ProBEC - Programme for Biomass Energy Conservation in Southern Africa

Comparison between various cooking stoves for households

	criteria	Efficiency		Fuel	Marketing	Costs	Maintenance	life span
Stove typ	**Stove name**	**PHU %**	**Fuel Sav. %**			**US $**		**years**
mud stoves mostly inbuild	Maendeleo stove	18-20	30-35 lab. 40-60 field	wood, maize cob, agric. resid.	semi commercial commercial	2-3 US$ liner total installed 5 US$	mud smearing 1-2 month, easy to replace	about 2 year for liner
	Jengetahuni stove	?	30-50	wood, twigs, agric. Resid., dung	stove promoters/ builders, N S C, agric. Extension officers, Forestry extension officers	less than 1US$ (one labour day),Chandulo stove Malawi 1.8 US$	mud smearing, easy to replace	1-2 years (3 month payback period)
	Chitetezo Mulanje stove	?	30 lab test, 60 with KM, 40 without KM, 80 using alternative biomass fuel (leave,twigs)	wood, pigeon pea stalks, twigs, agric. resid, briquttes., grate for charcoal	no commercial stage, promotionen through volounters, enhance commercilisation with IFSP, no marketing channel, farmer to farmer approach	7.7 MK/ month	easy to build and to replace	1-2 years
	Mirte Injera stove		18-23	wood, BLT branches, leaves, twigs, dung, agric. resid., saw dust	commercial decentralized production (in every major town)	4.5-6 US$	6 parts modular model, easy to repair or replace	5 years in house-holds, (3 month payback period)

single pot stoves	Kenyan Ceramic Jiko tove	30 (lab test)	20-40, 25-50 field test Sudan	charcoal, wood, maize cob, agric. resid.	small production center,	1-4 US$ (1994)	liner with paddle mould easy to build and to replace	depends on quality
	Mali stove	15	50	wood, charcoal, maize cob, agric. resid.	can be commercial build and sold	6-10 US$ (9 month payback time)	not so easy to repair due to the fixed design, grate replace after 1 year	about 3 years
high sophist-icated stoves	Turbo stove	15-17	50 (field test)	wood, twigs, maize cob	commercial with funding	about 25 US$ (2000)	grate replacement 1-2 year	5 years
	Rocket stove	28-33 (approvecho emission test Nicaragua 2000)	50 (Lorena stove), 80 (Guatemala)	wood, twigs, maize cob	local produced, workshop with building presentations	32 US$ (depend on type and country), Baldosa clay tile combustion chamber less than 1 US$	insulated combustion chamber bricks easy to replace	durable clay last 4 years, drum 1-4 years material dependend
	Eco stove	34 sunken pot Eco (stainlees steel), 22 Prolena Eco & Estufa Justa Eco	65 HELPS/ Approvecho cement stove, 40-75 Prolena Eco	wood, twigs, maize cob	local produced, workshop with building presentations	300 SAR material costs for sunken pot stove, 65 US$ Prolena stove, Estufa Justa about 45 US$	case not easy to repair due to compact design	Estufa Justa in Honduras 10 years expected (not including chimney)

semi-gasifier and gasifier stoves	Vesto stove	15-25 (german university RWTH Aachen), 35-45 (Newdawn Engineering)	around 75, 50 (field test), 85 with cow dung	any kind of biomass	industrial and commercial production,professionel marketing strategy	38 US$	single parts can be replaced but not easy to build	due to less field test difficult to predict
	Counter-Draft Gasifier stove	?	?	any dry biomass through which air can be drafted, wood chips, peanut shells, pellets from sawdust,other nut hulls, briquettes of many types reeds corn cobs coconut shells shredded paper (incl. glossy magazines) coconut husks coconut fronds (leaves) dung	private invention	?	?	?
	Namibian stove (Werner Schultz)	?	?	charcoal	private invention by Werner Schultz terrasol Namibia	60-80 US$	replace the clay by smearing	long experience by the inventor

stove material	efficiency features	convenience	air supply	chimney	Insulation	fire box height	aesthetics	stove suited for commercial approach
clay+sand mud+straw metal cladding	enclosure to prevent draft, small fire box door, height of firebed to pot	easy to build, different pot size, easy to use	through the firebed door	not easy to adapt therefore without chimney	wood ash, stones+air cement+ vermiculite straw	about 19 cm	depends on installation (some are polished)	local produced
mud+ash insulation with sand, termite sand, clay	dimension optimized for good heat transfer, insulation	asthetic fixed very nice in kitchen management	through the firebed door	no	termite sand, sand, clay	18-19 cm, 12x17cm door	fixed very nice in kitchen management	selled as package stove+kitchen management
clay fired, alternative mud	enclosure to prevent draft, small fire box door, height of firebed to pot	easy to build, cheap, safety, mobility, cleanliness, versatility of fuel	through the firebed door	not necessary		18-20 cm, 12x10 cm door	nice with indoor kitchen managment	promoter started selling in own villages
cement+ sand+ pumice or scoria	due to the food size problematicto distribute the heat at a 60 cm diam. plate	used 3 times a week for 3 hours, good accepted	through the combustion chamber door	is possible but not necessary	porose material added like pumice or scoria	22 cm height, diameter 60 cm baking plate	hugh and heavy but accepted for the special type of food (injera)	with promoter network system successful

metal, clay liner	enclosure to prevent draft, small fire box door, height of firebed to pot	widely spread in Asia, Kenya, Tanzania, Ethopia, Rwanda	through the firebed door	no	vermiculite cement mixture	20 cm diameter, 15 cm height	combination metal+clay, widely spread	with promoter and builder network system successful
2mm sheet metal	optimized radiative heat transfer firebox	variable pot support, easy to handle	through the combustion chamber door and grate openings in stove body	no	no	about 25 cm height and 25 cm diameter	look simple	local produced
bended stainless steel sheet	insulated double wall, secondary air, heat reflectiing combustion chamber wall	good apperance but less stability	via rotary grate secondary air variabel	no	air between the stove walls not enough efficient	about 25 cm diameter, about 25 cm height	shiny and attractive stainless steel stove	commercial produced in Finland
VIC (vernacular Insulated Ceramic), six bricks clay/ vermiculite or pumice or perlite or cement+organic material, metal drum as case	insulated low mass elbow design combustion chamber, internal chimney creates an air draft, insulated stove body	easy to operate and control the power output, doesn't fit all pots, very efficient with extra skirt	through the combustion chamber door and underneath the grate	internal rocket chimney	VIC bricks, clay+ vermiculite or pumice or perlite or cement+ organic material	1:1.5 ratio between fuel magazine and rocket chimney (e.g. 10:15 cm), 12.5 cm diam. or 10x10 cm door	looks simple and nice with drum	local produced, with promoter and presentation workshops
1 mm galv. steel, stainless steel, cement, bricks, vermiculite or perlite or pumice	insulated low mass elbow design combustion chamber, internal chimney creates an air draft, insulated stove body	easy to operate and control the power output, doesn't fit all pots, very efficient with extra skirt	through the combustion chamber door and underneath the grate	internal rocket chimney, external chimney needed	VIC bricks, clay+ vermiculite or pumice or perlite or cement+ organic material	1:1.5 ratio between fuel magazine and rocket chimney (e.g. 10:15 cm), 12.5 .cm diam. or 10x10 cm door	looks complex and compact with double pot support and oven	can be local produced (depend on the material availability, with promoter and presentation workshops

0.5 mm commercial steel drum, mild steel or treated steel	gas insulated, primary and secundary air pre-heating, semi-gassifying, creating air turbulences	heats rapidly, portable, clean and smokeless burning, burns cow dung wel, partly touchable outer case	via variable primary and fixed secondary air holes in the bottom and the outer case	no	secondary air tube acts as insulation	15 cm diameter top feeding grate tube	looks complex compact and good due to painted and label outer drum case	commercial produced and professionel marketing strategy selled by Newdawn engineering Swaziland
different types made of mud, clay, metal (cans etc.)	insulation can be added	burn every thing and produce charcoal which can be sold,	Primary air enters under the grate, burning is fed air from below, resulting in a “counter-draft” burning, secondary air is fed on top to burn the due too pyrolysis occuring smoke	with or without possible	can be insulated	10-40 cm tall column sitting on a 15 cm diameter grate	looks complecated and still in invention status	?
mild or galvanized metal drum, cement+vermiculite, copper pipe	clay insulated with integrated copper pipe as heat exchanger	clever idea but controversial disscussion about needs & acceptance	through the combustion chamber door and grate	no	clay insulated stove body	about 25 cm diameter, about 15 cm height		

dissemination	stove outside temperature	smoke removal	recommodation
15000 / year	due to the clay body it heat up and can be hot	average	clay quality high sand content required, chimney require proper design, using vermiculite for insulation increase
more than 600 built in demonstration areas	with the mud case around not too hot	average	using additives against cracking, using vermiculite for insulation increase
18500 portable, 4500 fixed, 185 villages with 40000 households	stove itself get hot, inbuild not too hot	average	sand adding if cracking occurs, using vermiculite for insulation increase
about 25000 commercial dissaminated, 86 prod. Sites in 33 towns	due to the big cement body it heat up and can be hot	average	better insulation, due to food type hugh design which relates to heat transfer losses, decreasing the weight

no figures	due to the clay body it heat up and can be hot	average	using vermiculite for insulation increase
>200 constructed and sold in rural, urban areas in Zimbabwe, >30 Metal artisans trained, Commercially adopted by a Pvt Enterprise	gets very hot outside, because no insulation	average	double wall with insulation,
30 units in Zimb. introduced to community on cost sharing basis	gets very hot outside, because no insulation	average	skirt should be used improve grate,stability, chamber size
over 15000 built, 5000 were made in 1994 for refugee camps in Rwanda	very low outside temp., easy to operate	good	pot support for different pot types to have good efficient without extra skirt
Estufa Justa 3000 in last 3 years in Central America, HELPS/ Approvecho cement stove 1000 in last 2 years	very low outside temp., easy to operate	good	decreasing of price with easier design and cheaper material

no	gets partly hot outside, but due to the design easy to handle	good	flexible pot support, partly insulation
?	gets hot outside	good	easy design, dissemination status should be reached
		average	skirt should be used improve grate,stability, chamber size