Health and environmental benefits of implementing the emission standards for coal-based TPPs

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Based on calculations done using emission data obtained by Greenpeace India from the CPCB under RTI, more than 76,000 people died due to non-implementation of emission standard notification within stipulated time frame (before 7th December 2017) till now during last 1 year.

In 2012, University of Maryland and University of Texas assessed premature deaths resulting from SO2, NOx and PM emissions from 89 coal-based TPP sites across India (Cropper et al 2012). The mean values of deaths per tonne of emissions of each pollutant can be used as the basis for an indicative estimate of the health benefits of implementing the TPP emission standards – or conversely the health costs of delaying implementation.

It is notable that the statistical methodology of Cropper et al results in a lower estimate of total health impacts than the estimate of 80,000-115,000 deaths obtained through more detailed atmospheric modeling carried out by Guttikunda & Jawahar (2014), making the estimates conservative.

Furthermore, the total volume of SO2, NOx and dust emissions reported by the CPCB is more than three times as high as the emissions volume estimated by Guttikunda & Jawahar, a difference that is only very partially explained by different base years: G&J emissions estimates are for 2010-11 while CPCB data is presumably more recent. This implies that the health impacts of coal-based thermal power plants are likely even much more severe than estimated by the authors. Similarly, the mercury emissions from thermal power plants reported by CPCB are more than four times as high as the emissions estimated by UNEP (2013, p. 216) for the year 2010.

Information obtained through an RTI request from CPCB indicates that the full implementation of the TPP emissions standard would reduce SO2, NOx and PM emissions by 48%, 48% and 40%, respectively. The total emissions from the sector reported by CPCB are shown in Table 1.

Combining the data from the CPCB and from Cropper et al, results in an estimate that full implementation of the TPP emission standards would avoid approximately 76,000 premature deaths from air pollution exposure every year (90% confidence interval: 52,000 to 96,000). Of this, 34,000 avoided deaths per year (44%) is due to the reduction in SO2 emissions, 28,000 deaths (36%) due to reduction in NOx emissions and 15,000 deaths (20%) due to reduction in PM emissions.

In other words, a 5-year delay to the implementation of the standards results in an estimated 380,000 avoidable deaths, not taking into account increase in coal-based power generation over that period. A delay of five years in the implementation of the NOx limits alone results in a projected 140,000 avoidable deaths. Additionally, 8.7 gigawatts of coal-based capacity has been commissioned in 2017-18 (Global Coal Plant

Tracker July 2018) and at least 70[1] GW is still under construction (CEA, Sept 2018). If this capacity is not required to comply with the new TPP emission standards, SO2, NOx and mercury emissions per gigawatt of capacity can be expected to be similar to recently commissioned existing plants – the emissions rates for these plants in the absence of new standards are projected from emissions data obtained through an RTI request for seven NTPC coal-based units commissioned in 2012-2016. For PM emissions, new plants have already been required to comply with the 30 mg/Nm3 limit of the new standards and hence further reductions are not expected. On this basis, we can project that compliance with the new standards will reduce SO2 and NOx emissions from new plants by approximately 89% and 79%, respectively. A 60% reduction in mercury emissions is assumed from the installation of Flue Gas Desulfurization and Selective Catalytic Reduction devices, in line with CPCB projection for existing plants.

Similarly to the calculation for existing capacity, these emission reductions will result in a projected 27,000 avoided deaths from air pollution exposure every year, compared with a situation in which all the plants come online and new emission standards are not enforced (90% CI: 18,000 to 34,000). Out of this total, 15,000 avoided deaths per year are due to reduction in SO2 emissions, 12,000 due to reduction in NOx emissions, and 1,000 due to reduction in PM emissions.

The projected reduction in mercury emissions from the power sector is enormous, approximately 180 tonnes per year. Given that India's mercury emissions from all other sources except coal combustion in thermal power plants were estimated at 95 tonnes per year in 2010 (UNEP 2013, p.216), the implementation of the TPP emission standards could reduce total national emissions by approximately 40%, even allowing for growth in emissions from other sectors. In absolute terms, the reduction is equal to three times the total mercury emissions of the United States[2]. Implementing the TPP emission standards would highly likely be the largest contribution to reducing mercury emissions to air anywhere in the world since China started implementing similar standards around 2005.

Table 1: Emissions data given by CPCB for existing plants

Pollutant	Current Emissions	Reductions from implementing standards	Emissions Estimates used by Guttikunda & Jawahar (2014)	Emissions Estimated by UNEP (2013)	unit
SO2	7.00	-48%	2.10	-	Mt/yr
NOx	6.46	-48%	1.99	-	Mt/yr
PM	5.43	-40%	1.21[23]	-	Mt/yr
Hg	216600	-60%	-	49500	kg/yr

Table 2: Avoided deaths from implementation of new TPP standards for existing coal-based plants

Pollutant	Emission reduction	Deaths per ton of emission		Avoided deaths per year

1 http://www.cea.nic.in/reports/monthly/broadstatus/2018/broad_status-08.pdf

2 The United States' mercury emissions were estimated at 56 tonnes in 2010 (UNEP 2013), resulting almost solely from coal combustion, which has fallen by more than 30% from 2010 to 2016.

3 PM10 emissions; total dust emissions not given but likely to be 50-100% higher.

	(Mt/yr)	Mean	5th percentile	95th percentile	Best estimate	5th percentile	95th percentile
SO2	-3.36	0.010	0.007	0.012	33600	23520	40320
NOx	-3.10	0.009	0.006	0.012	27907	18605	37210
PM2.5[4]	-0.65	0.023	0.015	0.029	14987	9774	18896
Total					76494	51899	96426

Table 3: Estimated emissions from coal-based TPPs newly commissioned and under construction, and projected emissions reductions resulting from implementing the new emissions standards

Pollutant	Baseline emissions	Current typical emissions value	Standard (mg/Nm3)	Emission reduction from implementing new standard		
				%	volume	unit
SO2	1.74	896	100	-89%	-1.55	Mt/yr
NOx	1.61	483	100	-79%	-1.27	Mt/yr
PM2.5	0.08	30	30	0%	0.00	Mt/yr

Table 4: Avoided deaths from implementation of new TPP standards for new coal-based plants

Pollutant	Avoided deaths per year		
	Best estimate	5th percentile	95th percentile
SO2	15465	10826	18558
NOx	11463	7642	15284
Total	26928	18468	33843

Table 5: Reduction in mercury emissions from existing and new TPPs as co-benefit of implementing the emissions standards for major air pollutants

Category	Capacity (GW)	Baseline emissions (kg/yr)	Emission reduction from implementing new standard	
			%	kg/yr
Plants operated by 2016	209.5	216600	-60%	-129960

4 To estimate PM2.5 emissions from total dust emissions, a ratio of 24:80 was used, based on U.S. EPA (1996).

Newly commissioned and under construction plants	83.7	86547	-60%	-51928
Total	293.2	303147		-181888

References

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