Technology Fact Sheet for Mitigation

Technology Fact Sheet – Advanced Pulverized Coal (Double Unit) [i]

Sector	**Power generation**
Technology name	Advanced Pulverized Coal (Double Unit)
Subsector GHG emission (mn mt CO2 equivalent	11.9 mn mt of CO_2 equivalent from power generation
Background/short description of technology	Pulverized coal power generation starts by crushing coal into a fine powder that is fed into a boiler where it is burned to create heat. The heat produces steam that is used to spin one or more turbines to generate electricity. Subcritical plants make up the bulk of the U.S. pulverized coal system, with efficiencies for new plants usually around 37 percent. Pulverised sub-critical plants can be taken to be the benchmark for evaluating super critical, ultra super critical and IGCC plants. Advanced Pulverized Coal Facility is provided for a nominally 650 MW coal-fired supercritical steam-electric generating unit which employs a supercritical Rankine power cycle in which coal is burned to produce steam in a boiler, which is used to run a ST to produce electric power. The steam is then condensed to water and pumped back to the boiler to be converted to steam once again to complete the cycle. The APC double unit has the same features as for APC single unit above with the provision that the rated nominal capacity is 1300 MW. But as we shall see, not everything gets doubled including costs. Based on: **1. Ngo, Christian and Joseph Natowitz*, Our Energy Future: Resources, Alternatives and the Environment*. 2. U. S. Energy Information Administration Office of Energy Analysis, *Updated Capital Cost Estimates for Electricity Generation Plants,* November 2010.**
Implementation assumption, how the technology will be implemented and diffused across the sub-sector	Many of the new power plants in the pipe-line are based on oil and are small as emergency measures for tackling the present shortages of electricity. One major problem had been the estimated shortage of gas. However, the present plants are very old and the same quantity of gas used in these plants can produce much more electricity using better technology. Also, new discoveries and assessments of gas reserves indicate that the future supply of gas may not dwindle as fast as may have been thought so far. While new gas-based plants may be set up, clean coal technology is an attractive alternative from two points in view. Firstly, the country has some, though not very abundant, coal reserves. This need to be utilized well and highly efficient technologies such as IGCC may be utilized for the purpose. Secondly, while there may be improved situation related to gas reserves, dependence on coal is likely to increase in future in

	which case efficient but also cleaner technologies (because coal is the dirtiest fuel from CO_2 emission point of view) needs to be employed to make the most of the scarce resource. And in that case global support leveraged by UNFCCC (in the form of Green Climate funding) is likely to be available if the case is made well. It should be noted, that of the 4 coal-based power generation technology, this one is ranked 4th although there are little differences in the final scores among the prioritized technologies. More emphasis is likely to be given, under coal based generation to dual unit advanced pulverized coal technology because the investment costs are somewhat lower while the power output becomes double of that for single unit plants. In fact, one Bangladeshi coal-based plant is having a similar capacity of nearly 1300 MW. The nominal capacity, heat rate and the emission factor that have been assumed for a Double unit plant are 1300 MW, 8,800 Btu/kwh and 206 lb of CO_2 emission per MMBtu.
Reduction in GHG emission	The benchmark as argued should perhaps be the Pulverised sub-critical plant. Unfortunately it is difficult to get comparable figures for sub-critical plants. Hence we use the CT as the reference point. In fact, perhaps that is what it should be as the most prevalent mitigation friendly power generation technology in Bangladesh is the conventional combustion turbine. Hence the comparison may be with CT. Given this, the CO_2 emission actually increases, not reduced, if the APC Double unit supercritical technology is used compared to the equivalent power generation with CT. The respective emissions are 5.75 mn mt for CT and 8.21 mn mt for APC Double unit with supercritical technology. Thus, the increase in CO2 emission is almost 43%, the same as for APC Single unit compared to CT.
Impact Statements – How this option impacts the country development priorities	
Country social development priorities	Each of the double unit APCs will produce nominally 1300 MW. This is more than double the capacity of even the NGCC typical plant size of 540 MW. Thus the additional output will allow more electricity to the citizens to consume allowing a better quality of life. With increased supply of electricity, and consequent access to it, the lighting for studies will improve leading to better education prospects as well as security. The process of women's empowerment will be better served as with increased access to electricity the may enjoy facilities to which their access was limited previously.
Country economic development priorities	*Productivity* may increase as with better supply of electricity new technology may be introduced or the run time of factories may lengthen. On the other hand, better supply may spur the establishment of new factories and facilities and various service

	centres. *Job creation* will be facilitated because of productivity increase or the establishment of new enterprises. Both direct and indirect job creation may happen. Poverty will be reduced as more and more jobs are created and people are gainfully employed. *BoP* may be negatively impacted; however, as the machineries need to import from abroad and more sophisticated technology may be costlier. However, for each case of new power generation technology, the marginal effect of import of newer technology equipments may not be large.
Country environment development priorities	The emission factors of SO_2 and NOx for APC double unit are higher compared to CT; 0.1 and 0.06 lbs/MMBtu for APC as opposed to 0.001 and 0.03 lbs/MMBtu for CT respectively. This means that air pollution may increase due to use of APC double.
Other considerations and priorities	-
Costs	
Capital costs	The investment cost of a double unit APC is US$ 2,844/kw. Given that the capacity of a double unit APC is 1300 MW the price tag of a double unit APC is US$ 2.844*130000 or 3.70 bn. For CT of equivalent capacity it is only US$ 1.26 bn. Going for a coal-based supercritical technology as one unit establishment, is thus going to almost 3 times costly investment compared to benchmark gas-based generation.
Operation and maintenance costs Fixed O&M Variable O&M	Fixed O&M costs are for double unit APC US$ 29.67 per year per kw. Thus for a double unit APC fixed cost is US$ 35.06 mn. For a CT of comparable capacity, the fixed cost becomes US$ 9.07 mn. Variable O&M for double unit APC it is 4.25/Mwh and the total comes to US$ 42.4 mn per year. For CT of equivalent power generation, the total variable O& M costs come to US$146.72 mn. Thus CT variable O& M costs are almost three times as much compared to APC double unit.
Cost of GHG reduction	The emission actually increases, not reduced, from equivalent CT-based generation. Hence the cost of reduction is redundant

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment and Technology Action Plans For Climate Change Mitigation– Bangladesh. You can access the complete report from the TNA project website http://tech-action.org/**