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A review of the existing policy instrument for transforming the brick kiln sector of Bangladesh

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Abstract

Application of Command and Control (CAC), as policy instrument with different technology options, in extremely polluting and informal brick kiln sector of Bangladesh over last decade has resulted in a shift in baseline technology. While market share of the new technology has grown from only 3% to around 63% in a sector of several thousand brick kilns, the achievement is jeopardized as the technology is arguable over environmental standards. This paper amply shows that prescribing different technologies following some pilot projects and banning the baseline technology to bolster market transformation has thus far not been effective. Building on previous reports, policies and literature, the paper explores what lessons can be drawn from CAC regime for Bangladesh and it raises fundamental issues related to alternative policy instruments and concludes that despite very qualified success in terms of effectiveness, CAC would continue to be the policy of choice in the foreseeable future. However, the existing policy would provide necessary leeway to choose and be prepared for the right policy instrument. The paper, furthermore, explores some possible contribution options of the sector to Nationally Determined Contributions (NDC) of Bangladesh.

Keywords: Policy Instrument; Brick Kiln; Pollution; Nationally Determined Contributions; Bangladesh

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1. Introduction

In the absence of stones and alternative building materials, brick is the most important construction material for construction sector in Bangladesh (ADB, 2012). Very informal in nature, most of the entities/establishments of the brick kiln sector have employed archaic and inefficient technologies (Croitoru and Sarraf, 2012). The sector is notorious for air pollution and emits approximately 10 million ton of CO_2 per annum, contributed mainly by traditional brick kilns (World Bank, 2016). With mostly small and medium sized enterprises (SMEs), the sector typically relies on migrant workers to carry out temporary operation during dry season. Lack of job security, environmental and social safeguards are pronounced features of the sector. Due to temporary nature of operation, most of the brick kilns do not have access to bank finance (UNDP, 2006). In addition, children perform risky jobs, suffer from health-related problems and live in a very poor condition in the sector. Child labors are deprived of their basic rights because of kiln owners' apathy (ILO, 2014). Due to the presence of negative externalities, i.e., greenhouse gas (GHG) emission, air pollution and long list of other social problems, the brick making sector has been the concern of the government and development agencies for many years. Over the last decade, the government has regulated the sector under "Command and Control (CAC) instrument", with directives of using certain advanced technologies in place of polluting Fixed Chimney Kilns (FCK), subsequent to the initiative of a development agency in the sector. Inclusion of these technology kilns in low cost green finance scheme and provision of tax rebate for these kilns demonstrate backing up of government's regulation with action. Nonetheless, even after a decade of CAC regulation, there is apprehension over the sectoral progress in general. In light of these, the paper gives an overview of the present status of the sector while analyzing different initiatives taken during the last decade for transformation of the sector under CAC regime. The paper further draws lessons from last decade of CAC instrument to offer experience for future. Finally, it attempts to evaluate the present policy and offers direction for future.

2. Methods

The paper is a review of the policy instrument and related regulations imposed on the brick kiln sector of Bangladesh during last decade. Revisiting the existing reports and journals on the sector, the paper assesses the present status of the sector and effectiveness of existing policy instrument. Theoretical background of alternative policy instruments is reviewed from literature of environmental economics to suggest future pathway for the sector. Finally, based on available data on mitigation potential of efficient brick technology, the paper develops possible contribution scenarios of the sector in national climate policy of Bangladesh.

3. Initiatives taken in brick kiln sector during last decade

In last decade, the brick kiln sector has been mediated by the government through CAC instrument with several technology options and circulars for closure of polluting FCKs (baseline technology). This CAC

instrument has been applied following the initiative of UNDP in the sector and supported by low cost funding and tax rebate. Developments over the last decade have been furnished below:

3.1. Piloting for energy efficient technology transfer

In view of aggregate GHG emission and long list of social problems, in 2006, UNDP introduced Chinese HHK technology, a hybrid version of German Hoffman Kiln, in Bangladesh and provided technical assistance in implementing pilot projects. However, the technology is more expensive compared to FCK (UNDP, 2006). Assuming that the high upfront cost of "HHK" has probable impacts on market acceptance, the World Bank along with a local financial institution, namely IIDFC, initiated Clean Development Mechanism (CDM) projects in the sector. Two CDM projects, each having 8 HHKs, have been implemented and carbon revenue of CDM has helped mitigate some of the challenges in terms of investment risk and initial technology transfer. These kilns are 50% less GHG emitting with respect to traditional FCKs (UNFCCC, 2011; UNFCCC, 2012). In the meantime, efficiency and cost of different alternative technology options, such as HHK, Tunnel, Zig-zag and Vertical Shaft Brick Kiln (VSBK), in comparison to FCK have been estimated (World Bank, 2011). As the sector needed additional support, the World Bank had further supported the Ministry of Environment and Forests (MOEF) through 10 demonstration projects under Clean Air and Sustainable Environment (CASE) Project. These kilns are found to be 30% more energy efficient compared to FCKs (World Bank, 2017). The pilot projects under technical assistance of development agencies along with implementation of CDM projects with involvement of local institution and available information on different technologies has laid the ground for technology transfer in the brick sector of Bangladesh.

3.2. Application of CAC instrument

The Department of Environment (DOE), under MOEF, is the mandated government agency to provide license for new brick kilns and to renew license of existing brick kilns as and when required. Having realized the necessity to bring the brick kiln sector under regulations to reduce pollution and increase energy efficiency, DOE issued a circular to the existing kilns in 2007 to either switch to alternative fuel or install energy efficient technologies, stipulating that, license of existing kilns would not be renewed in the event of default. Given the absence of readiness and technology options or emission standards, the attempt was futile (World Bank, 2011). Moving forward, as different efficient technology options have emerged from pilot projects of development agencies, the government became more aware of benefits of new technologies and felt the urgency to restrict FCKs to promote efficient ones. Against this background, the DOE issued a circular in 2010 banning FCK operation from 2013 and provided initial boost to the market for adoption of cleaner technologies (World Bank, 2011). Although advanced technologies, such as HHK, Tunnel etc., were considered efficient and environment friendly in the market, a clear regulation or act to that regard was missing. Subsequently, in 2013, the Brick Burning Act of Bangladesh was revised/amended with, among others, the inclusion of HHK, Tunnel, VSBK, Zig-zag or equivalent technology as eligible brick making technologies in Bangladesh (Government of Bangladesh, 2013). The act also provided the narratives on suitable locations where brick kilns could be built and has been in force since July 2014 (Department of

Environment, 2014). The other important aspect of the act was that, the deadline for conversion from FCK to advanced technologies was extended until July 01, 2016 (Naim and Gazzali, 2017).

3.3. Low cost funding by Central Bank

The Central Bank of Bangladesh regulates the banking sector and formulates monetary policy. It also develops time befitting policy to boost preferred sectors through, for example, developing low cost loan scheme. In one of such moves, the Central Bank included energy efficient HHK and equivalent technologies in its low cost refinancing scheme in 2010 to promote green banking and accelerate GHG mitigation in the brick kiln sector. The highest rate of lending was fixed at 9% (Bangladesh Bank, 2010). To ensure adequate fund for the sector, the Central Bank has arranged a dedicated refinancing scheme of USD 50 million, channeled by ADB. Technologies eligible for this refinancing are: HHK, Tunnel, VSBK and improved Zig-zag (Bangladesh Bank, 2015). As the lending rate of banks has recently been reduced significantly and is hovering around 9.4% (Islam, 2018), this refinance scheme is no longer attractive. However, earlier this scheme was lucrative as the weighted average lending rate was in between 10.39% and 13.67% during 2010 to 2016 (Sultana and Halim, n.d.).

3.4. Tax rebate

Recognizing the potential of green bricks, the Government of Bangladesh put forward proposal for the tax rebate on green technology in 2014-15 budget session (The Financial Express, 2014). Being approved by the government, the policy has been applicable since 2014-15.

4. Present status of the sector

Currently, 6,744 brick kilns are in operation in the country. With over 50% market share, Zig-zags have become the market leader as shown in Table 1. FCKs, being outlawed due to its polluting and energy intensive nature, have lost its dominance and primarily been converted to Zig-zags. With only 119 HHKs and Tunnel kilns (Department of Environment, 2017), the advanced technologies have failed to penetrate on the market.

Table 1. Comparison of brick kin sector in 2009 and 2017*

Type of Kilns	Number (Percentage) in 2009	Number (Percentage) in 2017
FCK	4,500 (92.21%)	2,373 (35.19)
Zig-zag	150 (3.07%)	4,247 (62.97%)
HHK	30 (0.61%)	61 (0.90%)
Tunnel Kiln	0	58 (0.86%)
Total	4,880	6,774

** (Department of Environment, 2017)*

On a positive note, application of CAC over last decade has resulted in installation of over 100 HHKs and Tunnel kilns. The real concern, nevertheless, remains on the persistently slow diffusion of these technologies. While majority of the FCK Owners have converted/upgraded their kilns to Zig-zag kilns, many of these kilns have been constructed without following any standards (UNDP-GEF, 2014). One advanced technology kiln, for instance HHK, can replace 8 FCKs and still now, Bangladesh needs approximately 1,000 HHKs or brick kilns of other advanced technologies for sustainable transformation of the sector (World Bank, 2016).

5. Lessons learned from last decade

5.1. The baseline has shifted

From 150 in 2009, the number of Zig-zag kilns has increased to 4,247 by 2017, representing approximately 63% market share against the falling share of FCKs from 92% to 35% over the same period (Table 1). In 8 years, there has been a considerable shift in baseline.

5.2. Transition towards Zig-zag raises alarm

As a rule, flue gas of Zig-zag kilns is drawn into water reservoir and scrubbed to control emission before being released to atmosphere. This scrubbing water is required to be changed periodically by kiln operator for proper functioning of the emission control process. But many Zig-zag kilns do not follow this. On the other hand, Regulator sees that, there has not been anything on the implementation of Improved Zig-zags as those are still at piloting phase (Department of Environment, 2017). UNDP claims that, there is no standard fixed for Zig-zag and stakeholders raise the issue that majority of the Zig-zags do not comply with emission standards set out by the government. This creates a precarious case – what if owners of the newly installed Zig-zags need to shift to better technology within few years? Many brick kiln owners also express their concern in that regard (UNDP-GEF, 2014).

5.3. The incentive trilemma

If the private cost-benefit of previous baseline, i.e., FCK and energy efficient technology, for instance HHK, are considered, HHK generates a slightly better net benefit compared to FCK for same number of bricks when upfront investment of HHK is 14 times more than that for FCK, ensuing a greater investment risk on HHK projects (Croitoru and Sarraf, 2012). Apart from that, firms of the informal sector are less concerned about environmental aspects since they are in continuous competition to reduce costs (Blackman and Bannister, 1998). Hence, HHK technology favors big investors instead of the small FCK owners (Darain, et al., 2015). On the demand side of the market, a traditional brick is 40% cheaper than the bricks produced in cleaner technologies (Luby, et al., 2015). As such, advanced technologies are facing a trilemma: high upfront cost that is not suitable for smaller investors like FCK owners, brick kiln sector is on continuous cost-cutting motto and traditional bricks are cheaper. To address the trilemma, the Central Bank has been offering a loan costing

9% per annum coupled with a tax rebate for efficient kilns. However, as the interest rate of loan in the country has gone down in general and is ranging from 9.3 to 9.39% per annum (Islam, 2018), the refinancing scheme doesn't provide the necessary incentive for the entrepreneurs to switch to advanced technologies.

5.4. Market is not fully ready for advanced technologies

Many small brick kiln owners are not well acquainted with the technologies of new kilns, lack technical knowledge in general and do not have access to necessary finance to switch to new technologies like HHK (Tehzeeb and Bhuiyan, 2014). Therefore, it can be concluded that, there is gap in necessary market readiness for advanced technologies.

5.5. HHK technology has failed to live up to the expectation

While kilns like HHKs are highly energy efficient compared to FCKs for same level of output (IIDFC, 2009), available evidences display that the failure rate of HHK is excessively high. Of the 15 demonstration projects of UNDP, only one HHK is in full operation and even three kilns have abandoned operation. Altogether over 50% of the HHK projects, implemented in the country, are non-operational (UNDP-GEF, 2014). The CDM projects of IIDFC-World Bank initiative shows a better scenario compared to UNDP's demonstration cases. One of the eight HHKs included in first CDM project has been abandoned by the owner after couple of years of operation and one more has not been implemented (UNFCCC, 2014 a). In the second CDM project, two HHKs have been dropped from the project (UNFCCC, 2014 b). With such a high rate of failure altogether, HHK has failed to live up to the level of expectation.

5.6. The missing control over the sector

The new Brick Kiln Act of 2013 has specific directives vis-à-vis location of kilns. Yet, kilns are found to be operational in ecologically critical area (Deshwara, 2018). Although using wood as a fuel in kilns is prohibitive, brick kilns still use woods, violating the law (Akash, 2017). What is more, Bull's Trench Kilns (BTK) were banned in 2002 (World Bank, 2011) but few BTKs are still in operation (UNDP-GEF, 2014). Lagging monitoring as well as enforcement, among others, are the reasons behind the status quo. It appears that, while the Regulator has been using Command and Control (CAC) instrument, the Regulator has only "Command" but not full "Control" over the sector.

5.7. Ambiguity in Brick Kiln Act and related policies

Zig-zag, VSBK, HHK, Tunnel or similar technologies have been prescribed in the new Brick Kiln Act of Bangladesh (Department of Environment, 2014). Whereas, the green financing scheme includes analogous wording, i.e., "HHK or equivalent technologies" would be eligible for low cost refinance of the Central Bank (Bangladesh Bank, 2010). There is ambiguity over "similar technology" and "equivalent technology" as to which technologies can be considered as "similar" or "equivalent" to HHK. Moreover, low cost fund channeled

by ADB to the Central Bank has perquisite that Improved Zig-zag kilns have to be considered in addition to HHK, VSBK and Tunnel for refinancing and this scheme doesn't include Zig-zag kilns. The other important feature stipulated in ADB's fund is that refinancing of Improved Zig-zags is subject to the adherence to the standards of DOE (Bangladesh Bank, 2015). However, Improved Zig-zags, according to DOE, are at the very early stage of adoption (Department of Environment, 2017). There is also no standard for Zig-zag available in the country. As such, there are doubts and some sort of contradictions among the policies.

5.8. CAC has been little effective

Environmental effectiveness of a policy means "to what extent the policy is meeting the environmental target" (IPCC, 2007). In an attempt to assess the effectiveness of the CAC policy, data on the total number of kilns are investigated. And what is of real concern is that, there is no consensus on the exact number of brick kilns in the country. The earlier estimate by the World Bank shows, the number of brick kilns in the sector was 5,000 (World Bank, 2011) but the World Bank later projected it to be around 8,000 (World Bank, 2016). The recent draft report of DOE claims that the number is 6,744 (Department of Environment, 2017). Moreover, as one advanced technology kiln is capable of replacing eight FCKs (World Bank, 2016), over 100 HHK and Tunnel kilns, implemented so far, should have reduced several hundred FCKs but there is no literature on that. While FCK owners were initially directed to convert to alternative efficient technology options by 2013 and then by 2016, hundreds of FCKs still exist in the country. The switch from FCK to Zig-zag remains questionable over lagging standards and remains to be seen how these are intervened in foreseeable future. With uncertainties in data, concern over Zig-zag technology and missing deadlines, it can be fairly concluded that, a decade of application of CAC has been very little effective in achieving its objective.

6. Way forward for Bangladesh

6.1. Policy Instrument in the foreseeable future

While the CAC has fallen short to transform the sector, it is necessary to swiftly turn to the possible instruments that may lead from now onwards or in future. In literature and real world, different environmental policy instruments are discussed and/or used for pollution control and can be categorized in general as in Table 2.

Imposing a tax per unit of emission, as proposed by A. C. Pigou, on the polluters can properly address the problem of pollution (Stavins, 1998). Another view to internalize externality is to reward a firm for reducing each unit of emission compared to baseline emission, expecting changes in the firm's production process through reducing input intensity and/or taking control measures at the exhaust (Goulder and Parry, 2008). Finally, the emissions trading, where firms can trade emissions among themselves, can help achieve environmental target at reduced cost if it is designed appropriately. The firms with lower abatement cost

would have high incentives to trade permits to the firms with higher abatement cost, resulting in benefits for the parties involved in trading (Tietenberg, 2003).

Table 2. Policy Instruments to Reduce Pollutions

Policies	Instruments
Market based instruments (MBIs)	Emission charge/tax, subsidy and emissions trading (Tietenberg, 1990)
Command and control (CAC) measures	Technology based standards (types of technologies/methods of productions) or performance-based standards (allowable emissions without dictating the process of achieving/emission standards) (Stavins, 1998).

Putting price on carbon emission gives industries the signal to invest on emission reduction as long as price is known or remains stable. But both Carbon Tax and emissions trading scheme (ETS) have inherent design features and these instruments also differ significantly in terms of necessary readiness to implement in a country. Although the tax is a more popular topic in public domain, an instrument like ETS is not. Implementation of carbon tax might utilize existing infrastructure, the same cannot be true for ETS, which is more sophisticated and requires the establishment of carbon market along with other features. Both Carbon Tax and ETS need vigorous monitoring and reporting system to ensure compliance. These reports are subject to verification by qualified professionals. Choosing between these two instruments depend on the market structure, size and government priorities (ADB, 2016).

Despite increasing acceptance of pricing instruments to control human induced environmental damages over CAC (Gunatilake and Guzman, 2008), the Carbon Tax/incentive doesn't seem suitable now for several reasons. Firstly, putting the right price on carbon emission that internalizes exact damage would require additional analysis. Secondly, although the monitoring system might be indirect, the government will have to establish the mechanism. This would take time to get prepared, given the lagging monitoring system that the government presently has. Thirdly, the challenge would be to bring the brick kilns into compliance to carbon tax as experiences, as discussed above, show that the government doesn't have full control over the sector. On the other hand, to make ETS a reality, national carbon market needs to be in place. Before moving to that stage, designing a national trading system would require strong political will, capacity development, developing framework conditions etc. This process would certainly take time and efforts of the government. While emissions standards through CAC is another option, the government currently lacks the necessary capacity (UNDP-GEF, 2014).

As environmental effectiveness i.e. to what extent the policies are meeting targets, (ii) cost-effectiveness i.e. achieving mitigation target at the lowest cost, (iii) distributional effects i.e. impact on the polluters and (iv) institutional feasibility i.e. capacity of the Regulators to enforce and/or implement, are important parameters to choose right instrument (IPCC, 2007), a detailed study would be necessary to choose the right instrument for the long run. In addition, environmental policy making involves certain degree of risks and the choices that we make also embody some tradeoffs. Therefore, these matters shall be taken care of in the

stated study. Under such circumstances, technology directives under existing CAC seems to remain the policy instrument for the sector in the foreseeable future despite its limited success in last decade. Still, the Regulator will be able to draw on from the lessons learned during last decade and may, based on that, improve the existing CAC instrument to increase effectiveness. More importantly, this would provide the Regulator necessary leeway to transit towards new instrument for the long run.

6.2. Potential of the Sector in light of National Climate Policy

Even after the dismal performance of the sector and little effectiveness of the CAC instrument in the last decade, the sector has opportunities to offer in the foreseeable future. As in (Intended) Nationally Determined Contributions (NDC), Bangladesh has vowed to reduce altogether 5% GHG emissions unconditionally and 15% conditionally in power, transport and industry sectors by 2030 compared to business-as-usual scenarios, brick kin sector, being one of the largest polluting sectors in Bangladesh, can contribute to industrial GHG mitigation and help achieve NDC. The industry sector under NDC has target of 4 million ton of CO_2 mitigation unconditionally (4% of the sector) and 11 million ton of CO_2 conditionally (10% of the sector) (Ministry of Environment and Forests, 2015). Notably, improving efficiency of the brick kilns is one of the measures that the government has already chalked out in NDC. Given that, the brick kiln sector emits around 10 million ton CO_2 and advanced technology like HHK or Tunnel is 50% less GHG emitting (World Bank, 2016), several possible scenarios can be drawn (see Table 3) on how mitigation in the brick kiln sector can contribute to NDC of Bangladesh.

Table 3. Possible Contribution Scenarios of Brick Kiln Sector to NDC

Scenarios	CO_2 Reduction target for Brick Sector	Possible CO_2 Reduction (million ton/annum) by Brick Sector	% of contribution by Brick sector to industry target
1	4% (unconditional like industry sector)	0.4[1]	10%[2] of industry's unconditional target of 4 million
2	10% (conditional like industry)	1.0[3]	9.1%[4] of Industry's conditional target of 11 million
3	If 50% of the kilns are converted to clean technologies, such as,	2.5[5]	62.5%[6] of industry's unconditional target of 4 million or 22.7%[7] of industry's conditional

[1] 4% of 10 million
[2] (0.4*100/4)
[3] 10% of 10 million
[4] (1*100/11)
[5] Brick Sector emits 10 million ton of CO2; HHK/Tunnel is 50% less emitting; if conversion target is 50%, emission reduction is (50%*50%)/10;
[6] (2.5*100/4)
[7] (2.5*100/11)

HHK or Tunnel Kilns	target

7. Conclusion

While on paper, CAC seems a very simple and straightforward instrument to achieve environmental objectives in a polluting sector; various challenges that have emerged over the implementation phase of the instrument in Bangladesh suggests it to be not so simple. The efforts of the decade manifest that, in the absence of market readiness and appropriate incentives, entrepreneurs have preferred the cheaper alternative (Zig-zag kiln), which even doesn't have standards, leading to a shift in technology baseline of the brick sector. On the one hand, advanced technology kilns face incentive problems. Lagging monitoring and lack of Regulatory control over the sector along with very high rate of failure of advanced technology kilns (HHK) have resulted in a very limited success of CAC. Study or research shall be conducted to choose appropriate instrument that would serve better from the point of effectiveness, distributional impact and institutional feasibility. In the interim period, CAC policy - with technology options - seems to remain the policy of choice in the foreseeable future. The area of further research interest could be identifying the reasons behind failure of advanced technology (HHK) in Bangladesh, how to incentivize expensive technologies and fixing standards for Zig-zags to ensure sustainable technology transfer. Moreover, despite a gloomy performance of the sector in the last decade of CAC regime, it shows favorable sign especially in light of GHG mitigation potential. Under varying circumstances, the sector may reduce in between 10% to over 60% of GHG mitigation targets of industries under NDC. And achieving that will depend on how the government devise plans for embarking on the transformation of the sector.

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