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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
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**DRAFT GUIDELINES FOR COST-EFFECTIVENESS THRESHOLDS IN THE
TOBACCO SECTOR**

Background

1. The Secretariat presented to the 20th Meeting of the Executive Committee a comprehensive document on CFC-11 and carbon dioxide technologies used in the expansion of tobacco, and their respective costs (UNEP/OzL.Pro/ExCom/20/64). The document also provided a summary of the only project approved until that time by the Executive Committee, and included a section on China's tobacco sector as well as the implications of the proposed method of calculating incremental cost to the Multilateral Fund.
2. The Executive Committee took note of the document and requested the World Bank to submit to its 21st Meeting, a project proposal for Indonesia based on the methodology outlined in document UNEP/OzL.Pro/ExCom/20/64 (Decision 20/44). However, the World Bank calculated the amount of the grant eligible for the Indonesian project on the basis of the cost-effectiveness value of the approved Philippines project because by applying the methodology referred to above, a very high incremental cost resulted.
3. The Committee approved the Indonesian project on an ad hoc basis and requested the Secretariat and implementing agencies to consider new guidelines for cost-effectiveness thresholds in the tobacco sector (Decision 21/8).

Tobacco expansion technologies

4. Expansion of tobacco leads to enhancement of taste and less tobacco content per cigarette. However, unlike other CFC usage, it is not a precondition for the production of tobacco products, as evinced by the fact that the majority of cigarette manufacturers in Article 5 countries do not use CFC to expand raw tobacco.
5. CFC and carbon dioxide tobacco expansion technologies are owned by a few technology providers worldwide. The equipment used for CFC tobacco expansion is simple to operate. The cost of a patented unit (commercially known as G-13C) with a production capacity of 180 kg/h is about US \$350,000 (the cost for a licensed locally made unit is US \$200,000).
6. Conversion to non-CFC technology necessitates total replacement of existing baseline equipment and expansion process, which operates at a much higher pressure. The cost of the replacement technology is 20 times more expensive than that based on CFCs. At the time of the 21st Meeting of the Executive Committee, the only carbon dioxide equipment commercially available had a production capacity of 720 kg/h; at a cost higher than US \$10 million. However, one implementing agency recently informed the Fund Secretariat of the availability of a 360 kg/h unit at a reduced cost of US \$5.4 million. Negotiations between this agency and the equipment manufacturer further reduced the costs of the 720 kg/h unit to US \$6.5 million. These costs include safety devices, but exclude royalty fees and installation costs.

Determination of a cost-effectiveness threshold value

7. An analysis to determine the cost effectiveness threshold value of the least expensive carbon dioxide process was carried out by the Secretariat. The analysis was based on the following assumptions:

- (a) The eligible incremental cost is the incremental cost of the new equipment plus the operating costs (or savings) of the conversion;
- (b) Salvage value of baseline equipment is offset against costs of dismantling and disposing of current equipment and costs of freight of the new equipment;
- (c) Savings in cost of labour are not taken into consideration;
- (d) Royalty fees are no longer an issue since the patent rights in most of Article 5 countries have either already expired or just about to do so, and is therefore excluded in this analysis;
- (e) Expansion achieved with the carbon dioxide process exceeds that with CFC-11 process by 25 per cent which results in lesser amount of tobacco required to produce the same number of cigarettes;
- (f) The cost of a new equipment ranges from US \$5.4 million for a 360 kg/h unit to US \$6.5 million for a 720 kg/h unit; installation, technical assistance and contingency costs are estimated at 15 per cent of the cost of the equipment; and
- (g) The rate of utilization of the equipment to expand a given amount of tobacco is included in the analysis.

8. Operating costs/savings are estimated for four different production levels of expanded tobacco: 1,000 tonnes (50 tonnes of CFC); 2,000 tonnes (100 tonnes of CFC); 4,000 tonnes (200 tonnes of CFC); and 7,000 tonnes (350 tonnes CFC), and for a duration of four, ten and fifteen years (net present value) using the parameters listed in Table 1.

9. The incremental costs and the corresponding cost effectiveness values for each production level of expanded tobacco are shown in Table 2.

10. The following observations could be deduced from the analysis:

- (a) Carbon dioxide expansion process would always realize net operating savings;
- (b) Savings in the consumption of raw tobacco due to the superior expansion achieved by the carbon dioxide process represent significant operating savings; and are very sensitive to the price of raw tobacco. For example, for the same operating

conditions (expansion of 3,500 tonnes of tobacco with a 720 kg/h equipment and considering operating savings over a 10 year period), the cost effectiveness value will be US \$9.71/kg assuming the cost of raw tobacco at US \$3.00/kg, or US \$32.75 when the cost of tobacco is US \$1.50/kg.

Conclusions and recommendations

11. Taking into consideration the significant savings in tobacco and other raw materials as well as reductions in labour costs (which were not considered in the analysis), the Executive Committee may wish to establish a US \$10.00/kg as the cost effectiveness threshold value for the tobacco sector and consider tobacco expansion projects on a case-by-case basis.

Calculations of operating costs and savings for tobacco expansion

Production data:		Unit	CFC-11	CO2					
Equipment capacity	kg/h	180	360						
Expansion ratio	%	75.0%	100.0%						
Operating costs to expand 1 kg of tobacco:									
Utilities	Unit	Amount needed		Unitary cost	Total cost (US\$/kg)				
		CFC-11	CO2	(US\$)	CFC-11	CO2			
CFC-11	kg	0.050	-	2.4500	0.1225	-			
CO2	kg	-	0.200	0.2780	-	0.0556			
Compressed air	m3	0.018	0.045	0.2100	0.0038	0.0094			
Steam	kg	1.469	0.800	0.0124	0.0182	0.0099			
Water	l	9.900	5.000	0.0004	0.0040	0.0020			
Natural gas	kg	0.020	0.053	0.1200	0.0024	0.0063			
Electricity	kWh	0.250	0.617	0.0920	0.0230	0.0568			
Tobacco	kg	1.000	1.000	3.0000	3.0000	3.0000			
Total unitary operating costs	US\$/kg				3.1739	3.1400			
Total operating costs for four different production levels of expanded tobacco:									
		Case 1		Case 2		Case 3		Case 4	
		CFC-11	CO2	CFC-11	CO2	CFC-11	CO2	CFC-11	CO2
Total input of tobacco (1)	kg	1,000,000	875,000	2,000,000	1,750,000	4,000,000	3,500,000	7,000,000	6,125,000
Total operating time	hr	5,556	2,431	11,111	4,861	22,222	9,722	38,889	17,014
CFC consumption	kg	50,000		100,000		200,000		350,000	
Total production costs	US\$	3,173,856	2,747,535	6,347,711	5,495,070	12,695,422	10,990,140	22,216,989	19,232,745
Net operating savings	US\$/y		(\$426,300)		(\$852,600)		(\$1,705,300)		(\$2,984,200)
NPV (4 years)	US\$		(\$1,351,300)		(\$2,702,600)		(\$5,405,600)		(\$9,459,500)
NPV (10 years)	US\$		(\$2,619,400)		(\$5,238,900)		(\$10,478,300)		(\$18,336,600)
NPV (15 years)	US\$		(\$3,242,500)		(\$6,484,900)		(\$12,970,600)		(\$22,698,100)
Note 1: Total amount of tobacco required to produce the same amount of cigarettes									

Table 2					
Cost effectiveness values for tobacco expansion projects					
		Case 1	Case 2	Case 3	Case 4
Production capacity:					
Amount of expanded tobacco (1)	kg	875,000	1,750,000	3,500,000	6,125,000
CFC consumption	kg	50,000	100,000	200,000	350,000
Capital cost:					
Number of units required (2)					
360	kg/h	1	1		
720	kg/h			1	2
Equipment cost (3)	US \$	5,400,000	5,400,000	6,500,000	13,000,000
Contingency (@15%)	US \$	810,000	810,000	975,000	1,950,000
Total capital cost	US \$	6,210,000	6,210,000	7,475,000	14,950,000
Capacity utilization factor (4)	%	50%	100%	100%	90%
Operating costs (4 years)	US \$	(1,351,300)	(2,702,600)	(5,405,600)	(9,459,500)
Incremental costs	US \$	1,753,700	3,507,400	2,069,400	3,995,500
Cost effectiveness value	US \$/kg	35.07	35.07	10.35	11.42
Operating costs (10 years)	US \$	(2,619,400)	(5,238,900)	(10,478,300)	(18,336,600)
Incremental costs	US \$	485,600	971,100	(3,003,300)	(4,881,600)
Cost effectiveness value	US \$/kg	9.71	9.71	(15.02)	(13.95)
Operating costs (15 years)	US \$	(3,242,500)	(6,484,900)	(12,970,600)	(22,698,100)
Incremental costs	US \$	(137,500)	(274,900)	(5,495,600)	(9,243,100)
Cost effectiveness value	US \$/kg	(2.75)	(2.75)	(27.48)	(26.41)
Note 1: This amount takes into account the 100% expansion ratio achieved by CO2 process.					
Note 2: Assuming two shifts (16 hours/day) and 300 days of operation per year.					
Note 3: US \$5.4 million for a 360 kg/h unit and US \$6.5 million for a 720 kg/h unit.					
Note 4: Rate of utilization of the equipment to expand the tobacco required in each case					