

# Policy Evaluation Exercise

## 1 Introduction

### 1.1 Learning goals of the policy evaluation exercise:

- to enhance the general understanding about different policy options available to address air pollution problems;
- to better understand the specific conditions in the South Asian region with regard to air quality management;
- to understand the pros and cons of different policy options in effectively supporting air pollution prevention and control strategies, particularly under the specific conditions in developing countries;
- to provide insight into methods and possibilities for ex-ante policy evaluation.

### 1.2 Outline of policy evaluation exercise

Workshop participants are grouped into 4 teams. Each team is given the task to address a specific sector causing air pollution problems in South Asia. The four teams are:

- TEAM 1: Emissions from large point sources: sulphur dioxide emissions in the power sector.
- TEAM 2: Emissions from area sources: private vehicle ownership and usage
- TEAM 3: Emissions from area sources: public transportation and commercial freight transport
- TEAM 4: Emissions from the informal sector: the case of brick kilns.

Each team can choose from a portfolio of policy instruments that potentially could help to mitigate the air pollution problem, e.g.

- Command & control approaches like emission standards, fuel quality standards, technology specification standards, vehicle inspection standards, etc.
- Economic instruments like emission taxes, product taxes, emission trading schemes, congestions pricing, etc.
- Voluntary agreements & self-regulation, like environmental management systems.
- Informative instruments...like information and awareness campaigns, eco-labelling of “green” products, information disclosure, education, training and capacity building, etc.
- Publicly funded infrastructure and provision of public services, like infrastructure for public transport systems, infrastructure for cleaner fuels, investments in road infrastructure and intelligent traffic management systems, land-use planning and traffic demand management, etc.

The policy instruments and strategies are described in the team handouts (see below). In order to allow for evaluation on different criteria, each policy option described should contain some information about the following issues:

1. General description
2. Monitoring
3. Sanctioning
4. Institutions involved and administrative resources required
5. Acceptance and appropriateness
6. Economic efficiency & cost-effectiveness
7. Predictability and flexibility
8. Incentives for (domestic) technological innovation

Teams are assigned the task to discuss and evaluate the different policy options on a range of evaluation criteria including environmental effectiveness, economic efficiency, administrative costs and institutional capacities required, enforceability, persistence and long-term effects, etc.

Each policy option should be evaluated with the help of a policy evaluation grid that will be handed out to team members. The policy evaluation grid can also be further developed and then serve as a simple check-list to policy makers for assessing new policy intervention from an ex-ante perspective. Participants should also consider the major barriers (financial, institutional, capacity, corruption, public and social customs, etc.) that may constrain effective air quality management in their country.

Upon finishing the exercise, participants should be able to better understand the advantages and disadvantages of different policy instruments for air pollution prevention and control, particularly with concern to the specific conditions of their country.

## **TEAM 1: Emissions from large point sources: sulphur dioxide emissions in the power sector**

The emission inventory in your country has just been completed and results show that the majority (>70%) of sulphur dioxide emissions derive from the burning of coal and oil in the power sector. Different scenarios indicate that the electricity demand in your country is projected to rise significantly over the next 20 years and as a consequence additional generation capacity will be required.

The emission scenarios and atmospheric transfer and deposition models you have conducted as part of the RAPIDC project indicate that the projected sulphur emissions from the current and future power plant fleet will cause significant harm to human health, crops and ecosystems.

Your manager has given you the task to plan and implement a policy intervention that shall help to reduce sulphur dioxide emissions from the power sector markedly. You have the following policy options:

**Option 1** is to introduce a tax scheme on the sulphur content of fuels used in the power sector, e.g. coal, oil and natural gas. The tax scheme is designed as follows:

- The tax is reimbursable if power plant operators can prove to the fiscal authorities through an independent third-party auditor that they have installed sulphur abatement equipment which effectively removes sulphur dioxide from the flue gas.
- The tax is collected by the same fiscal department in your country that also collects the Value Added Tax. The environmental protection agency is only involved as an advisor to the fiscal department, but does not have any executive function in the tax scheme.
- The level of the tax is set to the level of average sulphur dioxide abatement costs across the entire power sector. There are no plans to change the level of the tax over the next 10-15 years.
- The revenues from the new sulphur tax are strictly earmarked to financially support power station operators for the instalment of sulphur abatement measures.

**Option 2** is to implement minimum technology standards for all new installations in the power sector. This command-and-control approach has the following features.

- All new power plants have to be equipped with a specific flue gas scrubber that removes sulphur dioxide.
- The scrubber shall represent the best available technology on the global market. Unfortunately, suppliers of environmental technology in your country cannot supply this equipment and power station operators are forced to purchase the flue gas scrubbers from European, Japanese or U.S. firms.
- After completion of new power plants, your governmental agency will check the existence and functioning of the scrubber, later inspections are not planned.
- Old power plants are not required to be retrofitted as they are scheduled to be phased out in the next 20-30 years.

**Option 3** is to implement strict emission standards. These new emission standards are characterized as follows:

- All power plants, independent of their capacity and age have to reduce their individual levels of sulphur dioxide emissions by 70 % from current levels. This target has to be reached within 2 years.
- Newly commissioned power stations have to meet the average emission levels of the entire power plant fleet.
- Some power plant operators have not been very cooperative in the past with the environmental protection agency and they even have violated some regulations imposed by the agency. Thus, you have decided to design, implement and enforce the new emission standards without further consulting power station operators.
- After two years, the emission reductions are to be checked once by an environmental inspector from your governmental agency.
- If the power station has not achieved the requested emission reductions, a standard penalty of US \$10 000 has to be paid and the power plant operator is given the chance to meet the new emission standards within the next two years.

**Option 4** is to implement emission standards that are based on electricity production. These new standards have the following characteristics:

- All power plants have to meet emission standards per kilowatt-hour electricity they produce, e.g. 10 grams of sulphur dioxide per kWh electricity produced.
- Since you are not sure at what level the emission standards shall be set, you invite different stakeholders and experts for a workshop to get a better picture about technologies and costs of sulphur abatement equipment. For the workshop you can attract amongst others representatives from power station operators, suppliers of scrubber technologies, from regional/state EPA's, and also different environmental NGO's from your country.
- Your agency sets a roadmap how these emission standards will evolve over the next 10-15 years in order to give power stations operators a reliable and predictable legislative framework.
- Power station operators are required to install continuous emission monitoring equipment at their flue gas stacks. Monitoring data is collected by the power station and has to be verified by an accredited third-party auditor. Your agency decides to give accreditation to a limited number of auditors that shall compete on the market.

**Option 5** is to implement a cap-and-trade system which has the following features.

- In this system, the total sulphur emission load of the power sector in your country will be limited to current levels ("the cap"). The cap will be reduced progressively over a period of 15 years. During the same period, electricity demand is expected to increase significantly.

- Power stations covered by this cap-and-trade program receive authorizations to emit in the form of emissions allowances, with the total amount of allowances limited by the cap. Each power station can design its own compliance strategy to meet the overall reduction requirement, including sale or purchase of allowances, installation of pollution controls, implementation of efficiency measures, among other options.
- The cap-and-trade system requires instalment of continuous emission monitoring systems at all participating power stations. The accuracy and functionality of the continuous emission monitoring system has to be verified by an accredited auditor in regular intervals.
- Power station operators must completely and accurately measure and report all emissions to the Environmental Protection Agency in a timely manner to guarantee that the overall cap is achieved.
- A source that does not hold enough allowances in its unit account to cover its annual SO<sub>2</sub> emissions has “excess emissions” and must pay an automatic penalty of US \$3 000 per tonne.
- The main role of the environmental protection agency is to record allowance transfers that are used for compliance and to ensure at the end of the year that a source's emissions do not exceed the number of allowances it holds. To accomplish this, your environmental protection agency maintains a computerized Allowance Management System.

## **TEAM 2: Emissions from area sources: private vehicle ownership and usage**

The emission inventory in your country has just been completed and results show that a large part of NO<sub>x</sub> and Particulate Matter (PM) emissions derive from the transport sector. Different scenarios indicate that private vehicle ownership in your country is projected to rise significantly over the next 20 years.

The emission scenarios and atmospheric transfer and deposition models you have conducted as part of the RAPIDC project indicate that the projected emissions from private vehicle usage will cause significant harm to human health, crops and ecosystems.

Your manager has given you the task to plan and implement a policy intervention that shall help to reduce emissions and reduce congestion from private vehicles to sustainable levels. You have the following policy options:

**Option 1** is the implementation of higher fuel quality standards. This measure includes:

- Quality standards for motor vehicle fuel are substantially tightened, e.g. the maximum allowable sulphur content of fuel is lowered.
- Domestic oil refineries and fuel importers are obliged to self-report on the fuel quality of their products, occasionally governmental inspectors will take fuel samples for analysis and control of quality standards.
- Infringement of fuel quality standards will be prosecuted with a standard penalty of US\$ 10 000 and publication of the infringement in major newspapers.

**Option 2** is to increase taxation on motor vehicle fuels. The key elements of this strategy include that:

- Taxation on motor vehicle fuel is gradually increased over a period of 5-10 years.
- The revenues from the tax increase are strictly earmarked to finance the expansion of mass transit systems like new metro lines and designated express bus lanes in major cities.
- The tax increase is accompanied by a comprehensive information campaign, informing the public about the benefits of reduced congestion and better air quality.

**Option 3** is to reform the taxation system for motor vehicles. This would include:

- Implementation of an emission-related motor vehicle circulation tax. In this new tax scheme, the level of the vehicle circulation tax is determined by the emission class of the vehicle. Vehicles with high emission levels are subject to higher taxation and owners of low-emission vehicles pay fewer taxes than in the previous system.
- The tax reform aims to be cost neutral, total revenues of the emission-related vehicle taxation system shall remain at approximately the same level than in the old system.
- Like the old system, the new emission-related motor vehicle taxation system will be administered jointly by the long-established vehicle registration authority and the fiscal department.

**Option 4** is the introduction/tightening of vehicle emission standards, combined with the introduction/reformation of a vehicle inspection programme. This policy strategy has the following features:

- All newly registered vehicles have to meet tight emission standards.
- This rule will be enforced by the vehicle registration authority.
- To ensure proper maintenance of all vehicles in circulation, your agency introduces a vehicle inspection programme that requires all vehicles to be inspected in a test centres every two years.
- To guarantee the quality of the vehicle inspection programmes, only test centres operated directly by the environmental protection agency are allowed to inspect vehicles and issue the windshield stickers upon passing the inspection.
- To keep the inspection costs for the vehicle owner low, test centres are annually granted a subsidy from the government budget. For the same reason, salaries of employees at the test centres are kept reasonably low.

**Option 5** is to ban all vehicles with two-stroke engines and other vehicles older than 12 years. This command-and-control policy has the following features:

- All vehicles with two-stroke engines and other vehicles older than 12 years are completely banned and must be off the roads by 1. January next year. There is not transition period for the vehicles in use.
- The policy is enforced by the vehicle registration authority by reclaiming the license plate from vehicle owners.
- To compensate those vehicle owners affected by the ban, the government decided to give a deduction on the registration fee for two- and three-wheelers with four stroke engines for a period of one year.

## **TEAM 3: Emissions from area sources: public transportation and commercial freight transport**

The emission inventory in your country has just been completed and results show that a large part of NO<sub>x</sub> and Particulate Matter (PM) emissions derive from Diesel buses and trucks. Due to economic development, structural changes in the manufacturing sector, and the rapid growth of cities urban and intercity transport demand is expected to grow at a rate of 10 % annually over the next 15-20 years.

Your manager has given you the task to plan and implement a policy intervention that shall help to reduce emissions and reduce congestion from public transportation and commercial freight transport to sustainable levels. You have the following policy options:

**Option 1** is the introduction of bus rapid transit system (BRT) in the major cities of your country.

- The new BRT system shall have the following state-of-the-art features: (1) the exclusive right of way lanes, (2) rapid boarding and alighting, (3) free transfers between lines, (4) pre-board fare collection and fare verification, (5) enclosed stations that are safe and comfortable, (6) clear route maps, signage, and real-time information displays, (7) modal integration at stations and terminals, (8) clean bus technologies, and (9) excellence in marketing and customer service.
- Policy makers are excited about the advantages of BRT systems and you manage to obtain top-level governmental support for your plans. You manage also to integrate all relevant governmental institutions into the planning process.
- Since existing private bus operators have been very reluctant in the past to enforce environmental laws imposed on them, you decide to exclude them from the planning process of the new BRT system. Shortly before municipal elections, private bus operators and the vehicle manufacturing industry, being afraid of the new BRT system launch a massive campaign to “inform” the public about the steep fare increases the new BRT system will involve.

**Option 2** is to ban all freight trucks from urban roads during daytime hours in order to reduce congestion and emissions from these highly polluting vehicles when idling in traffic jams. The key characteristics of this policy intervention are as follows:

- After a non-public meeting of the government, this new policy for better air quality is to be implemented and enforced within 30 days by local municipalities.
- Municipal governments can decide on their own about the details of the new law, e.g. the hours when trucks are banned from the urban roads.
- The ban is to be enforced both by the (underpaid and overworked) traffic police as well as from individuals who can call a toll-free number of the police and report trucks that violate the ban.
- On behalf of some bigger forwarding companies, an independent consultancy has calculated the economic costs and benefits of this new policy regulation. Despite some noticeable economic benefits due to reduced urban congestion and better air quality, economic costs such as inefficient usage of trucks, reduced flexibility in



transport and supply chains, and noise pollution during the nights outweigh the benefits.

**Option 3** aims to promote greater use of transit, walking and cycling, and seeks to limit the growth in (urban) transport demand. These targets are to be achieved through an integrated urban and regional land-use planning and transport strategy with the following key elements:

- Major developments should be located in areas well-served by public transport, or public transport provision will be required as part of the development. The agency or company promoting development will provide transport impact assessment and a transport improvement plan.
- As part of the development plan, traffic management schemes should be implemented, including parking policies and traffic restrictions for sensitive areas.
- Planning authorities and developers should ensure safe conditions for pedestrians and cyclists, and put special emphasis on safe routes to schools for children.
- A public transport strategy should be designed and implemented, which makes transit stops easily accessible
- In order to serve major development areas well by public transport, the urban authorities responsible for transport planning and for traffic management will introduce dedicated public transport corridors, especially bus lanes.
- New development will be located near existing local high capacity transit routes, terminals, and interchanges.
- New developments attracting a significant amount of goods' transport will be located near existing highway facilities. Network design and traffic management will ensure that new through-traffic does not impinge upon housing areas, and does not interfere with non-motorised travel.
- Transport demand caused by the various land uses is assessed at a very early stage of urban planning to assure early integration with transport planning.
- Joint working groups consisting of urban planners from the involved offices, transport planners, and the traffic and public transport management units are established at the municipality level.
- The public and other stakeholder are invited to participate in all planning and implementation stages.

**Option 4** is a voluntary agreement between the Environmental Protection Agency and the largest bus operators in your country about reducing PM 10 and CO emissions by 70 %.

- The Environmental Protection Agency was initially planning to introduce very strict emission standards to all buses in use. Due to strong lobbyism from bus operators, the EPA couldn't manage to legislate these emission standards. However, the EPA managed to conclude a voluntary agreement with some of the largest bus operators in the country about reducing PM 10 and CO emissions by 70 % from current levels within the next five years.
- The emission reduction target applies to the entire bus fleet of participating bus operators, not to the individual vehicle. Bus operators preferred this approach as

POLICY EVALUATION EXERCISE

they consider it to be more flexible and cost-effective than a bureaucratic command-and-control regulation.

- Not meeting the emission reduction targets of the voluntary agreement would not entail any penalties. However, if bus operators haven't met their obligations after the five years the agreement was signed, EPA may consider obligatory emission standards.
- The voluntary agreement is signed by the largest bus operators, representing 50 % of the country's bus fleet.

**Option 5** involves the mandate to convert all diesel and gasoline powered buses and taxis for public transportation to compressed natural gas (CNG). This command-and-control approach involves the following elements.

- The government sets up a long-term strategy to phase out all diesel and gasoline powered buses and taxis for public transportation and to convert them to CNG within the next 4 years.
- A cost-benefit analysis with an Integrated Assessment Model has shown that converting bus-fleets from Diesel to CNG reduced PM emissions to an acceptable level at lower costs than any other policy intervention.
- The cost-benefit analysis has also shown that for 1 \$ of investment for converting vehicles to CNG, health costs will be reduced by 7 \$ due to better air quality.
- Bus and taxi operators, as well as businesses in the fuel supply chain have been extensively involved in the planning and implementation of this governmental strategy.
- The government financially supports gas stations in providing the necessary infrastructure to supply CNG.
- The government establishes a programme training garage owners and their mechanics on how to convert a vehicle from liquid fuel usage to CNG.

## **TEAM 4: Emissions from the informal sector: The example of brick kilns**

The emission inventory in your country has just been completed and results show that a large part of local and regional air pollution stems from the informal sector. As one major source of pollution, the emission inventory identified traditional brick kilns which are fired with a variety of cheap highly polluting fuels including plastic refuse, used tires, manure, wood scrap, and used motor oil.

Some scenarios conducted in the RAPIDC project forecast a high growth in demand for bricks in the next 20 years. This high growth is the result of growing incomes among broad parts of the population and consequently increasing demand for bigger and more comfortable housing.

Your manager has given you the task to plan and implement a policy intervention to reduce air pollution from the informal brick manufacturing sector. You find this a particularly challenging task, because from your previous experience at the Environmental Protection Agency you know that pollution from the informal sector is very difficult to address. Key problems with firms of the informal sector are, that (1) they have few pre-existing ties to the state, (2) they are difficult to monitor since they are small, numerous, and geographically dispersed, (3) they work under intense competition and hence are under considerable pressure to cut costs, regardless of the environmental impacts, and (4) they sustain the poorest of the poor which makes them to both regulators and the public less appropriate targets for regulation than larger, wealthier firms.

However, despite these challenges you consider the following policy options to reduce air pollution from the brick manufacturing sector.

**Option 1** requires all brickmakers to register and license their business at the Environmental Protection Agency. This policy scheme works as follows:

- Brickmakers have to annually obtain a license in order to operate their brick kilns.
- At the end of the year, brickmakers have to send a detailed environmental report to the EPA where they declare which fuels in which quantity they have used in the past year, and whether any pollution abatement equipment has been used. Since the EPA expects several thousand environmental reports to be submitted every year, a considerable number of new staff has to be hired in order to cope with the expected workload.
- In order to obtain an operating license for the following year, brickmakers are charged a licence fee. The level of this license fee is set according to the types of fuels being used. “Clean” fuels will entail a lower license fee than “dirty” fuels.
- Everyone living in the neighbourhood of a brick kiln is entitled to check the brickmakers’ operating license. Neighbours are encouraged to report brickmakers not holding a license to the EPA which then will take appropriate actions.

**Option 2** is to legally ban the use certain (dirty) fuels such as old tires and used motor oil. The campaign is accompanied by the following enforcement mechanisms:

- Neighbours, neighbourhood organizations and local trade unions are encouraged to report brickmakers that use dirty fuels to the police. For this, a telephone hotline is set up to register complaints about brickmakers violating the ban.
- A broad information campaign shall inform the general public about the ban of dirty fuels, the health hazards that can arise from combusting these fuels, and how neighbours can detect whether a brick kiln uses dirty fuels that are prohibited.
- The police is given the power to jail and fine violators were caught in response to complaints.

**Option 3** is to provide brickmakers with subsidized clean fuels.

- A cost-benefit analysis of the Environmental Protection Agency has revealed that the use of cleaner fuels will reduce health costs to society. As a consequence the EPA can convince the government to provide clean fuels (e.g. propane) to brickmakers at a cheaper, subsidised rate.
- Since it is the last year of the legislative period, the government can ensure providing subsidies for cleaner fuels for only one year.
- Due to financial constraints in the state budget and a possible change of the government, it is unlikely that the subsidy for clean fuels for brickmakers can be extended to subsequent years. However, it is expected that after one year brickmakers will be convinced of the advantages of cleaner fuels and that they will, despite the higher costs, continue using it.

**Option 4** is to create a market for bricks that are manufactured with “clean” fuels and according to minimum environmental standards. In this strategy...

- Bricks that are manufactured according to certain environmental and quality standards are entitled to carry the newly introduced “Green Brick” label. The label is awarded by the Environmental Protection Agency.
- Building contractors that work for public funded construction projects are obliged to only use “Green Bricks”. Contractors that violate this rule will be blacklisted and excluded from future public tenders.
- In addition, an information campaign shall advertise the advantages of “Green Bricks” among private-run housing companies as well as individuals of the rapidly emerging middle class. It is expected that “Green Bricks” become a status symbol and local newspaper regularly publish news items about construction projects and house owners that have been using “Green Bricks”.

**Option 5** seeks for the penetration of more efficient brick kiln technologies. This comprises of a bundle of measures, including training, technology transfer, and financing mechanisms:

- Vertical Shaft Brick Kiln (VSBK) technology has been identified as a more energy efficient and less pollution intensive technology, especially for owners of small-capacity kilns. Since knowledge of brickmakers about VSBK is rather low, the Environmental Protection Agency (EPA) decides to launch a programme for capacity building and dissemination of technology information among the stakeholders, which would help in large-scale adoption of VSBK technology.
- The programme is to be established by local support systems such as local industry associations. The existing activities of industry associations are extended towards technical seminars and training programmes providing technical and information services to brickmakers and contractors being in the business for construction of brick kilns.
- Investment costs for VSBK technology is higher than for other kiln technologies. On the other hand, since the energy and fuel saving potential with VSBK is quite high, VSBK technology is often economically viable. Therefore, to meet the higher upfront costs, there is a need for suitable financing mechanisms to provide loans to the unorganised sector of the brick industry. In this context the strategy of the local support systems is to play an intermediary role between brick kiln units and local banks.