Technology Fact Sheet for Mitigation

Technology Fact Sheet – Advanced Gas Combustion Turbine [i]

Sector	**Power generation**
Technology name	Advanced Gas Combustion Turbine
Subsector GHG emission (mn mt CO2 equivalent	11.9 mn mt of CO_2 equivalent from power generation
Background/short description of technology	The Advanced CT Facility produces electricity using a single natural gas-fueled, state of the art F-class CT and associated electric generator. The CT is equipped with an inlet evaporative cooler to reduce the temperature of the turbine inlet air to increase summer output. The Advanced CT Facility has the same general electrical and control systems as the Conventional CT Facility, except that the electric generator is rated at approximately 234 MVA and the corresponding General Set up Transformer is larger in the Advanced CT Facility. Note that there have been over time other variants, such as G and H-class CT which are somewhat improved versions of the F-class CT. We have chosen F-class, because, it is a completely proven technology. **Based on 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. The revision of the existing Power Sector Master Plan is therefore necessary to take account of these new realities. The revision may thus include provisions for this technology. It should be noted, however, that of the 3 gas-based power generation technology, this one is ranked 3rd. More emphasis is likely to be given, under gas based generation, to combined cycle and advanced combined cycle technology. The nominal capacity, heat rate and the emission factor that have been assumed are 210 MW, 9750 Btu/kwh and 117 lb of CO_2 emission per MMBtu

Reduction in GHG emission	While the actual lowering of CO_2 emission depends on the run time and production, note that the heat rate is somewhat lower for ACT compared to the conventional gas turbine. We assume a 320 days running time a year for 24 hours which give the CO_2 emission for one year's run time for ACT at 928 thousand mt and for equivalent CT power 834 thousand mt, i.e., 93 thousand mt or 10% less than for ACT compared to equivalent power generation with CT. This is for one year's run time. If an ACT and equivalent CTs are established today (say, 2010) by 2030, this will mean about 1.9 mn mt of less carbon di-oxide emission.
Impact Statements – How this option impacts the country development priorities	
Country social development priorities	Each of the ACTs will produce almost 2.5 times the nominal generation of combustion turbines and probably at much lower gas consumption. This will allow more gas and 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 be imported 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 have not be large.
Country environment development priorities	The emission factors of SO_2 and NOx will be the same as for the conventional gas turbines. But for equivalent output of electricity, again the emission will be broadly $1/3^{rd}$ of the conventional gas turbine. Thus there will be less emission and the air pollution will be comparatively less.

	There is likely to be a small fall in resource (gas) use efficiency as the heat rate is somewhat lower, 9750 Btu/kwh for ACT compared to 10850 Btu per kwh for CT i.e., for the latter it is 10% less.
Other considerations and priorities	-
Costs	
Capital costs	The costs of a ACT is 665/kw and a CT 974/kw. Given that the capacity of a ACT is 210 MW and that of a CT is 85 MW, the price tag of a CT with equal capacity as ACT is 2.47 times the cost/kw of each CT. That is for a CT it is 2.47*US$ 974//kw which comes to US$ 204 mn compared to an ACT of same capacity at just about US$140 mn. There is thus a huge cost advantage of ACT over CT.
Operation and maintenance costs Fixed O&M Variable O&M	Fixed O&M costs are for CT: US$ 6.98 and for ACT: 6.70 per year per kw. The differences are small on a kw basis, but when the comparison on an equivalent capacity basis is made, the costs for fixed O&M for CT becomes US$ 1.46 mn and for ACT US$ 1.40 mn. The differences are rather small and may be ignored for comparative purposes. The case for variable O&M is however quite different. For CT it is 14.70/Mwh and for ACT it is 9.87/MWh. If we assume that the two are run exactly the same number of hours in a year, CT variable O&M costs become US$24 mn and for ACT US$16 mn at the most. Again a somewhat clear cost advantage for ACT over CT for the same level of output.
Cost of GHG reduction	As the capital costs are far lower for ACT and the fixed O&M costs are similar while variable O&M costs are somewhat less for ACT for a year's run time, this means that the 10% lower emission is achieved at negative costs.

[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/**