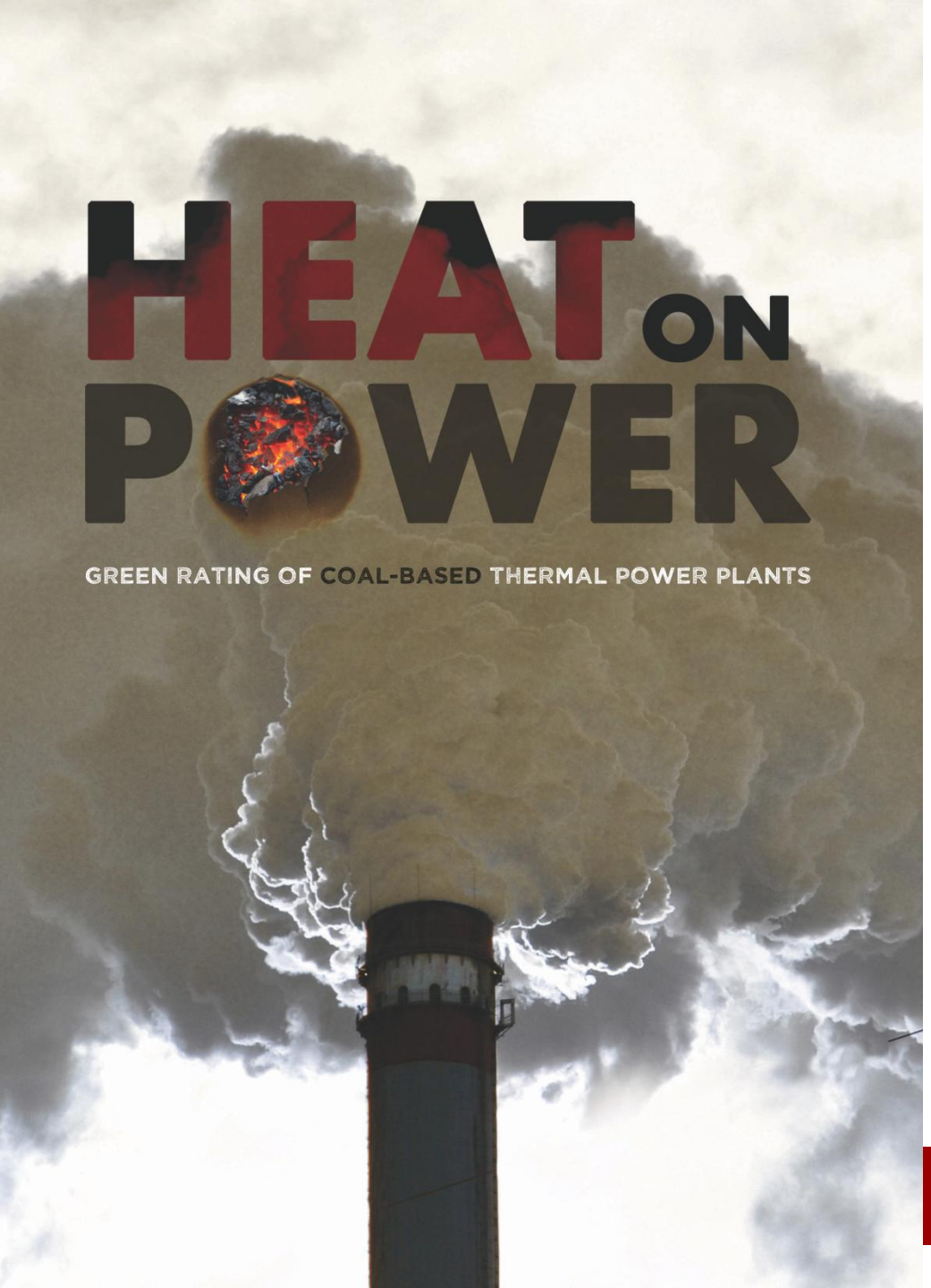
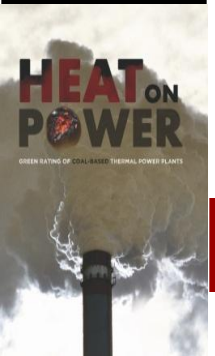


CSE THE FIVE LEAVES AWARD

Green Rating: What we do and why?

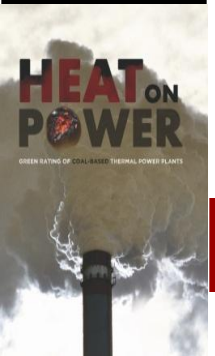
CSE's Green Rating Project - what and why?

- ✓ GRP is a public tool to leverage change
- ✓ It benchmarks the present. And points to the way ahead
- ✓ It sets difficult goal-posts: Pushes towards desirable not what is easily achievable



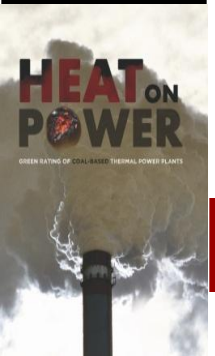
Our Belief

- ✓ Public disclosure must for credible action
- ✓ We rate everyone – who agree or those who do not. Environment is public good
- ✓ Industry will grow, but growth has to be business-unusual



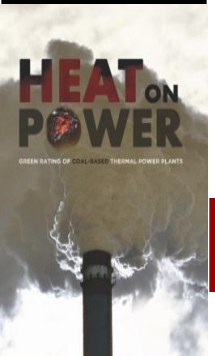
‘Working’ industry: rating and re-rating

- ✓ Pulp and Paper 1999
- ✓ Pulp and Paper revisited 2004, 2013

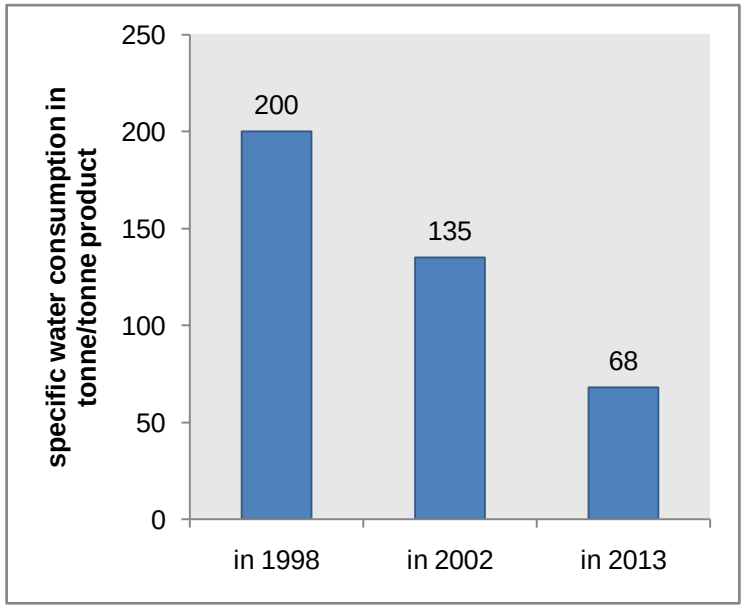


Differences made

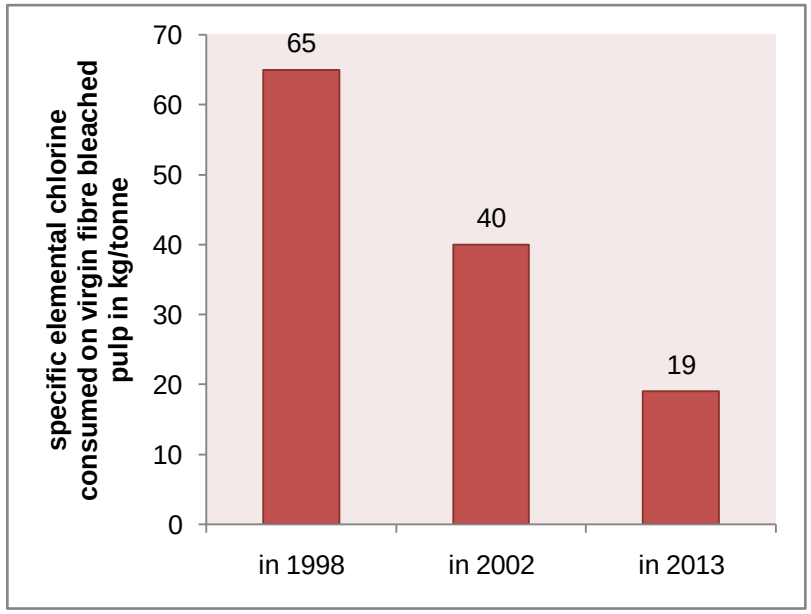
- ✓ Difference was willingness of the companies to participate and engage
- ✓ Difference was significant improvement in environment management systems



Reduction in specific water consumption

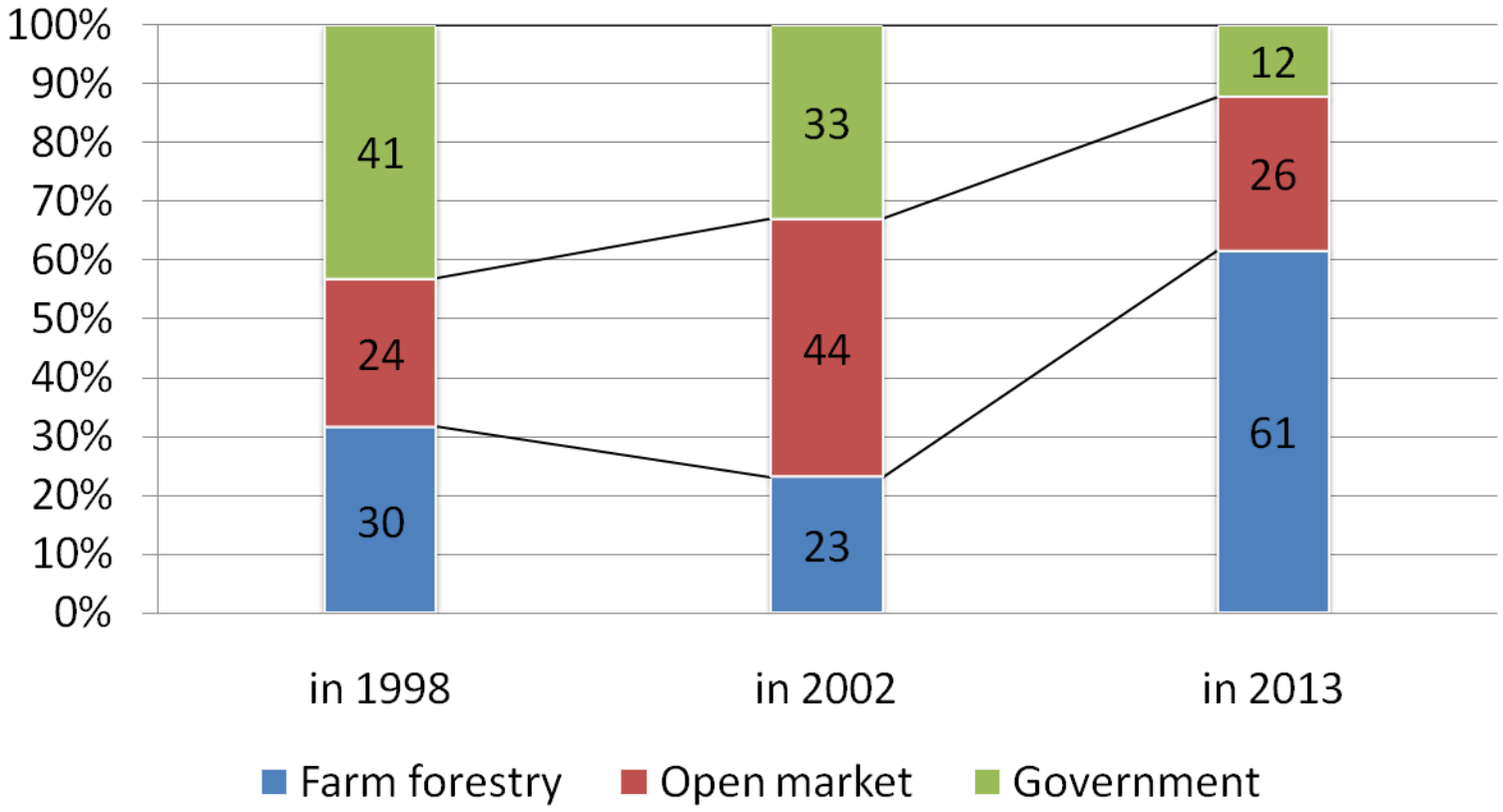


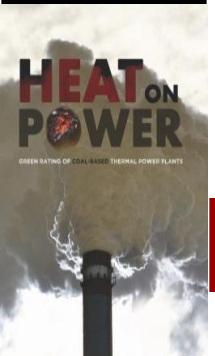
Reduction in elemental chlorine consumption



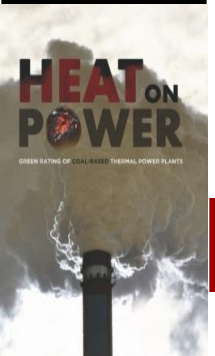
Differences made

Sustainable Sourcing: Increase in wood sourced from farms

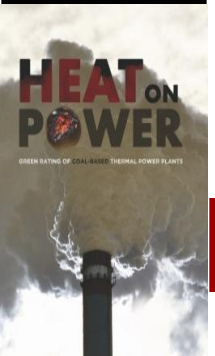




Automobile Rating 2001

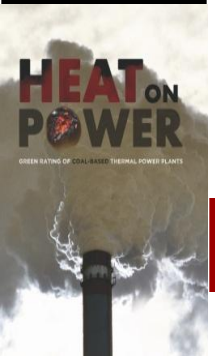


Chlor-Alkali 2002

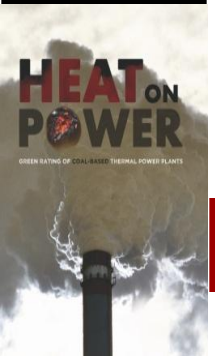


Cement 2005

- ✓ Recognition that Indian cement industry is matching global best standards for energy use and GHG emissions. Changed the perception of industry and pointed to challenges of mining

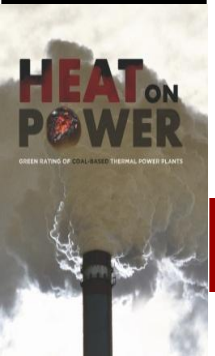


Steel 2012



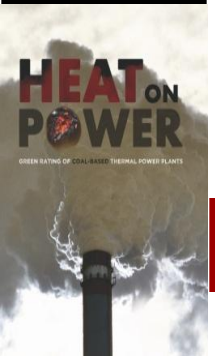
Rationale for rating coal- based thermal power sector

- ✓ Core industrial sector - set to expand
- ✓ Resource intensive – water, coal and land
- ✓ High pollution potential
- ✓ Responsible for more than half the country's GHG emissions



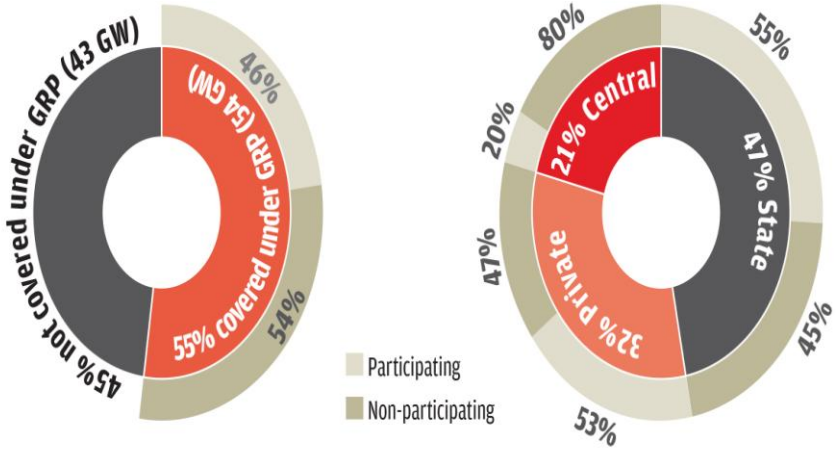
Coal thermal power

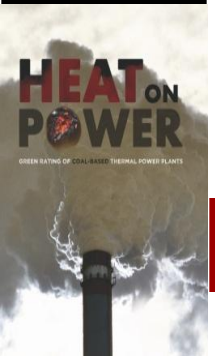
- ✓ Difficult issue for environmentalist
- ✓ Would like it to go. Huge costs of extraction; fossil use in climate change; pollution impacts on local communities
- ✓ But recognize that it will stay for countries like India. No country has disengaged as yet. So even as we push for renewables the question is how to clean coal thermal power
- ✓ Is it possible? What do we do? How?



Study coverage

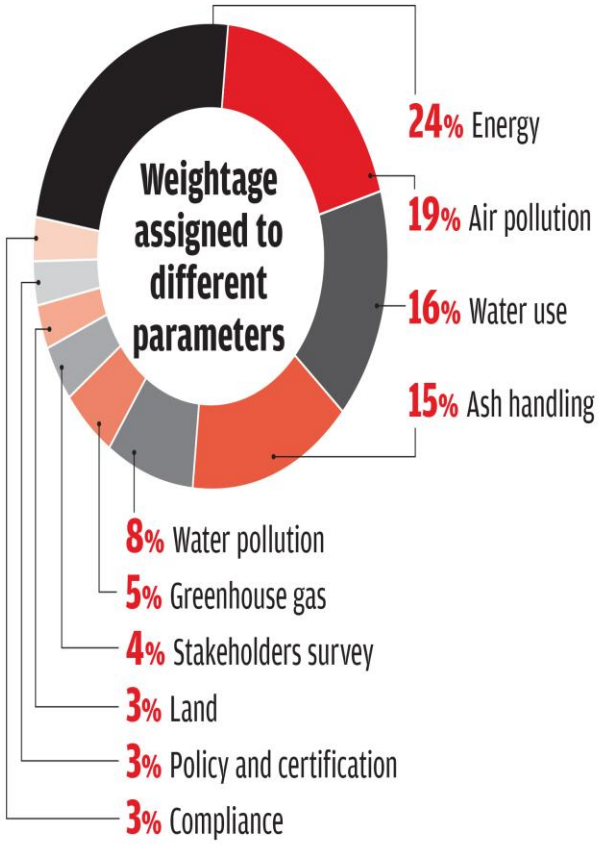
- ✓**Sample size:** 47 plants, 54 GW
- ✓**Over half the sector's capacity** when study began early 2012
- ✓**Just under half participated;** non-participating also rated based on survey of plant location and stakeholders, secondary information
- ✓Good participation by state-owned; Only 2 of 10 central ones agreed

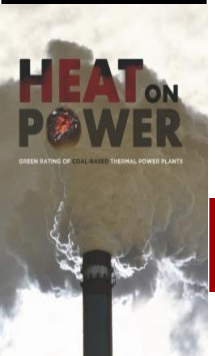




Weightages

Segments	Weightage (%)
Resource Efficiency	19
Land	3
Water	16
Energy and GHG	29
Pollution	42
Water Pollution	8
Solid Waste	15
Air Pollution	19
Policy, compliance and stakeholder 's survey	10

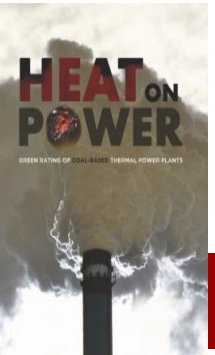




CSE

THE FIVE LEAVES AWARD

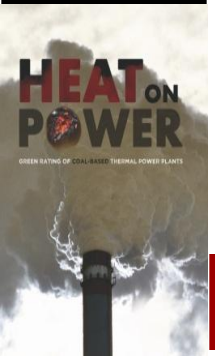
THE TOP THREE



Trombay Power: 3RD BEST PLANT

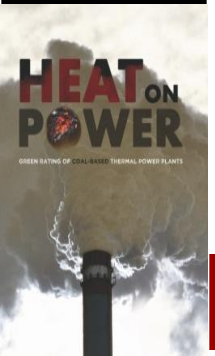
SCORE - 48 %

- ✓ Two coal- fired units (250MW and 500 MW)
- ✓ One of the highest plant availability; 94%
- ✓ Dry Fly ash handling; 100 % Fly ash use
- ✓ Coastal plant; low fresh water need;0.5 m^3/MWh
- ✓ Average efficiency; 34 %
- ✓ Above average pollution control; FGD for SO_2 emission control



JSW Toranagallu Power 2ND BEST PLANT
SCORE - 49 %

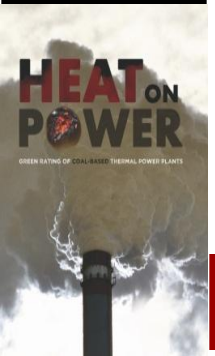
- ✓ Above average efficiency: 38%
- ✓ 91 % availability: 94 % PLF
- ✓ One of the lowest CO_2 emitter: 0.93 kg/kWh
- ✓ One of the most water-efficient ; 2m^3/MWh
- ✓ Zero liquid discharge: RO for effluent treatment
- ✓ Average ash use; Gainful use only 51%
- ✓ FGD for SO_2 control; not available



CESC Ltd

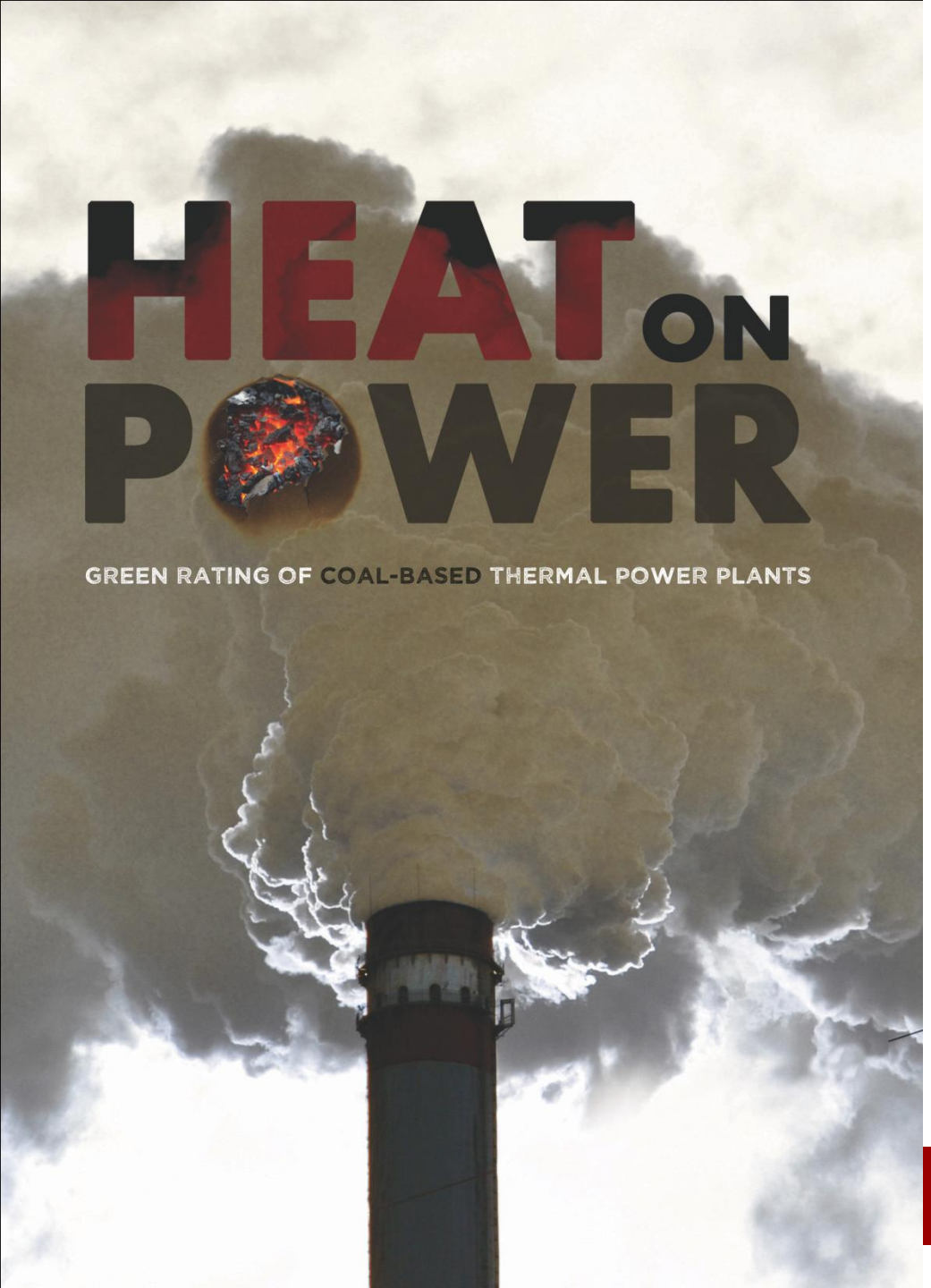
Budge- Budge Power BEST SCORE - 52 %

- ✓ Commendable efforts for water conservation; 2.2 m^3/MWh, Zero liquid discharge
- ✓ Commendable efforts for ash handling & use:
  - ♦ *Complete dry fly ash handling*
  - ♦ *Bottom ash dewatering system*
  - ♦ *100 % Fly ash use; 76 % gainful use*
  - ♦ *HSCD system, pneumatic ash transport & store*
- ✓ One of the highest plant availability: 93 %
- ✓ Efficiency better than average: 35.7 %
- ✓ Meets stricter PM norms of 50-75 mg/Nm^3
- ✓ No FGD for SO_2 control



	Plant	Score (%)	Award
1.	CESC-Budge Budge	52	
2.	JSWEL-Toranagallu	49	
3.	Tata-Trombay	48	
4.	JSWEL-Ratnagiri	44	
5.	Reliance-Dahanu	39	
6.	JPL-Raigarh	39	
7.	GIPCL-Surat	38	
8.	NLC-Barsingsar	38	
9.	Tata-Jojobera	37	
10.	Tata-Mundra	36	
11.	Reliance-Rosa	30	
12.	NTPC-Sipat	28	
13.	Torrent-Sabarmati	28	
14.	Lanco-Udupi	27	
15.	Adani-Mundra	26	
16.	NTPC-Kahalgaon	26	
17.	NTPC-Ramagundam	25	
18.	NTPC-Talcher Kaniha	24	
19.	RRVUNL-Kota	23	
20.	KSK-Wardha Warora	23	
21.	OPGCL-Ib Valley	23	
22.	MPPGCL-Birsinghpur	23	
23.	Maithon Power	22	
24.	NLC II-Neyveli	22	
25.	Lanco-Amarkantak	22	
26.	NTPC-Singrauli	21	
27.	APGENCO-Vijayawada	21	

28.	TANGEDCO-Tuticorin	19	No leaves
29.	WBPDCL-Bakreshwar	19	No leaves
30.	PSPCL-Ropar	18	No leaves
31.	TANGEDCO-Mettur	18	No leaves
32.	GSECL-Wanakbori	17	No leaves
33.	HPGCL-Hissar	16	No leaves
34.	NTPC-Badarpur	16	No leaves
35.	TSGENCO-Kothagudem V & VI	15	No leaves
36.	CSPGCL-Hasdeo	15	No leaves
37.	WBPDCL-Bandel	13	No leaves
38.	DVC-Mejia	13	No leaves
39.	MAHAGENCO-Chandrapur	12	No leaves
40.	UPRVUNL-Anpara- A & B	12	No leaves
41.	MAHAGENCO-Nasik	11	No leaves
42.	TSGENCO-Kothagudem ABC	11	No leaves
43.	KPCL-Raichur	10	No leaves
44.	TVNL-Lalpania	9	No leaves
45.	DVC-Bokaro 'B'	8	No leaves
46.	UPRVUNL-Obra	8	No leaves
47.	JSEB-Patratu	6	No leaves



CSE THE FIVE LEAVES AWARD

WAY AHEAD

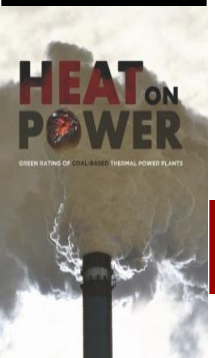
Huge environmental footprint

Water: 70 per cent of the total freshwater withdrawal by industrial sector

Coal: Over 70 per cent of the total coal consumed in country

Pollution: Of the total industrial sector:

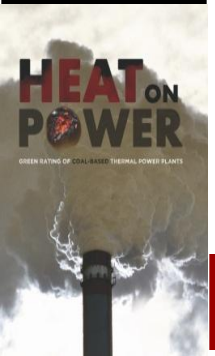
- 60 per cent of PM emissions
- 45-50 per cent of SO_2 emissions
- 30 per cent of NOx emissions
- More than 80 per cent of mercury emissions



Resource efficiency will determine future

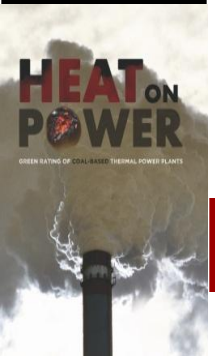
Resource efficiency is critical – energy, water and waste recycling

- **India too poor to waste**
- **India too poor to pollute and then clean up – more we use the more we have to spend to clean up. The way ahead is to be efficient in land, water, raw material use**
- **Efficiency determines CO2 emissions**

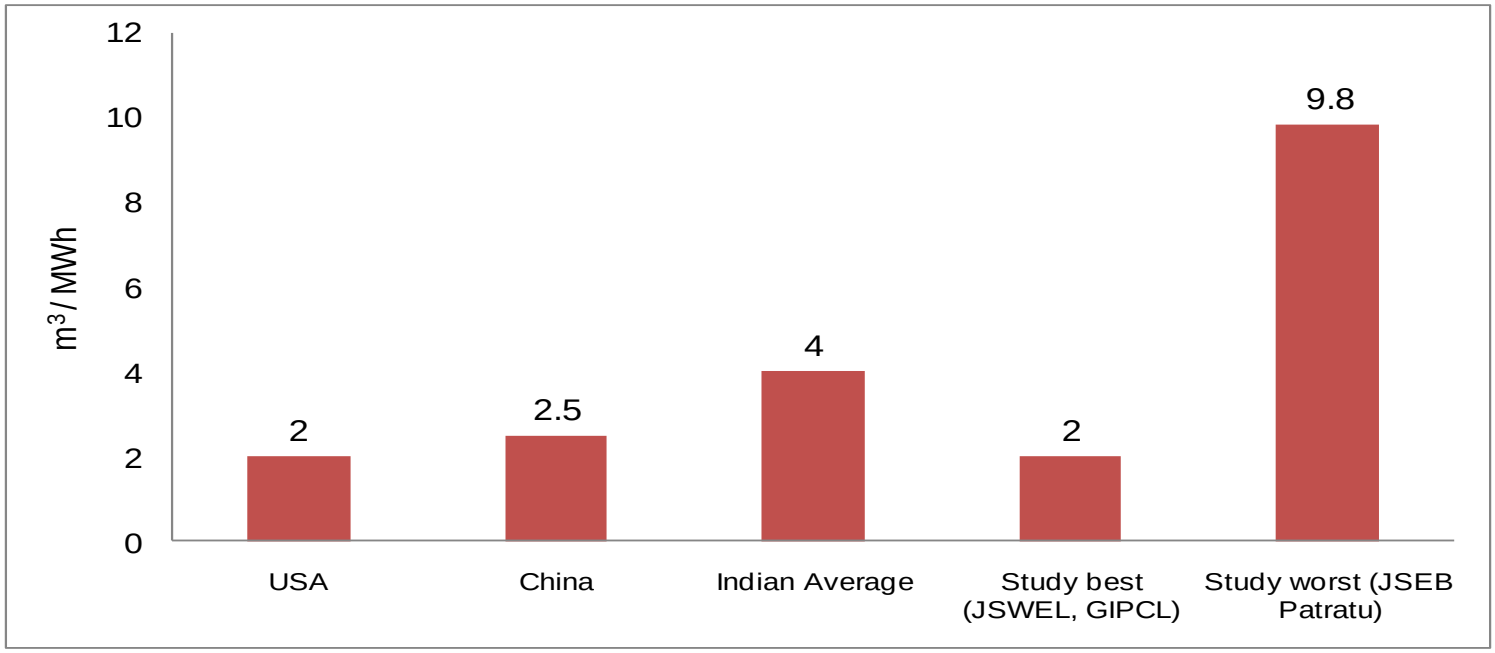


Resource use - land

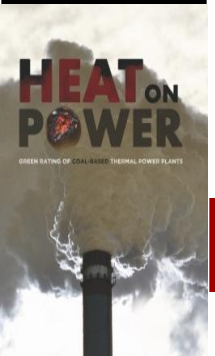
- Average around 2 acres/MW, CEA's latest guidelines suggest 1.09 acre/MW;
- Worst performer:- Mahagenco Chandrapur uses 10.8 acres/MW
- Over 40% was used for ash disposal
- Old state-owned plants have nearly 4 times more land per MW than new private plants



Resource use - water

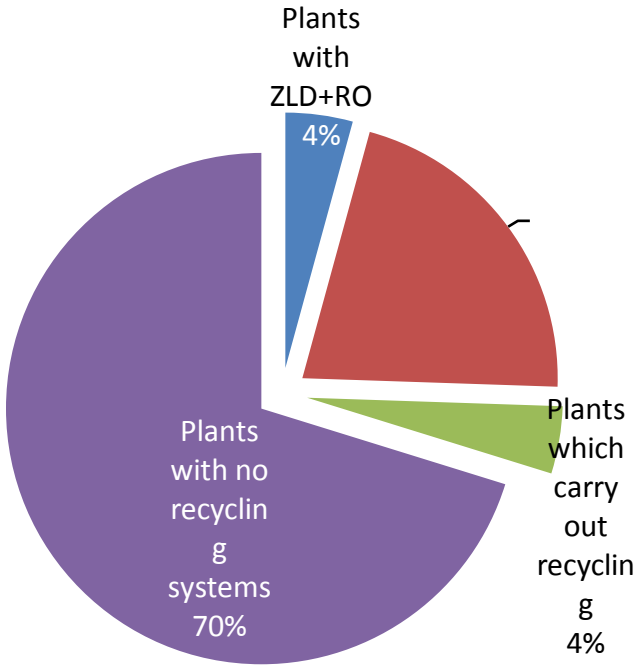


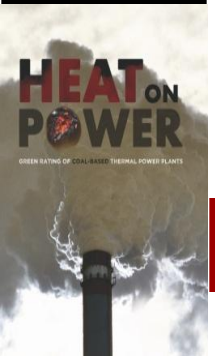
- Inefficient water users; global best 1.6 m^3/MWh
- Annual water draw (around 22 BCM), is over half of India's total domestic water needs
- Two thirds of the plants located in water stress areas



Waste water

- Power plants can easily be a zero-liquid-discharge; less than a third were even recycling.
- 20 plants were discharging ash slurry into water bodies, a serious violation
- Effluent samples taken by CSE show 39 per cent violated total suspended solid norm

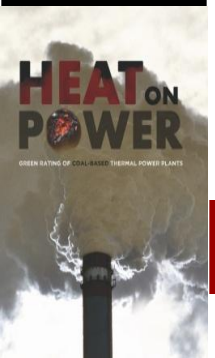




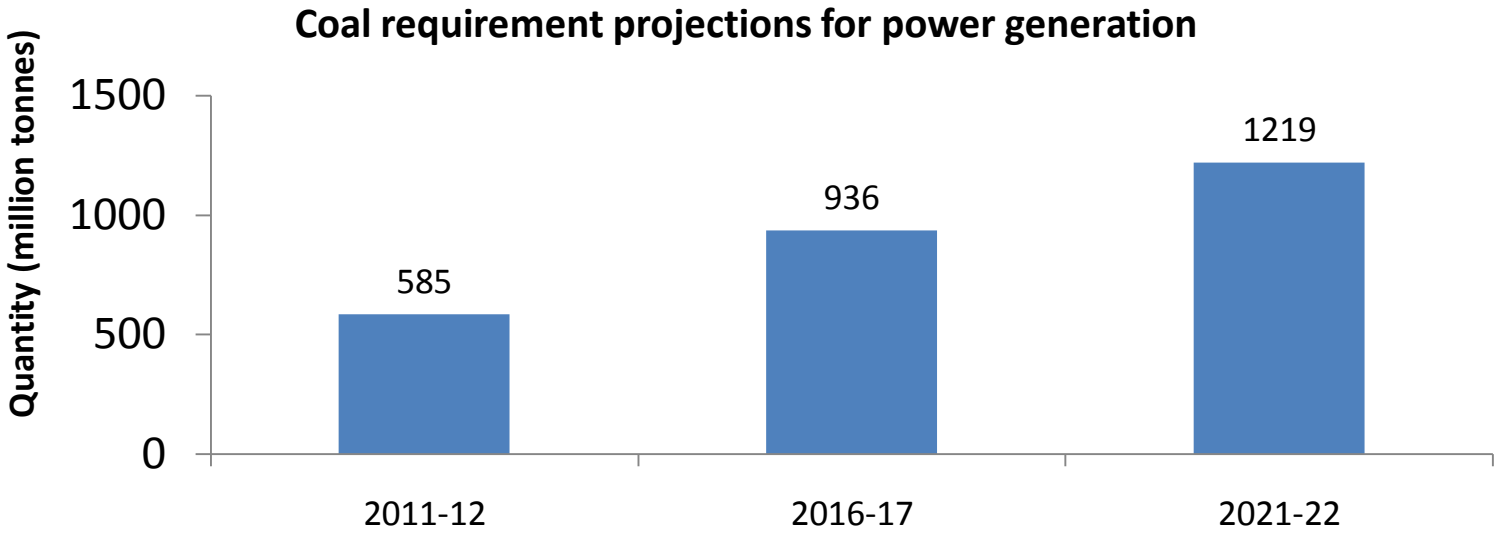
Way forward: set norms

- Norms for water use should be incorporated in clearances.

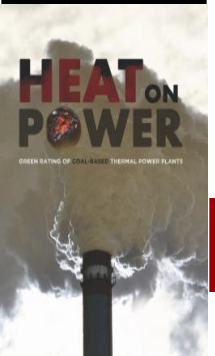
- MoEF draft notification April 2015
- All plants with once through cooling (OTC) to install cooling tower and achieve specific water consumption max 4 m3/MWh within 2 years
- CT plants to reduce to 3.5 m3/Mhr
- New plants after Jan 2017 to have 2.5 m3/Mhr/zero liquid discharge



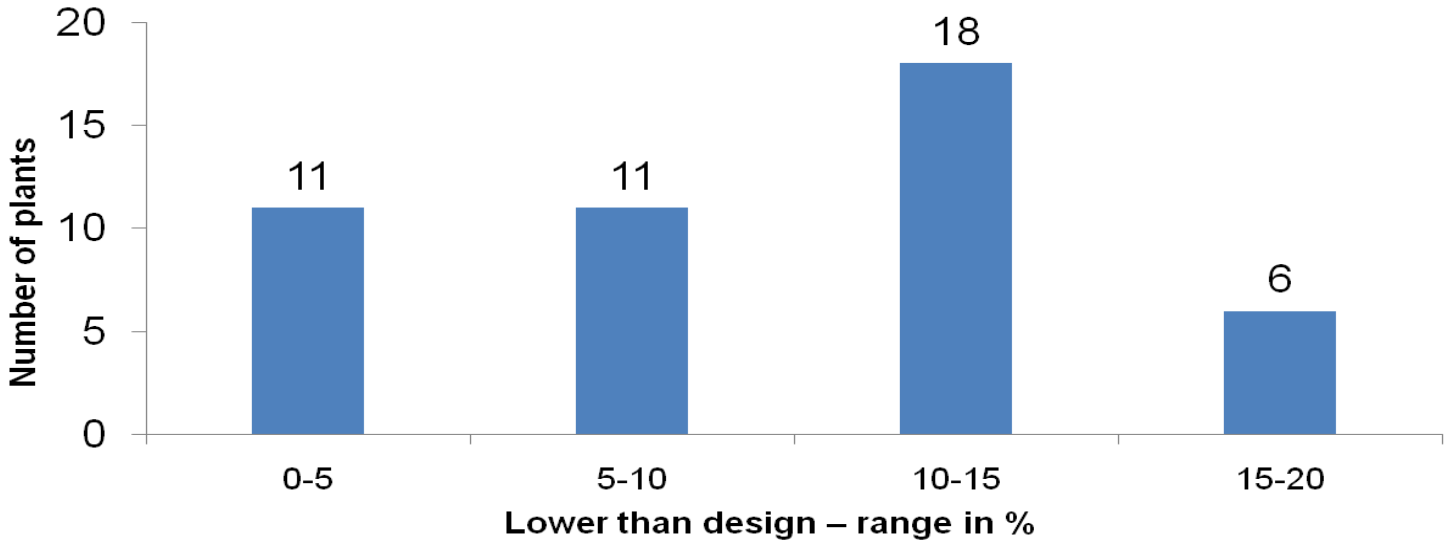
Resource needs - coal



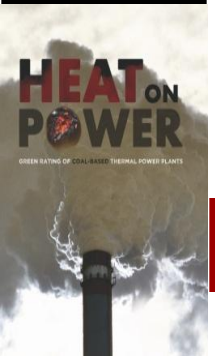
- Increase in transportation infrastructure
- 2-3 times increase in coal beneficiation capacity to use very poor quality coal



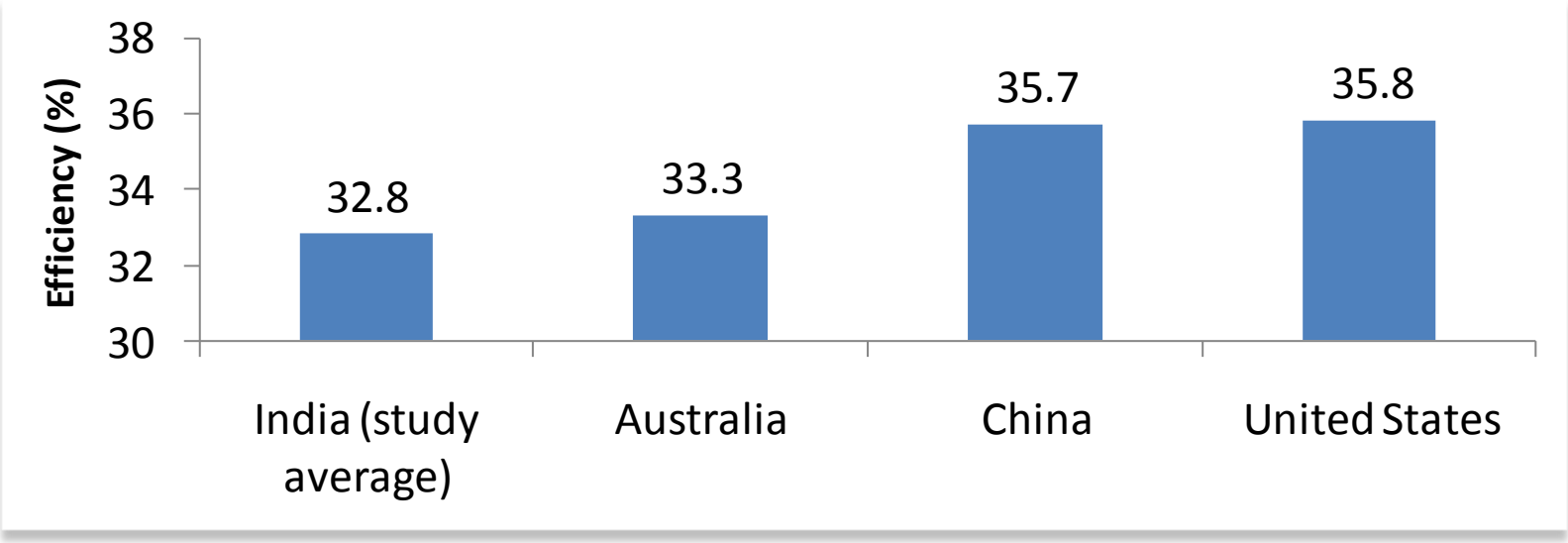
Efficiency: Actual vs. design



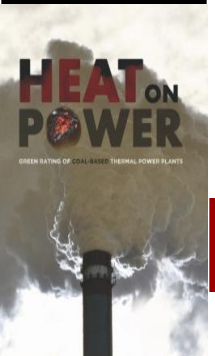
- ✓ In more than half plants efficiency was 10% lower than design. Points to poor O&M
- ✓ Age is factor, but huge variations; Newer plants such MPPGCL Birsinghpur – 20%+
- ✓ State-owned old plants were the worst performers



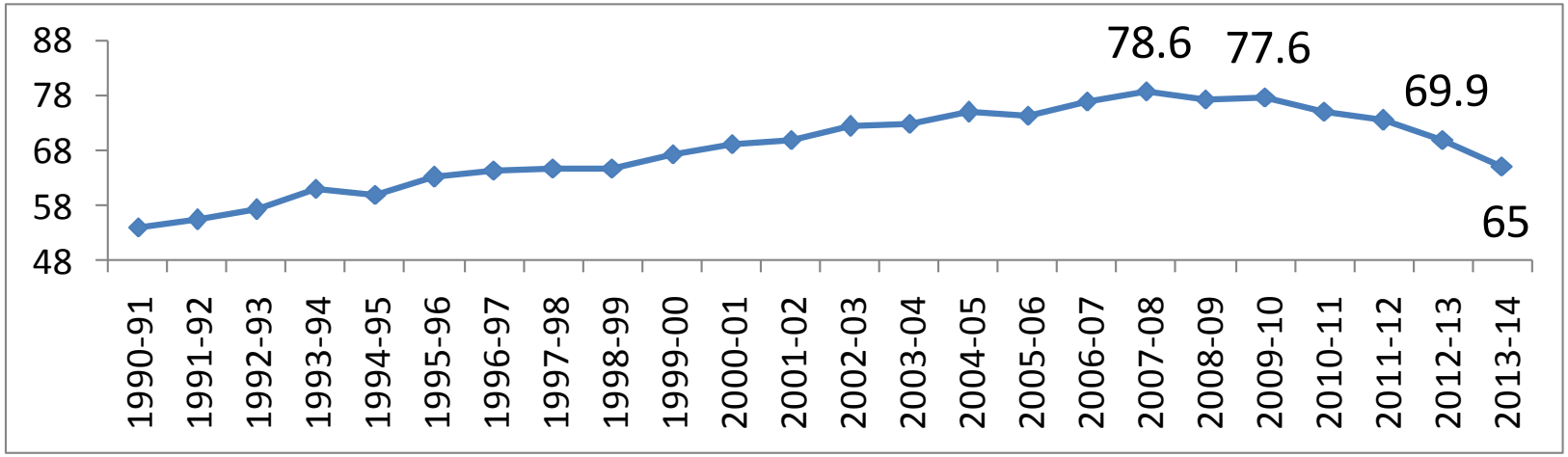
Energy (in)efficiency



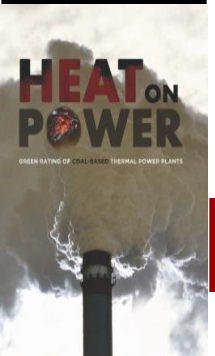
- ✓ Among the least efficient in the world. GRP study average was just 32.8%
- ✓ Impact on GHG
- ✓ Dated technology - SC offer 3-4% higher efficiency
- ✓ No policy push to close inefficient plants, to allow new only SC



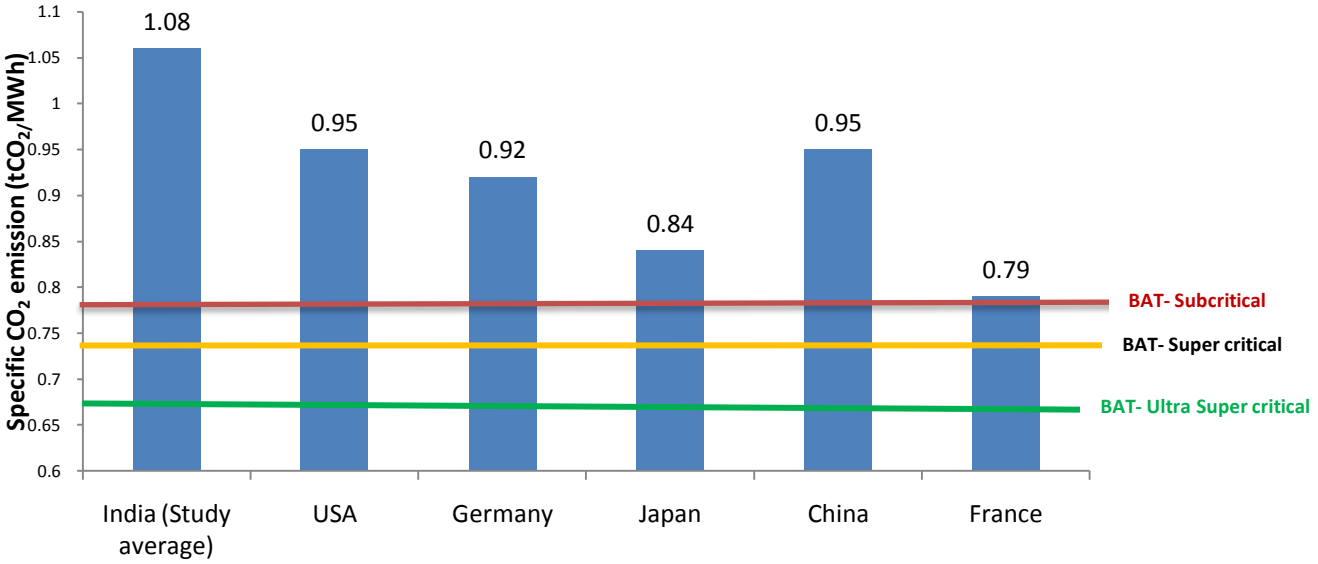
PLF (in %)



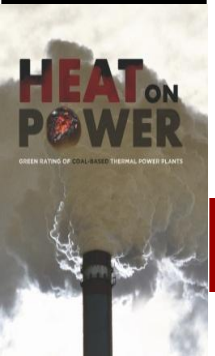
- ✓Overall demand down; excess capacity during night time decline in demand
- ✓Stagnant coal production, evacuation bottlenecks in railways have constrained supply
- ✓State discom weak financial position limited their power purchasing capability



CO_2 : improving efficiency key to cutting emissions



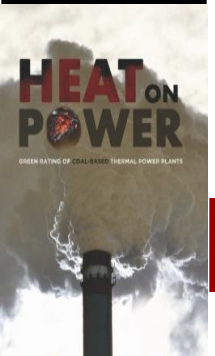
- Coal plants responsible for over half of GHG emissions
- Sample average was 1.08 tCO_2/MWh; 45% higher than the global best; 14% higher than Chinese average

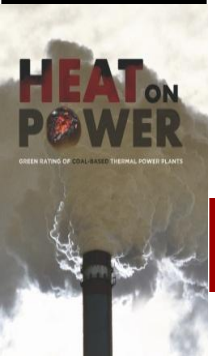


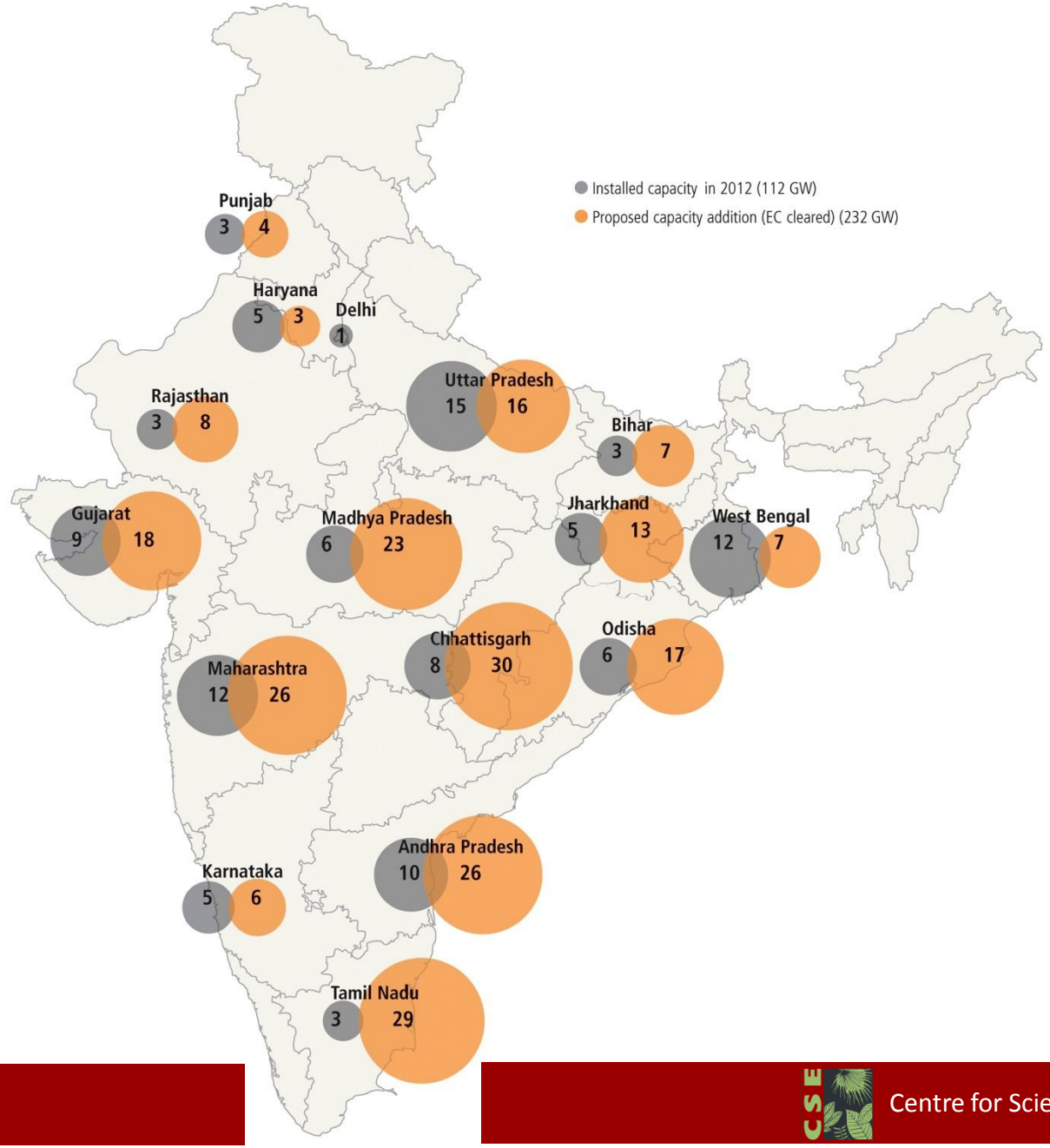
Most efficient stock least efficiently utilized

Rank (score)	Plant	Gross Efficiency (%)	PLF (%)
10 (36%)	Tata - Mundra	38.1	74
12 (28%)	NTPC - Sipat	36.5	68.3
15 (26%)	Adani - Mundra	31.5	52.4

Should we be building more power plants or incentivizing existing to produce more and efficiently?

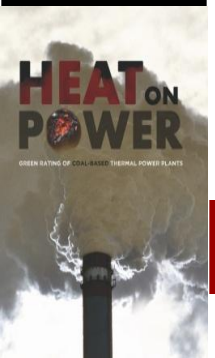



HEAT ON POWER

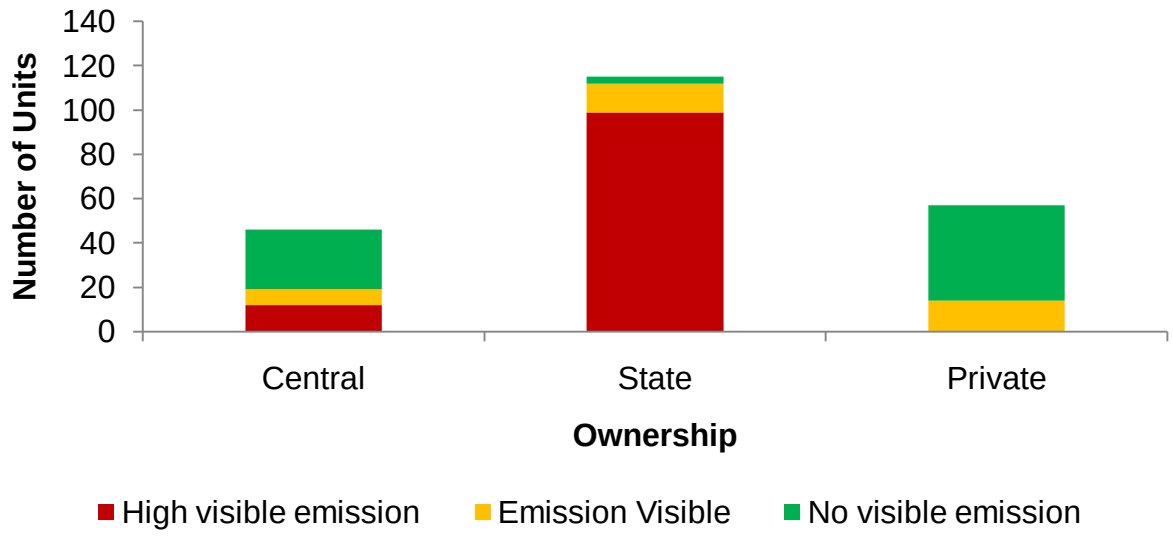

Installed capacity in 2012 (112 GW)
Proposed capacity addition (EC cleared) (232 GW)
Punjab 3 4
Haryana 5 3
Delhi 1
Rajasthan 3 8
Uttar Pradesh 15 16
Bihar 3 7
Gujarat 9 18
Madhya Pradesh 6 23
Jharkhand 5 13
West Bengal 12 7
Chhattisgarh 8 30
Odisha 6 17
Maharashtra 12 26
Andhra Pradesh 10 26
Karnataka 5 6
Tamil Nadu 3 29

Way forward: Technology and efficiency

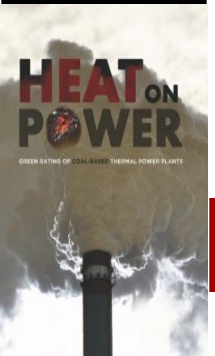
- Old inefficient plants that are heavily polluting should be retired or modernized at an accelerated pace; Environmental clearance process should incentivize this
- New capacities should be only supercritical/ultra super critical
- Inclusion of environmental costs/ compliance in Merit Order Dispatch; we should ensure that most efficient stock is utilised the most and polluting plants are not called first because they are cheaper.



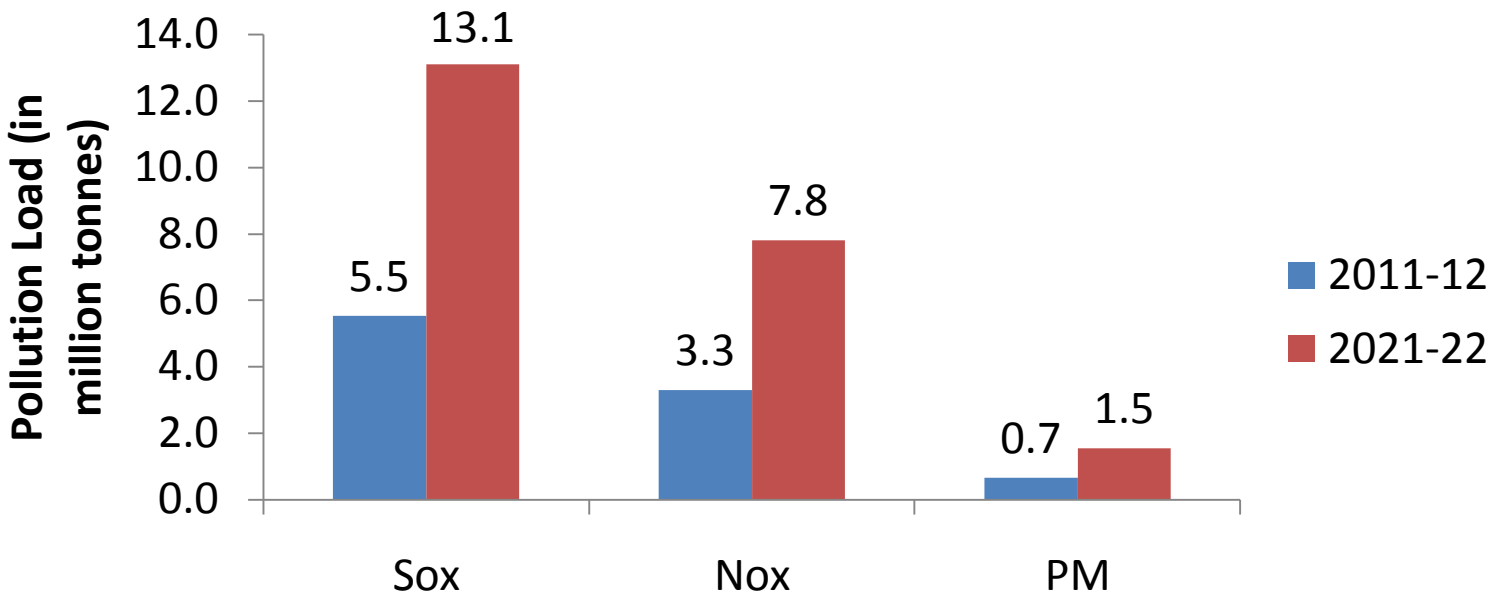
Air Pollution - PM



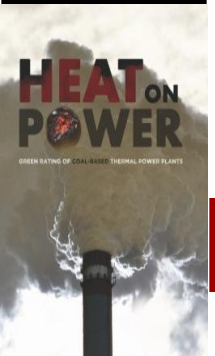
- **National PM emission norms lax (150- 350 mg/Nm^3), China: 30 mg/Nm^3.**
- **More than half violating, of which 85 per cent were state plants**
- **No national NO_x ,SO_2, and Hg standards**
- **Ambient Air Quality – only 7 monitor continuously**



Pollution load, if unchecked

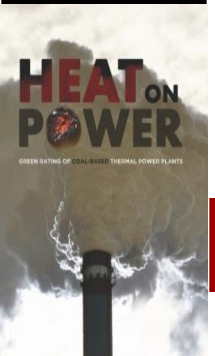


Massive increase in clusters: cumulative load



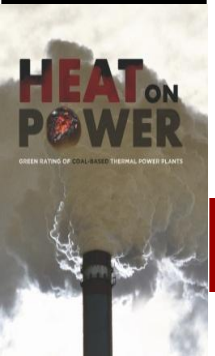
Mismatch between regulation and environmental footprint

	China	China *(polluted regions)*	India
PM (mg/Nm^3)	30	20	150-350 (50 for some)
SO_2 (mg/Nm^3)	100	50	None
NO_x (mg/Nm^3)	100	100	None
Hg (mg/m^3)	0.03	0.03	None

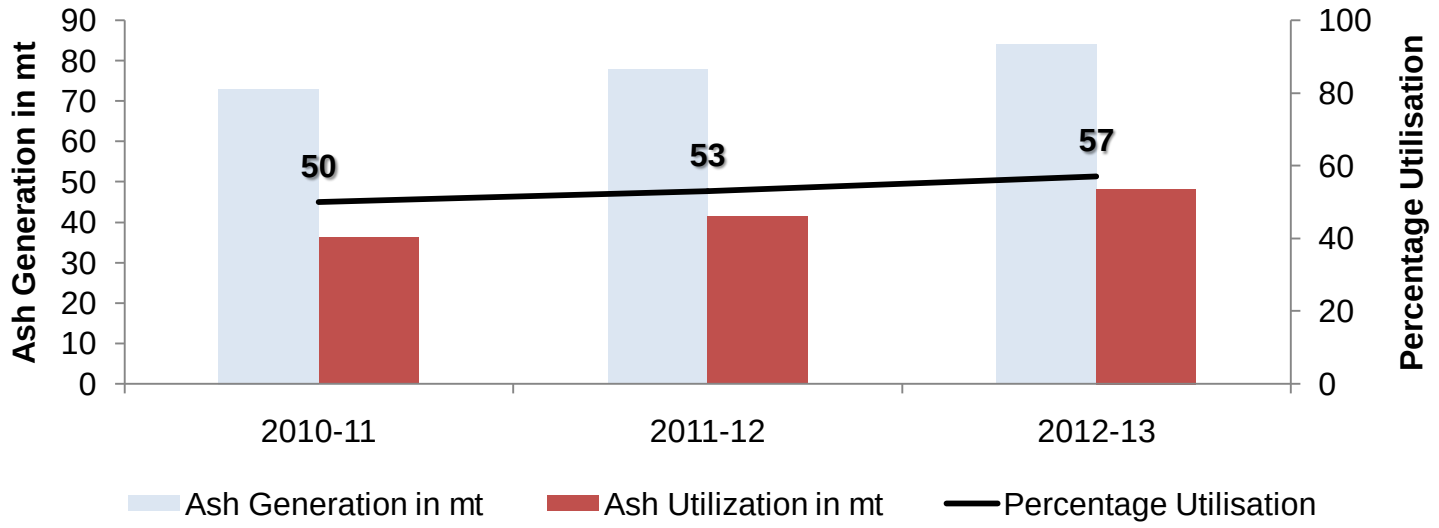


New Standards Proposed: draft notification

	India (old)	*India (2003-2016)*	India (2017 onwards)
PM (mg/Nm^3)	100	50	30
SO_2 (mg/Nm^3)	200-600	200	100
NO_x (mg/Nm^3)	600	300	100
Hg (mg/m^3)	0.03	0.03	0.03



Solid waste - Ash

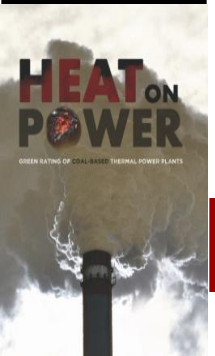


Second largest solid waste stream of the country.

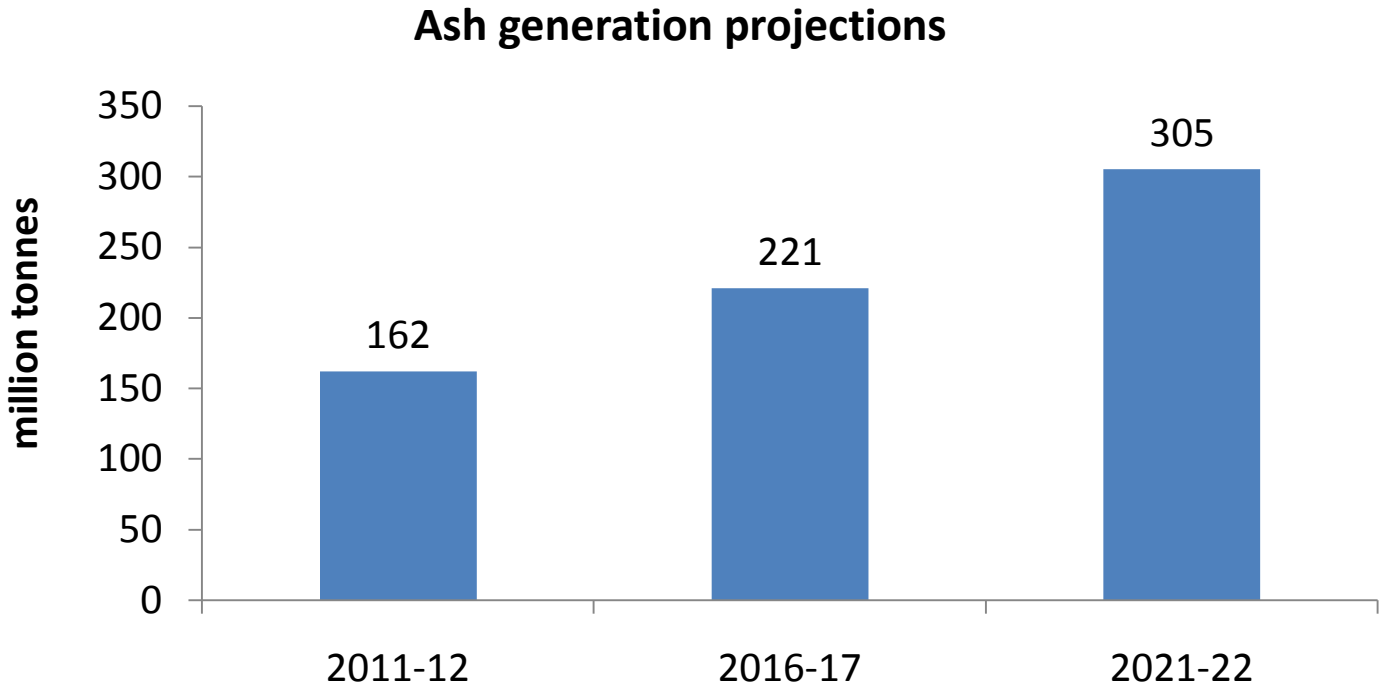
Average utilisation during 2010-13 was only 53 per cent for plants in study

However, one-third of this was not beneficial.

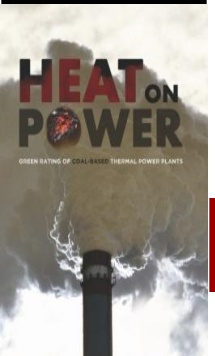
Unused ash dumped in poorly maintained ponds (around 80% non compliance – lining, leakage, no piezometers)



Fly ash

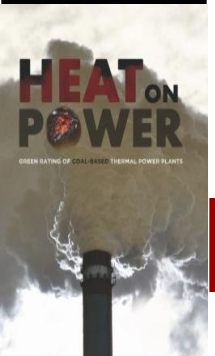


- **Presently, more than a billion tonne of ash lying unused in ash ponds across the country.**
- **Ash generation to double by 2022**



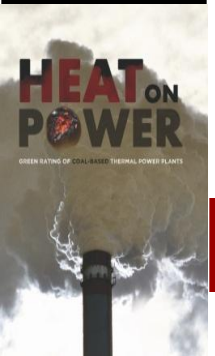
Way forward: Ash Handling

- Most plants will not meet ash use targets due to inadequate supporting policies to increase use;
- Policies and regulations to change
  - Promotion, standards for utilisation and then strict implementation of policies on ash use in infrastructure, bricks, cement industry etc.
  - Loopholes that allow dumping, yet consider it utilization (for eg. in low lying areas) need to be addressed;
  - Standards and guidelines for use of ash for mine filling
  - Flexible regulation to take into consideration plant location

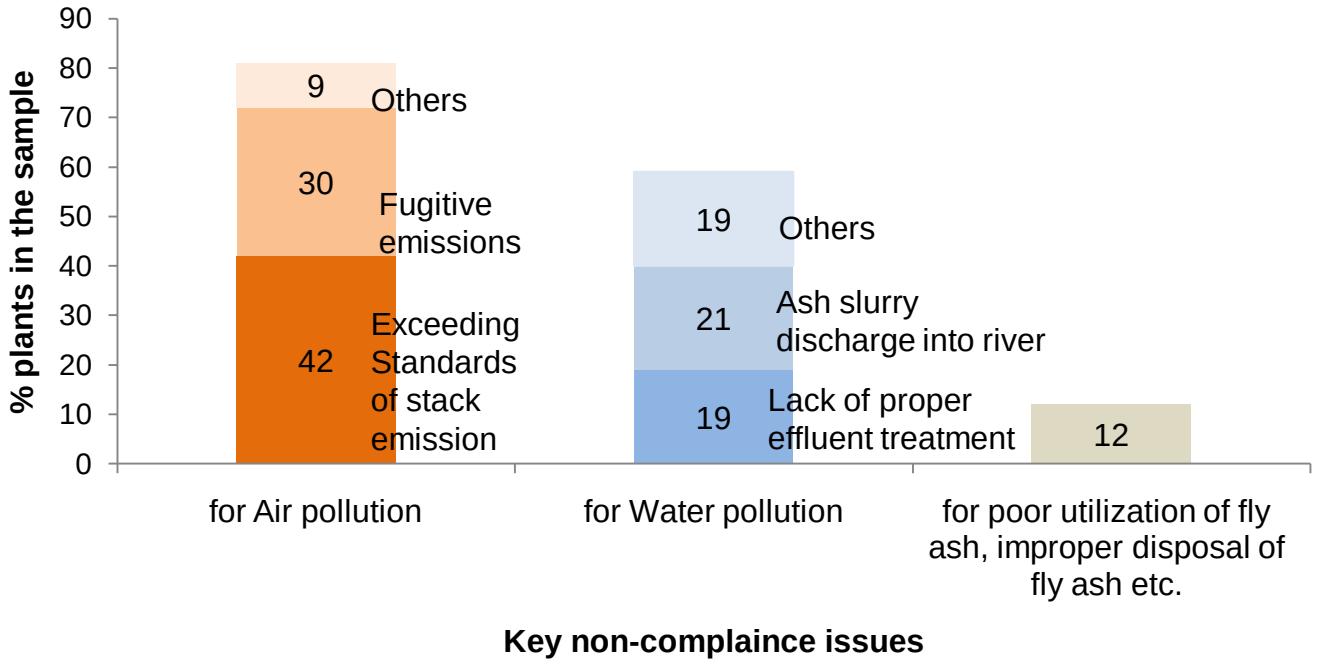


Way forward: Improved assessment and regulatory tool

- Pollution monitoring and control by regulators are weak; need capacity and tools
    - Protocol and infrastructure for online monitoring
    - Institutional strengthening and use of multiple tool to enforce norms
- Have to improve regulatory capacity for pollution control
- Cannot do environmental management without attention to goverance

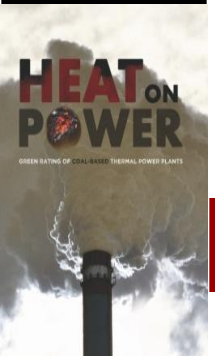


Enforcement



Show cause notices – but enforcement is poor

PCBs noted violations but unable to act – power needs



Conclusion

Coal is not the question

Question is energy access; pollution and need to meet the needs of all without blowing up the world

Must learn how we can do much more with less – tread lightly on Earth