Malé Declaration on Control and Prevention of Air Pollution and its Likely Transboundary Effects for South Asia
Seventh Regional Stakeholders cum Coordination Meeting (RSC7)
18-19 May, Dhaka, Banglaesh

Air Pollution Reduction Strategy for Bangladesh

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Background

- Implementation of Male Declaration – DoE to develop AP reduction strategy for Bangladesh
- BUET would assist in developing the strategy
- Draft strategy presented to Stakeholders in January and March 2012
- After receiving comments from peer review, Final Draft submitted in December 2012

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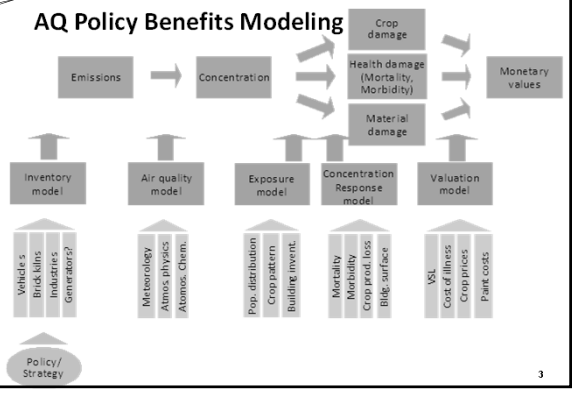
AQ Policy Benefits Modeling



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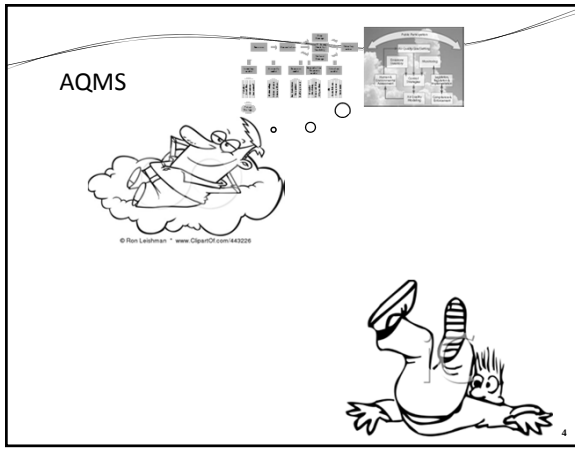
AQMS



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Work Breakdown

- Current status/Monitoring data
- Emissions inventory by the DoE/ Others
- Identify key pollutants
- Existing strategies, laws, standards
- Literature review on control strategies and policies and their effectiveness and efficiency
- Review of evidence in Bangladesh
- Identify key control strategies and potential policies
- Feedback from stakeholders
- Draft report

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Structure of Report

- **Chapter 1:** Background, objectives, scope
- **Chapter 2:** Current status of pollution
- **Chapter 3:** Emission sources
- **Chapter 4:** Air pollution impacts in Bangladesh; Key pollutants and sources
- **Chapter 5:** Past measures, successes and failures
- **Chapter 6:** Approaches to air pollution control (CAC, MBI), International case studies
- **Chapter 7:** Potential and recommended strategies to reduce air pollution, incorporating stakeholders suggestions
- **Chapter 8:** Other relevant issues
- **Chapter 9:** Conclusions

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Work Breakdown

- **Current status/Monitoring data**
- Emissions Sources
- Air Pollution Impacts
- Existing strategies, laws, standards
- Literature review on control strategies and policies and their effectiveness and efficiency
- Pollution Control Approaches
- Identify key control strategies and potential policies
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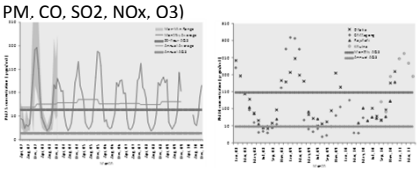
Work Breakdown

- **Current status/Monitoring data**
  (Pb, PM, CO, SO2, NOx, O3)



- Dhaka, Khulna, Chittagong, Rajshahi – CAMS
- BAEC, BUET, Others

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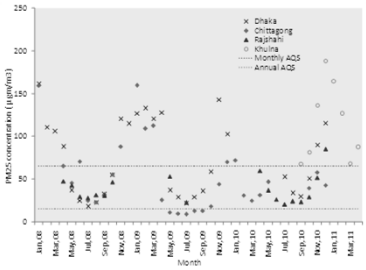
CAMS data for $PM_{2.5}$ at 4 major cities, along with AQS



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Work Breakdown

- Current status/Monitoring data
- **Emissions Sources**
- Air Pollution Impacts
- Existing strategies, laws, standards
- Literature review on control strategies and policies and their effectiveness and efficiency
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Work Breakdown: Emission Sources

- **Emissions inventory by the DoE**

- Under Male Declaration Work plan
  Year 2000 available (have major limitations)

- Emission inventory being developed for Dhaka and Chittagong under CASE project

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Work Breakdown: Emission Sources

- **Source Apportionment and Trends of Emissions Sources**:
  - Vehicles
  - Brick kilns (technologies being used)
  - Industries
  - Biomass burning (including indoor)
  - Construction activities
  - Power sector

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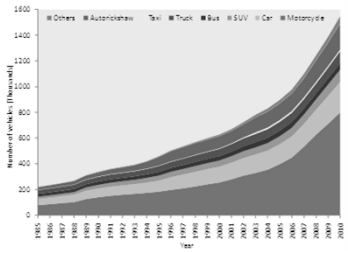
Vehicle growth in Bangladesh during 1985-2010



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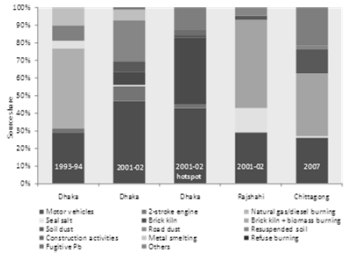
Source apportionment for $PM_{2.5}$ at various locations in Bangladesh



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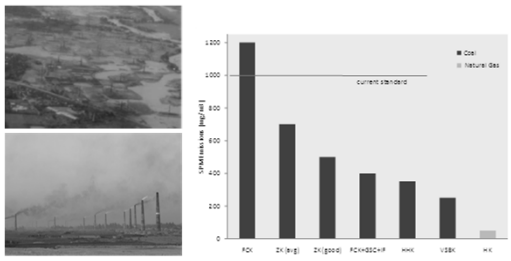
Suspended particulates emissions performance of different types of brick kilns



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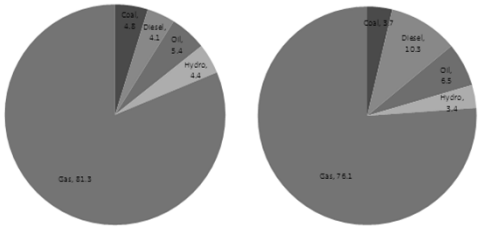
Percentage share of fuels used for power generation in (a) 2006 and (b) 2011



a b

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Work Breakdown

- Current status/Monitoring data
- Emissions Sources
- **Air pollution impacts**
- Existing strategies, laws, standards
- Literature review on control strategies and policies and their effectiveness and efficiency
- Pollution Control Approaches
- Identify key control strategies and potential policies
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- Draft report

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Work Breakdown: Air Pollution Impacts

- Documented impacts of air pollution
  - Epidemiological/ toxicological studies in developed countries relate elevated PM ($PM_{2.5}$) with increased risk of premature mortality
  - SLCPs, particularly BC, also identified as a major health concern
- Social costs of air pollution (Table 4.3 of Report)

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Work Breakdown: Key Pollutants and Sources

- Based on Emissions, Ambient concentration, and Impacts
- PM and its precursors (NO_2, SO_2) - most harmful + exceeds standards (by up to five times for $PM_{2.5}$)
- NO_x- slightly elevated; SO_2/CO/O_3 meets standards
- Most important sources of ambient air pollution:
  Vehicles, brick kilns, cement factories, open burning, metal smelters, glass factories, power plants and re-suspended soil or dust
- Indoor air pollutants PM, Soot (BC) - from cooking stoves using solid fuels and kerosene

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Work Breakdown

- Current status/Monitoring data
- Emissions Sources
- Air pollution impacts
- **Existing strategies, laws, standards**
- Literature review on control strategies and policies and their effectiveness and efficiency
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Work Breakdown

- **Existing strategies, laws, standards, policies**

- Ambient AQ standards
- Vehicle emissions standards (being updated under CASE project)
- Industrial emissions standards

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Work Breakdown

- Current status/Monitoring data
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- Identify key pollutants
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Work Breakdown

- **Past Air Quality Strategies in Bangladesh**

- Lead Phase Out from Petrol
- Ban on Two-Stroke Three-Wheelers in Dhaka
- Promoting CNG Conversion of Vehicles
- Ban on Older Vehicles
- Policies on Import of Personal Vehicles
- Vehicle Emissions Standards
- Policies to Reduce Emissions from Brick Kilns
- Ban on High Sulfur Coal

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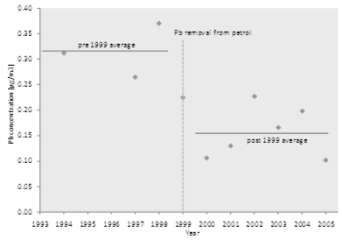
Past Air Quality Strategies in Bangladesh: Lessons

Policy/ Strategy	Policy	Year	Result	Lessons learnt
Lead phase out from Petrol	CAC	1999	Success	Media and public support allows easy implementation, implementation quick and easy if few, government run bodies are targeted
Vehicle emissions Standard	CAC	1997, Update 2005	Failure	There is limited testing facilities for monitoring vehicle emissions during certification, poor institutional capacity and enforcement hinder implementation
Brick kiln stack height	CAC		Success	Benefit to the owners (more efficient burning, better quality bricks) is good for policy implementation, ease of monitoring is also important
Ban on older vehicle import	CAC		Success	Small number of vehicle importers, no significant losses to businesses (increased cost of vehicles passed on to buyers) allow easier implementation, somewhat covers vehicle emissions standard initially
Differentiated vehicle import tariff	MBI		Success	Although not a perfect MBI, strong public support, smaller points of regulation means easier implementation
Ban on driving older vehicles in Dhaka	CAC	2010	Repeated failure	CAC did not work when many polluters are financially affected, especially when they have a strong lobby. MBI instruments with active stakeholder engagement during policymaking can be useful

Ambient Concentration of Pb in Dhaka



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Policy/ Strategy	Policy	Year	Result	Lessons learnt
Ban two stroke three wheelers	CAC	2002	Success	Extensive public support allows easy implementation, unforeseen practices (smaller diesel vehicles) can erase the benefits, monopoly in new CNG three wheeler supply can make a good policy costlier than necessary, multiple benefits
Promotion of CNG vehicles	MBI	2002	Success	Extensive public support, good pricing policy, good incentive to private sector, multiple benefits – all are important for a functioning MBI
Ban on use of wood in brick kilns	CAC		Success – qualified	Fuel choice primarily governed by economics – low sulfur coal is generally cheaper than wood currently (unless in remote areas), monitoring and enforcement lax in rural areas
Lane based traffic	CAC	2010	Failure	Not practical
Carpooling	CAC			Unrealistic proposal, met with ridicule by the citizens
Colored kerosene	CAC		Failure	Price is an important issue
Ban on import of high Sulfur coal	CAC		Failure	CAC did not work when many polluters are financially affected (fuel choice governed by economics), especially when they have a strong lobby to overturn the ban

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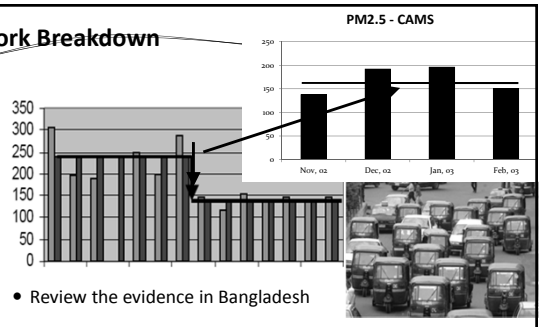
Work Breakdown



- Review the evidence in Bangladesh
- 2 stroke 3 wheeler ban – visible changes in PM2.5

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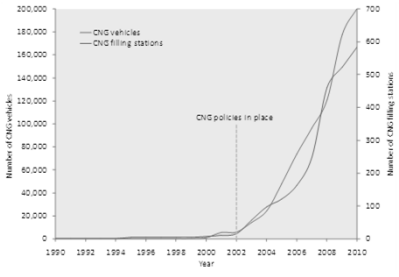
Evolution of CNG vehicles and CNG filling stations in Bangladesh



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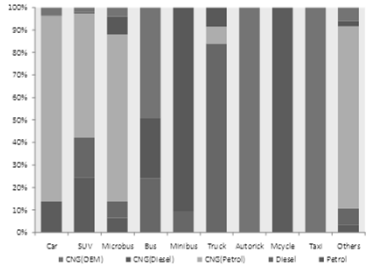
Share of different vehicles running of different fuels in Dhaka in 2010



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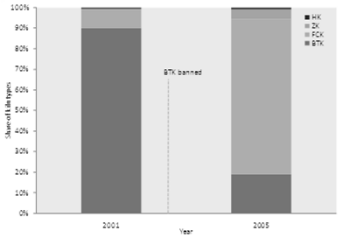
Share of different brick kilns before and few years after BTK are banned (source: Gomes and Hossain 2003 and UNEP-GEF 2006)



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Work Breakdown

- Current status/Monitoring data
- Emissions inventory by the DoE
- Identify key pollutants
- Existing strategies, laws, standards
- Literature review on control strategies and policies and their effectiveness and efficiency
- **Pollution Control Approaches**
- Identify key control strategies and policies
- from stakeholders
- Draft report

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Work Breakdown

- **Pollution Control Approaches**
  - Command and Control (CAC)
  - Market Based Instruments (MBI)

International Case Studies:

- Mexico City Car Rationing
- Vehicle Inspection and Maintenance
- Shift to Electric Vehicles in Nepal
- Vertical Shaft Brick Kilns in India, Nepal and Vietnam
- Diesel Vehicle Retrofit in Hong Kong

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Comparison of CAC and MBI Approaches

	Command and Control	Market Based Instruments	Comment
Effectiveness	Can achieve goals quickly, with greater certainty	May take longer to achieve goals, not always effective	MBI may not be effective in a weak institutional framework
Efficiency	Total cost of abatement is high	Theoretically, abatement is done at least cost to economy	MBI preferred, but if information unavailable, enforcement costly, then costs could be high in MBI too
Equity	Can put excessive burden to some firms or users	Marginal burden is equal across firms or users	MBI preferred
Ease of policy	Widely understood	Relatively new concept	Lack of capacity in Bangladesh – MBI could be difficult to design/ implement
Administration, monitoring and enforcement	Relatively easier	Requires more administrative efforts	Administration, monitoring and enforcement is weak in Bangladesh – MBI may be ineffective
Market requirement	Does not require a competitive market	Requires a properly functioning competitive market	Potential collusion among polluters, a real possibility in Bangladesh, can render MBI ineffective
Further emission reduction , innovation	No such incentives	Large incentive for reduction , innovation	MBI preferred as every unit of reduction has a financial benefit
Evolution with time	Less flexible	More flexible	Regulation is often slow to catch up with technology

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Work Breakdown

- Current status/Monitoring data
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- Identify key pollutants
- Existing strategies, laws, standards
- Literature review on control strategies and policies and their effectiveness and efficiency
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- **Identify key control strategies and potential policies**
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Strategies Considered: Motor Vehicles

- Stringent emissions standards: new
- Differentiated emissions standards: existing
- Diesel to CNG switch
- Discourage diesel: how to differentiate with agri use?
- Retrofit diesel catalytic converters, particulate filters
- Cleaner fuel, reduce fuel sulfur content
- Inspection & maintenance of vehicles
- Emissions based registration fee
- Enforce old vehicle bans

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Strategies Considered: Motor Vehicles

- Electric vehicles
- Electric motor cycles
- Hybrid vehicles
- Traffic flow management
- Odd/even vehicle days
- Improve public transport
- Discourage vehicle use
- Encourage walking

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Strategies Considered: Brick Kilns

- Ban on upstream locations
- Cleaner technology
- Ban on clusters
- Clusters based on technology
- Retrofitting new technology
- Cleaner coal
- Alternative Construction Materials

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Strategies Considered: Power plants

- Emissions standards for diesel generators
- Inspection and maintenance of diesel generators
- Emissions standards
- Emission-based tariff
- Technology specification
- Ban on upstream location

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Strategies Considered: Industries

- Cleaner technology & fuel
- Particulate control measures: cement
- Physical shifting of industries
- Industrial emission standards
- Enforcement of emissions standards

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Strategies Considered: Dust sources

- Better construction practices
- Construction ambient standards
- Wall to wall paving of roads
- Timely road maintenances
- Regular sweeping and watering
- Landscaping and gardening

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Strategies Considered: Indoor sources

- Domestic fuel switch (e.g., biogas)
- Improved cooking stoves (ICS)

Strategies Considered: Open burning

- Ban open burning of refuse
- Ban open asphalt burning
- Awareness on open buring
- Ban slash and burn practice

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Work Breakdown

Evaluation of Air Quality Strategies
(Qualitative)

- Evaluation Criteria:
  - Impact
  - Time to introduction
  - Technical effectiveness
  - Implementation effectiveness
  - Costs
  - Co-benefits

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Work Breakdown

- Current status/Monitoring data
- Emissions inventory by the DoE
- Identify key pollutants
- Existing strategies, laws, standards
- Future growth and strategies
- Literature review on control strategies and policies and their effectiveness and efficiency
- Review the evidence in Bangladesh
- Identify key control strategies and potential policies
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- Draft report

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Proposed strategies to reduce air pollution from different sectors

Control Sectors		Strategy	Area of application	Priority
A. TRANSPORT				
Vehicle use	A	Improve public transport	Large cities	High
Existing vehicles	B	Strengthen vehicle inspection and maintenance	All, especially large cities	High
	C	Ban vehicles older than 20 years	Commercial vehicles, large cities	High
	D	Encourage Diesel to CNG switch through incentives	All diesel vehicles, especially commercial in large cities	High
	E	Emissions based annual registration fees	All vehicles	Medium
New vehicles	F	Stringent emissions standards	All new vehicles	High
	G	Emissions based import tariff	All new vehicles	High

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Control Sectors		Strategy	Area of application	Priority
B. INDUSTRIES				
All industries	H	Comprehensive land use plan for industry locations	All industries, especially new ones	High
	I	Cluster management	Cluster of highly polluting industries	High
Brick kilns	J	Emissions based license fee	All kilns	High
	K	Technology standards	All kilns	Medium
	L	Alternate construction material	All country, especially large cites	Medium
Power industries	M	Ensure adequate power supply	-	High
	N	Emissions standards	All new plants	High
	O	Emissions standard for diesel generators	All new generators	High
	P	Inspection & maintenance of diesel generators	All existing generators	High
Other industries	Q	Technology specification	Existing steel mills, cement and glass factories	High
	R	Inspection and maintenance	Existing steel mills, cement and glass factories	High
	S	Emissions standards	All new and existing plants	High

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Control Sectors		Strategy	Area of application	Priority
C. FUEL				
Coal	T	Import control for quality of coal	Whole country, primarily brick and power industries	High
D. DUST				
Construction	U	Better construction practices on site and during transportation	All construction sites	High
	V	Air pollution mitigation plan and its enforcement	Large construction projects	Medium
Road	W	Timely road maintenance	All roads	High
Land use	X	Landscaping and gardening	All exposed soil in urban areas	Medium
E. INDOOR				
Fuel	Y	Encourage fuel switch	Urban slums and rural areas	High
Technology	Z	Improved cooking stoves	Rural areas	High

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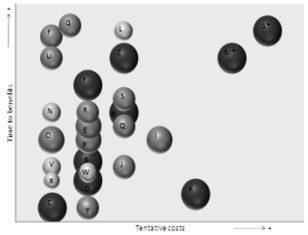

Qualitative comparison of different strategies with respect to tentative costs, time to benefits realization and potential benefits. Bubble size reflects benefits – qualitatively; Benefit code: Red ++++, Blue +++, Green ++, Yellow +. *very large co-benefits

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Other Policy relevant Issues:

- Regulatory and fiscal reform to implement strategies effectively
- Awareness and motivation across sectors
- Research and development to address knowledge and information gaps, so that future strategies can be based on quantitative modeling
- Co-operation and coordination among various stakeholders (regulators-businesses-general public)
- Capacity building and knowledge retention
- Institutional set up and governance

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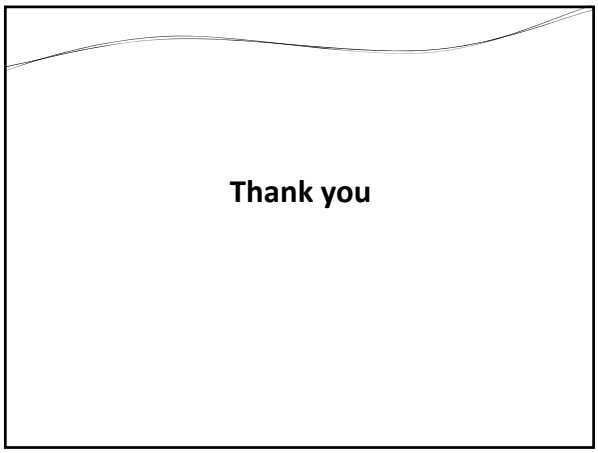
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