 12
DC and AEA (Verification) to reply to officer of BEE who has issued the show cause notice	EM (at DC) and AEA (Verification)	Within 15 working days (of receipt of show cause notice)	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 13
BEE to forward report (Form C) to SDA for initiating penalty proceedings with info on: • No. of ES Certs wrongfully obtained by DC • No. of ES Certs which DC was liable to purchase • Details of misrepresentation if any and unfair gain • Cost of check verification		Within 10 days of the receipt of Report in Form C	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 14
SDA to initiate, under intimation to BEE: Action to recover from DC the loss to Cent. Govt. due to unfair gain Penalty proceedings against persons mentioned in report		Within 2 months from the date of receipt of Report (Form C) from BEE	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 15
SDA to initiate: Register complaint for fraudulent unfair gain if DC does not pay penalty		Within 2 months from the date of receipt of Report (Form C) from BEE	Mandatory	PAT Rules 2012; Rule 8 Sub-rule 15

Acronyms

BEE – Bureau of Energy Efficiency
SDA – State Designated Agency
DC – Designated Consumer
AEA – Accredited Energy Auditor. Appointed by the respective DC for carrying out Energy Audit and certifying form 1 and form 2 data as per Regulations 2010

AEA (Verification) - Accredited Energy Auditor appointed by the respective DC for carrying out verification of energy consumption norms and standards achieved by DC. AEA (Verification) will be different from the AEA doing energy audit at a DC.

AEA (Check Verification) – Accredited Energy Auditor. Will be appointed by BEE for check verification at the respective DC. AEA (Check Verification) will be different than the AEA (Verification) for the same DC
ES cert – Energy Saving Certificate

A.1.3.2. Normalization and related aspects

Normalization of the measured energy consumption, production or SEC parameters to account for changes in various influencing parameters like capacity utilization, raw material quality etc. is a crucial aspect relating to MRV.

The determination of the influencing variables and method or formulae for normalization has been a key focus area for BEE. These have now been addressed to a large extent through the various sector and sub-sector level technical committees consisting of representation from DCs. The new Form1 formats including the Normalization Factors and calculations will be officially notified sometime soon, after necessary approvals. Some of the DC sectors may have more than one Form-1 formats that are sub-sector specific. BEE is currently in the process of disseminating the developed normalization factors and gathering feedback from DCs through a series of sector specific awareness workshops.

Both the baseline SEC and SEC measured during the reporting period will need to be normalized to a common value of each of the influencing variables before establishing SEC performance at each designated consumer. Thus the baseline SEC will be modified through the normalization process. The nature and extent of the influence of applied normalization factors on the baseline SEC will only be clear after the values of normalization variables for each DC are decided towards the end of the target period (ie March 2015).

A.1.4. Market Mechanism for Trading, Trading Platform and Rules

A.1.4.1. Entitlement and Requirement of Energy Savings Certificates (ES Certs), Central Registry or Depository

Energy saving certificates (ES Certs) would be issued to DCs who achieve the target reduction from the baseline SEC during the 3 year PAT cycle. One ES Cert will be equivalent to savings of one TOE of energy[74]. Rule 11 of PAT rules 2012 provides that the Bureau of energy efficiency after verifying the correctness of the information in verification report (and check verification report where commissioned) will recommend to the central government the entitlement or requirement of ES Certs for the DC. The central Govt. will then allocate the ES Certs to the DC.

Depositories shall hold the ES Certs in electronic form and provide client services in relation to ESCerts. The role of depositories shall include holding of ES Certs, tracking of the transactions of ES Certs made between various DCs and book-keeping of the resulting balance of ES Certs with each DC.

This depository (or depositories) is yet to be put in place. Possible options include the National Depositories viz. National Securities Depository Limited (NSDL) and Central Depository Services (India) Limited (CDSL). Another option would be to set up an independent depository. A bid process might need to be initiated by BEE or the Central Govt. for setting up of an independent depository if this alternative is chosen.

A.1.4.2. Trading platform and Trading Rules for ES Certs

As per the institutional mechanism put in place, the Energy Savings Certificates (ESCerts) will be traded on special trading platforms to be created in the two CERC approved power exchanges (IEX and PXIL). Both IEX and PXIL were engaged by BEE in the early stages of scheme evolution for studies related to the ES Certs trading platform requirements.

The trading will be conducted in accordance with broad trading rules which will be notified by the central Govt. in consultation with BEE. BEE is presently working with IEX towards framing of the trading rules, and the same will eventually be notified.

[74] PAT Rules 2012, Rule 11

A ball-park figure for demand and supply of ES certs that will be generated by the end of the first PAT cycle has been an area of interest. These ball-park figures, if they can be credibly estimated upfront, can be useful for ES Certs trading platforms for determination of Fee and Charges, and estimating the financial viability of platform.

There is a general feeling among stakeholders that the SEC targets for the first cycle are not very stringent and will be achieved by a majority of the DCs. There are speculations regarding possibility of a surplus supply of ES Certs at the end of the first cycle. The PAT rules 2012 specifically permits banking of ES Certs from the current cycle until the next compliance cycle.

Power exchanges and other stakeholders are keeping a keen eye on the evolution of PAT scheme and trading mechanism. Areas of interest include price discovery mechanism, early price discovery, trading frequency, need for floor/ceiling prices of ES Certs, appropriateness / adequacy of penalties, strengthening of enforcement mechanism, fungibility of ES certs with RECs and other international schemes like White Certificates etc.

A.1.5. Compliance and Enforcement

While PAT is a scheme primarily intended to incentivize energy performance at designated consumers (large industries) national and international experience on similar schemes clearly bring out the importance of compliance and enforcement processes. Recent national experiences like REC mechanism provide the most convincing evidence of the fact that effectiveness of compliance enforcement becomes crucial to the last mile success of the programme despite the best of scheme design.

The PAT scheme employs provisions that are put in place for compliance and enforcement through the EC Act (including amendments). These include provisions for penalties on non-compliance, adjudication and imposition of penalties and a quasi-judicial system for grievance redressal through appellate tribunal.

While the mechanism has been put in place, the institutional capacity and experience for implementation of these provisions are largely non-existent since the arrangements will only be brought into implementation after the close of the first cycle and subsequent MRV processes are completed. Efforts will be required in building requisite institutional capacity at the SDAs who paly the crucial role of monitoring compliance and initiating proceedings for adjudication and imposition of penalties. Further, domain expertise and technical support may also need to be built up or hired on case to case basis at the SERCs and Appellate Tribunal where adjudication and subsequent appeals will respectively be handled.

A.1.5.1. Penalty for Non-compliance

Section 26 of the EC act provides for imposition of penalties in case of violations to various provisions under the act that are relevant to PAT. These include violations to provisions under section 14 and section 15 which represent the enforcement powers of central government and state governments respectively.

A key provision relevant to PAT is clause n of section 14 to the EC Act, which empowers the central govt. to direct every designated consumer to comply with energy consumption norms and standards. The penalty prescribed in clause 1A, section 26 of the EC Act, for violation of this provision is as follows:

- A penalty not exceeding rupees 10 lakhs
- In case of continuing failure, an additional penalty not less than the price of every MTOE of energy that is in excess of the prescribed norms

It is unclear how ‘continuing failure’ is defined in the case of PAT. However, the PAT consultation document published by BEE in January 2011, gives specific examples to clarify the following:

- A DC who has not fully met the energy consumption norms notified for the DC (and therefore has a requirement of ES certs) but does not opt to purchase ES certs, will have to pay both the penalty of rupees

10 lakhs and the additional penalty equivalent to the price of every MTOE of energy consumed that is in excess of the prescribed norms for the DC

- In case such a DC has purchased ES Certs to meet part of its obligation, the DC will have to pay penalty for meeting the balance part of its obligation. The penalty in this case also shall include both components. i.e. rupees 10 lakhs plus the additional penalty equivalent to price of every MTOE of excess energy consumed, for which ES Certs have not been purchased.

The PAT rules 2012, define the price or value of one MTOE of energy as rupees 10,154 for the year 2011-12. It is also stipulated that this price shall be reviewed every year, and the method of calculation of the same is also prescribed in PAT rules, 2012. There has been no new notification of the price of MTOE post 2012, and hence we assume that the price notified in 2012 will be valid until a new price is notified.

Apart from the penalty that may be imposed on DCs for not complying with energy consumption norms and standards, violations to few other provisions under section 14 and section 15 of EC Act will also attract penalties. Among these the provisions most relevant to PAT scheme are listed below:

Clause in EC Act	Details of Provision
Section 14 - powers of Central Govt. to enforce	
Clause h, i & s	Mandatory Energy Audit by AEA at DC
Clause k	DC to provide to SDA, information on Energy Consumed and action taken on recommendations of AEA
Clause l	DC to appoint Energy Manager, submit Energy Return Annually to SDA
Section 15 - powers of State Govts. to enforce	
Clause c	Owner or occupier of Building (being DC) to get Energy Audit done by AEA This provision will be relevant to PAT if in future, SDA or State Govt. notifies Buildings or a certain sub-category thereof as DCs and include them under PAT scheme
Clause h	DC to furnish to SDA, information on Energy Consumed Form, manner and period of submission may be specified by rules made by SDA or State Govt.

The penalty to be imposed on violation of these provisions is as follows:

- Penalty not to exceed Rs. 10 lakh for each failure
- Additional Penalty in case of continuing failure – may extend to Rs. 10,000/- for every day during which such failure continues.

Section 26 also stipulates that any penalty which is payable and not paid may be recovered as if it were an arrear of land revenue.

A.1.5.2. Holding Enquiries, Adjudication and Imposition of Penalties

Sections 27 and 28 of the EC Act deal with the power of adjudication. The act empowers SERCs to appoint any of its members as **adjudicating officers** for holding an inquiry for the purpose of imposing any penalty. Energy Conservation (Manner of Holding Inquiry) Rules 2009 further specifies the manner and timelines for holding enquiries by the adjudicating officers. Salient features of Rules 2009 (Manner of Holding Inquiry) include:

- Adjudicating officer to follow as far as possible the same procedure as is followed in the proceedings of the State Commission in exercise of its powers and in discharge of its functions

- Adjudicating officer to issue notice with particulars of violations under Section 26 to the person concerned requiring him to appear before the adjudicating officer within twenty-one days from the date of issue of such notice
- Adjudicating officer to provide adequate opportunity to the concerned person to present his case
- Adjudicating officer to complete the inquiry within sixty days from the date of issue of the notice, or, where inquiry cannot be completed in sixty days, seek extension of time from the SERC for a further period of sixty days, after recording reasons in writing

Section 27 of the EC Act further mentions that:

- Adjudicating officer shall have power to summon and enforce the attendance of any person to give evidence or produce any document
- On being satisfied that the person has failed to comply with provisions of any of the clauses in section 26, he may impose such penalty as he thinks fit (according to provisions in section 26)

Section 28, EC Act mentions that while adjudicating the quantum of penalty under section 26, the adjudicating officer shall have due regard to the following factors:

- Amount of disproportionate gain or unfair advantage, wherever quantifiable, as a result of the default
- Repetitive nature of the default

A.1.5.3. Appellate Tribunal

Section 30 and 31A of EC Act **empowers** the **Appellate Tribunal established under** section 110 of the **Electricity Act, 2003** to act as Appellate Tribunal for the energy conservation act also, and hear appeals against the orders of the adjudicating officer or the Central Government or the State Government or any other authority under the EC Act. Procedure and powers of Appellate Tribunal shall be as they apply to the discharge of its function under the Electricity Act, 2003.

Section 31 of EC Act details the procedures and timelines for **appeal to Appellate Tribunal** by any person aggrieved by an order made by an adjudicating officer or the Central Government or the State Government or any other authority under the EC Act. Provisions include aggrieved person to deposit the amount of penalty while filing the appeal, appeal to be filed with 45 days of receipt of order by aggrieved person, Appellate Tribunal to endeavor to dispose of the appeal finally within 180 days from the date of receipt of the appeal etc.

Section 29 of EC Act stipulates that **civil courts will not have jurisdiction** to entertain any suit or proceeding in respect of any matter for which the Act appoints/empowers an Adjudicating Officer or Appellate Tribunal.

Section 44 of EC Act stipulates the **right of appellant to take assistance of legal practitioner or accredited auditor** and of **Government to appoint presenting officers**. A person preferring an appeal to the Appellate Tribunal may either appear in person or take the assistance of a legal practitioner or an accredited energy auditor of his choice to present his case. Similarly, the Central Government or the State Government may authorize one or more legal practitioners or any of its officers to act as presenting officers with respect to any appeal before the Appellate Tribunal.

Section 45 of EC Act stipulates that any person aggrieved by any decision or order of the Appellate Tribunal, may, file an **appeal to the Supreme Court** within sixty days from the date of communication of the decision or order of the Appellate Tribunal to him, on any one or more of the grounds specified in section 100 of the Code of Civil Procedure, 1908.

A.2. Questionnaire for Industry Stakeholder

General Information		
S.No.	**Question**	**Response**
1	Name of Industry Association	
2	Address	
3	Coordinating Officer	
4	Designation	
5	Telephone No.	
6	E-mail ID	
7	Year of commissioning	
8	Types of Memberships	
9	Number of Members	
10	Sectors	
11	Geographical coverage	

PAT Scheme		
S.No.	**Question**	**Response**
12	How many members of your IA are DCs under PAT Scheme? (Member List)	
13	What are the types of units operating below the present threshold as per PAT Scheme (Scope for Deepening)?	
14	Please name a few industries (DCs) actively involved with your Association	
15	What is your opinion on level of pro-activeness and participation of DCs towards PAT Scheme? (Seek reasons)	
16	Have the DCs reported energy saving in the first year of PAT cycle?	
17	Are the DCs reporting specific issues and barriers related to target setting? If so, what are these?	
18	Are the targets set for the first cycle of PAT realistic or do you feel them to be easy or difficult to achieve?	
19	What are the challenges faced in the period 2012-13 under the first cycle of PAT Scheme?	

20	Based on feedback from your member industries, What are your views on target setting methodology adopted under PAT?	
21	What are your views on various submission Timelines given under PAT Rules?	
22	What are the specific issues and barriers faced in meeting PAT targets?	
23	Feasibility and barriers faced in adoption of energy efficient technologies? (use examples of Energy Efficient Technologies identified for the sector in BEE's PAT booklet)	
24	Is Financing a Barrier for Energy Efficiency Implementation?	
25	If technology solutions are available, what are the other main barriers faced by the industries?	
26	What is your opinion on the boundary setting methodology (Gate-to-Gate) followed under the scheme?	
20	Based on feedback from your member industries, What are your views on target setting methodology adopted under PAT?	

21	What are your views on various submission Timelines given under PAT Rules?	
22	What are the specific issues and barriers faced in meeting PAT targets?	
23	Feasibility and barriers faced in adoption of energy efficient technologies? (use examples of Energy Efficient Technologies identified for the sector in BEE's PAT booklet)	
24	Is Financing a Barrier for Energy Efficiency Implementation?	
25	If technology solutions are available, what are the other main barriers faced by the industries?	
26	What is your opinion on the boundary setting methodology (Gate-to-Gate) followed under the scheme?	
20	Based on feedback from your member industries, What are your views on target setting methodology adopted under PAT?	
21	What are your views on various submission Timelines given under PAT Rules?	
22	What are the specific issues and barriers faced in meeting	

	PAT targets?	
23	Feasibility and barriers faced in adoption of energy efficient technologies? (use examples of Energy Efficient Technologies identified for the sector in BEE's PAT booklet)	
24	Is Financing a Barrier for Energy Efficiency Implementation?	
25	If technology solutions are available, what are the other main barriers faced by the industries?	
6	What is your opinion on the boundary setting methodology (Gate-to-Gate) followed under the scheme?	

DISCLAIMER:

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