Reducing greenhouse gas emission in bangladesh economics essay

Atmosphere is a global public good and all nations around the globe dump pollution in the atmosphere at zero cost. As a result the concentrations of Greenhouse Gas (GHG) have been increasing in the atmosphere leading to its market failure. The four major components of GHG are carbon dioxide, methane, nitrous oxide and F-gases. In targeting GHG emission, main focus is given to CO2 since it constitutes a large share of the GHG . The rising concentrations of GHG in the atmosphere are bringing considerable changes to climate for example rise in global mean temperature by 0. 4-0. 8°C and average annual rate in sea level by 1-2 mm in the last century .

Reducing GHG emissions in Bangladesh

Bangladesh is one of the most vulnerable countries of the threat to climate change. IPCC report suggests, a one-metre rise in sea levels would flood 29846 sq km (total area of Bangladesh is 147570 sq km) of Bangladesh and create 14. 8 million people landless . Most of the land of Bangladesh is less than 20 feet high from the sea level. Bangladesh’s population is 150. 5 million in 2011 and per capita greenhouse emission is 0. 3 in 2008 . Bangladesh is currently contributing to global carbon emissions by an amount slightly less than its share in world GDP .

CO2 emissions per capita

(Tonnes)

Year

Figure 1: GHGs emission by Bangladesh, India, China and Pakistan

Source:

Although Bangladesh has low GHG emission, it’s paying higher prices for the consequences of climate change associated with higher GHG concentration in the atmosphere. The frequency of natural disasters has rapidly increased. Bangladesh has been always arguing in favour of reduced global GHG emission in climate negotiations. Bangladesh’s own GHG emission is also showing an increasing trend. There is a projection of Bangladesh’s greenhouse gas emission under different growth scenarios up to 2050:

Source:

Figure 2

The vulnerability of Bangladesh for climate change demands interventions to reduce GHG emission from her own end. There may be different policy intervention instruments for reducing greenhouse gas emission like creation of property rights, market based incentives (a tax, emission trading scheme), different forms of regulation, subsidies etc. When taking any policy, it is important to evaluate the policy under certain standards like environmental effectiveness, cost effectiveness, distributional impacts and institutional feasibilities. Two proposed policy interventions to reduce GHG emissions in Bangladesh are:

Regulation (setting renewable energy target to reduce carbon emission)

Regulations are most common form of interventions to reduce GHG emission like renewable energy target, light bulbs, specifying production technology or input to use or not to use etc.

Market based incentives to reduce pollution (tax on carbon emission)

Market based interventions create a price incentive to internalise the cost of externality and correct the market failure.

Regulation : Renewable energy target

A tax on carbon emission

Regulations can be imposed by considering the particular circumstances of a firm or industry. For example, it is possible to set a renewable energy target for a firm consuming more energy after a limit.

A tax on carbon emission is uniform in nature. For example, two companies – electricity generating and transport, have to pay same amount of tax on each tonne of GHG emission.

The connection between regulations and GHG emission outcome is more direct. So the outcome of regulation on GHG emission can be predicted with some degree of certainty.

Tax gives assurance about the marginal cost of reducing pollution but the amount of pollution reduction is uncertain under taxation.

Regulation requires reliable and accurate information because abatement cost will possibly rise when the regulators do not have accurate information.

Sometimes tax is more complex compared to regulations. In setting the tax rate, knowledge of all functions, MPC, MEC and MPB, or MB and MC is required.

Regulations require changes over time as MC function changes with changes in production technology, input costs, and product demand.

MC curve shifts over time with changes in production technology, input costs, and product demand requiring changes in tax.

Regulations are unlikely to be lowest cost.

Tax allows the producers to find least cost or cost effective way of reducing pollution.

Regulation does not generate government revenue but creates transaction cost for monitoring and implementing those.

Tax generates government revenue.

Regulations are appropriate for developing countries as they build initial capacity by bringing new technology e. g. solar energy, wind power etc.

Tax interventions are appropriate for developed countries as they require more institutional feasibility and sensitive monitoring system

Regulation adds implicit extra production cost.

Tax adds explicit extra production cost and often politically unpopular and may assist rent seeking by lobby groups.

Regulations are imposed by targeting goods and services which emit more carbon.

Tax on carbon gives signal to producers and consumers about which goods and services produce more carbon and which produce less or none. Therefore, consumers and producers can plan to shift from high-carbon products and technologies to low-carbon products and technologies.

Under regulation, firms do not have incentives to reduce pollution after meeting the regulation target.

Under tax, firm have incentives.

Renewable energy target

The current potential demand of energy in Bangladesh is 5569 MW where supply is less than 4000 MW . The economy of Bangladesh has been growing at a rate of 6-7 percent from last few years . These are causing rise in energy demand which in turn increases GHG emission. Bangladesh’s GHG emission from energy sector is relatively low as most of the power is generated from natural gas which causes low carbon emission. The current contribution of renewable energy is 0. 5 percent. The government is planning to increase the share of renewable sources in total power generation by 5% in 2015 and 10% in 2020 .

Source:

Figure 3: Power Generation Fuel Mix of Bangladesh in 2009

But as the reserve of natural gas has been depleting very quickly and the demand of energy is increasing, dependency on fossil fuel and coal based energy is increasing. As a result it is expected that the GHG emission will rise. Natural gas contributed 64 percent of CO2 emission and petroleum products contributed 36 percent emission of Bangladesh during 2008-2009 .

Efficiency of regulation

There will be an efficiency gain for regulation if the regulation is implemented in cost effective way.

Price ($) KW electricity

S'= S + Regulatory Cost

S= MPC Regulatory Cost

MC

MB

Welfare Gain

0 = em

Reduction of pollution

Figure 4: Market effects of regulation

Quantity of coal and fuel produced electricity

P'

P

Q

e*

Q'

D= MPB= MSB

Price and cost per unit pollution

As the government is trying to increase the share of renewable energy in total energy, its imposing some regulatory costs on coal and fuel produced electricity. In figure 4, MPC= S curve shifts to S' due to the regulatory cost. The amount of electricity produced by coal and fuel has decreased from Q to Q' while price has increased from P to P'. In the second part, initially at the market solution, reduction of pollution is 0. Due to the regulation, the

amount of pollution reduction increases from 0 to e*. Optimal level of pollution reduction will be at the intersection of MB and MC curve. From 0 to e* level of pollution reduction MB > MC and the amount of welfare gain is the blue triangle.

The correlation between production of coal and fuel based electricity and GHG emission is very high. So the regulations imposed on those will directly influence the amount of GHG emission. Regulations are unlikely to be lowest cost. For example, the cost of producing electricity by solar panel is higher compared to the cost of producing electricity by coal.

Table 1

Source:

But the price of coal and gas is also increasing which is lowering the gap of the costs. A renewable energy plant like solar panel can reliably serve for decades without emitting GHG at lowest maintenance cost. Under regulation, once firms meet the regulation target Q*, no incentive for further reduction.

Reduction of pollution

Cost per unit

Q*

Figure 5: Regulation and pollution reduction

$ If regulations are not met

Distributional effects

Firms producing energy by using coal and fuel will lose their share in the market as their quantity decreases which will also reduce the amount of GHGs emission. The price of coal and fuel produced electricity will rise. The prices of products which use electricity a lot will also increase and influence the buyers of those goods.

To increase the supply of renewable energy, more renewable energy plants will be built. It will increase the demand for renewable energy accessories like solar panel, wind turbine etc. So the suppliers of those inputs will gain. Initially at the market solution, amount of pollution reduction is zero. When the regulations are imposed the amount of pollution reduction increases to e*. The people who are polluted initially are gaining as the amount of pollution is decreasing.

A tax on carbon emission

A tax on the emitter of GHG can also be proposed to reduce GHG emission in Bangladesh. The tax will place an explicit additional cost on per unit emission. Before the tax, polluters emit GHG at zero marginal costs. The result is excess supply of GHG gas in the atmosphere leading towards its market failure. In presence of the tax, polluters emit GHG at a cost equal to tax rather than zero. This tax sets a price of GHG emission in the market where the market chooses the quantity of emission.

Efficiency of carbon tax

Price ($) KW electricity

Quantity of electricity

MSC= MPC + MEC

S= MPC Regulatory Cost

MC

MB

Welfare Gain

0 = em

Reduction of Pollution

MEC

Govt. Revenue

Figure 6: Market effects of tax

e*

Pt

P

Qt

Qm

MPB

Pm

Price and cost per unit pollution

In figure 6, the production of electricity generates GHG emission by product and MEC curve shows this negative externality. Market equilibrium is at the intersection of MPC and MPB curve and the market price is Pm and quantity is Qm. But the social optimum is at the intersection of MSC and MPB curve. To attain the efficient level of Q, if a tax is imposed on Q by the amount of MEC then the level of output and price will be Qt and Pt respectively. The amount of electricity has decreased from Qm to Qt while price has increased from Pm to Pt. In the second part, initially at the market solution, reduction of pollution is 0. Due to the tax, the amount of pollution reduction increases from 0 to e* and the amount of welfare gain is the blue triangle. In the above figure, tax sets price, market chooses quantity. The efficiency of the programme depends on the ability of setting tax at a point that induces behavioural change.

Distributional effects

Firms producing output that by product emit GHG will lose their share in the market as their quantity decreases which will also reduce the amount of GHG emission. The price of electricity will rise which will also increase the prices of products which use electricity a lot in production. The consumers of those products will be worse off by paying higher prices. Moreover, more than 75 percent of Bangladesh’s export revenue comes from Ready Made Garments (RMG) sector which consumes high electricity in the production process. A rise in electricity price led by the carbon tax will increase their production cost and reduce their competitiveness in the international market.

There is a gain in government revenue by the yellow rectangle. A portion of the generated revenue may be used to compensate RMG producers by

providing financial incentives. Most taxes create distortions but carbon tax corrects distortion. Carbon tax may yield double dividend – one by reducing emission and another by financing the reductions of incentives.

Carbon tax increases the amount of pollution reduction from 0 to e*. The people who were polluted initially are gaining as the amount of pollution is decreasing. Tax allows the producers to find least cost or cost effective way of reducing pollution. In figure 8, from 0 to e* level of pollution, tax is higher than MC of pollution reduction. Firms will find it profitable to reduce pollution by inventing new technology, investing in research and development rather than paying the tax. After e* level of pollution reduction, MC of pollution reduction is higher than the tax. So it will be cost effective for the firm to pay the tax.

Price and cost per unit pollution

Reduction of pollution

T

MC of reduction of pollution

e*

Figure 7: Pollution reduction efficiency

0 = em

Tax

In Bangladesh, relative elasticities of the products should be considered in setting the carbon tax because tax imposed on carbon passes to buyers and the share that will pass on depends on relative elasticities. In figure 8, the full burden of taxes passes on to consumers when elasticity is perfect.

Price ($) KW electricity

Quantity of electricity

MSC= MPC + MEC

S= MPC Regulatory Cost

MSC= MPC+MEC

MB

Qt

Quantity of electricity

MEC

Figure 8: Effects of tax on price depending on elasticities

Qm

Pt

P

Qt

Qm

MPC

Pm

Pt

Pm

Price ($) KW electricity

A carbon tax will increase the cost of production for not only the products directly involve pollution e. g. electricity and transport but also for other products using electricity and petroleum inputs in production. As their

production cost rise, their price will also rise. 31. 5% population of Bangladesh live below the poverty line in 2010 . The carbon tax will increase the burden of poor people through increased price. To ameliorate the burden, financial assistance can be provided to the low-income households by using the tax revenue . In figure 9, we can see that as tax is imposed on electricity, the price of electricity increases so the budget line of the consumers will rotate inward and the consumer will move to a lower indifference curve ICt. The consumer can be compensated by an income subsidy which attains the same level of utility as before tax.

Quantity of electricity

IC

ICt

Quantity of X

Figure 9: Income substitution to the consumers

In 2009, 5 percent of total labour force of Bangladesh was unemployed . A carbon tax may deteriorate the scenario by occurring creative destruction associated with the jobs of carbon intensive products and production processes. But it will also create jobs for carbon extensive products and production processes. The net aggregative employment effect is close to zero.

Recommendation

Energy is the lifeblood of growing industry sector of Bangladesh. The intensity of current potential energy deficit can be substantially met by fuelling the growth of renewable energy. Different financial incentives can be offered for that purpose. For example, Bangladesh imports renewable accessories from abroad like solar panels from Germany. If import duties are removed from the accessories of solar panel, the cost of producing solar energy will decrease. Moreover, the poor people living in the rural areas having no electricity access also lack the capability to install renewable energy at household level. Government can provide them financial assistance in launching solar panel. Private investment should also be encouraged by creating proper financial incentives. For large scale investment Public Private Partnership (PPP) can be formed. R&D for inventing renewable accessories at domestic level can reduce the production cost substantially.

It may be difficult to enforce a carbon tax with underdeveloped institutions occurring higher administrative costs. In Bangladesh, the current tax structure lacks the capability and institutional feasibility to implement carbon tax. Before introducing carbon tax, the tax mechanism is needed to be restructured by developed institutional capability. In setting the tax main focus should be given to on electricity, gas, coal, some petroleum, fugitive emissions and some manufacturing while exclude agriculture, petroleum used by small vehicles and primary production and small business.

Conclusion

Although Bangladesh is attaining persistent economic growth, per capita energy consumption is still very low. So in future there will be increase in total energy production and consumption which in turn will increase the amount of carbon emission . A key way to transform into low carbon economy is imposing regulations on renewable energy target which can create two-fold benefits for Bangladesh- environmental and energy sufficiency. The reduction in GHG emission in the atmosphere will bring environmental improvements. Moreover, it will reduce the potential demand and supply gap of power and help to attain energy sufficiency. A carbon tax can also be charged by restructuring tax mechanism with substantial infrastructural improvements.