

# POLLUTION IN RESIDENTIAL SOCIETIES FROM DG SET



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POLLUTION FROM DG

Diesel Generator (DG) sets are often used as the backup for power cuts in most of the residential societies across the country. Given the huge installed capacity of DG sets and a significant proportion of electricity generation from DGs in the Delhi NCR region, they have a material impact on air quality. Furthermore, it appears logical that the DGs would have an even more serious impact on air quality within the residential society premises; however no study had been conducted to estimate it. Centre for Science and Environment (CSE) has conducted the very first study to assess the impact of DG set operation on the pollution levels inside the residential societies.

## CRITERIA FOR SELECTION OF SOCIETIES

For the study, CSE selected five residential societies located across Gurugram based on the following parameters:

- Varied mix of societies, some with high rise and others with low rise buildings
- No other significant sources of unusual pollution changes near the building (like construction work, high traffic congestion on roads etc.)
- DG sets in societies of varied capacities.

## DATA COLLECTION

Five locations were chosen for data collection – DLF Phase 1, DLF Phase 2, Devinder Vihar, New Colony and Time Residency. At majority of these locations, DG sets are owned and operated by a third party, which often operates like a DISCOM.

- CSE installed automatic air pollution monitoring equipment (Envirotech APM 8020) to collect data for five consecutive days.
- Continuous monitoring of PM1, PM2.5, PM4, PM10 and Total Suspended Particles (TSP) for 24 hours with data logging at 5/10/15 minutes intervals.
- Operation hours of DG sets were noted separately.

## POWER CUTS AND DG USE

CSE collected the data for the hours of DG's operations during the study period in all of the selected societies. By sheer chance, the selected societies faced a range of power cuts over the monitoring period both in terms of days as well as number of hours of cut per day (see Figure 1: *Duration of power cut at various locations during the monitoring period*).

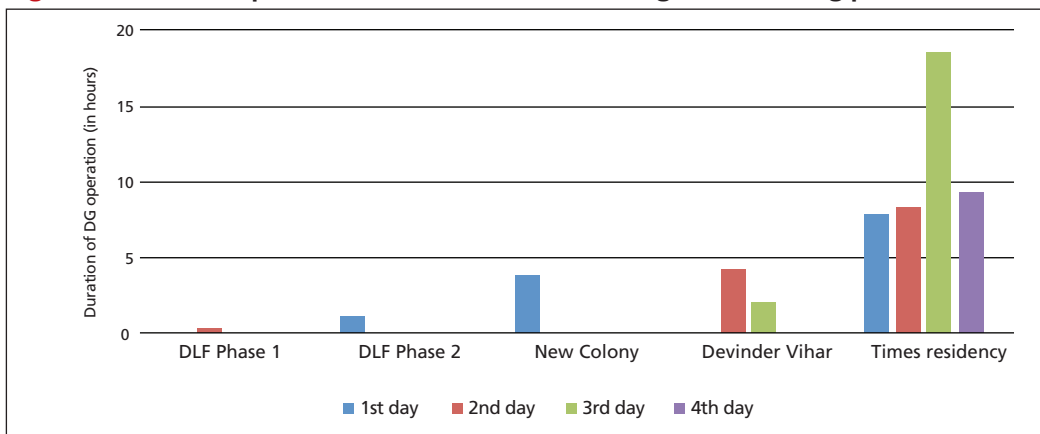


CSE is grateful to Shakti Sustainable Energy Foundation for their support. Shakti Sustainable Energy Foundation works to strengthen the energy security of the country by aiding the design and implementation of policies that encourage energy efficiency, renewable energy and sustainable transport solutions, with an emphasis on sub sectors with the most energy saving potential. Working together with policy makers, civil society, academia, industry and other partners, The Foundation takes concerted action to help chart out a sustainable energy future for India ([www.shaktifoundation.in](http://www.shaktifoundation.in)).

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Figure 1: Duration of power cut at various locations during the monitoring period



Note: There was no power cut on the fifth day of monitoring at any location.

### METHODOLOGY FOR ANALYSIS

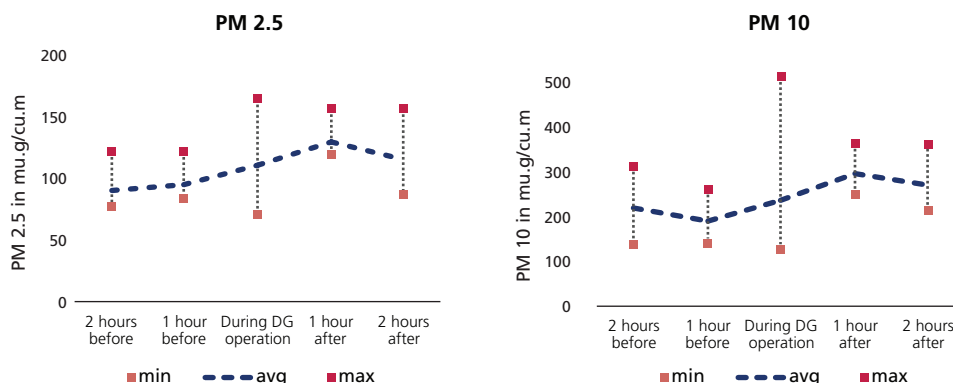
CSE analyzed the minimum, average and maximum level of PM<sub>2.5</sub> and PM<sub>10</sub> pollution levels corresponding to several time periods: two and one hour prior to DG operation; during DG operation; and one and two hours after DG was shut down to understand the immediate impact of DG on pollution in each locality.

For the sake of simplicity, we are including the analysis of the day with the highest number of hours of the DG operation, for the locations which experienced more than one DG operation interval during the period of study (Devinder Vihar and Times Residency).

### CASE STUDY 1: DEVINDER VIHAR

Location	Devinder Vihar
Address	Sector 36, Gurugram
DG capacity	325 kVA
DG serving	Complex with 450 flats in 9 buildings
Monitoring period	17 <sup>th</sup> to 21 <sup>st</sup> May 2018
DG operation time analysed	18 <sup>th</sup> May between 02:34 and 06:44 hrs (for 4 hours)

Figure 2: Pollution levels in Devinder Vihar



### Observation

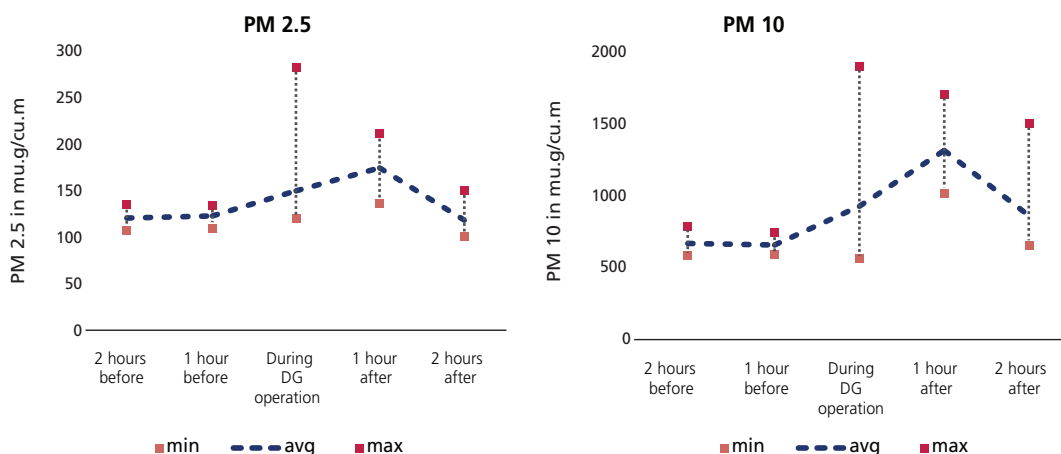
- There was a clear increase in the pollution levels from the period just before the DG was turned on till an hour after the DG set was shut.
- The average PM<sub>2.5</sub> level during the approximate 4 hours the DG was operated was 35% higher than the rest of the day.
- The average PM<sub>2.5</sub> level increased from 90 µg/N.cu.m prior to DG being operated to 110 during DG operation and was as high as 130 for an hour even after it was shutdown. The maximum PM<sub>2.5</sub> level increased from 130 to 180 µg/N.cu.m

- The average PM10 level increased from 190 to 300  $\mu\text{g}/\text{N}.\text{cu}.\text{m}$ . Notably, the average for later 2 hours of the DG operation was as high as 450. After DG was shut the levels were  $\sim 300 \mu\text{g}/\text{N}.\text{cu}.\text{m}$  for the next 2 hours. The maximum PM10 level increased from 250 to 500  $\mu\text{g}/\text{N}.\text{cu}.\text{m}$  when DG was operating.

## CASE STUDY 2: NEW COLONY

Location	New Colony
Address	Sector 7, Gurugram
DG capacity	64 kVA
DG serving	3 houses and a commercial entity
Monitoring period	23 <sup>rd</sup> to 27 <sup>th</sup> May 2018
DG operation time analysed	23 <sup>rd</sup> May between 04:07-07:30 hours (more than 3 hours)

Figure 3: Pollution levels in New Colony



## Observation

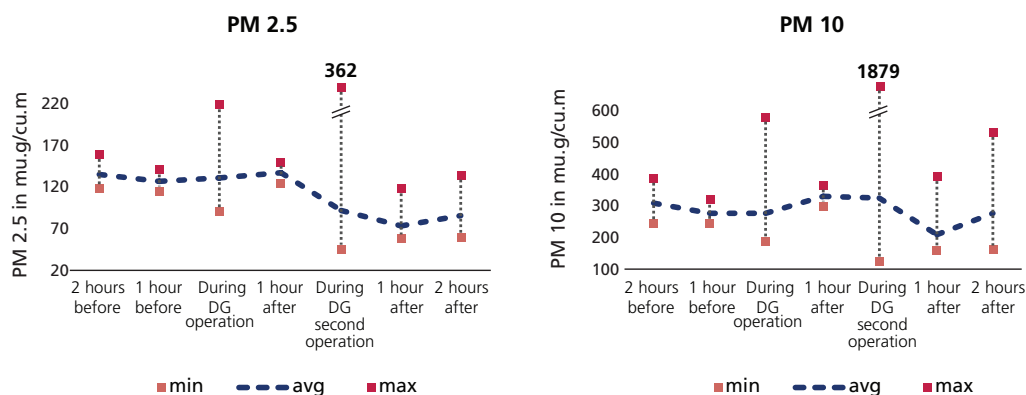
- In this locality, the pollution levels recorded are generally higher than the other locations. This is partly because of its proximity to Delhi-Jaipur expressway and partly because of large number of commercial activities. The average PM 2.5 level was close to 100  $\mu\text{g}/\text{N}.\text{cu}.\text{m}$  for four of the five monitored days and average PM10 concentration was more than 600  $\mu\text{g}/\text{N}.\text{cu}.\text{m}$  for all the monitored days.
- The average PM 2.5 level increases from 120 to 150  $\mu\text{g}/\text{N}.\text{cu}.\text{m}$  during DG operations. This remained over 150 for next 1 hour. The maximum PM2.5 level increased from 130 to 280  $\mu\text{g}/\text{N}.\text{cu}.\text{m}$ .
- The average PM10 level reaches 900  $\mu\text{g}/\text{N}.\text{cu}.\text{m}$  during DG set operation and, since the pollutants accumulated, the PM10 stays at more than 1300  $\mu\text{g}/\text{m}^3$  for the next one hour. The maximum PM10 level increases from 650 to 1900  $\mu\text{g}/\text{N}.\text{cu}.\text{m}$  during DG operations. Post DG operation the level remains  $\sim 1500 \mu\text{g}/\text{N}.\text{cu}.\text{m}$  for over 2 hours.

## CASE STUDY 3: TIME RESIDENCY

Location	Time Residency by Dhoot Builders
Address	Sector 63, Gurugram (at the junction of Sohna road and DLF golf course road)
DG capacity	500 kVA
DG serving	875 residential units in 7 towers
Monitoring period	22 <sup>nd</sup> to 26 <sup>th</sup> May 2018
DG operation time analysed	24 <sup>th</sup> May, from 03:00-10:01, 11:09 - 22:42 (longest operation span within a day).

**Figure 4: Pollution levels in Time Residency**

The graphs below represent the data for the day when DG was operated twice, the first time for seven hours and after a one hour break, for another more than eleven hours.



### Observation

- The area near the Time Residency is going through rapid development hence there is a rising demand for electricity in the area. The society faces frequent power cuts for long duration. and therefore the DG was being operated for number of hours - it was under operation for more than eight hours for four of the five monitored days..
- The average PM2.5 level increases from 125 to 135 µg/N.cu.m before and after DG set operation. The maximum PM2.5 level shoots to 215 µg/N.cu.m during DG operation.
- The average PM10 level increases from 275 to 330 µg/N.cu.m before and after DG set operation. The maximum PM10 level increases from 250 to 500 µg/N.cu.m during the interval of DG operation for the first time. For the interval when DG was under operation for the second time on the day, the maximum PM10 level rises to 1900. For over 25 mins the levels were above 1000. At the same time maximum PM2.5 was over 250.

### CONCLUSION

The DG study by CSE illustrates a grim picture highlighting the contribution of the DG sets to pollution in various localities in Gurugram. Both PM2.5 and PM10 maximum levels shoot up during the DG set operation. The pollution keeps on accumulating during DG set operation resulting in even higher average values in the next hour.

The three case studies above include one society with moderate levels of power cuts and ambient pollution levels (Devinder Vihar), one society with very high ambient pollution (New Colony), and one society with long power cuts and DG operation times.

The average PM2.5 levels increased 30-40% after three to four hours of DG operations and the levels remain high even after one hour of DG shutting its operation. The average levels were more than twice the safe values<sup>1</sup>. The maximum PM2.5 reading in two societies reach worrying levels (about 300 µg/N.cu.m) and were quite high even with moderate hours of DG use.

The average PM10 levels increased by 20-50% after the DG operations of three to four hours and the levels remain considerably high for next one hour. The average levels were more than thrice the safe limits. The results reflect a grave situation with the maximum PM10 readings in two societies is extremely high going beyond 2000 mark and persisting for a fair amount of time. The maximum PM10 levels during DG operation intervals are 5 to 20 times more than the safe limits.

In societies with exceptionally high duration of DG operation the dissipation of pollution is limited resulting in sustained high levels of PM – longer the DG use, higher the ambient levels.

For the societies with very limited power cuts (15-30 minutes) and DG use there is barely discernible impact of DG on air pollution.

Hence, we can conclude that the DG sets' operation in all types of residential societies have very significant impact on the air pollution levels. The localized pollution from DG sets makes it even more dangerous for the people residing in the societies that are operating the DG. CSE believes that installation of Solar Roof Tops can partly and in some cases fully address the issue.

<sup>1</sup> As per National Ambient Air Quality Standards, the safe levels of PM2.5 and PM10 are 60 and 100 µg/m<sup>3</sup> respectively.