REPLACEMENT OF SMALL BOILERS WITH COMMON STEAM BOILERS IN INDUSTRIAL AREAS

FEASIBILITY ASSESSMENT

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FEASIBILITY ASSESSMENT

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1. Background

Recently, Centre for Science and Environment (CSE) came out with a *Report on Assessment of Industrial Air Pollution in Delhi-NCR*. The report found that the number of small boilers operating in the industrial sector of the region is significant. (Any boiler with a capacity of less than two tonnes per hour, or TPH, is classified as 'small'). These boilers are mainly used for generating steam which is generally used in process or for heating purposes. They consume massive quantities of fossil fuels (majorly coal). Emissions standards applicable to such boilers are quite lenient. In most cases, installation of air pollution control devices is either not applicable, or they are insufficient to control emissions. Also, these boilers follow a batch operating process—each batch of fuel is consumed in about 30–40 minutes and then fuel feeding is required. One small boiler can be monitored for actual emissions only for about 30–40 minutes in an hour or may be even less than that. Moreover, fuel feeding is mostly done manually. Therefore, installation of any type of Continuous Emissions Monitoring Systems (CEMS) will not be fruitful as the boilers are in standby mode for a sizable amount of time during a day.

In CSE's experience, once the fuel is fed into a small boiler, it takes about 20–25 minute to combust. During this period, one can record flue gas emissions. Once the fuel is consumed in the boiler bed, air (with an oxygen content of about 19–21 per cent), starts flowing into the stack in place of flue gases. There is no benefit in measuring the emissions level at this stage as it will not yield a representative sample. Putting any kind of monitoring system in place is not techno-economically feasible under such conditions. There is an urgent need to either evolve a better practice to monitor emissions from small boilers or to replace these inefficient and polluting boilers with efficient and less polluting systems.

The responsibility of developing a better monitoring mechanism for small boilers rests with the regulatory bodies of the state and the Central Pollution Control Board (CPCB), keeping in mind that it is not possible to monitor each and every boiler at the current capacity of the pollution control boards.

In this paper we will try and assess the feasibility of replacement of small boilers (< 2 TPH) or even medium-sized boilers (upto 10 TPH) in industrial areas or clusters with a common facility for steam generation. Such systems are sometimes termed as common boilers or community boilers and can cater to the steam requirement of a specific number of industrial units. If feasible, such technology could free the regulatory bodies of the hassle of monitoring a large number of small boilers in certain industrial areas.

1.1 Capacity range of industrial boilers in Delhi-NCR

The study conducted by CSE covered various industrial areas in the districts of the neighboring states of Delhi, which are also part of the Delhi-NCR's air shed. In Uttar Pradesh, the Ghaziabad district was covered; in Haryana, Faridabad, Gurugram, Panipat and Sonipat were studied; and in Rajasthan, Alwar and Bhiwadi were examined. It was observed that most of the small- and medium-scale industrial units located in each of these districts use small boilers to generate steam for process. Data regarding the number and installed capacity of boilers, and the type of fuel used, has been provided by the various state pollution control boards (SPCBs). CSE's analysis shows that more than 50 per cent of the boilers installed in these industrial areas are of less than 2 TPH capacity. Another 35 per cent of boilers have capacity in the range of 2–10 TPH (see *Table 1: District-wise number of small boilers and capacity range*).

Table 1: District-wise number of small boilers and capacity range

District or region	Number of boilers	Boiler capacity range (TPH)			
		< 2	2–10	10–15	>15
Alwar	63	44 (70%)	8 (13%)	5 (8%)	6 (10%)
Bhiwadi	111	53 (48%)	48 (43%)	7 (6%)	3 (3%)
Ghaziabad	140	102 (73%)	24 (17%)	4 (3%)	10 (7%)
Faridabad*	132	54 (41%)	65 (49%)	8 (6%)	5 (4%)
Gurugram*	69				
Panipat	163	53 (33%)	98 (60%)	7 (4%)	5 (3%)
Sonipat*	212				
Total	890	306	243	31	29
Share		53%	36%	6%	5%

*Details not available or only partially available

Source: Report on Assessment of Industrial Air Pollution In Delhi-NCR, 2019–20, CSE

1.2 Issues with small boilers

- **Emissions standards are lenient:** The emissions standards for small boilers are quite relaxed. For boilers with capacity of less than 2 TPH, the PM emissions norm limit is 1,200 mg/Nm^3. Thus, even if these boilers are meeting applicable standards, pollution load from them will be high.
- **Number is large, difficult to be physically monitored by SPCBs:** About 50 per cent boilers installed in the seven study areas in the Delhi-NCR air shed are small boilers. It is difficult to follow the mandate of monitoring these boilers periodically with the limited capacity of regional SPCBs.
- **Air pollution devices have not been installed:** Proper air pollution control devices have not been installed in most of the industrial units. Even when installed, they are not working satisfactorily.
- **Usually operate through batch-type process**: Frequent restarts result in poor operational efficiency and inaccurate monitoring results through CEMS.
- **Manual coal feeding and no automation.**
- **Safety**: Several cases of boiler explosions are recorded every year, including causalities (mostly of manpower involved in boiler operation and other skilled or unskilled labour). Installation of big boilers with professional management will save lives and prevent injuries.

2. Common boilers in India

Common boilers or community boilers are centralized systems that cater to the demand of steam generation of member industrial units by establishing a steam pipeline network within an industrial area. For such systems, either atmospheric fluidized bed combustion (AFBC) boilers or circulating fluidized bed combustion boilers (CFBC) are preferred. In an AFBC boiler, the furnace pressure is atmospheric pressure whereas in a CFBC boiler, to increase the thermal efficiency of the boiler, the furnace is pressurized and furnace gas is recirculated to capture unburnt carbon.

Thermal efficiency of a common FBC boiler is in the range of 80–85 per cent. Since proper air pollution control devices (APCDs) are available for such systems, PM emissions levels can be reduced to as much as 30–50 mg/Nm^3. Low furnace temperature inside a CFBC boiler suppresses NO_x formation. SO_2 emissions can be controlled by auto-injection of lime and selection of the right fuel. The availability of steam at the doorsteps of units operating in an industrial estate is one of the major advantages of common boiler systems. It lets industrial units focus manpower, space and money on their core production activity.

Having said that, the idea has not really taken off till now. A few states like Gujarat have experimented with such systems. At present, three such projects are in operation in Gujarat at Ankleshwar GIDC, Sachin GIDC, and Vapi GIDC, with around 90 units connected to three common boiler facilities. The concept was also included in Gujarat's Industrial Policy of 2015, as a scheme of assistance for common environment infrastructure.

CREATING A COMMON BOILER

Once an area has been identified (in consultation with either an industry association or other stakeholders), a survey of the industrial area and units is conducted for assessing the steam demand. The capacity of the common boiler is finalized based on the steam demand, which is generally taken as 1.5 times more than the assessed capacity. The most important requirement is that of land, which is either procured through a sub-lease for 20–25 years or purchased by the manufacturer. The major cost involved in the project is of the pipeline network—longer the pipeline network, more is the overall cost of the project. Once the land and capacity has been finalized, meeting with representatives of the industrial units is done to seek letters of intent to avail the common boiler facility.

Simultaneously, the manufacturer applies for consent to establish and consent to operate with the concerned SPCB. For the pipeline network, an industrial development agency is consulted. Various permissions related to boiler installation from different agencies are also obtained.

The overall commissioning and installation time of a common boiler is about 18–24 months. The payback period for the manufacturer is 6–10 years.

3. Aspects of feasibility assessment

Steam is an inevitable requirement of numerous industrial sectors like dyes and dye intermediates, pharmaceuticals, pesticides and textile processing. To generate steam, each industrial unit has to establish its own boilers. Generally speaking, these small boilers consume a lot of fuel, have high maintenance cost and downtime, emit significant quantities of pollutants and are a safety hazard. Nearly half of an industrial unit's fuel consumption is required only for steam generation. The health of workers also gets adversely affected because of intense use of fuels. Centralized steam generation can provide a common solution to all these problems.

The major stakeholders in this debate are owners of the individual industrial units, industrial associations, boiler manufacturers, technology providers of common boilers, industry development corporations (e.g., Rajasthan State Industrial Development and Investment Corporation or RIICO and Haryana State Industrial and Infrastructure Development Corporation or HSIIDC), regulatory bodies (CPCB and SPCBs) and boiler inspectors.

Many factors need to be assessed to determine the feasibility of introducing common boilers in place of small boilers in small industrial units in industrial clusters.

3.1 Technical aspects

Steam has to be produced at a certain pressure and temperature as per the requirement of the process and transferred to the shop floor. The quality and availability of steam are technical constraints for small boilers. During boiler operation, fly ash is generated as the major byproduct. Handling and managing fly ash often becomes an issue for the industrial units.

On the other hand, a common boiler is a separate entity, wherein a boiler of larger capacity is installed to cater to the requirement of specific number of industrial units in the cluster. The system has an automated boiler control system and fuel feeding mechanism, and a proper emissions monitoring mechanism. It usually constitutes of a large, high-pressure, coal-fired FBC boiler with state-of-the-art emissions control technology. Steam is generated based on the demand of the industrial units. These boilers generate sufficient steam to be provided to the entire cluster of industries through a large grid of pipelines.

3.2 Economic aspects

The installation of a small boiler with a capacity of less than 2 TPH costs about Rs 7 lakh, whereas medium-sized boilers (upto 10 TPH) may cost more than Rs 10 lakh. In addition, the costs of fuel and maintenance adds to the financial burden on the industrial unit. Small boilers need industrial units to procure fuel at a certain cost. The boiler is operated by at least two–three personnel, who are required for fuel handling and feeding, which adds to the cost to the industrial unit. During the frequent downtime, there is loss of productivity, which also translates into financial losses. Add to this the cost of any APCD installed. All in all, common boilers are much more cost-efficient than small boilers for industries (see *Table 2: Comparative cost of steam from small and common boilers*). Industrial units receive the required steam at their doorsteps within the same cost, while being offered remarkable other benefits.

Table 2: Comparative cost of steam from small and common boilers

Boiler fuel	Cost of steam (Rs per kg)
Coal-fired: Inconsistent usage	3
Coal-fired < 2 TPH	2
Coal-fired > 2 TPH	1.6
Gas-fired	3–3.5
Fuel oil-fired	3.5
Briquette-fired	2.5–3
Common boiler with coal	1.8–2.2

Note: Cost of steam includes fuel, electricity, water and its treatment, waste management, salaries and wages, maintenance, interest and depreciation costs.

Breakup of cost of steam—70 per cent: fuel cost; 30 per cent: fixed cost

Source: Steam House, Surat

Industrial units relying on a common boiler system for steam reduce capital investment as follows:

- **Cost of boiler**: No need to install the boiler within premises
- **Cost of fuel:** No need to procure fuel
- **Cost of boiler operation and maintenance:** None
- **Cost of boiler APCD:** None
- **Productivity:** The unit can increase its productivity by concentrating on core production without having to worry about steam generation
- **Cost of CEMS:** The cost of installing CEMS at a small boiler sometimes exceeds the cost of the boiler itself. Switching to a common boiler network waves off these expenses

3.3 Legal aspects

Industrial units relying on a common boiler for steam need not take additional permissions for boiler installation. Since boilers are not installed on their premises, industrial units are not subject to boiler inspections. This saves a ton of management hours and liabilities. It also reduces the regulatory obligation of SPCBs to inspect and monitor. Instead of having to monitor a bunch of boilers, CEMS can take care of the requirement at a single, central entity (common boiler).

The land required for setting up of common boiler systems is made available to the boiler manufacturer by the agency engaging and initiating the installations—it can either be an industry association or an industrial development agency. Various permissions like consent to establish, consent to operate, and environmental clearance for boiler installation are taken by the boiler manufacturer and industrial units often do not have to get involved in the process.

INVESTMENT REQUIRED FOR ESTABLISHING A COMMON BOILER IN A NEW INDUSTRIAL AREA

In developing industrial areas, where new units are expected to come up in the near future, common boiler systems can be a financially viable option. The CAPEX and OPEX cost of 15 industrial units installing individual small boilers of 2 TPH each or one boiler of 30 TPH has been estimated (see *Table 3: Comparative CAPEX and OPEX of small and common boilers*). Although commissioning of a common boiler may require each industrial unit to invest a specific share in the overall capital cost of the setup, yet it accrues definite overall savings to all of them.

Table 3: Comparative CAPEX and OPEX of small and common boilers

Parameter	Unit	Small boilers (15 industrial units)	Common boiler	Remark
Capacity	TPH	30	30	Considering 15 industrial units having 2 TPH boiler each
Boiler cost	Rs	1,05,00,000	19,50,00,000	Cost of 15 small boilers each of 2 TPH and one single boiler of 30 TPH
Pipeline cost	Rs	Not required separately	10,50,00,000	
O&M cost	Rs/year	5,40,00,000	4,20,00,000	Assumed monthly O&M cost is Rs 3,00,000 for every small boiler and Rs 35,00,000 for a common boiler. This includes salaries and wages, repair and maintenance, electricity, water and miscellaneous expenses
Cost of APCD	Rs	82,50,000	Included in the boiler cost	APCDs are often not installed in small boilers
Monitoring cost	Rs/year	18,00,000	1,20,000	Considering stack monitoring cost to be Rs 10,000 per month
CEMS cost	Rs	1,50,00,000	Included in boiler cost	
Total CAPEX and OPEX	Rs	8,95,50,000	34,21,20,000	

Source: CSE, based on Steam House, Surat, stakeholder interactions with small boiler manufacturers and APCD suppliers

3.4 Environmental aspects

Single common boilers in industrial areas and clusters are energy efficient and provide steam with a better environmental compliance. Nevertheless, a robust steam distribution network is required to make steam available to member industrial units.

Existing emissions norms for small boilers are very lenient and provide industrial units a wide margin to pollute the environment. Moreover, efficiency of small boilers is relatively low and results in higher fuel consumption. Applicable emissions standards on common boilers are more stringent, and these boilers have reliable APCDs, reducing their overall pollution load.

Table 4: Emissions norms for small boilers

Fuel type	Capacity (TPH)	PM emissions limit (mg/Nm^3)
Small industrial boilers (coal or liquid fuel)[1&2]	Less than 2	1,200
	2 to less than 10	800
	15 and above	150
Boilers using agriculture waste as fuel[3]	All	500

Source: Central Pollution Control Board

The PM emissions standards for boilers with capacity of more than 15 TPH are stringent (150 mg/Nm^3) compared to small boilers with capacity of less than 2 TPH (1200 mg/Nm^3). The capacity of common boilers is often more than 20 TPH, as they fulfill the steam demand of a number of industrial units. This is subject to actual demand and economic feasibility. The main focus of common boiler projects is to protect the environment; therefore they use the most reliable available technology, i.e., ESP with extra fields.

Moreover, industrial units also save the money they would have to spend on at-stack air emissions monitoring otherwise. Third party monitoring is done on a monthly or quarterly basis, which is not required after switching to the common boiler system.

4. Overall benefits

There are several benefits of switching over to common boiler-based steam generation from small boilers installed in the premises of industrial units:

1. **No hassle (and cost) of operation and maintenance as no boilers installed:** No downtime and improved availability of steam. Shutdowns are minimized as common boilers of larger capacity do not require frequent maintenance.
2. **Reduction in industrial air pollution** by 65–70 per cent, with better emissions control and a 25-30 per cent reduction in coal consumption.
3. **One point monitoring** for SPCBs. The liability to install CEMS not applicable to small industrial units as the common boiler functions independent of them.
4. **Increasing productivity** as requirements to procure fuel, set aside manpower for operation of the boiler, and coordination between demand and supply of steam no longer required on the part of the small industrial unit.
5. **Increased efficiency**: Fuel-to-energy conversion improves as producing steam in bulk reduces the per unit fuel consumption.
6. **Safer industrial areas**: Removal of boilers from small industrial operations makes them safer.
7. **Auto-firing and automatic ash handling**: Providing hygienic conditions to workers.
8. **No fuel storage area required:** Thus saving space for small industrial units.
9. **Ease of doing business** for industrial units.

A common boiler facility scores over a boiler with a capacity of 2 TPH on key economic, technical, regulatory and environmental aspects (see *Table 5: Comparative cost–benefit analysis of a small boiler and a common boiler*).

Table 5: Comparative cost–benefit analysis of a small boiler and a common boiler

Type of benefit	Parameter	Unit	Industrial units with a small boiler (2 TPH)	Industrial units with a common boiler	Remark
	Capacity	**TPH**	**20**	**No boiler installation**	
Economic	Boiler cost	Rs	7,00,000	0	Cost of installation of one small boiler of 2 TPH saved
Economic	Operation and maintenance (O&M) cost	Rs per year	1,00,000	0	Assumed cost of O&M is Rs 1,00,000 for one small boiler
Economic	Cost of APCD	Rs	5,50,000	0	An APCD is often not installed on a small boiler; cost of a wet scrubber has been considered
Economic	Productivity		Less	More	More productivity means more profit
Technical	Automation		Nil	Not required, as no boiler present	Manual feeding in case of a small boiler, no automated control, more labour requirement, and an unhealthy working environment
Technical	Efficiency	Per cent	65–70	80–85	Increased efficiency
Technical	Steam availability		Intermittent	Continuous	
Environmental	Emission standards for PM	mg/Nm^3	1,200	No norms to be followed (as boiler not installed on-site)	Reduction in air pollution by 65–70 per cent as PM norm limit for common boilers is generally 150 mg/Nm^3
Environmental	Monitoring cost	Rs per year	1,20,000	No monitoring required	Considering stack monitoring cost to be Rs 10,000 per monitoring per month
Environmental and economic	CEMS cost	Rs	10,00,000	No CEMS installation required	
Regulatory	Regulatory inspection	Number of visits per year	4	May visit for other inspections	Four inspection visits per year (quarterly) by SPCB officials for each industrial unit. Once the industry switches over to the common boiler system, no inspection is required related to air pollution control
Regulatory	Boiler permission		Required	Not required	

Note: In case of common boilers, industrial units need to pay the steam cost only as per the consumption and all other costs are borne by the agency managing the common boiler.

Detailed cost–benefit analysis has been done for a pilot proposal in the following section.

Source: CSE analysis, 2020–21

5. A pilot proposal for Loni industrial area

5.1 Data required

To work out the detailed techno-economic feasibility of installation of a common boiler in an industrial cluster, the following information or data is required:

1. Number of units in the captioned industrial cluster using steam in their manufacturing processes.
2. Quantity, pressure and temperature of steam required (whether high-, medium- or low-pressure steam).
3. Average monthly fuel consumption and expenditure on production of steam at each industrial unit using steam.
4. Future expansion plans of each unit and expected increase in steam consumption in the near future.
5. Trends of steam requirement in the relevant industrial sector(s).
6. Availability of space, including for storing fuel, for setting up the proposed plant within the industrial cluster as well as availability and landed costs of various fuels that can be used.
7. Plot plan of the industrial cluster, giving location of each unit and the proposed steam plant. This helps to estimate the steam distribution cost from the proposed plant to individual units.

5.2 Proposal for establishing a common boiler in Loni industrial area

Loni industrial area (consisting of Arya Nagar, Loni Road, Roop Nagar and Tronica City) houses 86 industrial units. About 75 per cent of the units are located in Arya Nagar and Roop Nagar. To meeting their steam requirements, individual industrial units have installed coal-fired small boilers. Put together, their capacity is about 35 TPH. If we assume that each unit runs for 12 hours daily and has an efficiency of 65 per cent, estimated coal consumption is about 107 tonnes per day; at 100 per cent loading, steam generation will be 420 tonnes per day. The overall monthly fuel cost is estimated to be about Rs 2.6 crore. Average cost of steam comes out as Rs 2.05/kg.

If these industrial units shift to a common boiler system, a single 35 TPH boiler can cater to their needs (depending on the spread of the industrial units within the area, more than one common boiler may be required). The efficiency of such systems is about 80 per cent (as per the Bureau of Energy Efficiency's handbook and boiler manufacturers). Therefore, estimated daily coal consumption (with 12 hours of operation) will be about 87 tonnes; at 100 per cent loading, steam generation will be 420 tonnes per day. The overall monthly coal cost for common boilers is about Rs 2.1 crore, and the average steam cost is Rs 1.7/kg.

This means that the monthly savings of all industrial units on the production of steam will be Rs 50 lakh. The individual cost savings for each industry will depend on the capacity of the boiler replaced with the common system. To illustrate, an industrial unit with an installed small boiler of 0.5 TPH will save about Rs 3.7 lakh per month as it will not be required to procure fuel from the market to generate steam.

Table 6: Cost-benefit analysis in Loni industrial area

Parameter	Unit	Remarks	Small boilers (66 in number)	Common boiler	For a single industrial unit	Source
Total capacity	TPH	A	35	35	0.5	Data provided by UPPCB
Efficiency of boiler	%	B	65	80	65	Efficiency assumed, BEE
Calorific value	kcal/kg	C	4,000	4,000	4,000	BEE handbook
Useful cal value	kcal/kg	D = B x C	2,600	3,200	2,600	Calculated
Enthalpy of steam (10 kg/cm^2 and 180°C)	kcal/kg	E	665	665	665	BEE handbook
Steam production (at 100 per cent loading)	TPD	F	420	420	6	Estimated considering 12 hour operation at 100 per cent loading
Factor for estimating coal consumption		G = E/D	0.26	0.21	0.26	Calculated
Average coal consumption (for a 12 hours operation)	TPD	H = G x A x 12	107	87	1.5	Calculated
Cost of coal	Rs/ tonne	I	8,000	8,000	8,000	Market cost estimated
Monthly coal cost	Rs		2,57,81,538	2,09,47,500	3,68,308	Calculated
Fuel saving	TPD		20		1.5	
Monthly cost savings on fuel (for 66 industrial units)	Rs			48,34,038	3,68,308	
Steam consumption	Tonnesteam/ tonnecoal	J = H/F	3.91	4.81	3.91	Calculated
Cost of steam	Rs/tonne	K = I/J	2,046	1,663	2,046	
Savings on steam cost	Rs/tonne			384	384	Each industrial unit will save on steam cost
Savings on steam cost	Rs/month			48,34,038	69,058	Since the steam cost for an industrial unit also changes, savings are with reference to before and after switching to the common boiler
	Rs/year			5,80,08,462	8,28,692	

Source: CSE analysis, 2020–21

REGION AND INDUSTRIAL AREA-WISE POLLUTION LOAD FROM SMALL BOILERS

Existing pollution load for various districts and industrial areas has been calculated based on fuel consumption in small boilers (see *Table 7: Percentage share of small boilers in pollution load*).

Table 7: Percentage share of small boilers in pollution load

S. no.	District or industrial area	Average share of small boilers in loading	PM	SO_2	NO_x	Number of industrial units with small boilers
			Pollutant (tonnes/ year)			
1	Panipat	13%	215	89	134	83
i.	Bapoli	5%	8	6	10	1
ii.	HSIIDC Samalkha	4%	1	1	1	2
iii.	Industrial Area Panipat	27%	46	21	32	25
iv.	Israna	3%	13	5	8	4
v.	Madlauda	5%	3	1	2	1
vi.	Sector 25, HUDA Phase 1 and 2	3%	1	0.4	1	1
vii.	Sector 29 HUDA Phase 1	19%	8	3	5	5
viii.	Sector 29 HUDA Phase 2	35%	135	51	76	44
2	Alwar	6%	93	71	107	34
i.	Khairthal	100%	11	4	5	2
ii.	MIA	6%	43	27	41	12
iii.	Neemrana	14%	22	21	32	11
iv.	OIA	3%	3	2	3	1
v.	Sotnala	12%	6	7	11	4
vi.	Others	4%	7	10	14	4
3	Bhiwadi	12%	177	151	227	53
i.	Bhiwadi Phase I to IV	6%	81	46	69	32
ii.	Chopanki	30%	84	92	138	15
iii.	Khushkhera	8%	12	13	20	6
4	Faridabad	10%	250	104	156	57
i.	Ballabhgarh	9%	156	64	97	25
ii.	Faridabad	12%	94	40	60	32
5	Ghaziabad	16%	285	123	185	105
i.	BS road	4%	14	5	7	1
ii.	Loni	74%	186	87	131	83
iii.	Modinagar	1%	2	1	2	1
iv.	Rajinder Nagar IA	100%	10	5	8	5
v.	Sahibabad	11%	74	27	40	15

Source: CSE analysis, 2020–21

The average share of small boilers in the overall pollution load is in the range of 6–16 per cent. However, it is viable to develop common boiler systems in areas where the share of small boilers in the total pollution load is significant. Feasibility assessments may be conducted in such areas.

5.3 Reduction in pollution load

Since the PM emissions standards for small boilers are remarkably lenient (at 1,200 mg/Nm^3), switching over to a common boiler system will reduce the pollution load significantly. PM emissions load will be reduced by 84 per cent as the norm limit for a boiler of more than 15 TPH capacity is 150 mg/Nm^3. SO_2 and NO_x emissions will be reduced by about 13 per cent each.

Table 8: Comparative pollution load of small and common boilers in Loni industrial area

Industrial cluster	Pollutant emissions (tonnes per year)		
	PM	SO_2	NO_X
Small boilers	186	87	131
Common boiler	29	77	116

Source: CSE analysis, 2020-21, Report on Assessment of Industrial Air Pollution In Delhi-NCR, 2019–20

6. Challenges and requirements

As per CSE's discussion with manufacturers, the prime requirements and challenges for setting up common boiler facilities in industrial areas are as follows:

1. **Land availability**: It is not always easy to get a central location in an industrial area. A 60 TPH boiler needs a space of 5,000 sq ft.

2. **Raw water availability:** More than 50 per cent top-up water is required in case of large-sized customers and 100 per cent fresh top-up water is required in case of small customers. Continuous supply of water with total dissolved solids (TDS) of less than 200 mg/litre is required.

3. **Effluent water management**: Around 3 per cent of the raw water, with high TDS and very low chemical oxygen demand (COD) or biological oxygen demand (BOD), needs to be discharged as wastewater after each cycle. Hence, connection to the common effluent treatment plant (CETP) in the area is required. Alternatively, a multi-effect evaporator has to be set up, which adds to the costs.

4. It is advisable to set up such systems in an Industrial Development Corporation area or organized park only, as **pipeline permission** could be a challenge.

5. **Fast track permissions** from all government departments is also a challenge.

6. Common boiler systems have limitations in terms of distributing steam in an industrial area spread over a large area. Ideally, one boiler with 10 TPH capacity can cater to industrial units within a range of 2 km. Beyond that, the capacity of the boiler needs to be increased. Technically, steam can be supplied by a 10 TPH boiler beyond the 2 km range but it is not viable commercially.

7. **Safety:** A common boiler project as well as its pipelines are governed by the Boiler Act, 1923 as well as the Electricity Act, 2003. Maintenance of an emergency management team with a high level of automation is mandatory.

8. **Movement of vehicles:** Structures erected for installing the pipeline network need to be at least eight metres above the road level. They should be designed keeping in view the margin of six metres mandated by National Highway Rules.

7. Recommendations

1. The average share of small boilers in the overall pollution load in industrial areas is in the range of 6–16 per cent. However, this number may be much higher in industrial areas with a significant number of small boilers. In such areas, common boiler systems may be considered.

2. It is recommended that industrial associations, with the support of industrial development agencies like HSIIDC and RIICO, should initiate preliminary feasibility studies of installing common boilers in industrial areas in Delhi-NCR to replace small boilers.

3. Following in the footsteps of the government of Gujarat and Gujarat Pollution Control Board, states in Delhi-NCR should encourage and share the technical and environmental benefits of having such systems with owners and administration of industrial units.

4. Common boilers should be included in the developmental plan of an industrial area at the planning stage itself as a basic necessity, and sufficient land should be allocated for such facilities in the initial development stage of the area.

5. Clauses concerning common boilers, to the effect that industrial units should prefer common boilers over small boilers, should be included in industrial policy.

6. Stakeholder interactions should be conducted between owners and administration of industrial units, industrial associations, boiler manufacturers, industrial development agencies and technology providers to understand the cost economics and benefits in detail.

7. Estimates suggest that the cost of producing steam in small boilers with inconsistent usage of coal is around Rs 3/kg. The cost of producing steam in coal-fired boilers of less than 2 TPH capacity is Rs 2/kg. If an industry switches over to a common boiler service, the cost will be in the range of Rs 1.8–2.2/kg, but the overall CAPEX and OPEX will decrease significantly. In addition, there are advantages related to environment and increased productivity. Moreover, about 30 per cent of the steam cost is fixed cost whereas 70 per cent is fuel cost and tends to vary. The latter will be stabilized and reduced in common boiler facilities.

References

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Replacement of small boilers with common boilers in industrial areas makes a lot of sense. Financially, it helps small industrial units to save the money spent on running and maintaining small boilers. From an environmental perspective, it reduces emissions substantially, particularly in industrial areas with a significant number of small boilers. For regulators, it saves loads of official time and energy, which might otherwise have to be spent on inspecting small boilers. It is truly a win-win-win situation.

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