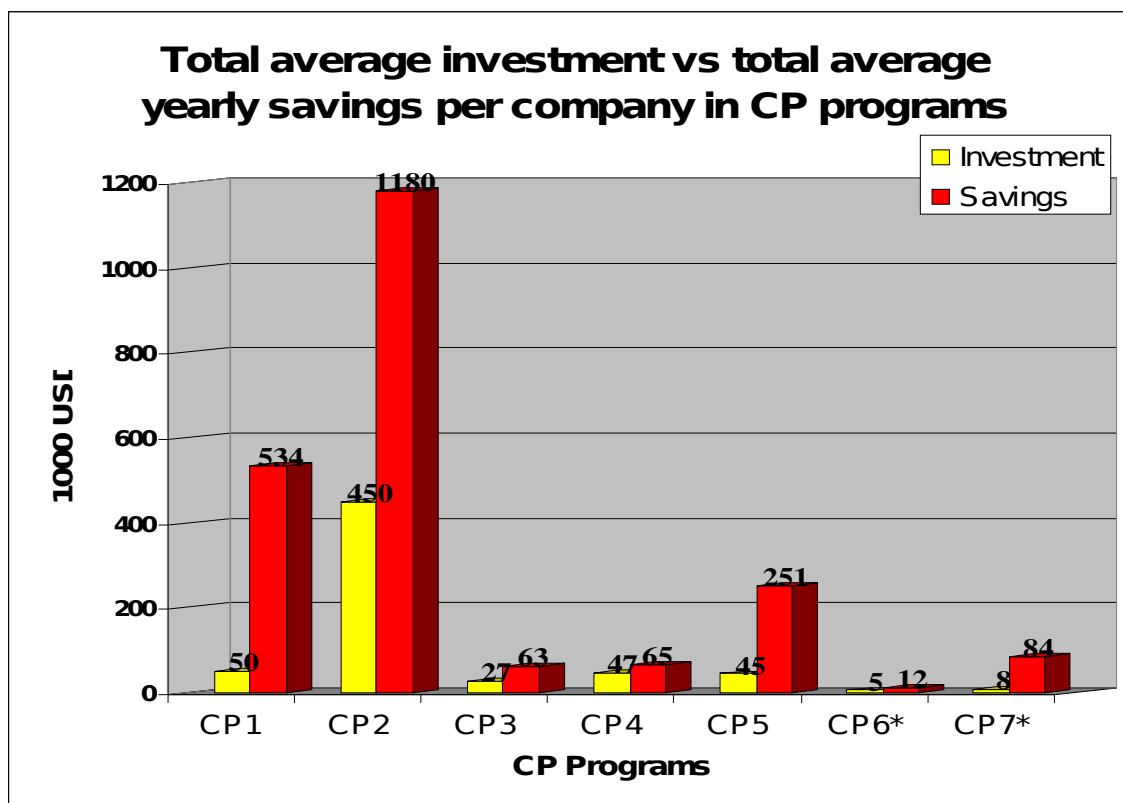


Training Programme	Companies	Participants			Average Costs (USD)	Average Savings (USD)
		Institutions	ECZ staff	Industry		
CP1 (1998)	8	5	3	29	50,000	530,000
CP2 (1999)	16	2	4	30	450,000	1,180,000
CP3 (2000)	11	3	3	24	27,000	63,000
CP4 (2001)	9	3	2	21	47,000	65,000
CP5 (2002)	8	2	2	23	45,000	251,000
CP6 (2004)	5	2	2	16	5,000	12,000
CP7 (2004)	14	3	5	21	8,000	84,000
Total	71	15	21	143	632,000	2,185,000

Total average costs vs. total average yearly savings in Zambia



*Small and medium enterprises (SME)

Results for Specific Training Programmes

The Second Zambian - Norwegian Cleaner Production Program (1999) Results from company CP case study projects				
Company	Projects/options	Savings/ year, US\$	Payback period	Environmental Improvements
Bitumen Products	1.Bitumen recovery 2.waste material analysis 3.Modification of water pumping system 4.Drum cleaning	1,376 5,395 403 8,510	Immediate Immediate Immediate Immediate	1.Reduction of land pollution 2.Reduction of land pollution 3.Improved working environment 4.Improved working environment
BP (Z) Ltd.	1.Oil sample recycling 2.Used oil disposal 3.Compressor utilisation	1,910.00 18,125 3,215.00	Immediate Immediate 15.5 months	1.Reduced oil in the effluent 2.Reduced land and water pollution 3.Efficient energy use
Central Breweries	1. (I) water usage minimisation (ii) beer leakage (iii) Cooling tower 2.Energy recovery 3.Use of already milled mealie - meal	1,920 5,644 411 16,000	Immediate Immediate Immediate 2.4 months Immediate	1.(I)Effluent reduction by 50% (ii)Effluent reduction by 50% (iii)Effluent reduction by 75% 2.Reduction of coal consumption by 12.5% 3.Safe working environment
Chilanga Cement, Chilanga	1.Change of input material - coal from peas and nuts to fines 2.Using used oil blended with diesel for kiln preheating 3.Kiln 3 overhaul 4.Product change - Blockmate	270,000 57,773 390,000 229,196	Immediate Immediate 1 year 4 months	1.Reduced coal dust pollution 2.Reduced ground water pollution 3.Reduced CO ₂ ,SO _x and NO _x emissions 4.Reduced CO ₂ ,SO _x and NO _x emissions

Kafco	1.Reduce fuel costs at Piggot Maskew	45,882	Immediate	1.Reduced waste oil disposal
	2.Reduce fuel costs at Mulungushi Textiles	942,117	Immediate	2.Reduced waste oil disposal
	3.Reduce fuel costs at Nkana Mine	697,575	Immediate	3.Reduced waste oil disposal
Kafironda Explosives	1.Replacement of citric acid with 70% acetic acid	2,554	1 day	1.Less solid waste
	2.Installation of electric heaters	1,120	1 day	2.less solid waste
	3.Reuse of ANS spills	234	1 month	3.Less effluent discharges
	4.Use of NH ₄ NO ₃ solution instead of NH ₄ NO ₃ solids	9,183,437	1 month	4.Less solid and air pollution
Kafue Bata Tannery	1.Salt recovery and reuse	2,161	Immediate	1.Reduced salinity 2.Reduced mg/L of TDS
	2.Chemical use reduction	2,124		
	3.Chrome liquor recycling	14,400	3 months	3.Complete elimination of Cr ³⁺
Company	Projects/options	Savings/ year, US\$	Payback period	Environmental Improvements
Maamba Collieries	1.Replacement of dilute media	16,435	3.5 months	1.Reduced iron, acids and sulphuric minerals 2.Reduced energy costs and effluents
	2.Build a slurry thickener	476,033	1.89 years	
RAMCOZ	1.Reduce effluents from tailings pump	31,399	0.94 years	1.Reduced metal and cyanide pollution
	2.Suppress dust in the crushing plant	479,985	0.96 years	2.Reduced air pollution
	3.Process control at concentrator	2,443,929	0.54 years	3.Reduced spillage and effluent discharges
Scaw Ltd.	Core making in the core plant	86,635		Reduced air pollution
Swarp Spinning Mills	1.Treatment of trade effluent	720	immediate	1.Reduced water pollution 2.Reduced smoke emissions
	2.Housekeeping			
	3.Innovation in water softening plant	28,470	immediate	3.Low salt concentration in final effluent 4.Reduced smoke emissions
	4.Recycling of combre lap filters	986	immediate	

Vitrex Paints	1. Housekeeping 2. Use of hand pumps and funnels 3. Use of plastic beakers for sampling	1005 467 801	Immediate 3 months 4 months	1. Safe working environment for the workers 2. Less solid waste and sludge 3. Reduced solid waste and solvents
ZAFFICO	1. Replace automatic valves with manual 2. Install separate piping system 3. Construction of boiler	8,896 17,792 65,520	3 days 3 days 3 days	1. Reduced chemical sludge 2. Reduced contamination of Kafubu River 3. Good working environment
ZCCM - Nchanga Div.	1. Flocculant handling and mixing 2. Recirculation of SX-T/H Solution 3. Crud pumping and treatment	22,995 1,252,680 2,208,250	1.3 days 1.22 days 2.94 days	1. Reduced land and water pollution 2. Less polyacrilamide levels in water 3. Reduced water contamination
ZCCM - Konkola Div.	Reduce TSS in process waste water	19,500	7 days	Reduced land pollution
ZCCM - Nkana Div.	1. Pre-heater off gas at acid plant 2. Retrofitting of gas cooling and cleaning system at cobalt plant	55,660 4,329,817	3 months 5 months	1. Reduced CO ₂ emissions 2. Reduced SO ₂ emissions
Total		23,449,458		

**The Third Zambian - Norwegian Cleaner Production Programme:
Results from Company CP Case Study Projects**

Company	Projects/options	Savings/ year US\$	Payback period	Environmental Improvements	Comments
Lever Brothers	1. Sale of redundant chemicals		0	1. a. Less waste storage space b. Less disposal transport costs	Projects 2 and 3 are B options while CP1 is housekeeping

	2.Load cells in caustic soda 3.Installation of closed steam coils in oil tanks	128,000	0 0.3 years	2.Safe working environment 3. Reduced water pollution	
Lublend Limited	1.Reduction of oil spillages 2. Reduce wastage of 1/2 Lt cans	1,844 2,488	0.6 years 2.6 years	1. Reduction of waste oil 2. Reduced damaged 1/2 Lt cans	Two projects pending approval and investment
Nitrogen Chemicals	1.Improved process control	38,880	0	1. Waste reduction by 50%	Excellent report!! Future plans include assessment of implemented projects and in plant training of workers on CP
	2.maintenance of adequate pump sealing stocks	21,224	0	2.reduced chemical loading of council sewer Kafue River	
	3.Catchment pan to collect leaking solution from the pump	5,312	< 1 month	3. Reduced corrosion of the effluent channels and sewer	
	4. Brink mist eliminator	67,147	0.89	85% waste reduction + other env. benefits	
	5. New pumps	26,971	0.93	100% waste reduction + env. benefits	
Zambia Railways	1.Extension of smoke stack	1,570	0.069 yrs	1.Increased combustion of flue gases	CP initially introduced at w/shops and to cover all departments
	2.sealing of water leakages	11,258	0.0004 yrs	2. Reduced energy losses	
	3. Repair of water leakages	1,814	0.0043 yrs	3. Reduced water losses	
Ndola Weaving Textiles	1.Humidity maintenance 2.Work on steam leakages 3.Recycling of water	260		1.Less breaking of yarn 2.Reduced heating time by 2% 3.Less effluent	Future plans to include heat recovery instrument installation
Metal Fabricators	1.Return of timber used on cathode Cu		0	1. 33 trees saved	Analysis of projects 2 and 3 to continue
	2.Replace charcoal with N ₂ gas	34,498	0.32 years	2. 45 trees saved	
	3.Purchase already planed timber	12,245	0.068 years	3. 105 trees saved	
TAZARA	1. Housekeeping	5,656	0	1.Less land and water pollution	Housekeeping options will continue with further analysis on CP3
	2.Semaphore lamps	3,188	0.22 years	2.Reduced land pollution	
	3.Bearing cleaning using heat	18,356	0.056 years	3. Reduced grease contamination	
Amanita Premier Oils	1. Refinery was/cooling water recycle	14,350	1.8 hrs	1. Reduced effluent disposal	CP2 already approved Both projects already implemented.
	2. Installation of steam traps	79,315	18.25 days	2. Reduced gas emissions	
	3. Power factor correction	33,366	0.4 years	3. Energy savings	
Zamcapitol Enterprises	1. Leaking taps 2. Cotton waste	App. 10 165	0.22 years 0	Cleaner toilets Waste reduction	Planned for implementation

	3. Time switch 4. Joining workshop II and IV 5. Housekeeping	603 20,906	0.2 years < 1 month 0	1258 kW energy saved/month Reduced transport of materials by 50% More space for other use created	Future plans include installation of electric meters to monitor consumption.
Golden Breweries	1 a) Milling plant 1 b) Milling plant 2 a) Boiler house 2 b) Boiler house 3. Brew House 4. Automated Switch	52,143 8,349 35,571 5,893 3,441 3,545	0 0,02 years 0,3 years 0,03 years 0 0.012 years	Reduced raw material use Waste reduction Energy conserved Energy conserved Reduced raw material use Reduced waste and effluent	All options implemented except those in the Boiler house (feasible)
Bwana Mkubwa Mining	1.a.Change of catalyst in converter b. replacing and sealing of tubes c. Install new Monsanto cooler 2.Rehabilitation of 4 valves	55,480 540	0.11 yrs 0.44 years	1. Minimised sulphur emission by 30%; Compliance to env. legislation 2. Minimised effluent discharge	All options implemented. Future plans - minimising Mn in the electrolyte system by using scrubbing settler to reduce sulphur emissions
Total, USD		694,378			

Results from company CP case study projects

Company	Projects/options	Savings/ year, US\$	Payback period	Environmental Improvements
Zambian Breweries Plc	1.Sale of drums and plastic containers 2.Sale of spent grains and malt sweepings	79,405 270	Immediate Immediate	1.Reduced solid waste and land pollution 2.Reduced land pollution
Match Corporation	1.Housekeeping 2.Raw material storage 3.Fabrication of screens	146.00 420 66.00	Immediate 0.9 1.02	1.Safe and healthy working environment 2.Reduced dust emission 3.Slag discharge reduced
SIDO Tanning and Leather	1. Reduce sodium sulfide in liming 2.Reduce chrome in tanning 3.Minimise water leakage 4.Employee awareness and training	18,480 13,610 3,287	Immediate Immediate Immediate Immediate	1.Reduced sodium sulphide from 3.2% to 2% 2.reduced Chrome from 6% to 5% 3.Reduced effluent discharge 4.chemical spillages reduced 3.Safe working environment
Copperfields Brewing	1.Mash recovery from cookers 2.improved boiler efficiency 3.employee awareness on material usage	9,788 2,936 463	0.038 0.11 Immediate	1.Reduced porridge spillage by 97% 2.Less stack emission by 25% and ash content by 50% 2.Reduced mealie meal spillage by 50%
Kafubu Water and Sewerage	1.Housekeeping 2.Improve pumping efficiency	14,348	Immediate 0.95	1.Clean environment 2.-improved DO in the stream from 3mg/l to 7.5mg/l -less organic load from 350mg/l to 10mg/l -less phosphates and chlorides by 10% and 40% resp.

	3.Improve sewage treatment efficiency 4.Separation of grit from organic matter	16,900 2,500	0.95 0.4	3.Reduced weed proliferation by 10% 4.Reduced foul odour and ground water pollution
ZESCO	1.Replacement of generator sets 2.Housekeeping	183,756 416	2.3 Immediate	1.-Reduce oil leakages by 80% -Reduced excess leakages by 70% -Reduced water usage by 99% 2.-Reduced ground contamination -reduced fire hazard -reduced scrap metal by 100%
UTH	1.Reduction of waste nshima 2.Separation of waste 3.Eradication of rats	2,918 784	4 2	1.Reduced meal wastage 2.Reduced injuries caused by sharps 3.Health and safe environment
Indeni Petroleum Refinery	1.production of low sulfur content diesel 2.Housekeeping	129,730 3,298	0.00036 Immediate	1.Reduced iron,acids and sulphuric minerals 2.Reduced energy costs and effluents
Zambia National Oil Company	1.Product reclaiming 2.metal plastic seal collection 3.Loading equipment maintenance	98,682 1,028 720	0.03 yrs immediate immediate	1.-increased fuel recovery; less air emissions -reduced effluent discharge 2. solid waste reduced by 98% 3. Reduced spillage and emissions
Total		583,951		

**The Sixth Zambian - Norwegian Cleaner Production Program (2004)
Results from company CP case study projects**

Company	Projects/options	Savings/	Payback	Environmental Improvements
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		Year, US\$	Period	
BLE Technical and Consulting	1.Sale of used oil 2.Recondition 200 ball joints	766 4,468	Immediate 10 months	1.Reduced water and land pollution 2.Reduced land pollution through reclamation of 10,923Kg of scrap
Meltcast Engineering	1.New methods of cutting 2.Selling and reuse of scrap 3.Reuse of scrap	3,643 689	Immediate Immediate	1.Reduced scrap generation 2. Land pollution reduced as 26.18 tons of scrap is sold or reused.
Nitrogen Chemicals	Yet to submit Reports			
Konkola Ex-Miners	Changing Packaging Materials	27, 968	Immediate	1. Reduced occupational health liabilities 2. Reduced solid waste generated
Tomarg Enterprises	Replacing Crusher	11, 250	1.48	1. Reduced waste generation 2. Energy savings 3. Improved production
Total		48,784		

The Seventh Zambian - Norwegian Cleaner Production Program (2004)

Results from company CP case study projects

Company	Projects/options	Investment US\$	Savings/ year, US\$	Payback period	Environmental Improvements
Monarch (Z) Ltd	Recycle steel off-cuts to make smaller ones	125	46,230	7 days	1.Reduction of waste disposal costs 2.Reduction of land pollution
Rokana Breweries Ltd	1. Water usage and beer leaks minimisation 2. Refurbish Boiler 3. Mash spill management 4. Coal ash disposal	416	458.00 729 416	Immediate 0.3 years Immediate Immediate	1.Reduced water leakages 2.Reduced air pollution by 70% 3. Reduced land pollution 4.Reduced waste disposal costs
Copperbelt Energy Corp.	Lead acid batteries recycling	573	370	1.6 years	1.Reduced land and water pollution 2. Abatement of lead poisoning
Lusaka Water & Sewerage	1. Rehabilitation of primary sedimentation tanks 2, Rehabilitation of biological filters Rehabilitation of secondary sedimentation tanks				1.Less soil pollution from raw sludge 2. Reduced water pollution of the stream 3. Safe water for aquatic life 4. Reduced legal costs
Top Star Breweries	1.Extend blow pipe	100	1,200	1 month	1.Reduced air pollution
Lusaka City Council	Improve waste collection system	9375	5,208	1.8 years	1.Reduced tailings discharge to Luanshya River
Kalantho Breweries	1.using one ton of coal with saw dust for energy		68,100	Immediate	1.Reduced dust emission by 75% 2.Reduced effluent discharges
Luanshya Copper Mines	1. Installation of anti pollution pump 2. Alternative source of gland seal water	44367 18865	20,926 8178	2.12 2.31	Environmental Improvements

Zamchin Steel & Foundry	Reuse 95% of steel waste generated		318,240 476,033	immediate	1. Reduced solid waste
Mongu Water	Reduce unaccounted for water				Reduced water and ground pollution
PG Bisonite	1. In situ debarking of logs 2. Recycling of waste material 3. Innovation of do it yourself kits		1042 52083	immediate immediate	1.Reduced disposal costs 2.Reduced disposal costs and land pollution 3.More space in the factory
Pigott Maskew	1.Improved sand blasting 2.Replace diesel boiler with electrical one	30000	1180 132780	Immediate 3 months	1.Safe working env for workers 2.Elimination of air pollution
Northern Breweries	Recycling of waste waste	1077	30,785	13 days	1.Reduced pH in effluent 2.Reduced water pollution
Chat Breweries	1. Construct effleunt line 2. Increase venting period of mash	604 90	960 4,320	7.5 months 0,25 months	1.Reduced land and water pollution 2.Less solid waste by 75%
Total		105592	1,169,238		