Integrated Environmental Strategies India: Cost-Benefit Analysis

EPTRI

June 2004

PRESENTATION ON

INTEGRATED ENVIRONMENTAL STRATEGIES - INDIA
COST-BENEFIT ANALYSIS

EPTRI

USAID

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

METHODOLOGY

❖ **Four Mitigation Scenarios Considered For Cost-Benefit Analysis:**

1) **Transportation- Bus Transit Mitigation Scenario (C1)**

2) **Industrial- Combined Natural Gas and Biogas (C2)**

3) **Industrial- Fuel Additive Scenario (C3)**

4) **Industrial- Particulate Control Scenario (C4)**

ASSUMPTIONS USED

❖ **CY 2001 Assumed as Base Year**

❖ **Costs and Health and Ancillary Benefits Considered for CYs 2011 and 2021.**

❖ **All Costs are in CY 2001 Rs./$.**

❖ **Benefits Figures are Not Discounted.**

❖ **For Health Benefits, PCI and 1.0 Eta. And PPP and 0.4 Eta. Used as Minimum and Maximun Values, Respectively.**

❖ **VSL assumes life expectancy of 62.5 years;average annual wage US$357.55 (VSL for Hyderabad estimated at US$ 6,212).**

TRANSPORTATION SCENARIO

❖ **Bus Transit Mitigation Scenario Costs Include:**

▪ **Bus Lane Markings**

▪ **Construction of Bus Bays**

▪ **Traffic Signs**

▪ **Overhead Signs**

▪ **Pavement Markings**

TOTAL COSTS FOR BUS TRANSIT SCENARIO

ITEM	AMOUNT (Rs. In Millions)
Bus Lane Markings	104.5
Construction of Bus Bays	450.0
Traffic Signs	9.0
Overhead Signs	34.2
Pavement Markings	28.5
Contingencies, Project Management, etc.	125.2
Total:	751.4 (CY2003)
	698.0 /$ 15MM(CY2001)

GHG Benefits:

CY 2011: US$ 2.16MM

CY 2021: US$ 10.8 MM

HEALTH BENEFITS FOR BUS TRANSIT SCENARIO

❖ **Short Term Exposure Mortality (MM US$/YR)**

❖ <u>**CY 2011**</u>

	PCI/1.0 Eta.	PPP/0.4 Eta
Low	9.48	9.48
High	91.89	2,850.5

❖ <u>**CY 2021**</u>

	PCI/1.0 Eta.	PPP/0.4 Eta
Low	49.61	49.61
High	472.75	14,638

❖ **Long Term Exposure Mortality (MM US$/YR)**

❖ <u>**CY 2011**</u>

	PCI/1.0 Eta.	PPP/0.4 Eta
Low	12.77	12.77
High	124.9	3,878.6

<u>**CY 2021**</u>

	PCI/1.0 Eta.	PPP/0.4 Eta
Low	136.63	136.63
High	1,345.5	41,814

Year-wise Benefit Estimates for Bus Transit Scenario (in Millions Rupees)

Year	Scenarios	Net Costs	GHG Reductions Value		Health Benefits Vales			
					Short-term Exposure		Long-term Exposure	
					PCI and Eta = 0.1	PPP and Eta = 0.4	PCI and Eta = 0.1	PPP and Eta = 0.4
2011	C1	698.00	101.7	Low	446.51	446.51	601.47	601.47
				High	4,328.02	134,258.55	5.882.79	182,683.47
2021	C1	------	508.68	Low	2,336.63	2,336.63	6,435.27	6,435.27
				High	22,266.53	689,449.80	63,373.05	1,969,439.40

COSTS FOR COMBINED INDUSTRIAL MITIGATION SCENARIO (NATURAL GAS AND BIOGAS).

❖ **For NG, Net Costs= Boiler Conversion Costs + Costs of NG Used – Amount of Coal Replaced.**

❖ **For BG, Net Costs= Investment for BG Units + Maintenance Costs + Fuel Costs (Wood) – Costs of FO Replaced.**

❖ **Net Costs for Combined Scenario:**

CY 2011: (- Rs. 35.63 MM/ -US$ 0.76 MM)

CY 2021: (- Rs. 218.47 MM/ -US$ 4.64MM)

❖ **GHG Benefits:**

CY 2011: US$ 0.65 MM

CY 2021: US$ 1.85 MM

Year-wise Benefit Estimates for Combined NG&BG Scenario (in Millions Rupees)

Year	Scenarios	Net Costs	GHG Reduc-tions Value		Health Benefits Vales			
					Short-term Exposure		**Long-term Exposure**	
					PCI and Eta = 0.1	PPP and Eta = 0.4	PCI and Eta = 0.1	PPP and Eta = 0.4
2011	C2	- 35.63	30.62	Low	12.25	12.25	28.26	28.26
				High	102.68	3,128.38	265.17	8,182.21
2021	C2	- 218.47	87.14	Low	92.32	92.32	257.17	257.17
				High	843.09	25,977.53	2,495.83	77,441.82

COSTS FOR FUEL ADDITIVES MITIGATION SCENARIO

❖ **Net Costs for This Scenario = Cost of Liters of Additive Used – Cost of Quantity of Fuel Oil (Liters) Saved.**

❖ **Net Costs for This Scenario:**
   CY 2011: (-Rs. 43.40 MM/- US$ 0.92 MM)
   CY 2021: (- Rs.81.55 MM/ -US$ 1.73 MM)

❖ **GHG Benefits:**
   CY 2011: US$ 0.09 MM
   CY 2021: US$ 0.17 MM

Year-wise Benefit Estimates for Fuel Additive Scenario (in Millions Rupees)

Year	Scenarios	Net Costs	GHG Reduc-tions Value		Health Benefits Vales			
					Short-term Exposure		Long-term Exposure	
					PCI and Eta = 0.1	PPP and Eta = 0.4	PCI and Eta = 0.1	PPP and Eta = 0.4
2011	C3	-43.40	4.24	Low	7.07	7.07	16.01	16.01
				High	56.99	1,722.92	146.48	4,515.48
2021	C3	-81.55	8.01	Low	99.38	99.38	254.81	254.81
				High	929.28	28,717.81	2,487.35	77,220.45

COSTS FOR INDUSTRIAL CONTROL MITIGATION SCENARIO

❖ **Net Costs For This Scenario = Investment Required for Installation and Equipment + Operational and Maintenance Costs.**

❖ **Net Costs For This Scenario = Rs. 20.44 MM/US$ 0.43 MM.**

Year-wise Benefit Estimates for Industrial Control Scenario (in Millions Rupees)

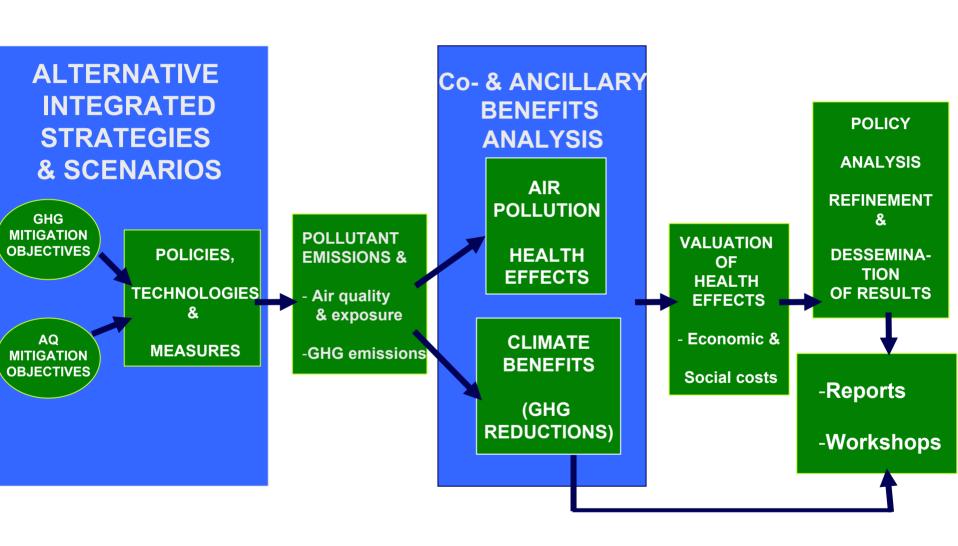| Year	Scenarios	Net Costs	GHG Reduc- tions Value		Health Benefits Vales			
					Short-term Exposure		Long-term Exposure	
					PCI and Eta = 0.1	PPP and Eta = 0.4	PCI and Eta = 0.1	PPP and Eta = 0.4
2011	C4	20.44	--	Low	8.48	8.48	20.25	20.25
				High	74.42	2,279.17	192.64	5,964.27
2021	C4	--	--	Low	86.19	86.19	234.56	234.56
				High	802.58	24,788.26	2,294.24	71,238.75

Cost Benefit Summary for All Mitigation Scenarios (in Millions Rupees)

Scenarios	2011			2021		
	Net Costs (Rs. Million)	Benefits (Rs. Million)		Net Costs (Rs. Million	Benefits (Rs. Million)	
		Lower Bound	Upper Bound		Lower Bound	Upper Bound
C1	698.00	548.24	182,785.21	--	2,845.31	1,969,948.08
C2	-35.63	42.86	8,212.83	-218.47	179.45	77,528.96
C3	-43.40	11.30	4,519.72	-81.55	107.39	77,228.46
C4	20.44	8.48	5,964.27	--	86.19	71,238.75

CONCLUSIONS FOR C/B ANALYSIS

❖ **All Four Mitigation Scenarios Show Health Benefits in Terms of Long Term and Short Term Exposure Mortality.**

❖ **The Transportation (Bus Transit) Scenario Shows the Greatest Health Benefits.**

❖ **The Combined Natural Gas and Biogas and the Fuel Additive Scenarios Show Net Cost Benefit to Industry.**

❖ **GHG reductions are greatest for the Bus Transit Scenario, followed by the Combined NG & BG Industrial Scenario.**

IES METHODOLOGY

PARTNERS IN THE STUDY

❖ **Sponsors- USAID and USEPA**

❖ **Technical Contractor- NREL**

❖ **Overall coordination, AAQ analysis and Cost /Benefit analysis–EPTRI**

❖ **Health Effects Analysis and Economic valuation -IHS.**

❖ **Transportation Planning - RITES**