PROCEEDINGS OF THE
ROUND TABLE ON
SUSTAINABILITY IN INDUSTRIAL ENERGY USE
IN TAMIL NADU

Energy Conservation Measures: Hits & Misses - Scope for Techno-Economic and Policy Interventions

***Date*: 23rd November 2019 | *Venue:* Hall 3 – IC&SR Building, IIT M**

Acknowledgments

The Energy Group at Centre for Technology and Policy (CTaP), IIT (Madras) would like to thank Thiru. Kumar Jayant, I.A.S., Principal Secretary to Department of Textiles, Govt. of Tamil Nadu for readily accepting our invitation and gracing the event as the chief guest. We thank him valuable inputs and suggestions for follow up.

We would like to thank our Director Prof. Bhaskar Ramammurthi for his thought provoking welcome remarks. We thank various office bearers of the South India Mills Association (SIMA), Dyers Association of Tirupur (DAT) and National Textile Corporation (NTC) for their active participation and their willingness to support CTaP's efforts towards promotion of energy conservation measures in TN textile industry.

We wish to thank officials from the Spinning, Weaving, Dyeing and Common Effluent Treatment Plants (CETPs) sparing their valuable time and participation in the Round Table.

Special thanks to the core team of Phoenix (Steam Expander); Vipin V Gopal, R. Balachandran, S. Gautam, Manish Chandra and all others for their phenomenal efforts in making the video and live streaming the test run of the steam expander from the lab during the event. Once again thanks to the team for their time and efforts during the lab visit session as well.

Finally thanks to all the volunteers; K. Ashok, M. Rajesh, R. Babu, D. Haripriya, K. Sandeep, S. Ramkishore, K. V. Rishikesh, P. Sirisha, B. Nilojendu and Priya Singh for their active involvement in coordinating things and making key notes of the round table proceedings helpful in preparation of this report.

1. Welcome Session

1.1 Welcome Remarks:

Prof. V.R. Muraleedharan, Co-ordinator, Centre for Technology and Policy (CTaP) formally welcomed the chief guest Thiru. Kumar Jayant, I.A.S., Principal Secretary Textiles – Govt. of TN, Prof. Bhaskar Ramamurthi, Director IIT Madras and the participants. He briefly highlighted the agenda of the programme and requested Prof. Bhaskar Ramamurthi to deliver his welcome remarks.

1.2 Remarks by Prof. Bhaskar Ramamurthi:

Prof Bhaskar Ramamurthi welcomed the chief guest and the participants. He highlighted the reasons for the establishment of CTaP (in 2014) and the nature of work being carried out by various groups within CTaP. As for the energy group, he mentioned the significance of the field survey and the research activities carried out in the textile sector and how it has evolved gradually to present stage. The emphasized the need for active participation and involvement from the industrial stakeholders, which is essential for the institute to take forward their efforts.

Saving electricity at the final point of usage always brings lots of energy and resources savings in its generation side and also on the emission side as well. He congratulated the CTaP energy group for their efforts in identifying energy saving measures in the textile sector and also the Govt. of TN for their continuous encouragement and constant support. He was optimistic that there will be more take away for the participants from textile industry from this Round Table.

1.3 Remarks by Thiru. Kumar Jayant, I.A.S.:

His initial remarks was that “energy efficiency plays a critical role when we speak about the concept of sustainability and efforts to be made to save the earth”. He stated that it is meaningless to say “save earth” as it is very much capable of adopting itself to all the natural changes and so far it has evolved similarly. The actual point is that, we as humans should save humanity in all possible ways by creating sustainability through proper resource management, so that we and our future generations will survive better.

He further stated that the economic development and competency in developing countries doesn’t make sense if it is only in terms of economy. It also lies in the fact of resource and energy management. He made a special request to focus more on integrated lighting solution with motion sensors, etc so that it serves as an energy saver in all sectors - right from domestic to industry.

He assured TN Govt. is ready to interact with textile associations, industry and academia to come up with integrated solutions in favour of the sector and the recent textile policy from the government, which already is sufficiently generous. He informed that the industries can approach the government for subsidies on innovation in the energy front through formal proposals wherein they should have a clear understanding of the technology and the schemes as well.

1.4 Release of Energy Assessment Reports:

IITM had recently performed detailed energy assessments in spinning mills, composite mill (weaving & dyeing) and CETPs. The energy assessment reports of the same were officially released and the copies were handed over to the Textile Secretary, SIMA and DAT.

2. Session 1

Chaired by Prof. Satyanarayanan Seshadri, session had two presentations,
- Survey outcomes from the textile sector by CTaP energy team, and
- Industrial Energy Assessment Cell (IEAC) of IIT Madras by Dr. Mahesh Panchagnula.

2.1 Textile Energy Survey and Its Outcomes – Presentation by Mr. Dhipankumar K and Mr. Karthick M

The presentation commenced by acknowledging the role of Govt. of TN in rightly understanding the nature and the objective of the survey and directing CTaP energy team to the textile associations SIMA and DAT by which a clear path was laid to approach the industries and other relevant officials to gather primary data. The presentation clearly outlined the work flow, activities carried out and the data collected over the past two years since 2017 by the team.

Following that, the questionnaire for pilot survey and the response from the industries for this study were shared. The actual primary survey plan, schedule and the detailed observations from on and off the field was explained in detail for spinning, weaving, dyeing and CETPs. A detailed tabulation of energy consumption as percentage of various departments in spinning and weaving mills was presented.

Subsequently, an extract from the master list of energy conservation measures for various departments and systems were presented. It was categorized into two – (i) The most commonly adopted and implemented and (ii) The conservation measures with high potential

for savings but not effectively implemented. The overall status of implementation of these energy conservation measures was discussed with particular emphasis on the high implementation rate in spinning department and low rates in dyeing. In the end, an overview of the next phase of detailed energy assessment was presented.

2.2 Industrial Energy Assessment Cell (IEAC) of IIT Madras – Presentation by Dr. Mahesh Panchagnula, Dean IAR

Dr. Mahesh briefly introduced the IEAC and its interdisciplinary nature, and explained its conceptualisation based on industrial assessment centres (IACs) in US universities which have been in vogue for over 40 years providing energy conservation solutions to the industries. He observed that since TN is the second most industrial state in India, there is a lot of potential, across various industrial sectors, for energy conservation and that always only the best practices will bring about significant savings. The uniqueness of this cell is the involvement of students and research scholars directly in energy assessment activities which make them aware of these concepts and thus making them more employable. Faculties also benefit, as they get to solve more real and ground level problems and thus enlarge the scope for their R&D activities.

He stated that the current target is 12 audits/assessments per year, in which each assessment contains three phases. First is the pre-assessment visit or a walk-through audit to understand the basic nature of the process and typical energy consumption pattern. Next is the detailed assessment lasting about 4 to 5 days depending on the size of the industry, and finally the post assessment phase of data analysis and report generation. A detailed energy assessment report, containing recommended energy conservation measures along with costs and ROI,

will be submitted to the customer within 6 to 8 weeks of the detailed assessment and follow up after 3 months on the same. On the implementation of recommended measures, IEAC will assist in sourcing appropriate vendors while implementation is the responsibility of the customer. At present, the activities of IEAC is being progressed with internal funds while on long run basis IIT will seek help from industries through their CSR funds.

2.3 Discussions on Session 1:

Post the presentations, there was an open discussion regarding the implementation of energy conservation measures among spinning and weaving sectors. Following sample cases were discussed.

1. Providing Process interlock between blow room, carding and WRS (Waste Recovery System)
2. Providing flap control system for individual carding and combing machines

Mr Ramasubramaniam of M/s Ramco Tex mentioned that interlocking with off delay timing is possible but choking will be a major issue. Since carding is the bottle neck of the spinning process, its utilization is 90% and is just stopped for 1 or 2 hrs for cleaning. Through doff cut-off, power saving is possible and the time for the same can be controlled as a process parameter.

Mr Chandramouli of M/s NTC mentioned that VFDs can be used to reduce suction pressure in carding and combing machines for their WRS systems but again it is very crucial to maintain the optimum suction pressure and the leakages within the limit. If it is not done properly, VFD will start consuming more power which will be exponential.

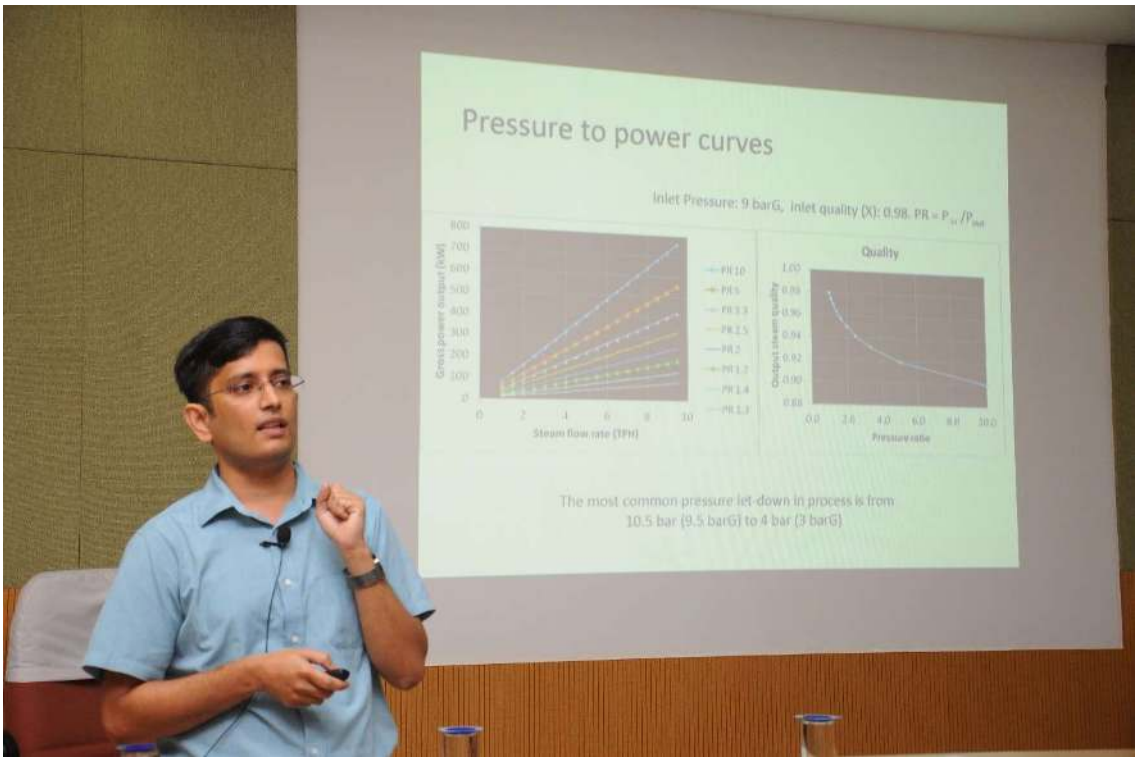
Dr Mahesh stated that IEAC has domain experts regarding system related issues but on process side, the industry has to provide clear inputs and data, so that a proper solutions are suggested. Regarding HF plant, most attendees insisted upon using RO water instead of raw water, as regular cleaning of trenches and usage of rotary filters will be very much effective on energy conservation aspect.

3. Session 2

Chaired by Prof. V. R. Muraleedharan:
Prof Satyanarayanan gave a detailed presentation about the steam expander (Phoenix), followed by a video session and open discussion.

3.1 Presentation on Steam Expander (Phoenix):

Dr. Satyanarayanan observed that the textile sector is generally dominated by electrical energy and there are certain sub sectors like dyeing, printing and effluent treatment plants which are significant consumers of steam. Power generation using steam turbines are feasible only for high steam pressure values and with high steam flow rates. Practically, there are lot of technical issues involved in scaling down a steam turbine for process industries. Screw expanders and reciprocating engines are also used in the place of PRVs in some applications. For better efficiency of screw expanders, a minimum of 100 kW capacity is required. For process industries, with varying loads and pressures, a more pliable solution is required for power generation. IITM has developed a patented technology for the same – the steam expander.



Steam expander is based on Wankel engine and it has two power strokes, with two steam inlet points and two steam exit points. Dynamic capacity control is possible for varying steam loads, which is typical in a process industry. The steam quality (pure dry saturated) is not a major concern, as the expander is capable of handling wet steam as well. The expander will be coupled with an Induction Generator to generate power and it can be connected to the

internal LT grid. In the industries, this expander-generator combo will be set up across the PRV by making the former as the primary line and later as the bypass line. It gives higher efficiency for the same CAPEX value with a payback period of less than a year.

At present, the first version has been tested in the lab and the second version (Phoenix 2.0) is under development which will come up for testing by April 2020 and these will be deployed in the industries by May/June 2020. Textile Secretary Thiru Kumar Jayant accepted to support on the deployment cost of the first four units of Phoenix 2.0.

Then followed a pre-recorded video session of the steam expander trial run conducted in the IIT Madras lab along with a live video session of the same.

3.2 Discussions on Session 2:

1. ***Question***: Will it work for 8 to 9 bar steam pressure?

Answer: Yes, it is specifically designed to work in the range of steam pressure at 8 to 9 bar, which will be the typical pressure range in process industries.

2. ***Question***: Is retrofitting possible for this system?

Answer: Yes, absolutely it can be retrofitted in the existing steam line across the PRV by making it as the primary line and PRV as bypass line.

3. ***Question***: What is the steam condition required to generate 5 kW power?

Answer: 8 bar saturated steam with a flow of approx. 150 kg/hr is required.

4. ***Question***: Is it a kind of captive power plant and do we need to get clearance from TNEB?

Answer: No, this is basically an energy recovery device where we are recovering the latent potential from the available steam and thus no need of any approval from TNEB.

5. ***Question***: What will be the steam exit pressure in the expander?

Answer: The steam output pressure from the expander is the process pressure. It is always the steam trap which controls the pressure at the process end.

6. ***Question***: What about power synchronisation?

Answer: The power output from the induction generator (4 pole, 1500 rpm) will be 415 V, 3 phase power. In future, 2 pole generator with 3000 rpm is planned.

7. ***Question***: Is the generator also of variable capacity?

Answer: Yes, it can be operated through its entire capacity range and beyond 60% loading, its efficiency will be high and the Power Factor values will also be high.

8. ***Question***: What will be the capacity of Phoenix version 2?

Answer: 19 kW power output at 600 kg/hr of steam input.

9. ***Question***: How the output of the steam expander will differ from CETP and process industry?

Answer: The power output will be different based on the process parameters, particularly depends on the steam pressure requirement of each and every process.

10. ***Question***: Is there any limitation with the steam expander capacity?

Answer: Maximum of 20 kW power can be generated and beyond that range of pressure difference, the steam is just let out as in a PRV.

11. ***Question***: Is it possible to connect the power from steam expander to HT grid?

Answer: So far it is connected to LT grid and for HT connection it has to be studied further.

12. ***Question***: Is there any similar type of turbines available in the market?

Answer: 50 kW to 90 kW energy conservation turbines from M/s Spilling, Germany and a particular type of steam engine manufactured in Rajkot, India.

13. ***Question***: What about Power Quality?

Answer: Power quality deteriorates if the input power goes too low.

14. ***Question***: What is the typical steam pressure ratio required for the expander?

Answer: Pressure ratio as low as 1.5 will be very much suitable to generate power through this steam expander.

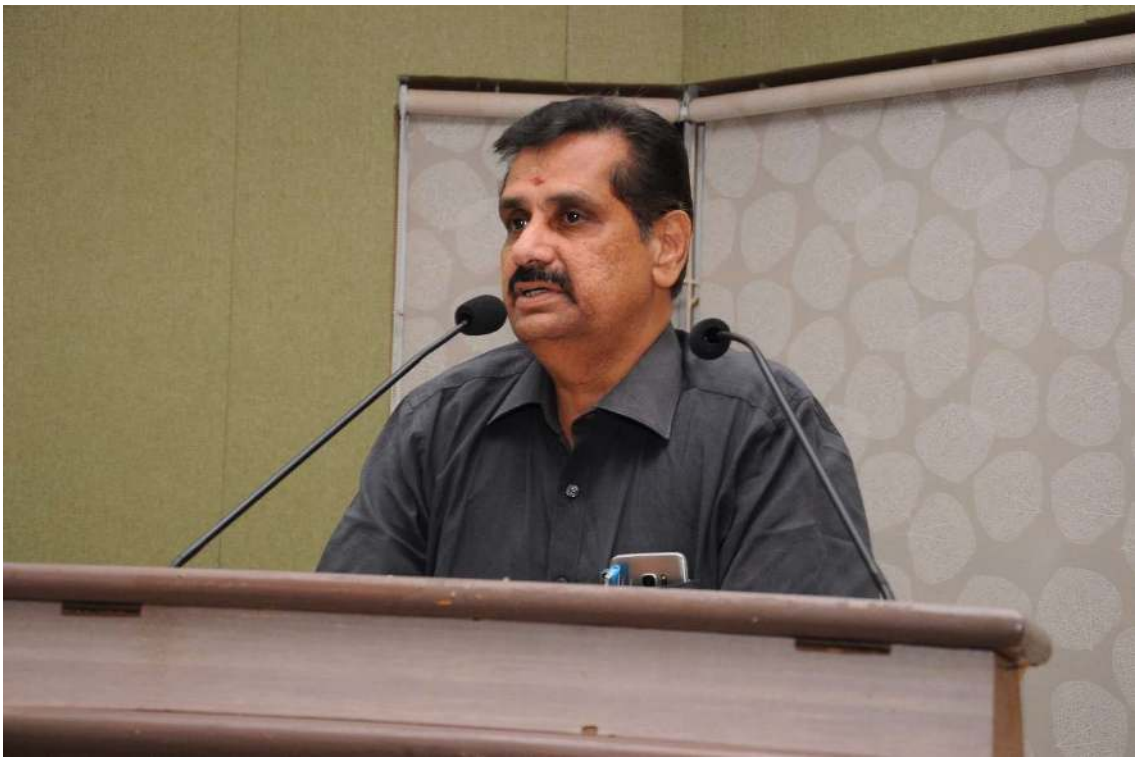
The officials from Dyeing and CETPs observed that there is a huge potential for steam expander in the Tirupur belt, as there are around 2000 boilers operating in that area.

4. Session 3 - Way Forward:

The final session of the event was a panel discussion, chaired by Thiru. Kumar Jayant. The panel members were Mr Ganaesh from SIMA, Mr, Madeshwaran from DAT, Dr. Satyanarayanan from IIT Madras, Mr. Chandramouli from NTC and Mr. Ramachandran from IEAC, IIT Madras. The discussion in this session centred around (a) plans to commercialize the steam expander and (b) forming a government supported official energy audit cell in IIT Madras.

4.1 Remarks by Mr Ganaesh, Joint Secretary, SIMA:

Mr. Ganesh proposed an energy assessment cell from IIT Madras, which should be a body recognised by the government, to undertake energy assessments in spinning and weaving sectors. He observed that while industries were initially hesitant to participate in the energy assessment survey, they are now ready to take part in this effort, as the benefits of such surveys are abundantly evident.



He further stated that in the current situation, the textile sector which runs on a very thin profit margin, any effort to conserve the resource, will be welcome. He assured that SIMA would be ready to act as a bridge between the industries and IITM for conducting energy assessments. And that only through a continuous follow up and support this exercise can become a meaningful one. A one-time audit will be a wasteful exercise. He also observed that on the renewable energy front, wind power is very much helpful for textile industries to cater to their continuous power needs but unfortunately there are some hurdles from the government, in wheeling the power and storage. He requested IIT Madras to work more on battery technologies for effective energy storage of renewable energy. He was pleased with the positive feedback from this survey and the interest many industries have shown in participating in the energy assessment activity.

4.2 Remarks by Mr Madeshwaran, Joint Secretary, DAT:

Mr. Madeshwaran mentioned that the Dyers Association of Tirupur are very much thankful to CTaP IIT Madras for its efforts and coming forward to save energy on the processing sector of the textile industry. It was an eye opener for them in terms of effective energy usage and have learnt lot about the amount of energy they have been wasting in the past. He clearly opined that the development of steam expander is really a boon to the sector and there is much scope for its deployment.

CETPs are operating based on the principle of Zero Liquid Discharge (ZLD) through which they are recycling about 10 million litres of effluents every day which is an aggregate figure of all the 18 CETPs in Tirupur area – this is equivalent to saying that we are creating 10 million litres of rain every day in Tirupur!. The steam expander, in his opinion, is very much suitable for these CETPs and hence the entire dyers' fraternity is happy and now it looks forward to government's support by way of subsidies for its deployment. He finally also stated that solar power has much potential and the government should look for suitable policy to enhance its deployment rate.

4.3 Remarks by Mr Chandramouli, General Manager, NTC:

Mr. Chandramouli mentioned that this was one of the first of its kind of initiatives by an academia to help industry both on technology and policy front and lauded IIT Madras for this effort. Most of the individual spinning mills are running under very marginal profit or in loss. Composite mills are generating better profits in comparison to individual spinning/weaving units through reduced raw material cost and effective utilization of the process value chain.

He also mentioned about the dominance by the Chinese market in the global textile industry and the Indian market should be more competitive to overcome their dominance. As far as spinning is concerned, the power cost accounts about 10 to 12% of the entire process cost and the UKG values are about 4 to 4.5 for a modernized mill. For weaving, the UKG comes around 4.5 to 5 for a modernized mill. He also seconded the point raised by Mr Ganaesh of SIMA that wind energy is having a lot of potential to cater to the power needs of the spinning and weaving sectors and it should be used effectively.

4.4 Response from Textile Secretary Thiru. Kumar Jayant:

As a representative from the TN textile department, the principal secretary pointed out that the recent textile policy note has covered most of the points requested by the industry and the association. Industries who really take up these energy assessments in an effective manner with proper clarification on the technology will be given 50% subsidy.. In general, it is observed that for any new technology or a process, the RoI calculation goes wrong since some of the crucial points are misjudged or missed out. RoI based on conservative method is the need of the hour. Government is providing 20% to 25% subsidy for existing technology upgradation on energy conservation and for deploying energy efficient equipment. TN Government has already supported the Tirupur fraternity by funding 500 crores to set up common effluent treatment plants and its operation.

He further stated that if the industries are willing to adopt new technologies for making themselves energy efficient and also to conserve energy and if they come with proper validated documents through a proper forum, they will be definitely provided with 75% subsidy for the same. So, if the technologies are available then the initiatives must come from the industries to take it forward and get benefit out of it and make the society sustainable on the energy front.

4.5 Discussions on Session 3:

Participants from CETPs mentioned that in CETPs, just for the thermal evaporation of the effluent to achieve ZLD, they are spending lots of energy in which 60% of it goes for coal to operate boilers and 30% of it for electrical power. They also observed that IITM team has visited only 3 CETPs and they requested the visit for all the remaining 15 CETPs in order to explore the potential for energy saving and deployment of the steam expander.

SIMA official mentioned about rain water harvesting in spinning and weaving mills as much water is required to operate Humidification Plant and that M/s Premier Mills from Coimbatore region is effectively doing rain water harvesting and deployed techniques like ultrafiltration and Sewage Treatment Plants to save usage of fresh water for HF plants.

On a question raised by Mr Bhaskar of ACETP on availing Integrated Power Development Scheme (IPDS) for CETPs, Mr Kumar Jayant responded that since the CETPs are already CAPEX supported by the government, they are not eligible for IPDS.

5. Vote of Thanks by Prof. V R Muraleedharan:

Prof V. R. Muraleedharan, Co-ordinator of CTaP, IIT Madras formally thanked the chief guest and participants for taking their time and efforts to attend the event.

The event came to a formal closure followed by lunch and lab visit to see steam expander in operation.

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Appendix 1

Programme Agenda

- Registration – (09:00 to 09:30 AM)
- Welcome Session – (09:30 to 10:00 AM):
    - Welcome Address by Prof. V.R. Muraleedharan
    - Remarks by Prof. Bhaskar Ramamurthi, Director IIT Madras (15 mins)
    - Remarks by Chief Guest Thiru. Kumar Jayant I.A.S., Principal Secretary, Textiles, Govt. of Tamil Nadu (15 mins)
- Session 1 – (10:00 to 10:45 AM):

  Chair: Dr. Satyanarayanan Seshadri, CTaP, IITM
    - Part 1 – Presentation on Textile Energy Survey and its Outcomes (15 mins)
        - Mr. Dhipankumar K and Mr. Karthick V
    - Part 2 – Role of Industrial Energy Assessment Cell (IEAC) of IIT M (15 mins)
        - Dr. Mahesh Panchagnula, Dean, IAR, IIT M.
    - Part 3 - Discussions (15 mins)
- Snacks & Tea (10:45 to 11:00 AM)
- Session 2 – (11:00 AM to 12:00 PM):

  Chair: Dr. V.R Muraleedharan, CTaP, IITM
    - Part 1 – Presentation on Steam Expander Developed by IIT M (30 mins)
    - Part 2 – Steam Expander Video Session & Detailed Discussions (30 mins)
- Session 3 – (12:00 to 01:00 PM):
    - Way Forward: Round Table Discussion

  Chair: Thiru. Kumar Jayant, I.A.S.
        - Taking Steam Expander to Commercial Grounds
        - Establishment of an Energy Audit Cell
        - Role of the Government

  (Invited Panellists: from SIMA, DAT, NTC, Satyanarayanan Seshadri and Ramachandran)
- Lunch – 01:00 to 02:00 PM
- Lab Visit - Steam Expander (2:00 to 3:00 PM).

List of Participants

Name	Designation	Organization
Mr K. M. G. Ganaesh	Joint Secretary	South India Mills Association
Mr C. B. Bhaskaran	Joint Director	Angeripalayam CETP
Mr P. Deivasigamani	Joint Director	Angeripalayam CETP
Mr B. A. Madheswaran	Joint Secretary	Dyers Association of Tirupur
Mr D. Sasikumar	Assistant Manager Electrical	M/s Shiva Tex Yarn
Mr R. Satyanarayanan	Electrical Engineer	Palladam Hi-Tech Weaving Park
Mr M. Balamurugan	Electrical Engineer	M/s KG Fabriks Ltd
Mr M. Jeyakumar	Chief Engineer	M/s Srinivasa Mills Ltd
Mr C. Vishwalingam	Vice President (Technical)	M/s VTM Ltd
Mr R. Mariappan	Utility Manager	M/s Bannari Amman Weaving
Mr R. Sivakumar	Assistant Manager	M/s Adwaith Texitles Ltd
Mr P. Rajan	Energy Advisor	Private
Mr D. Kanagaraj	Energy Manager	M/s Premier Mills Ltd
Mr A. R. Anbarasa	Deputy General Manager	M/s GHCL Ltd
Mr M. Anbazhagan	Group Electrical Engineer	M/s Thiagaraja Mills Ltd
Mr S. Thirumurugan	Associate Professor	Coimbatore Institute of Technology
Mr M. Rajendran	Associate Professor	Hindustan College of Engineering & Tech
Mr B. Janardhanan	Managing Director	M/s Murugan Enterprises
Mr G. Chandramouli	General Manager	National Textile Corporation
Mr Murugesa Pillai	Vice President (Fabrics)	M/s Ramco Textiles Ltd
Mr R. Ramasubramaniam	Assistant General Manager	M/s Ramco Textiles Ltd
Mr P. Rajaram	Group Electrical Engineer	M/s Anughraha Textiles
Mr Pradeep Prabhu	Engineering Head	M/s Apollo Tyres
Mr P.V. Lakshmi Narashimhan	Instrumentation In-Charge	M/s Apollo Tyres
Mr S. Vijayakumar	Group Manager - Maintenance	Royal Enfield
Mr Jitendra Prasad	Maintenance Manager	Royal Enfield
Mr K. Sivaraman	Project Advisor	Industrial Waste Management Association
Mr B. Hari Prakash	Assistant Manager	Industrial Waste Management Association
Mr G. Sekar	Board Advisory Member	Consultant - IIITD
Mr Sriram Narasimhan	Managing Trustee	Samriddhi Foundation
Mr S. Viswanathan	Editor & Publisher	Industrial Economist
Mr S. Karthik	Deputy Manager - Sales	M/s Aspiration Energy
Mr S. R. Sivarasu	Assistant Professor	Sri Eswar College of Engineering & Tech
Mr K. Kartheeshwaran	Electrical Engineer	M/s Arunachala Weaving
Mr T. Sivakumar	Power Plant Manager	M/s KG Denim Ltd
Mr R. Ramaraj	Research Engineer	M/s Aspiration Energy
Mr R. Ragotama Rao	Chief Executive Officer	Gopalakrishna Deshpande Centre
Mr Bhoo Thirumalai	Chief Executive Officer	M/s Aspiration Energy
Mr K. Sudhakaran	Joint Director	Veerapandi CETP
Mr M. C. Vijayakumar	Joint Director	Veerapandi CETP
Mr D. Ravichandran	Office Bearer	Dyers Association of Tirupur
Mr A. Guneasekaran	Office Bearer	Dyers Association of Tirupur

Appendix 2

Lab Visit Session