

D-Lab: *ENERGY*

Week 6: Cooking

AGENDA

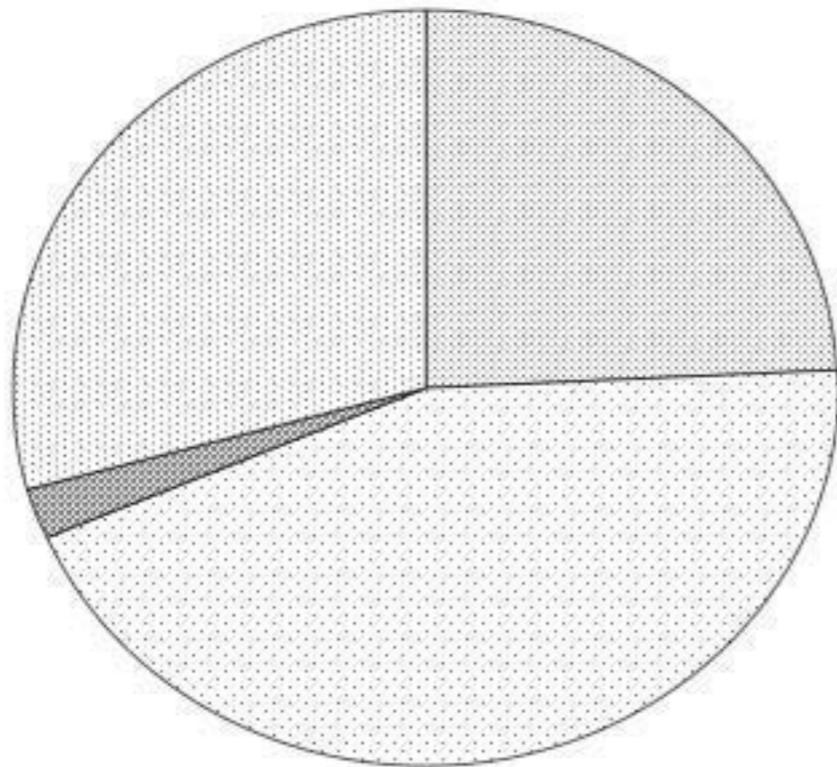
- Where are we?
- Cooking
 - Fuels
 - Charcoal
 - Solar cookers
 - Wood & charcoal stoves
- Time for project work
- Muddy Card

COOKING IN DEVELOPING COUNTRIES



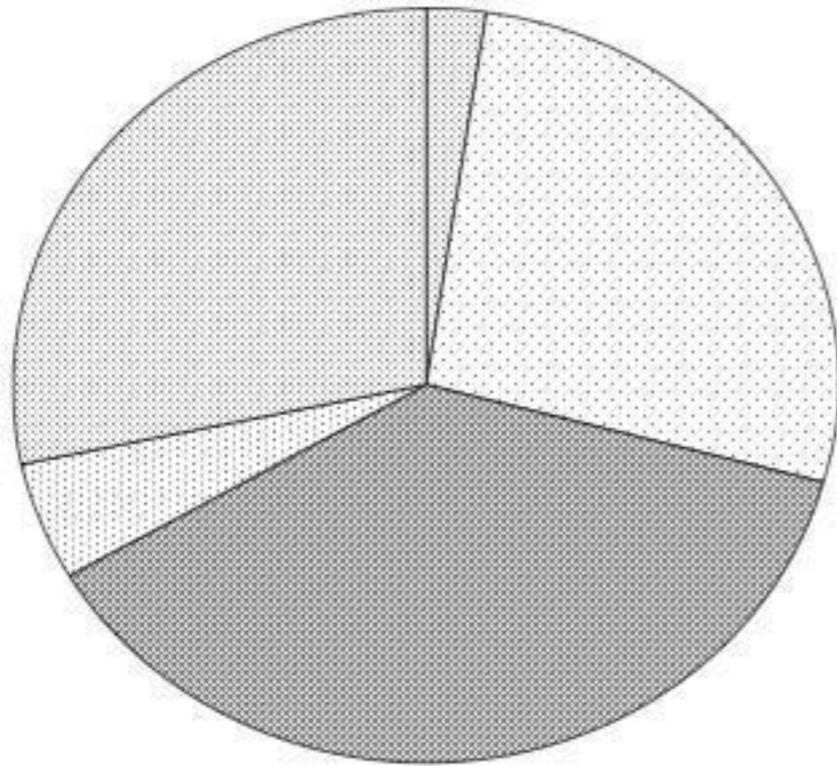
HOUSEHOLD FUEL USE SURVEY

- usage of all modern fuels increases with income except kerosene (peaks at middle income)
- in urban areas, biomass fuels less common than in rural areas, where biomass often remains common for all incomes
- income growth is not enough; infrastructure is needed
- a surprisingly large share of rural households purchase wood



- 24% LPG
- 44% Electricity
- 2% Kerosene
- 29% Cash wood

Guatemala



- 2% LPG
- 27% Electricity
- 37% Kerosene
- 5% Cash wood
- 28% Coal/charcoal

Ghana

ENERGY DENSITIES

Fuel	MJ/kg
wood charcoal	20-30
our charcoal	~25
bagasse, corn cobs & husks	15-20
air-dried wood	15
dung	12
heating oil, (bio)diesel, kerosene, propane	40-50

COOKING OPTIONS

Photos of many types of fuel and stoves removed due to copyright restrictions.
For example: electricity, gas, wood, dung; jiko, adobe, 3 stones around open fire...
See lecture video.

Estimation!

in teams of 2:

1. Energy required to boil a liter of water
2. Efficiency of doing so
(ratio of energy that made the water hot to total energy)

DESIGN CONSIDERATIONS: WOOD & CHARCOAL COOKSTOVES

- thermal mass / insulation
- air flow
- volume
- robustness (water)
- cost
- longevity
- heating options
- ease of use
- emissions
- efficiency
- style
- flexibility

TOP COOKSTOVE RESOURCES

- <http://cookstove.net/>
- <http://www.aprovecho.org>

Photos of cooking with wood and dung removed due to copyright restrictions.
See lecture video.

2.4 BILLION
cook with biomass

NO VIABLE ALTERNATIVE

Photos of electric power grid lines, propane canisters, solar cooker removed due to copyright restrictions.
See lecture video.

THE COOKING FUEL PROBLEM

Health

1.5 million deaths from smoke inhalation

Poverty

cooking fuel 5-30% of family budget or
up to 7 hours/day gathering

Environment

Increase of 6-10% deforestation rate in
regions 60-98% deforested

AGRICULTURAL WASTE CHARCOAL

- Burns as cleanly as wood charcoal
- Saves trees & uses true waste: bagasse, corn cobs & husks, etc.
- Cheaper than charcoal & micro-franchise opportunities
- Readily adoptable



FUEL FROM THE FIELDS (FftF) PROGRESS TO DATE

- \$200K World Bank Grant
 - 60+ Ateliers in Haiti
 - 35 trainings for 1000+ people
- \$15-30 manufacturing costs, made locally





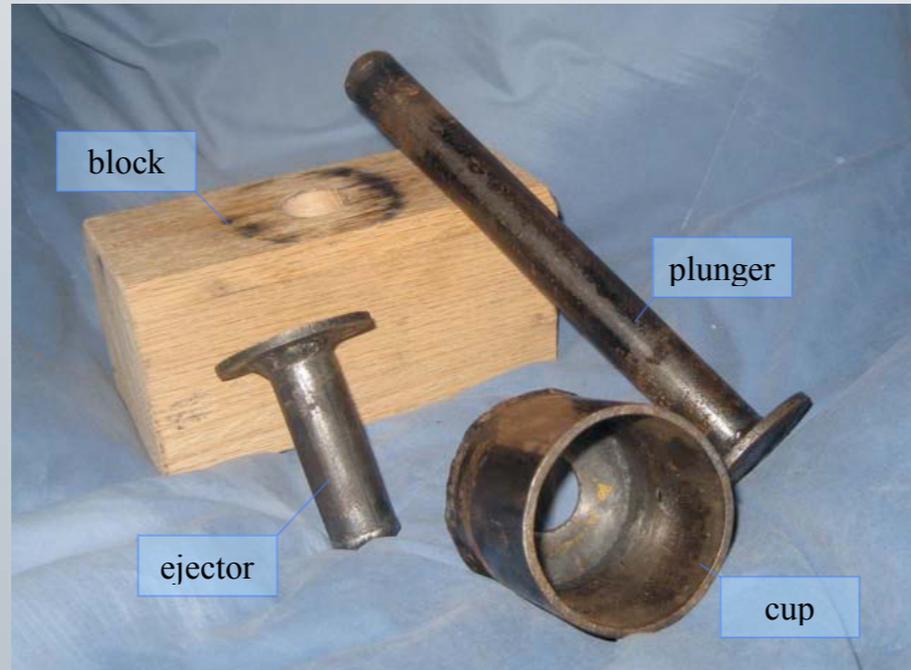
CURRENT PROCESS



CARBONIZATION



BINDER



BRIQUETTING

EVOLUTION OF THE BRIQUETTE PRESS



Photo removed due to copyright restrictions.
See lecture video.

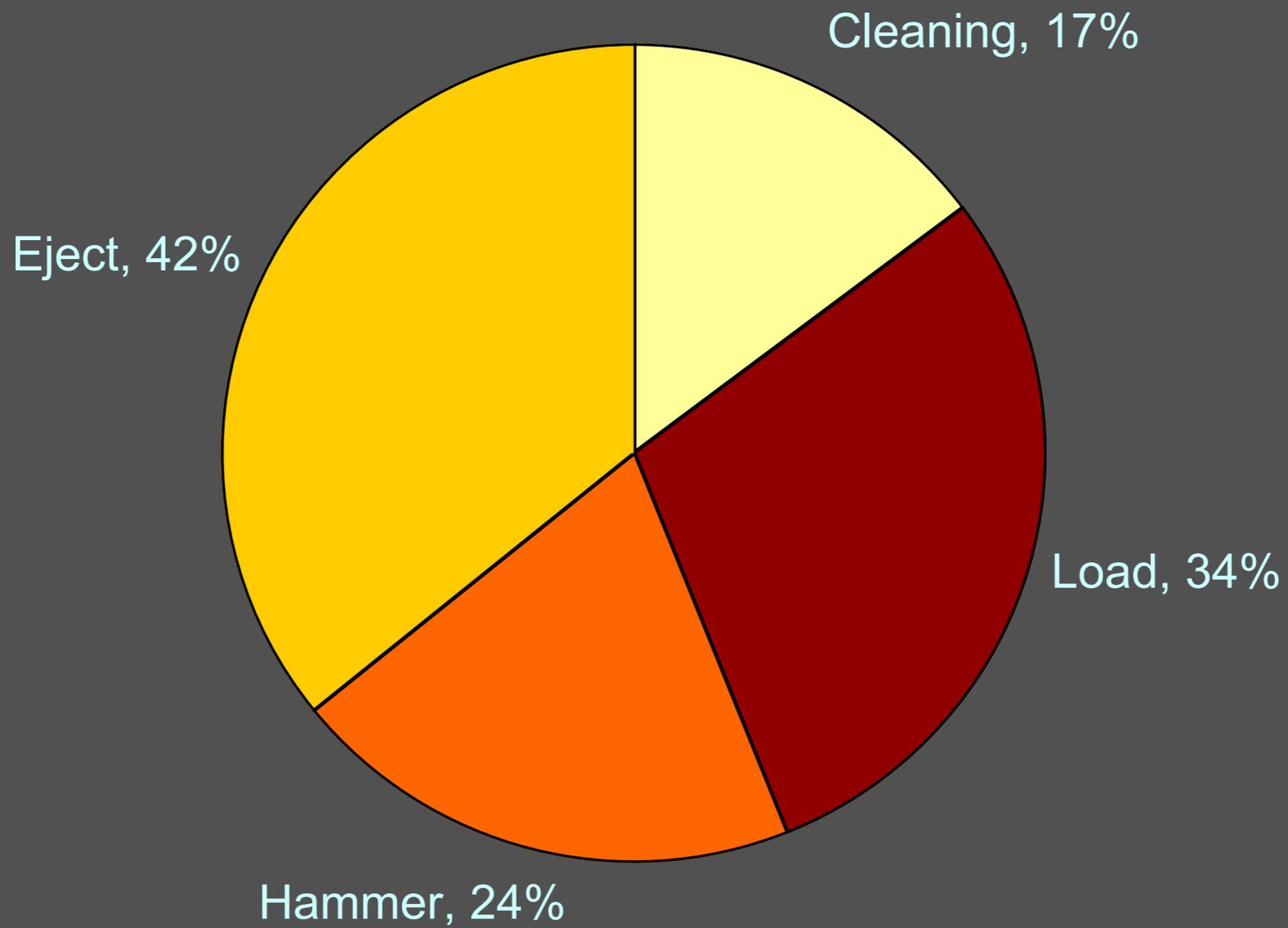
MECHANIZED BRIQUETTE
MAKER ~\$8,000



THE FIRST PROTOTYPE: ~\$25



4 - 5 BRIQUETTES/MINUTE



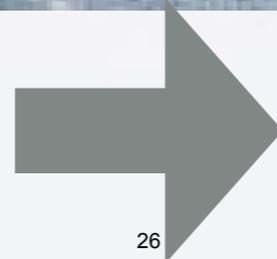
TIME STUDY



6 - 8 BRIQUETTES/MINUTE, \$30



\$30



\$20



6 - 8 BRIQUETTES/MINUTE, \$30



“If you want to make something 10 times as cheap, remove 90% of the material.” - Amy Smith

\$20 → \$2



EVEN SIMPLER



RUNNING A TRAINING

Muddy Cards!



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