Sustainable Household Cooking in the Philippines

The Development of the Mayon Turbo Stove

Roger Samson and Claudia Ho Lem

REAP-CANADA

Box 125, Maison Glenaladale Ste. Anne de Bellevue, QC, H9X 3V9

Tél: (514) 398-7743; Fax: (514) 398-7972

E: **info@reap-canada.com**; ***W:*** **www.reap-canada.com**

Why is Sustainable Household Cooking Important

- **Financial** : Purchasing LPG typically costs $100/yr, importing fossil fuels is a major drain on developing economies
- **Women's labour**: women can spend 60-120 days per year gathering fuelwood
- **Household air quality**: women and children are the most vulnerable to respiratory and eye infections from inefficient combustion
- **Landscape ecology**: reducing fuelwood use protects watersheds and biodiversity

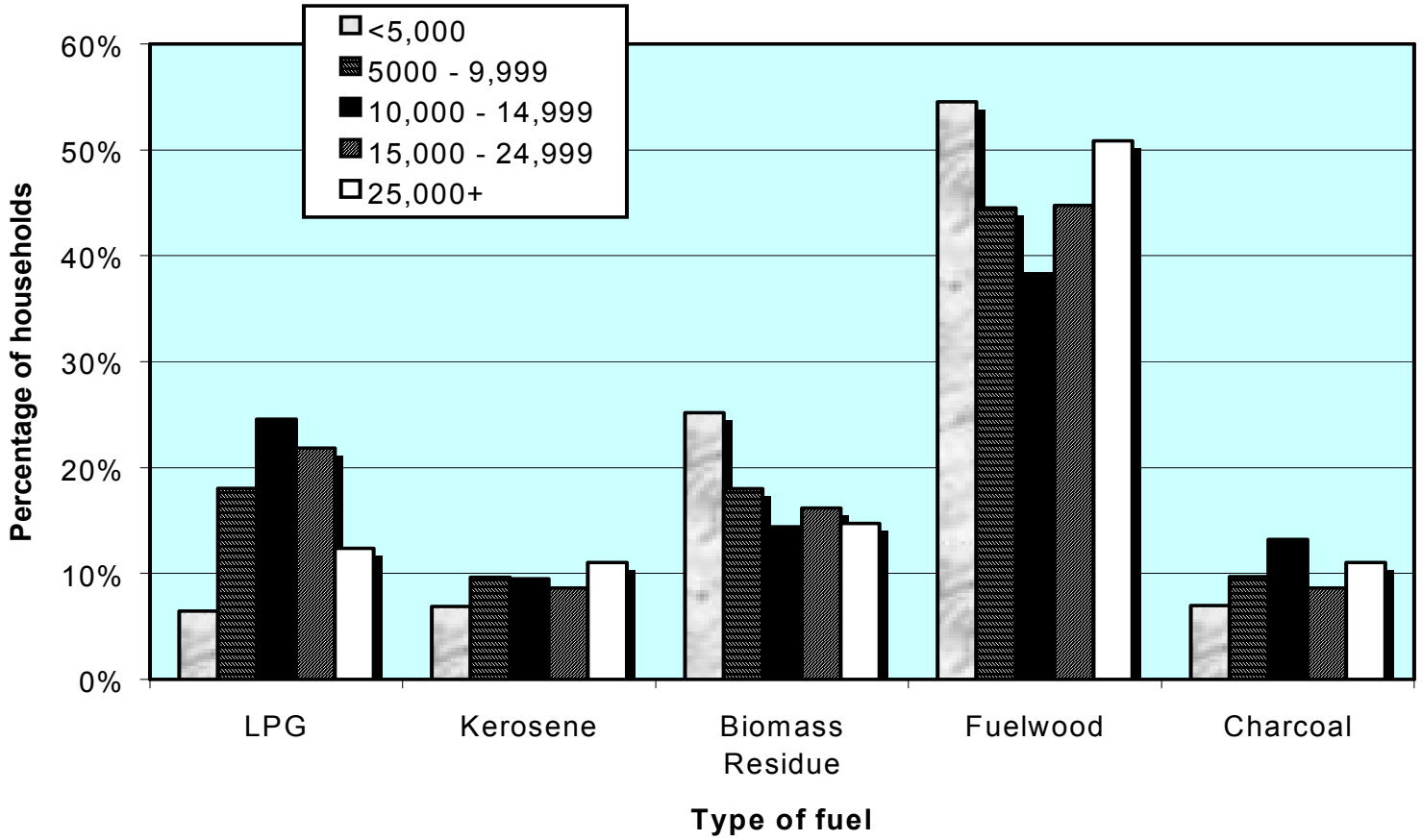
How are rural people cooking and eating in the Philippines?

- Traditional diet is centered around rice, fish and vegetables
- Typically boiling foods in aluminum pots over a biomass stove and grilling fish over charcoal
- Tend to have multiple cooking devices for convenience and for the various foods they like preparing
- LPG is preferred as a quick cooking method especially early in the morning

LPG (Liquid Petroleum Gas)

- Most convenient but prohibitively expensive for poor households
- increases fossil energy imports

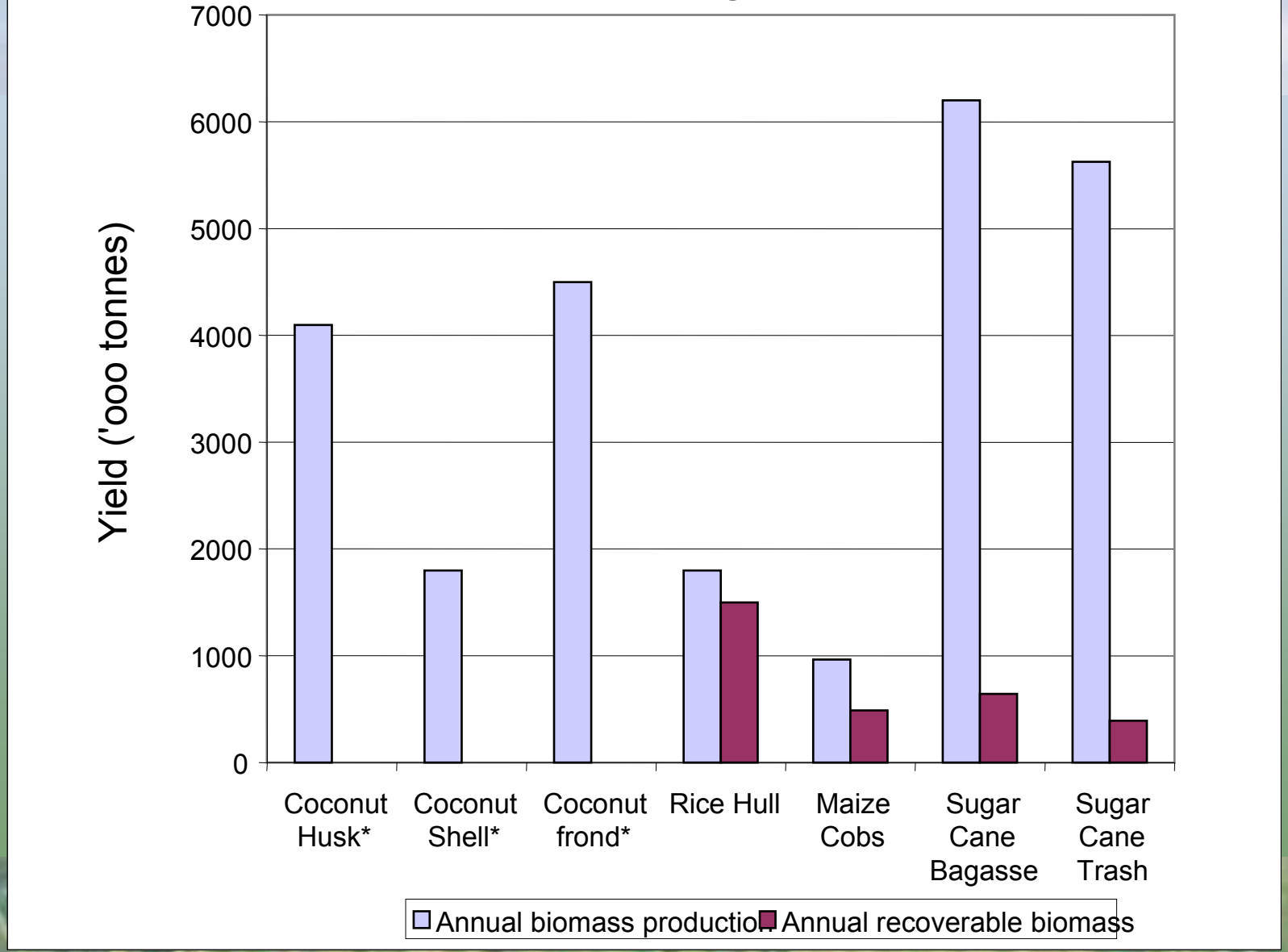
What Fuels are Rural Households Using?



Household Fuel Use Trends in the Philippines (1989-1995)

- ↓ 3.5% in woodfuel use/yr
- ↓ 8.5% in charcoal use/yr
- ↑ 9.5% in LPG use/yr
- ↑ 9.4% in kerosene use/yr
- ↑ 7.1% in biomass residues/yr

Annual production and estimated recoverability of selected agricultural residues



An Improved Biomass Residue Stove needs to:

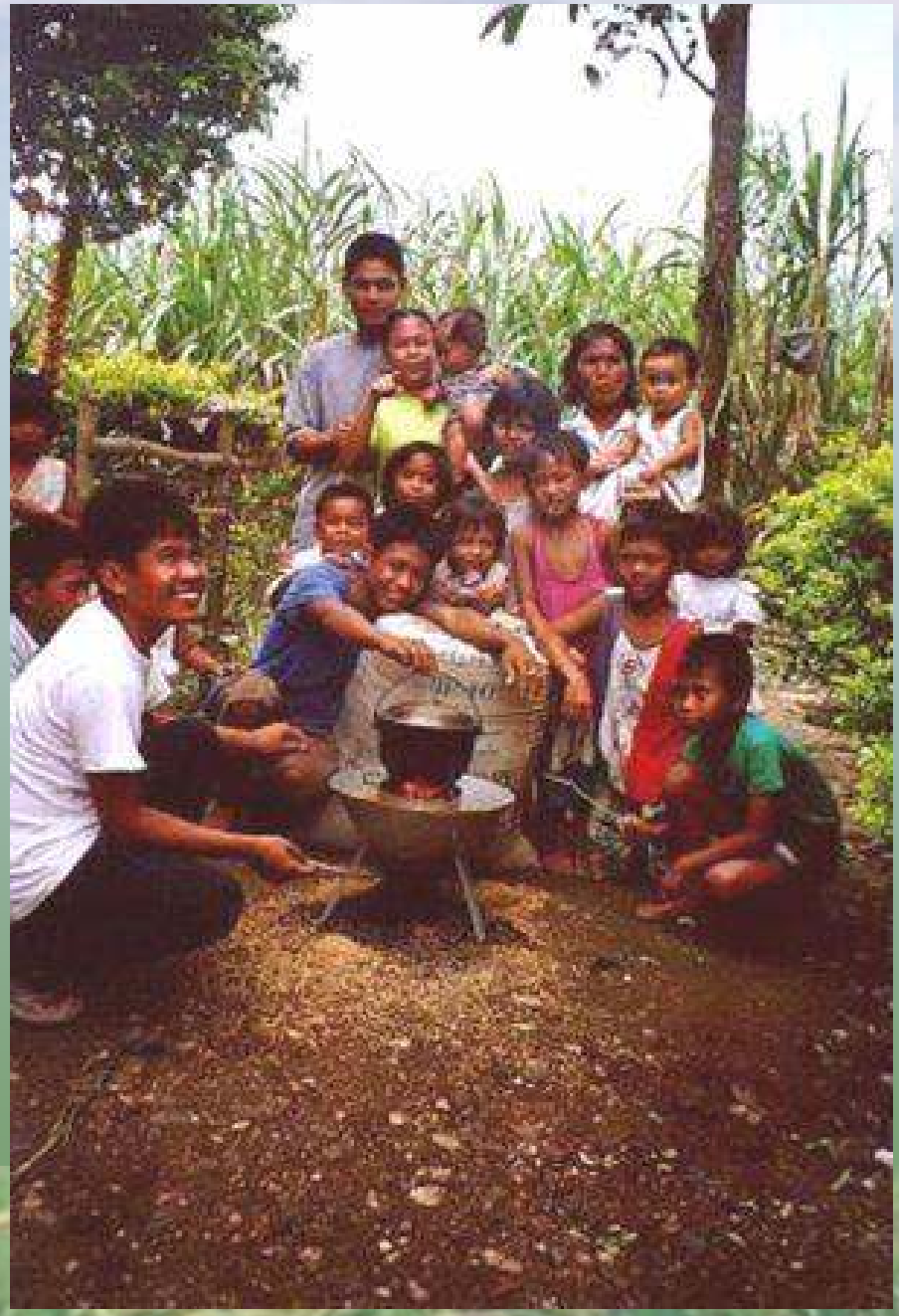
- Decrease cooking time
- Reduce smoke and suspended particulates
- Be designed with traditional cooking methods in mind
- Cost effective
- Minimize fuel consumption
- Aesthetically pleasing

Typical Problems with Conical Rice Hull Stoves

- Excessive smoke
- Excessive maintenance (tapping to allow fuel to drop)
- Excess air causes uncontrolled combustion
- Fuelbed fires
- Too expensive for poor

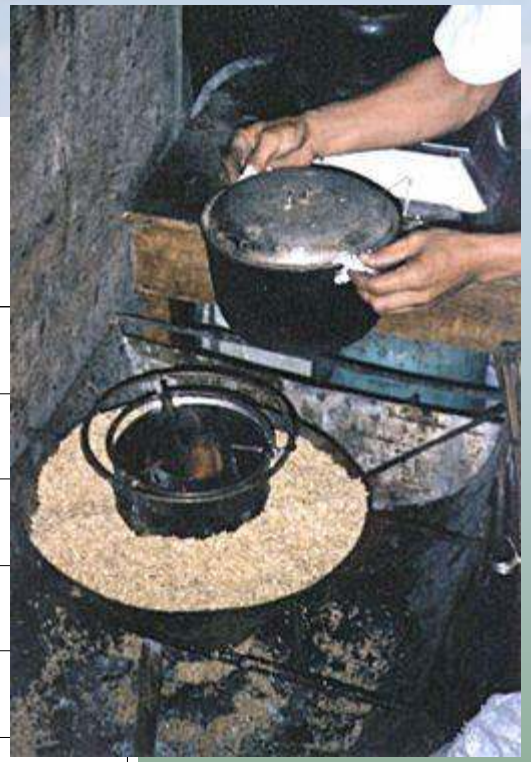
REAP-Canada chose the Lo-Trau stove from Vietnam for further pilot introduction as it was simple and inexpensive.

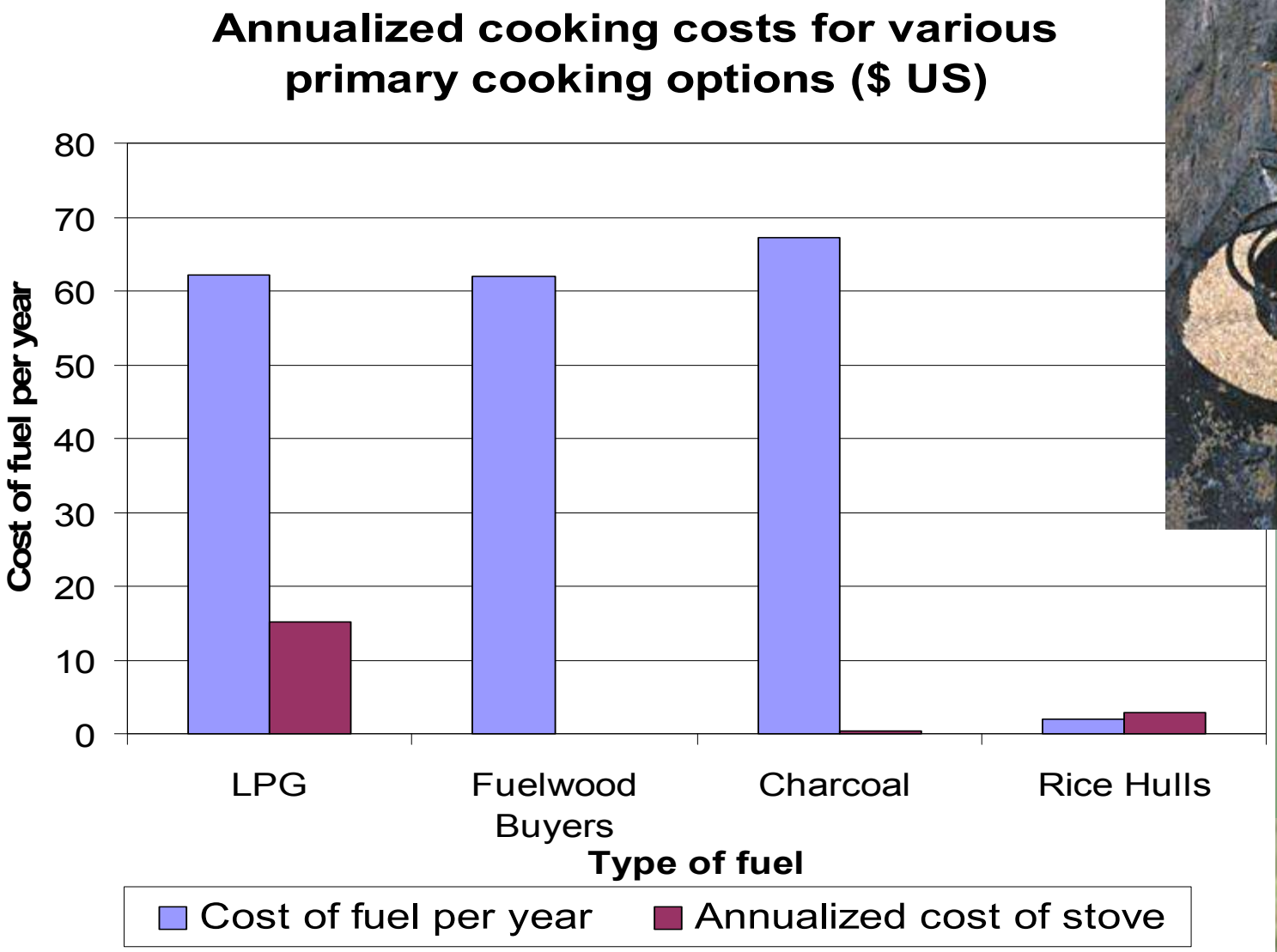
In 1999 we developed the LT-2000 as an improved model of the Lo-Trau.



5000 RHS stoves have been manufactured in the Philippines

Poverty Reduction through household energy self-reliance





Consumer Assessment of the LT-2000 Rice Hull Stove

	Excellent	Good	Satisfied	Unsatisfied	Very Unsatisfied	Median Ranking
Time Required to heat up	8	7	5	0	0	**Excellent-Goc**
Fuel Cost	11	8	1	0	0	**Excellent**
Smokiness	3	6	9	2	0	**Satisfied**
Design/Aesthetics	2	11	6	1	0	**Good**
Cleanliness	3	10	5	2	0	**Good**
Ease of Use	4	10	5	1	0	**Good**
Stove Purchase Price	2	8	9	1	0	**Good-Satisfie**
Overall Economy	5	9	6	0	0	**Good**

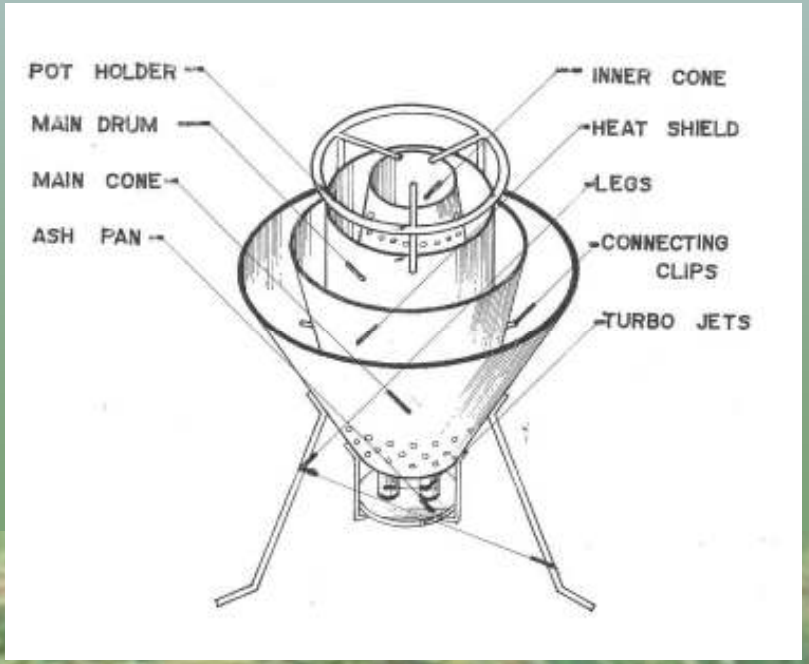
The Mayon Turbo Stove (MTS)

- A biomass residue stove optimized to burn rice hull (a loose, bulk fuel) with a high quality of combustion
- A stove that enables the use of a wide variety of secondary fuels including:

  peanut shells, coffee shells, corn cobs, crushed coconut shells, and sawdust (mix at a level of 1/3-1/2 rice hull)

Major Design Change Improvements of the Mayon Turbo

- Optimization of the air flow through the use of twin air injectors, & air holes on inner cone for secondary combustion
- Use of heat shield to prevent fuelbed fires
- Increase in length of inner cone
- Decrease in stove size (MTS 6500) and use of materials



Impact of the introduction of the LT-2000 on conventional fuel use

Fuel	Before (kg)	After (kg)	Fuel Use Reduction (kg)	% Reduction
Fuelwood	2398.8	664.8	1734	72.20%
Charcoal	70.8	16.8	54	76.30%
LPG	15.6	8.4	7.2	46.20%
Kerosene (firestarter)	10.3	3.5	6.8	66.30%

Average Projected Savings from the Introduction of a LT-2000 RHS (2002).

	Negros Conventional Fuel Expenditures	Panay Conventional Fuel Expenditures	Average Conventional Fuel Expenditures	*Average Projected Fuel Savings after introduction of a rice hull stove
Fuelwood	993	887	940	677
Charcoal	252	368	310	237
LPG	386	1081	734	339
Kerosene (firestarter)	184	255	220	145
Total	1814	2591	2204	1398

** Based on the LT-2000 stoves displacing an average of 76% of charcoal use, 72% of firewood use, 46% of LPG use and 66% of kerosene firestarter use in households adopting the stove.*

Impact of Introducing the LT-2000 RHS on GHG Emissions

Fuel	Fuel Use Reduction (kg)	Greenhouse Gas Emission Reductions (kg CO2 equiv)					GWC*
		CO2	CH4	N2O	CO	TNMOC	
Fuelwood	1734	0	243.75	150.17	216.39	152.78	0.44
Charcoal	54	0	43.36	10.54	53.48	68.65	3.26
LPG	7.2	22.21	0.01	0.73	0.22	1.35	3.41
Kerosene	6.84	16.69	0.04	0.30	0.19	0.82	2.64
		Direct GHG = 487.8			*Indirect GHG = 493.9*		
		Total GHG Emissions = 981.7 kg CO2 Equiv per year					

REAP-Canada Summary of Activities

Developing Sustainable Cooking Systems In the Philippines

- Biomass Resource and Economic Assessment:1999-2000
- Technology Assessment of Conical Rice Hull Stoves (75 stoves) : 2000-2001
- Pilot GHG mitigation project in the Visaya's (5000 stoves) 2001-2002
- Development of Mayon Turbo (Advanced Conical Rice Hull Stove) 2002-2003
- Scale up of National Mayon Turbo Stove Project for GHG Mitigation (100,000 stoves) 2004-2010

Energy values:

	LPG	Kerosene	Fuelwood	Charcoal	Rice Hull
Units	kg	lt	kg	kg	kg
Energy content (MJ/unit)	45.5	35	16	28	14.7
Thermal Efficiency (%)	0.6	0.5	0.1025	0.15	0.15
Energy delivered (MJ/unit)	27.3	17.5	1.64	4.2	2.205

Thank you! Salamat Gid!