Proceeding on
National Dissemination Workshop: Sectoral Roadmap (Chemical)

19 July 2022 (Tuesday)

Venue: Ahmedabad cluster, Gujarat

Prepared for

Bureau of Energy Efficiency
New Delhi

Prepared by

The Energy and Resources Institute
New Delhi

July 22, 2022

Contents

National Dissemination Workshop: Sectoral Roadmap (Chemical)

The national dissemination workshop on sectoral roadmap for chemical sector under the project 'Energy and Resource Mapping of MSME sector in India' was organized in Ahmedabad cluster at Ahmedabad, Gujarat on 19th July 2022 (Tuesday). The workshop was conducted both off-line and online to cover various stakeholders, share findings of the study and present the potential roadmap for the sector. The agenda of the meeting is enclosed as Annexure 1.

The key participants of the workshop included officials from the Bureau of Energy Efficiency (BEE), Gujarat Energy Development Agency (GEDA), MSME-DFO (Ahmedabad), District Industries Centre (DIC - Ahmedabad), office bearers and representatives of Gujarat Dyestuffs Manufacturers Association (GDMA), Gujarat Chamber of Commerce and Industry (GCCI), Vatva Industries Association (VIA), Naroda Industries Association (NIA), Odhav Industries Association (OIA), The Ahmedabad Engineering Manufacturer's Association (AEMA), entrepreneurs of chemical industries, technical experts and sectoral experts.

The list of participants is given in Annexure 2 and the select photographs of the event are shown in Annexure 3. The summary of the deliberations in different sessions is provided below.

Inaugural session

- Mr. Girish Sethi, Program Director, TERI, welcomed all the dignitaries and participants at the outset and expressed gratitude to the Bureau of Energy Efficiency (BEE) and specifically thanked all industry representatives for sparing their time and attending this national dissemination workshop in person at the venue as well as through an online platform. He provided a brief insight into the project that focuses on developing a roadmap for making the chemical sector in the country energy efficient and environment friendly. Mr. Sethi also highlighted the support received from the local associations and entrepreneurs of various clusters during the implementation of different activities of the project for preparing sectoral reports and road map for this sector. He encouraged all participants in gathering to take an active part in the discussions and contribute in finalising the roadmap. He also assured that TERI will be available in providing handholding support to the MSMEs for adopting energy efficient technologies and practices.

- Mr Yogesh D Parikh, Vice President, GCCI appreciated the study conducted by TERI with support from BEE, which will be immensely useful for improving the energy performance of chemical industries. He presented an overview of chemical sector highlighting Gujarat's contribution of almost 90% of total chemicals produced in the country. He informed the major issues for any chemical industry is the environmental issues and also highlighted issue of uncertainties such as raising freight charges, raw material cost, energy cost and requested support from government. He concluded that it may not be possible for individual industry to implement capital intensive EE measures and therefore proposed BEE to undertake suitable

programs or initiatives for demonstration of pilot projects in the cluster on priority basis taking into account dynamics of the cluster. He expressed his confidence in the study and mentioned that it will surely help the industries in improving their energy performance and facilitate addressing other challenges related to growth of the cluster.

- Mr Vikas Gupta, Joint Director, MSME-DFO stressed on the importance of MSME sector in Indian economy. He informed about various beneficiary schemes and programmes offered by MSME-DFO for the benefit of MSMEs. He highlighted benefits under revamped ZED scheme for energy and resource conservation, technology support and upgradation projects and financial support for technology driven incubation scheme for start-ups. He also informed that the MSME ministry can support developing common facility centres for clusters such as ETPs, testing centres, etc. through various schemes and encouraged the entrepreneurs and associations to avail the benefits.

- Mr P Shyam Sunder, Joint Director, BEE provided an overview of the various initiatives undertaken by BEE in improving the energy intensity of Indian economy the initiatives for SME sector. He mentioned that MSME, being an informal sector, need handholding for capacity building and mainstreaming. He elaborated the energy mapping study for MSME sector and explained how this is a unique study initiated to understand the energy consumption characteristics of ten different energy intensive MSME sectors and clusters. He elaborated on the broader objectives of BEE's ongoing initiatives to capture both supply-side and demand-side issues for formulating a sustainable roadmap for the intervening sectors.

- Mr Milind Deore, Director, BEE provided detailed insight into various activities carried out in chemical cluster under the energy and resource mapping programme to develop the sectoral roadmap. He added policy initiatives of the Government of India play key roles in transforming all energy intensive end-use sectors for improving energy performance. Adoption of advanced technologies and best operating practices are important in improving key performance indicators for which policy instruments can a play role. He requested all participants to engage in detailed discussion on various strategies and action plans proposed in the sectoral roadmap. He informed that the sectoral roadmap developed will be used as a guide to undertake further interventions which is beneficial for the sector and the nation.

Keynote Address

- Mr Rajendra Pandya, Retired Sr. Project Executive & HOD, Gujarat Energy Development Agency (GEDA) delivered the keynote address on de-carbonization of Indian economy. He stressed the importance of energy efficiency which not only addresses the environmental issues but also plays an essential role in growth of industries to remain competitive by optimizing production costs. He requested BEE to develop initiatives which must lead to development of 'model clusters' in terms of technology, operating practices, energy efficiency performance, etc. and improving the overall energy efficiency of chemical sector in order to remain competitive.

Presentation on key highlights and launching of sectoral roadmap

Mr Ananda Mohan Ghosh, Fellow, TERI, provided an in-depth presentation on project activities, sectoral analysis focusing on technologies in use, production, energy and resource consumption, benchmark energy performance including comparison with the global benchmark, need of the individual cluster/sector as a whole, potential options for improvement, implementation barriers (technologies, financial and human skill, etc.), implementation plan of the proposed strategies in the roadmap. He also shared details of two distinct strategies i.e. cluster level strategies and policy level intervention plans proposed for transition towards energy efficiency in chemical sector. A copy of the presentation is enclosed as Annexure 4. At the end of the presentation, Mr P Shyam Sunder, Joint Director, BEE, Mr N Vasudevan along with other dignitaries launched the sectoral roadmap.

Presentations on Emerging Technologies

Mr Vineet Bhardwaj, Hi-Therm Boilers Private Limited, provided a presentation on electrification of process utilities such as steam boilers and thermic fluid heaters. He shared case studies showcasing the benefits achievable by shifting from utilities using carbon based fuels (coal, oil, gas fired boilers and thermic fluid heaters) to electricity based utilities. A copy of the presentation is enclosed as Annexure 4.

Mr Amol Raykar, FLOWRHEX PROBURGEON Pvt. Ltd, presented on the topic “technology for process optimization” and briefed about the technological advancement in raw material processing and batch preparation processes through use of continuous flow reactors. He also showcased case studies on various benefits achieved such as reduction in cycle time leading to reduction in energy consumption, enhanced production and conservation of resources such as water, raw materials, etc. A copy of the presentation is enclosed as Annexure 5.

At the end of the presentation, Mr R D Barhatt (IAS), Joint Commissioner of industries and GM, DIC, Mr Vikas Gupta, Joint Director, MSME-DFO, Mr Ananda Mohan Ghosh and C Vijayakumar along with other dignitaries launched the sectoral roadmap.

Panel and open house discussion

Moderator:

The panel discussion was moderated by Mr Ananda Mohan Ghosh, Fellow, BEE. The salient points discussed during this session are summarized below.

Mr R D Barhatt (IAS), Joint Commissioner of industries and GM - DIC, shared about various policy supports of the Government of Gujarat towards development of MSME clusters, providing financial support for cluster development initiatives, etc. Acknowledging the commitment of Government of Gujarat in energy saving aspects, Mr Barhatt also elaborated the initiative undertaken by the DIC with support of various government organisations in various sectors. These include (i) awareness generation, (ii) demonstration projects and financial support, and (iii) capacity building.

Mr P N Solanki, Deputy Director, MSME-DFO, Government of Gujarat shared about various policy supports provided to MSME units and emphasized on fund availability to set up energy management centre to undertake studies for improving energy efficiency and emission reduction leading to cluster level improvement and job creation. He requested the associations and MSME entrepreneurs to develop a plan to undertake initiatives and avail various benefits offered by MSME-DFO.

Mr P N Solanki, Deputy Director, MSME-DFO, Government of Gujarat shared about various policy supports provided to MSME units and emphasized on fund availability to set up energy management centre to undertake studies for improving energy efficiency and emission reduction leading to cluster level improvement and job creation. He requested the associations and MSME entrepreneurs to develop a plan to undertake initiatives and avail various benefits offered by MSME-DFO.

Mr Haresh Bhuta, President, GDMA thanked BEE and TERI for conducting energy and resource mapping study for chemical cluster. He appraised the adaption of emerging technology options presented is the need of the hour for chemical cluster and move towards continuous process technologies which will result in reduction in water use, energy use and raw material used in process. He also opined that while technology modernization is important, it would require significant investments towards high precision process equipment and automation controls which the industry has to look for, as there is always an associated risk while deploying new technologies. He further added that there is a need for pilot demonstration of identified technologies at cluster level for acceptance by the industries and suggested both state level government and BEE may evolve relevant intervention plan for Ahmedabad cluster.

Concluding remarks and way forward

Mr Ananda Mohan Ghosh shared the way forward in his closing remarks. He affirmed that there is a significant potential to improve the overall performance of the chemical sector. He also informed the participants that BEE is keen on launching suitable programs for improving the overall energy performance of the sector and the following way forward initiatives:

- The aggregation of technologies and energy conservation measures are being carried out by BEE to formulate financing scheme to suit the needs of chemical industries.

- The outcomes of the study will be discussed among inter-ministerial committee members to evolve an appropriate action plan. BEE is expected to initiate financing options for energy efficiency as soon as possible.

Annexure 1: Agenda

Annexure 2: List of participants

Annexure 3: Select photographs of proceeding

Annexure 4: Copies of presentation of TERI

Annexure 5: Copies of presentation of Hi-Therm Boilers Private Limited

Annexure 6: Copies of presentation of FLOWRHEX PROBURGEON Pvt. Ltd.

Annexure 1: Agenda

National Dissemination Workshop
Sectoral Roadmap (Chemical)

Date: 19th July, 2022

Venue: Ahmedabad Management Association (AMA), Ahmedabad

Background

The Micro, Small and Medium Enterprises (MSME) sector in India is a unique mix of enterprises using conventional as well as modern technologies. At national level, relevant information of MSME sector on various parameters like production, technology employed, types of fuel used and their consumption, energy saving potential, growth scenarios, etc. are not readily available. This limits the design of appropriate policy instruments to ensure sustainable growth of MSME sector. To address this barrier, the Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India, has initiated an ambitious project of mapping the energy intensive MSME sub-sectors across the country. The chemical sector is one of the energy intensive MSME sub-sectors covered under the project. The BEE has entrusted The Energy and Resources Institute (TERI), New Delhi to undertake the study in the chemical sector.

TERI has completed an in-depth study of chemical sector, which includes

(i) Undertaking detailed energy and resources conservation audits in representative MSME units in selected clusters

(ii) Carrying out consultations with key stakeholders (like manufacturing units, industry associations, government bodies, technology providers, etc.) on various technological, chemical products and relevant policy as well as regulatory aspects of the chemical industry sector.

(iii) A draft sectoral report is prepared covering sectoral details with relevant strategies and implementation plan to improve overall energy performance and competitiveness of the Indian chemical sector.

The workshop will share the findings of energy and resource mapping study and salient features of the roadmap prepared for chemical sector. The features of roadmap include implementation mechanism at cluster level with support from key stakeholders including relevant ministries and government departments.

It will provide insight into emerging technology options in process and utility systems used in chemical sector to reduce GHG emission from the process. Further, the workshop will create awareness on technological options for energy and resource efficiency for MSMEs in chemical sector. The target participants in the event include MSME entrepreneurs, technology suppliers, consultants, etc., which is expected to be more than 100.

Agenda

Registration and Tea: 03:00 PM – 03:30 PM
Inaugural Session: 03:30 PM –04:00 PM
Welcome Address and opening remarks: Mr Girish Sethi, Program Director, TERI (Online)
Cluster overview: Mr Yogesh D Parikh, Vice - President, GCCI
New initiatives for MSMEs: - Mr Vikas Gupta, Joint Director, MSME-DFO
Project background: Mr Milind Deore, Director and Mr P Shyam Sunder, Joint Director, BEE (Online)
Keynote Address: 04:00 PM - 04:15 PM
- Mr Rajendra Pandya, Retired Sr. Project Executive & HOD, GEDA
Launch of Sectoral Roadmap: 04:15 PM – 05:15 PM
- Key Highlights of Sectoral Roadmap: Mr Ananda Mohan Ghosh and C Vijayakumar, Fellow, TERI
Technical presentations on emerging technologies - Electrification of process utilities: Mr Vineet Bhardwaj, Hi-Therm Boilers Private Limited - Technology for process optimization: Mr Amol Raykar, FLOWRHEX PROBURGEON Pvt. Ltd
- Launch of Roadmap on Chemical sector
Panel discussion on chemical sector roadmap (MSMEs) : 05:15 PM – 05:45 PM
Moderated by Mr Ananda Mohan Ghosh, Fellow, TERI - Mr R D Barhatt (IAS), Joint Commissioner of industries and GM, DIC - Mr Vikas Gupta, Joint Director, MSME-DFO - Mr P N Solanki, Deputy Director, MSME-DFO - Ms Amita Pandya, Senior Executive, GEDA - Mr Yogesh D Parikh, Vice - President, GCCI - Mr Haresh Bhuta, President, The Gujarat Dyestuff Manufacturers Association
Open - house discussions: 05:45 PM – 06:15 PM
Way forward: 06:15 PM – 06:30 PM
Announcements for way forward – Mr Milind Deore, Director, BEE *Technology demonstrations, policy action and schemes*
Networking Dinner: 06:30 PM onwards

Annexure 2: List of participants

Sr No	Salutation	First Name	Last Name	Organization	Email ID	Mobile
1.	Mr	Ashwin	Patel	AEMA	ashwin@ashwinautocast.com	
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19.	Mr	Yogesh	Parikh	Gujarat Chamber of Commerce & Industry	gcci@gujaratchamber.org; yogesh@avanidyechem.com	9824015817
20.	Mr	Amita	Pandya	Gujarat Energy Development Agency (GEDA)		
21.	Mr	Ketan	Kakkad	Gujarat Industrial and Technical Consultancy Organization Ltd (GITCO)	info@gitco.co.in;	9898184581
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Sr No	Salutation	First Name	Last Name	Organization	Email ID	Mobile
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27.	Mr	Rajesh	Jhunjhunwala	Hi-Therm Boilers Private Limited	hithermboilers@gmail.com;	9819515555
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Sr No	Salutation	First Name	Last Name	Organization	Email ID	Mobile
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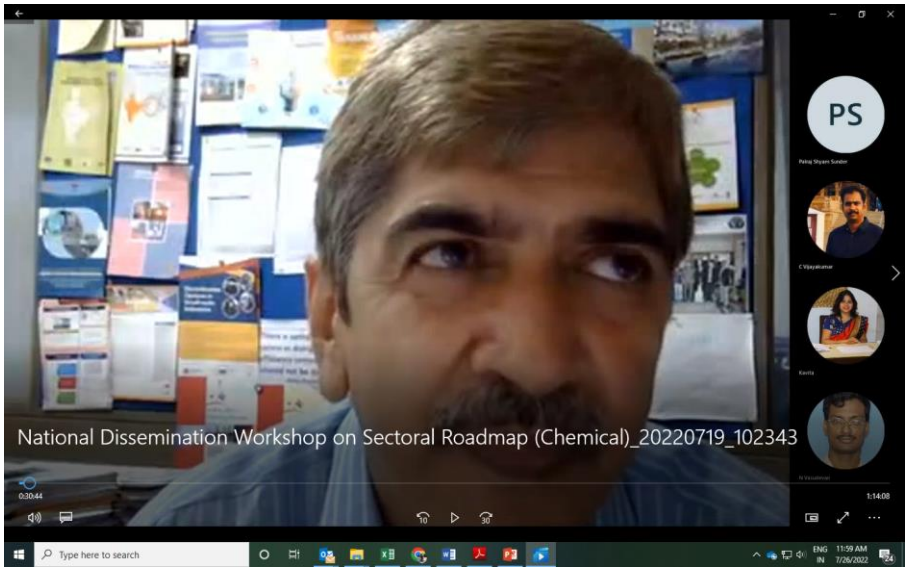
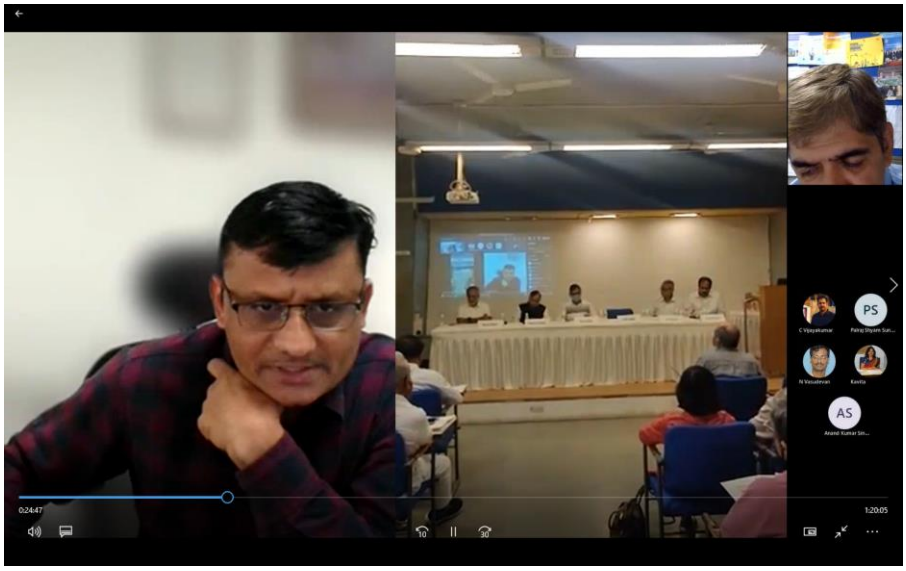
52.	Ms	DARSHANA	RAWAT	The Green Environment Services Co-op. Society Ltd	info@geda.org.in	7567570400
53.	Mr	Haresh	Bhuta	The Gujarat Dyestuff Manufacturers Association	gdma.gujarat@gmail.com	
54.	Mr	DARSHAN	Shah	The Gujarat Dyestuff Manufacturers Association	gdma.gujarat@gmail.com	9510303395
55.	Mr	Vedant	Panchal	Valiant Organics	Vedantpanchal50@gmail.com	8154945800
56.	Mr	Darpan	Paho			

Annexure 3: Select photographs of proceeding






Mukesh Bhutra
Yogesh D Parikh
Vikas Gupta
R D Barhatt
P N Solanki


National Dissemination Workshop
Energy and Resource Mapping of
MSME Clusters in India (Chemical Sector)
Date: 19 July 2022
Venue: Ahmedabad Management Association,
Ahmedabad
Vikas Gupta
R D Barhatt
P N Solanki


National Dissemination Workshop
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National Dissemination Workshop
Energy and Resource Mapping of
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Haresh Bhuta
Yogesh D Parikh
Vikas Gupta
R D Barhatt


P N Solanki

Annexure 4: Presentation of TERI

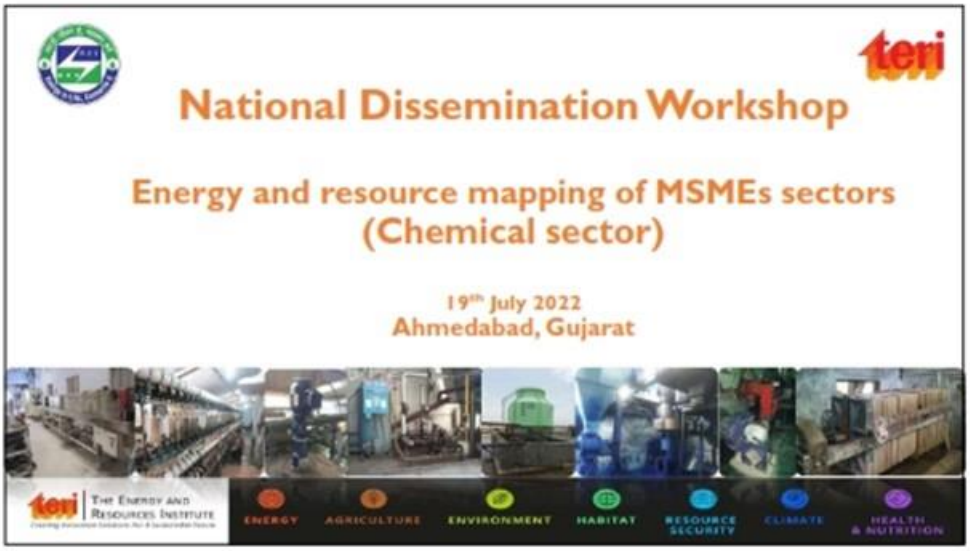

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Table of contents – Sectoral roadmap

About the Project

Objectives and key activities

Objective

- Mapping of sectors from energy perspective
- In-depth study on energy consumption and identify opportunities for savings
- Preparation of sectoral roadmap with energy efficient perspective

Key activities and deliverables

- In-depth studies covering representative industries in select clusters
- Identification of potential energy efficiency options including technology upgradation
- Preparation of cluster profiles and sectoral report
- Development of sectoral roadmap with implementation plans
- Stakeholder consultations and validation of roadmap

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Major MSME clusters covered

Targeted	Additional
Jamshedpur (Jharkhand)	Ankleshwar (Gujarat)
Thane (Maharashtra)	Ernakulam (Kerala)
Karnal (Haryana)	Valsad (Gujarat)
Ahmedabad (Gujarat)	Ghaziabad (Uttar Pradesh)
Vapi (Gujarat)	Nandesari (Gujarat)

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SECTORAL ANALYSIS
Chemical sector

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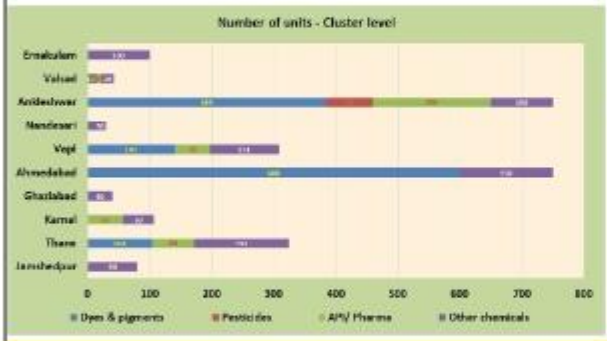
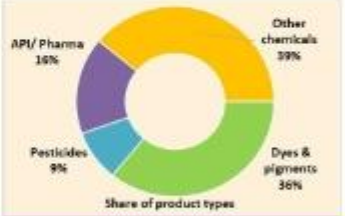
Cluster profile

- Major products : Dyes & pigments, Pesticides, API/Pharma Intermediates, Others *(Paints, resins, soaps, detergents, etc.)*
- Estimated production : 2.9 million tonne per year



Segment	No. of units (-)	Production (tpy)
Dyes & pigments	1,240	1,353,641
Pesticides	79	122,191
API/ Pharma	379	309,671
Other chemicals	834	1,103,763
Total	**2,532**	**2,889,666**



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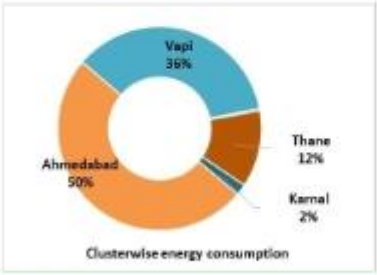
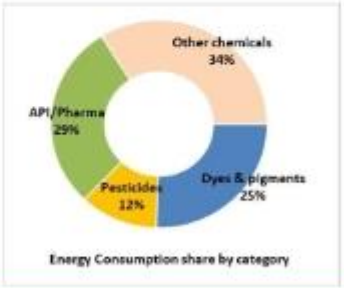
Energy consumption profile – Cluster level

- Energy sources : NG, coal, biomass, LDO, FO, HSD and electricity
- Estimated energy consumption: 322,370 toe per year
- Equivalent GHG emissions: 1.1 million tonne CO_2 per year



Clusterwise energy consumption



Energy Consumption share by category

Share of energy consumption and GHG emission

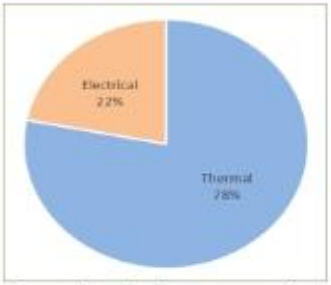


Figure: Cluster level energy consumption

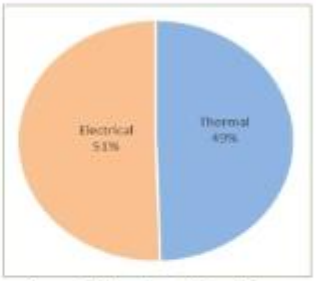


Figure: Cluster level GHG emissions

- Thermal : 78% & Electrical : 22%
- Emissions from both thermal and electrical energy are almost equal

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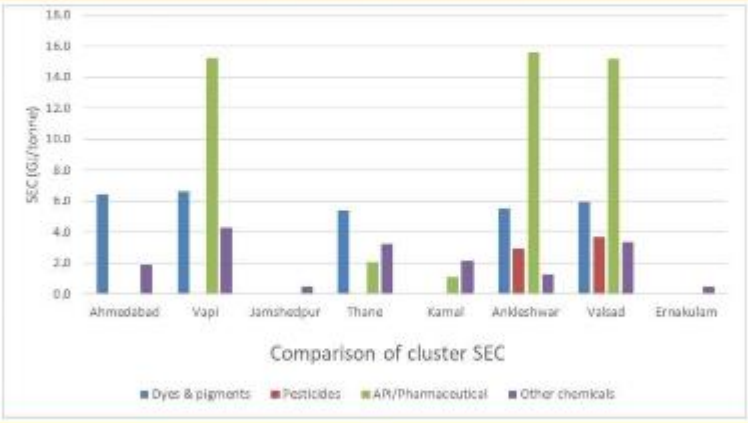
SEC levels in chemical clusters



Energy consumption profile - Sectoral

Category	Energy consumption (toe)			GHG emissions
	Thermal	Electrical	Total	($t\text{-}CO_2$)
Dyes & pigments	210,935	48,254	259,188	860,603
Pesticides	9,028	19,762	28,791	198,486
API/Intermediates	41,828	42,153	83,982	455,956
Other chemicals	107,722	13,594	121,316	313,065
Total	369,513	123,764	493,277	1,828,110

Energy Source:

- Thermal - NG, coal, biomass, LDO & FO
- Electricity – Grid and DG set (HSD used for power backup)

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Segment-wise analysis - Sectoral

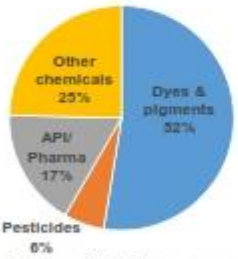


Figure: Break-up of sectoral energy consumption

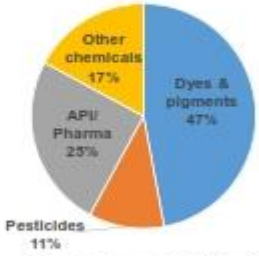
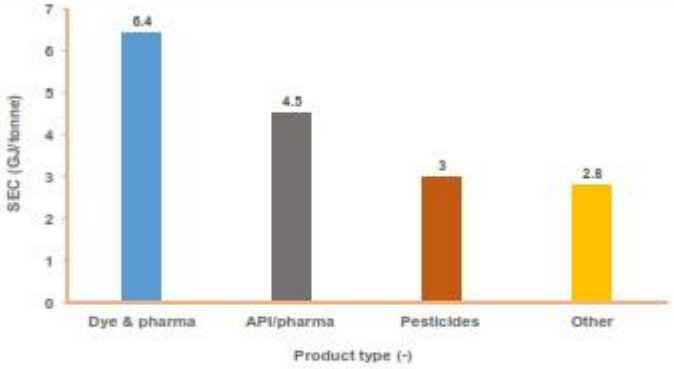


Figure: Break-up sectoral GHG emissions

- Dye and pigment accounts for major share of energy consumption (52%) and GHG emissions share of 47%

Energy performance indicators



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Energy efficiency options

EE options and potential impacts in chemical sector

Energy and resource efficiency option	Energy saving (toe/yr)	Monetary benefits (Rs lakh/yr)	Investments (Rs lakh)	Payback period (year)	GHG emissions (t CO_2/yr)
Optimisation of steam generation and distribution system	6,636	3,028	1,962	0.6	**6,883**
Performance improvement of thermic fluid heater	3,403	1,921	1,415	0.7	**5,763**
Replacement of tray dryer with fluidized bed dryer	6,389	28,992	19,223	0.7	**94,539**
Fuel switch over in thermic fluid from LDO to NG	582	3,423	649	0.2	**2,724**
Technology upgradation: Electrification of thermic fluid heater	5,104	12,531	18,768	1.5	**11,675**
Cross-cutting technologies	8,861	7,726	25,208	3.3	**81,385**
Total	**30,975**	**57,621**	**67,226**	**1.2**	**202,970**

Chemical sector will lead to an energy saving of 30,975 toe per year equivalent to a GHG reduction of 202,970 tonne CO_2 per year considering replication potential of 65 – 30% for process 100% for cross cutting technologies

8

EE options and potential impacts in chemical sector_contd.

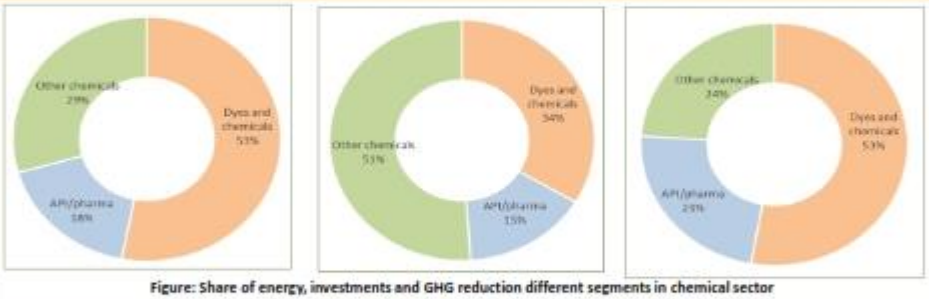

Figure: Share of energy, investments and GHG reduction different segments in chemical sector

- Energy saving potential : 5.2% to 6.9%
- Total investments requirement : Rs 67,226 lakh
- Simple payback : 1.2 years
- GHG reduction potential : 202,970 tonne CO_2 per year.

BARRIERS & CHALLENGES
Chemical sector

7/19/2022

Barriers and challenges

Key challenge	Specific challenge	Impact
Technical	Lack of awareness on efficient technology options	❑ Use of outdated technologies ❑ Higher capital costs for efficient technologies ❑ Longer period for adoption of energy efficient technologies ❑ Reluctance of entrepreneurs on technology upgradation ❑ Apprehension in loss of production
	MSME is not the priority sector for technology providers	
	Limited knowledge of entrepreneurs and focus on low hanging fruits	
Financial	Higher transaction costs for financing low value loans by banks	❑ MSMEs are not able to reap the benefits from technology promotion schemes of banks ❑ Lack of technology adoption on a wide scale among MSMEs ❑ Poor disbursement of loans on EE projects by banks ❑ Low prospects for large scale adoption of new and modern technologies at cluster level
	Mandatory collateral requirements for financing and low credit rating of MSMEs	
	Lack of updation to banks on EE technologies/ equipment	
Skillsets	Non-availability of sub-sector specific training institutes at cluster level for skillset improvements	❑ Variations in quality, productivity and energy performance ❑ Investment by individual units on development of skilled manpower ❑ Lack of in-house innovation on EE projects ❑ Less exposure on new and EE equipment leading to inefficient operation
	Inadequate in-house technical capabilities	
Policies	Non-existence/ availability of sector- specific programmes	❑ Limited technology upgradation by MSMEs
Infrastructure & others	Non-availability of cleaner fuels at cluster level.	❑ Inefficient use of energy hence high impact on environment

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Recommendations & implementation plan

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10

Strategies for implementation

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Cluster level strategies

Facilitating adoption of equipment/technology having at least minimum EE levels at competitive prices (self-sustainable model)

- Targeting basic utilities requiring low investments and periodic replacement.
- Involvement of EM Cell is crucial to ensure faster implementation and sustainability
  - Proactive engagement with OEMs, LSPs, sectoral experts, ESCOs, banks & FIs inline with need assessment of the cluster.

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Roles & responsibilities of cluster level EMC

Key roles	Responsibilities of relevant organizations
1. Cluster level needs assessment 2. Establishment of linkage with technology/equipment OEMs 3. Setting up minimum efficiency and quality levels for equipment/ system and spare parts 4. Rate contract for bulk procurement 5. Ensure minimum inventory level to avoid procurement delay and opportunity cost 6. Establishment of single-window financing with Banks/FIs 7. Development of financially self sustainable model	1. Bureau of Energy Efficiency and SDAs - Supporting establishment and coordination with cluster level "Energy Management Cell" 2. Industry associations/ apex bodies - Coordination and facilitation of programme - Periodic need assessment, review and customisation 3. Ministry of Micro Small and medium enterprises and MSME-DI - Development of basic infrastructure for local bodies 4. Energy Efficiency Services Limited (EESL) - Linkage with existing national level programme 5. SIDBI, FIs and Banks - Single window financing

- Budget: Rs 3 crore @ Rs 25 lakh per cluster

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Policy level strategies – primary stakeholders

The key stakeholders for implementing the policy level strategies include government agencies, infrastructure development agencies, development institutions, and financial institutions / ESCOs

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Policy level strategies - Technology upgradation fund

- High initial cost may be mitigated through ease of financing as well as fiscal benefits
- Facilitation to diversify product through cluster level development centres will help in sustainable business to MSME sector

Upgradation Fund

- Technology upgradation
- Skill development
- Technology and Product Development centres

Upgradation fund – key activities and stakeholders

Key activities	Facilitation
• Energy efficient technologies in steam generation system • Energy efficient technologies in dryer system • Energy efficient technologies in cross-cutting technologies and utilities Total budget: Rs 50 crore	1. Bureau of Energy Efficiency and SDAs - Facilitate technology specific DPRs - Technology demonstration through pilot projects in PPP /ESCO modes - Develop/ strengthen technology providers and LSPs - Create awareness 2. Ministry of Micro Small and medium enterprises and MSME-DI - Implementation of scheme in MSMEs - Establishment of cluster level technology and product development centres 3. SIDBI, FIs and Banks - Financial assistance and linkage with partial risk guarantee fund

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Policy level strategies -Common facility centre (CFC)

- Supporting sustainability and growth of MSMEs by addressing common issues like high end technology, market access, financing, etc.

Common Facility Centres

- **Efficient processing technologies**
- **Testing facilities**
- **Raw material banks**

CFC – Role and implementing agencies

Key activities	Implementing agencies
• Banking of quality raw materials, access to manufacturing process, technology, etc. • Build capacities through formation of special purpose vehicle (SPV) • Providing easy access to standard testing and infrastructure facilities • Strengthening the existing infrastructure facilities Budget : Rs 5 crore towards feasibility study and DPR preparation	1. Ministry of Micro Small and medium enterprises and MSME-DI 2. State government 3. Cluster level associations

14

Policy level strategies - Infrastructure development

- To enable MSMEs access to green fuel supply system, industrial estate, and other relevant infrastructure to improve competitiveness and sustainability

Infrastructure Development

- Facilitate industrial sheds
- Facilitate clean fuels

Development of industrial zones – key activities and responsibilities

Key activities	Implementing agencies
1. Development of clean fuel supply system such as piped natural gas, LPG (Karnal, Jamshedpur, etc.) 2. Development of industrial zone/industrial park for chemical manufacturing units Budget : Rs 0 crore	1. Ministry of Micro Small and medium enterprises and MSME-DI 2. State government 3. Cluster level associations

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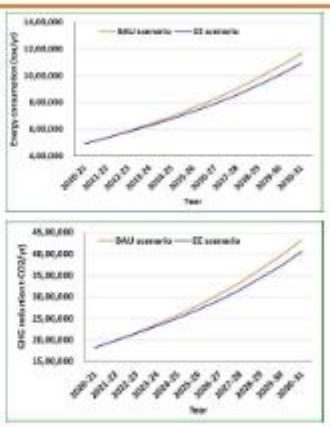
Potential impacts on policy implementation

Impacts of implementation: Overall chemical sector

Year	Production (tonne)	Energy consumption, toe		GHG emissions	
		BAU scenario	EE scenario	BAU scenario	EE Scenario
2020-21	47,13,886	4,93,277	4,93,277	18,28,110	18,28,110
2021-22	51,38,135	5,37,672	5,37,672	19,92,640	19,92,640
2022-23	56,00,568	5,86,062	5,83,132	21,71,977	21,61,118
2023-24	61,04,619	6,38,808	6,29,226	23,67,455	23,31,944
2024-25	66,54,034	6,96,300	6,78,893	25,80,526	25,16,013
2025-26	72,52,897	7,58,967	7,32,404	28,12,774	27,14,327
2026-27	79,05,658	8,27,275	7,90,047	30,65,923	29,27,957
2027-28	86,17,168	9,01,729	8,56,643	33,41,856	31,74,764
2028-29	93,92,713	9,82,885	9,28,826	36,42,624	34,42,279
2029-30	1,02,38,057	10,71,344	10,07,064	39,70,460	37,32,232
2030-31	1,11,59,482	11,67,765	10,94,437	43,27,801	40,56,041

- Energy savings in 2030-31 is estimated to be 73,329 toe assuming a CAGR of 9% in the sector.
- Corresponding GHG reduction potential is 271,760 tonne CO_2 per year



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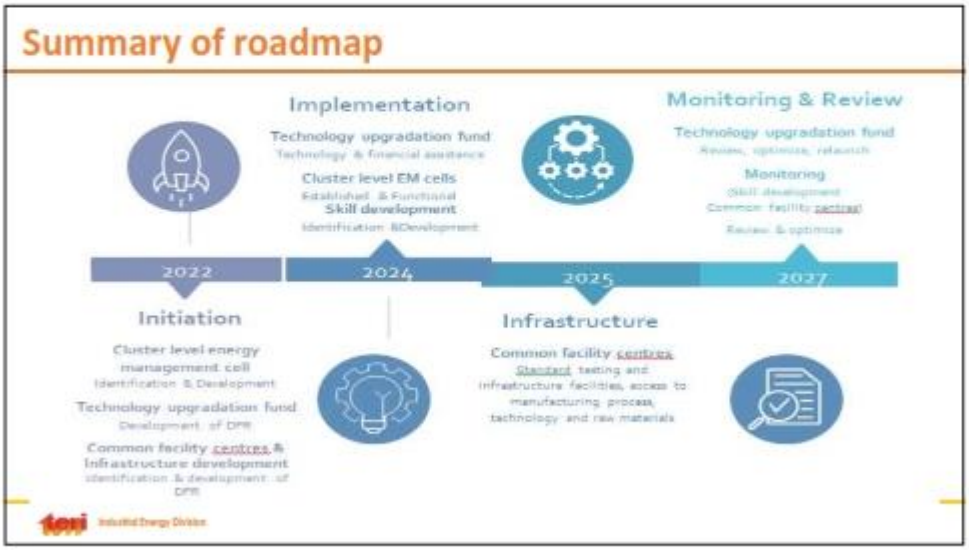
Summary of roadmap
Implementation
Technology upgradation fund
Technology & financial assistance
Cluster level EM cells
Established & Functional
Skill development
Identification &Development
Monitoring & Review
Technology upgradation fund
Review, optimize, relaunch
Monitoring
Skill development
Common facility centres
Review & optimize
2022
2024
2025
2027
Initiation
Cluster level energy management cell
Identification & Development
Technology upgradation fund
Development of DPR
Common facility centres & Infrastructure development
Identification & development of DPR
Infrastructure
Common facility centres
Standard testing and infrastructure facilities, access to manufacturing process, technology and raw materials
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Thank you
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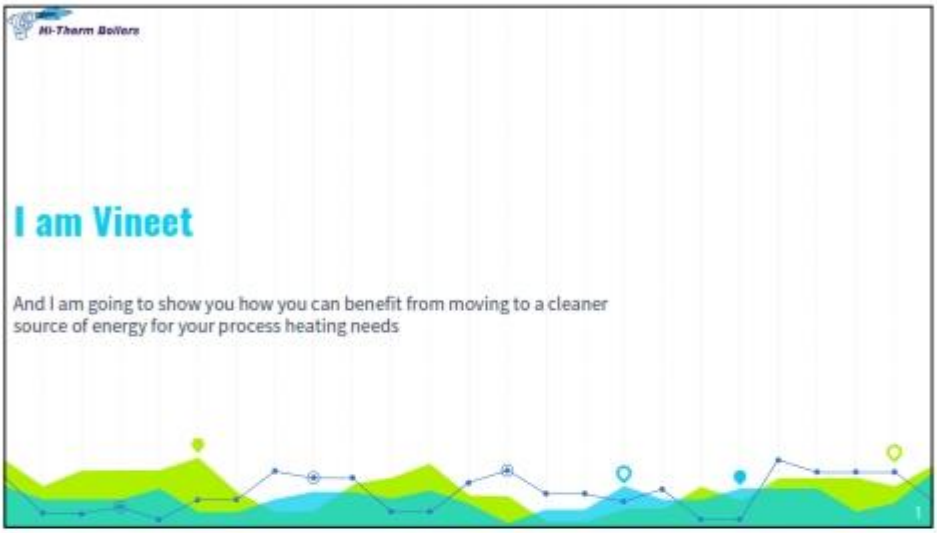
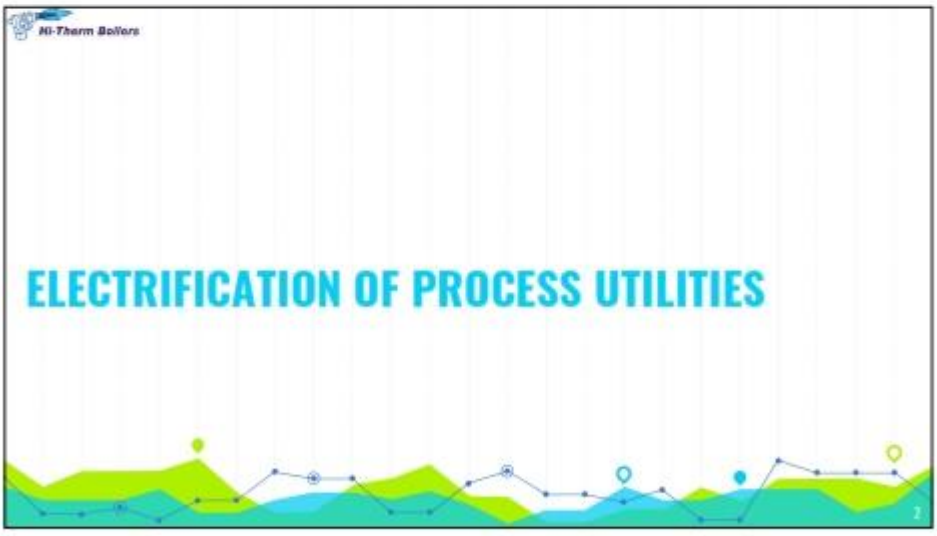
Annexure 5: Presentation of Hi-Therm Boilers Private Limited

7/19/2022



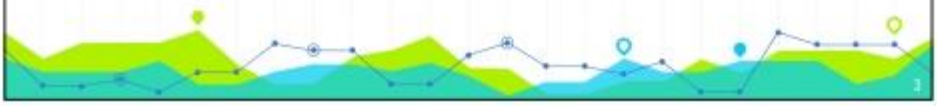


1

Hi-Therm Boilers

INTRODUCTION

- More than 3 decades of experience in the process heating industry
- Proven and efficient equipment for various heating processes in diverse set of industries
- Have served over 2000 clients across India and globally
- Offer electric operated heating equipment and have made a niche in these products



1

2

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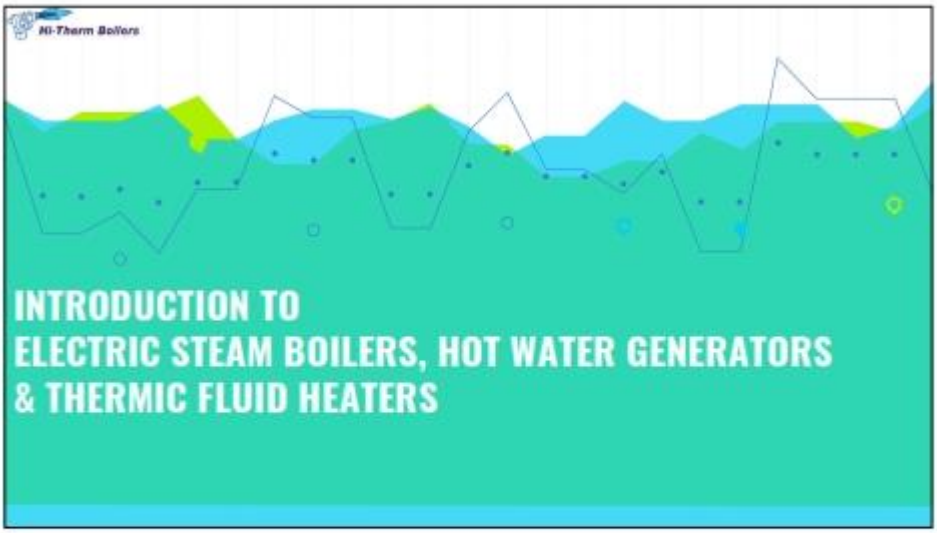
Hi-Therm Boilers
Elon Musk @elonmusk · Jul 15
Tesla is to protect life on Earth,
SpaceX to extend life beyond.
18K
21.2K
209K


WANT BIG IMPACT?
START SMALL
We believe in making each step a clean and green step towards our future

3


Hi-Therm Boilers
WHAT ALL WILL BE COVERED IN THIS PRESENTATION
1. Introduction to Electric Boilers and Electric Thermic Fluid Heaters
2. Advantage of Electric over Fuel fired Boiler & Thermic Fluid Heater
3. Case studies of installations with benefits achieved
4. Economic benefits and environmental emission reduction benefits
5. Scope of work involved in installing and operation


Hi-Therm Boilers
INTRODUCTION TO
ELECTRIC STEAM BOILERS, HOT WATER GENERATORS
& THERMIC FLUID HEATERS

4

7/19/2022

Hi-Therm Boilers

ELECTRIC OPERATED STEAM BOILERS

Hi-Therm Boilers

ELECTRODE STEAM BOILER VS ELECTRIC STEAM BOILER

Electrode steam boiler series work on the principle of passage of electricity through water, which causes a rise in the temperature of water. It comprises of an insulated boiler vessel, special alloy electrodes, feed water pump, various mountings and fittings along with an electrical control panel.

Electric steam boiler series employs electric heating elements as the heating media. It comprises of an insulated boiler vessel, SS heating elements, feed water pump, water level controller, various mountings and fittings along with an electrical control panel. All these equipment are housed in a packaged unit.

5

PRODUCT FEATURE	USER BENEFITS
UNIQUE DESIGN	NO CHIMNEY, NO OIL TANKS
NO BLOWERS/ FANS	NOISELESS OPERATION
INSTANT STEAM	IDEAL FOR INTERMITTENT OPERATIONS ALSO
NON IBR DESIGN	LOWER INVESTMENTS, NO DOWNTIME FOR YEARLY PASSING
READY TO USE PACKAGED DESIGN	FASTER INSTALLATION & COMMISSIONING, NO HIDDEN COSTS
EASY ACCESS FOR MAINTENANCE & CLEANING	EASE OF OPERATION & MAINTENANCE
COMPLETELY SAFE	NO WATER – NO ELECTRICITY FLOW

Hi-Therm Boilers

beekaylon

- Beekaylon Synthetics Pvt. Ltd., Silvassa has installed **3 units of 150 kg/hr Non-IBR Electric Steam Boilers**. The plant has special subsidy on electricity rates and has successfully adopted Electric Boilers as an integral part of their yarn manufacturing process.

6

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Hi-Therm Boilers

TITAN COMPANY

- Titan Company Ltd., Hosur, Bangalore has replaced their 400 kg/hr diesel fired boilers with 2 sets of 100 kg/hr electric steam boiler for their canteen jacketed heating
- The plant has transformed in to a complete electric operated plant, having replaced their large fleet of vehicles into Tata EVs. Thus reducing their carbon footprint.

Hi-Therm Boilers

ELECTRIC HOT WATER GENERATOR WITH CALORIFIER TANK

7

Hi-Therm Boilers

- RSPL Ltd., Indore has recently installed a **162 kW Electric Hot Water Generator made of complete SS316** along with a **5000 Liter Calorifier Tank**.
- The system generates 2500 Litres per hour of 90°C Pasteurized Hot Water from ambient temperature free from pathogens and ready for use in their shampoo manufacturing process

Hi-Therm Boilers

SALIENT FEATURES

Multiple passes - Complete SS316 design - Indirect Heating - Ceramic Cartridge Type Heaters with Long Life and Easy Replacement - Thyristor based PID controlled Panel - High Efficiency - Control Panel with Air Conditioning for cooling purpose

8

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Hi-Therm Boilers
ELECTRIC THERMIC FLUID HEATER


Hi-Therm Boilers

9

Hi-Therm Boilers

Vertellus

- Vertellus Specialty Materials India Pvt. Ltd., Vapi, Gujarat has installed a 3 Lac kcal/hr - **360 kW Electric Thermic Fluid Heater** for their intermediates and specialty chemical manufacturing process.

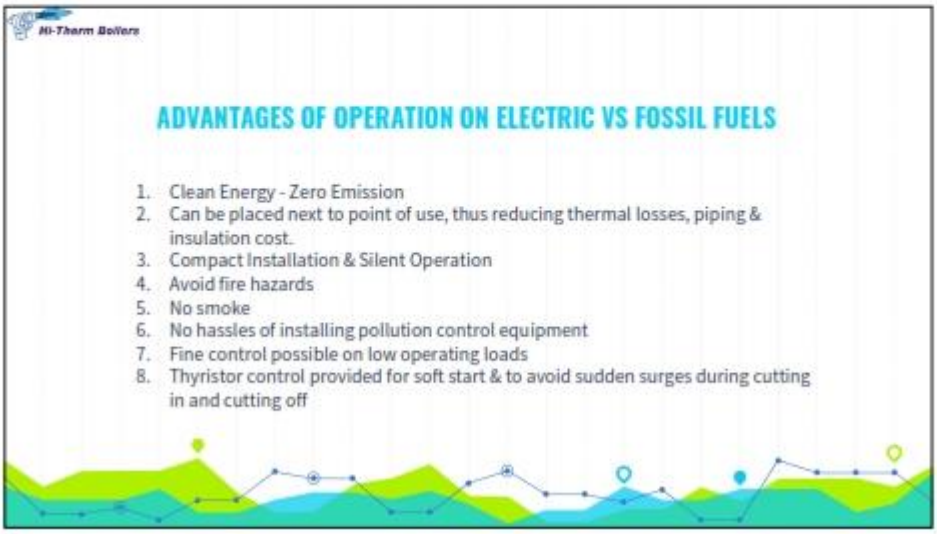
Hi-Therm Boilers

SALIENT FEATURES

Multiple passes - Indirect Heating - Ceramic Cartridge Type Heaters with Long Life and Easy Replacement - Thyristor based PID controlled Panel - High Efficiency - Control Panel with Air Conditioning for cooling purpose

10

7/19/2022



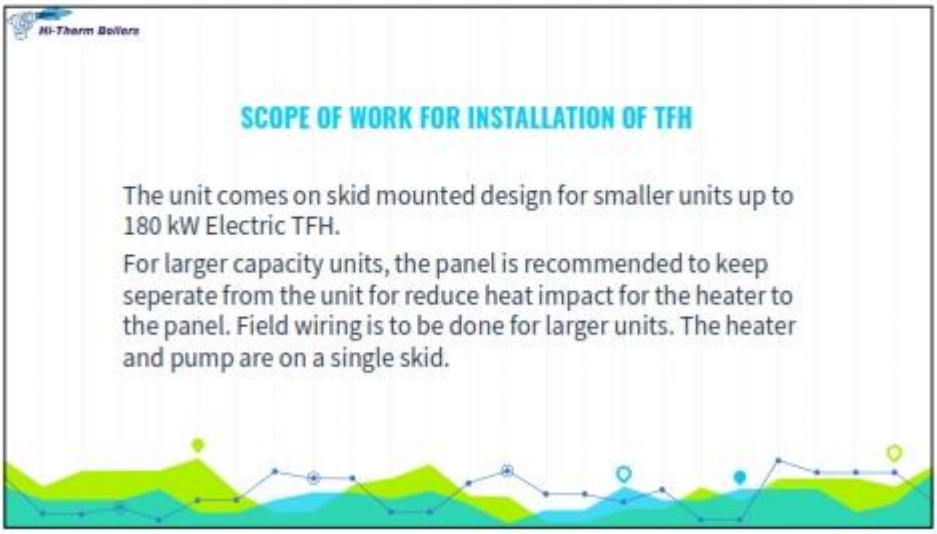
FUEL	ELECTRICITY	LDO	NATURAL GAS
HEAT LOAD CONSIDERED KCAL/HR	200000	200000	200000
THERMAL EFFICIENCY OF BOILER IN %	99	90	90
HOURS OF OPERATION PER DAY	24	24	24
CALORIFIC VALUE OF HEATING MEDIA KCAL/KG/(KW)	860.4	9900	8500
FUEL COST	8	100	79
FUEL CONSUMPTION (KW/KG)	235	26	26
FUEL CONSUMPTION PER DAY KW/DAY | KGS/DAY	5635	619	627
FUEL COST PER DAY	**45081**	**61922**	**49569**

11


CleanFuel
ZERO EMISSION
NO POLLUTION
Chimneys Eliminated
Fuel Handling Eliminated
Inefficient Fuel Burning Eliminated


1000 kgs of CO2 per day
That is the GHG emission of a 2 Lac Kcal/hr Gas Boiler
A return flight from NY to London
That is the equivalent emission of plane travel
https://www.nesta.org.uk/project-updates/how-much-your-gas-boiler-costing-earth/

7/19/2022


Hi-Therm Boilers
SCOPE OF WORK FOR INSTALLATION OF TFH
The unit comes on skid mounted design for smaller units up to 180 kW Electric TFH.
For larger capacity units, the panel is recommended to keep seperate from the unit for reduce heat impact for the heater to the panel. Field wiring is to be done for larger units. The heater and pump are on a single skid.


Hi-Therm Boilers
SCOPE OF WORK FOR INSTALLATION OF ELECTRIC STEAM BOILERS
The unit is packaged. The user must only connect utility connections such as power supply, steam outlet and water connections.
Separate dedicated earth pit is required for Electrode Boilers.

13

Hi-Therm Boilers

- Control panel of electric operated boilers is the heart of the system. The image is for the panel of the 360 kW Electric Thermic Fluid Heater. A 5 kW Air Conditioner is fitted on the side of the panel for cooling purposes to remove the heat of such heavy duty panels maintaining efficiency and life

THANKS!

Any questions?

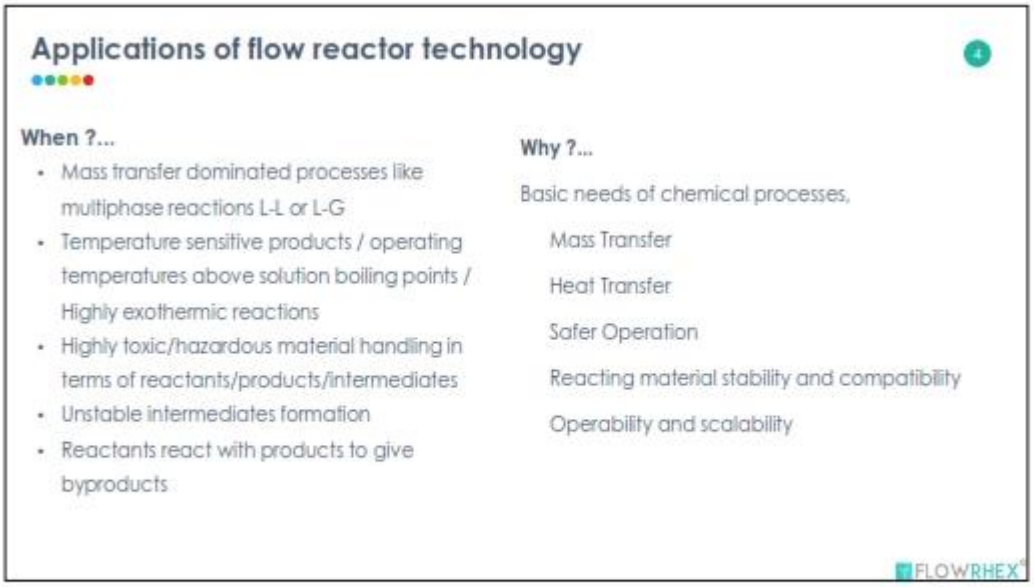
Visit us on **www.hithermboilers.com**

Annexure 6: Presentation of FLOWRHEX PROBURGEON Pvt. Ltd.

7/19/2022

7/19/2022


Ideal system operation
3
Mixer
Residence time volume
Mixer
Pre-Heating / Pre-Cooling of B
Reactant A
Reactant B
Process Temperature Zone
Product Stream
Proper dosing lines and instrumentation is required
Quench Material
FLOWRHEX


Applications of flow reactor technology
4
When ?...
Mass transfer dominated processes like multiphase reactions L-L or L-G
Temperature sensitive products / operating temperatures above solution boiling points / Highly exothermic reactions
Highly toxic/hazardous material handling in terms of reactants/products/intermediates
Unstable intermediates formation
Reactants react with products to give byproducts
Why ?...
Basic needs of chemical processes,
Mass Transfer
Heat Transfer
Safer Operation
Reacting material stability and compatibility
Operability and scalability
FLOWRHEX

Applications of flow reactor technology

5

Chemistries readily doable

- No solid handling
- Low temperature reactions
- Faster kinetics

Chemistries possible with challenges

- Solid / slurry handling
- Slow kinetics
- Gas evolutions

Chemistries not doable

- Operating conditions out of reactor constraints
- Incompatible Reactor MOC
- Equilibrium reactions???

Reaction examples,

Halogenations, Nitrations, Aminations, Phosphonations, Oxidations, Diazotizations, Organometallic reactions, Per acid formations, Sulphonations and Many more...

FLOWRHEX®

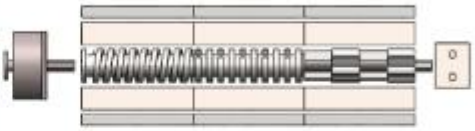
FLOWRHEX Innovation and Uniqueness

6

FRHexell
Intensified Reaction Unit
(Micro-mini channel flow paths with Surface/Volume ranging to 2500 m^2/m^3)

→ Heat Transfer Improved by **100-1000** times

→ Mass Transfer Improved by **10-100** times



Wide Operation Range,

- Temperature: -30°C to 200°C,
- Pressure: Up to 20 bar
- Reactions: L-L, L-G, Slurry-Gas, Slurry-L, Catalytic, etc.

- Unique Splitting – remixing Flow paths
- Flexible assembly with modular approach, active mixing, etc.
- Process Specific module selection and arrangement

Inherently Safe with
100 – 1000 times Lower Internal Volume

Novelty

Indian Patent Granted : 202121031526

Innovative and unique design with Multipurpose use

Flexible business model with user specific tailored solutions

7/19/2022

FLOWRHEX Innovation and Uniqueness

7

Applications

1 Chemical Reactions
- Gas evolution reactions
- Low pressure reactions
- Liquid-liquid, Liquid-gas, Slurry gas reactions

2 Process development and Process optimization services related to products

3 Unique Chemical Separations in progress
- Crystallization
- Distillation
- Evaporation

FLOWRHEX

Product features

6

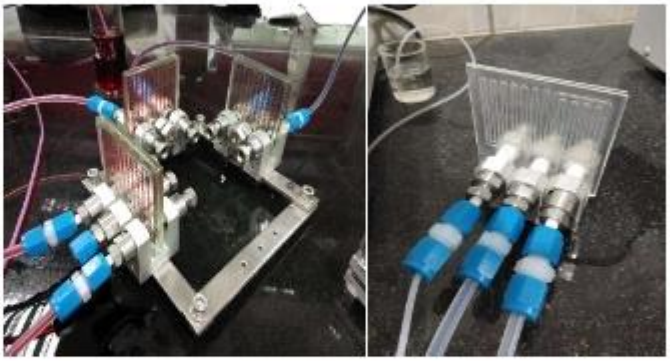
1 Channel Shape

2 Effective mixing at low pressure drop

3 High throughput with small volume

4 Only Indian Startup doing Glass reactors

5 Scale up made easier

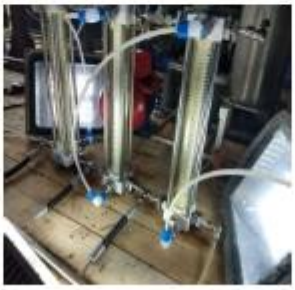


FLOWRHEX

Product features ....

9

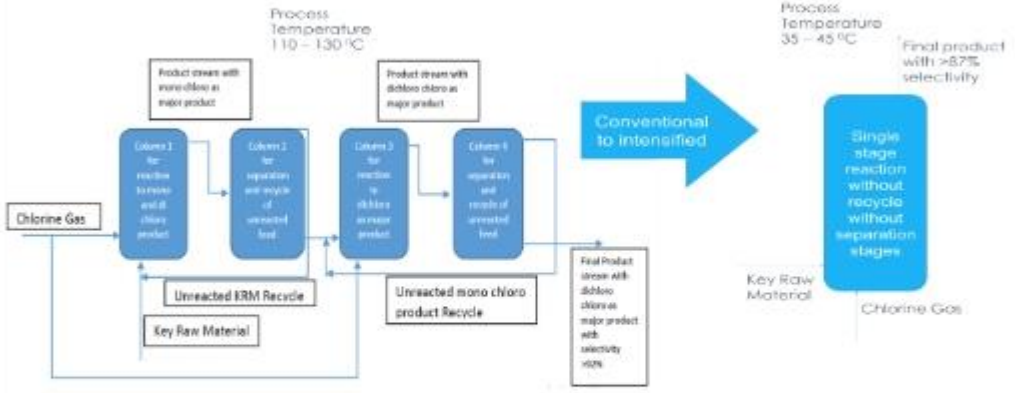
1. Easy and flexible assembly
2. Wide range of applications
3. MoC with Tantalum/Titanium/ SIC available as per customer demand
4. Customization / Development of product as per USR
5. Technology Provider for Process Intensification
6. Efficient and Affordable



FLOWRHEX

Technology / Process / Product

10



*Some actual reactions carried out using the innovation are mentioned in below link
https://drive.google.com/file/d/1G_BFmUnbRboXvn3CDJzwIFYjmhU_JOZ_/view?usp=sharing

Some of the optimized results

11

E.g. 1: Gas-Liquid Chlorination with Cl_2 gas

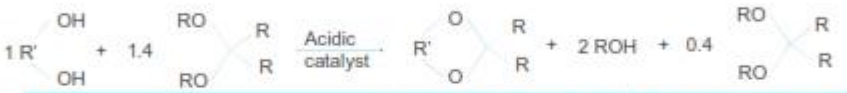
	Batch Process	Continuous Process
Reaction time (min)	600	7.5
Reaction temperature (°C)	120-130	35-40
Conversion (%)	Complete	Complete
Operation stages	4	1
Separation and Recycle	2 stage separation	Not needed
Utility	High pressure steam	Water circulation

Elimination of separation stages

Some of the optimized results

12

E.g. 2: Condensation reaction with aim for reduction in excess reagent in stoichiometry (target 1.4 eq. reagent to 1.05 eq.)



	Batch Process	Continuous Process
Reaction time (min)	180-240	1
Reaction temperature (°C)	30	60
Conversion (%)	94	95
Yield(%)	80	84
Selectivity(%)	90	92
Reagent Equivalent Required	1:1.4	1:1.1

Removal of excess reagent to eliminate post treatment operation

Some of the optimized results

13

E.g. 3: Amination reaction with aim for reduction in byproduct and yield improvement

	Batch Process	Continuous Process
Reaction time (min)	15-20	1
Reaction temperature (°C)	30-50	60
Conversion (%)	98.5-99	100
Yield (%)	82	91
Selectivity (%)	80	87
Reagent Equivalent Required	1:12	1:8

Reduction of excess reagent with yield and selectivity never observed in batch before

Snaps of our products, accessories and recent installations

14

7/19/2022


Complete Hastelloy Reactor Assembly
with Automation, High pressure Teflon Dosing line,
Residence time 3D mixer and utility circulation


Pilot-Production Scale Installations


Contact
17
THANK YOU
Amol Raykar
amol@flowrhex.com
09420586572
www.flowrhex.com
FLOWRHEX