‚Stoves 101‘

An introduction to improved biomass cookstoves

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presented in cooperation with GIZ-HERA

Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH,

Programme for Poverty oriented basic energy services

ETHOS, 28th January 2012 Kirkland Northwest University

„….When I get up in the morning
the first thing is to make fire…"

How about you?

What energy sources do you use?

Why?

What types of ‚stoves' do you have at home?

- We ALL need food to live
- Most food needs to be cooked
- For cooking we need energy (fuel)
- Cooking energy accounts for >90% of household energy in developing countries
- Over 2.5 billion people use solid biomass fuels (firewood, charcoal, dung, agricultural residues)
- Firewood and charcoal are often from non-renewable sources and getting scarce
- In conventional fires they often cause harmful emissions

common scenarios

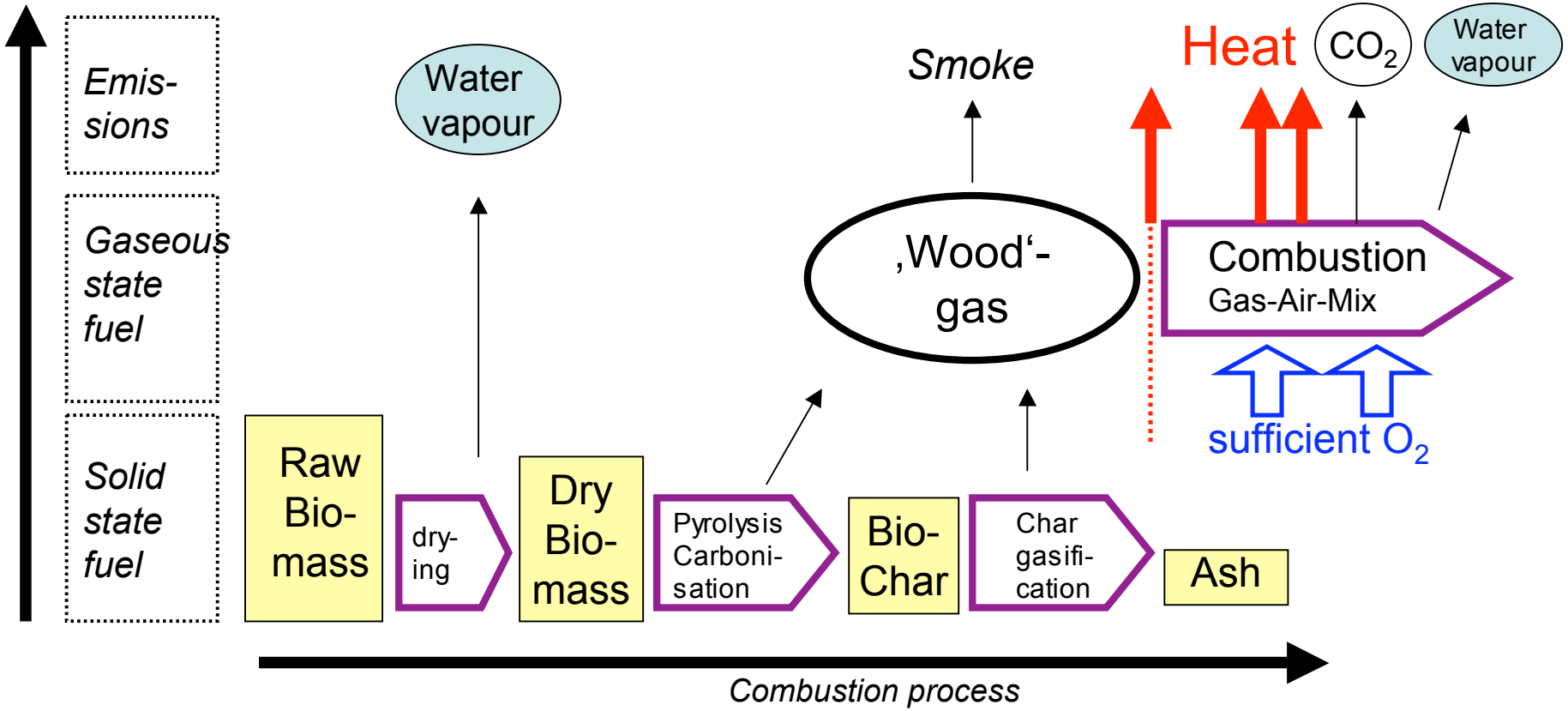
- wasteful
- dangerous
- smoky

How does fire burn?

Where is the hottest part of a flame?

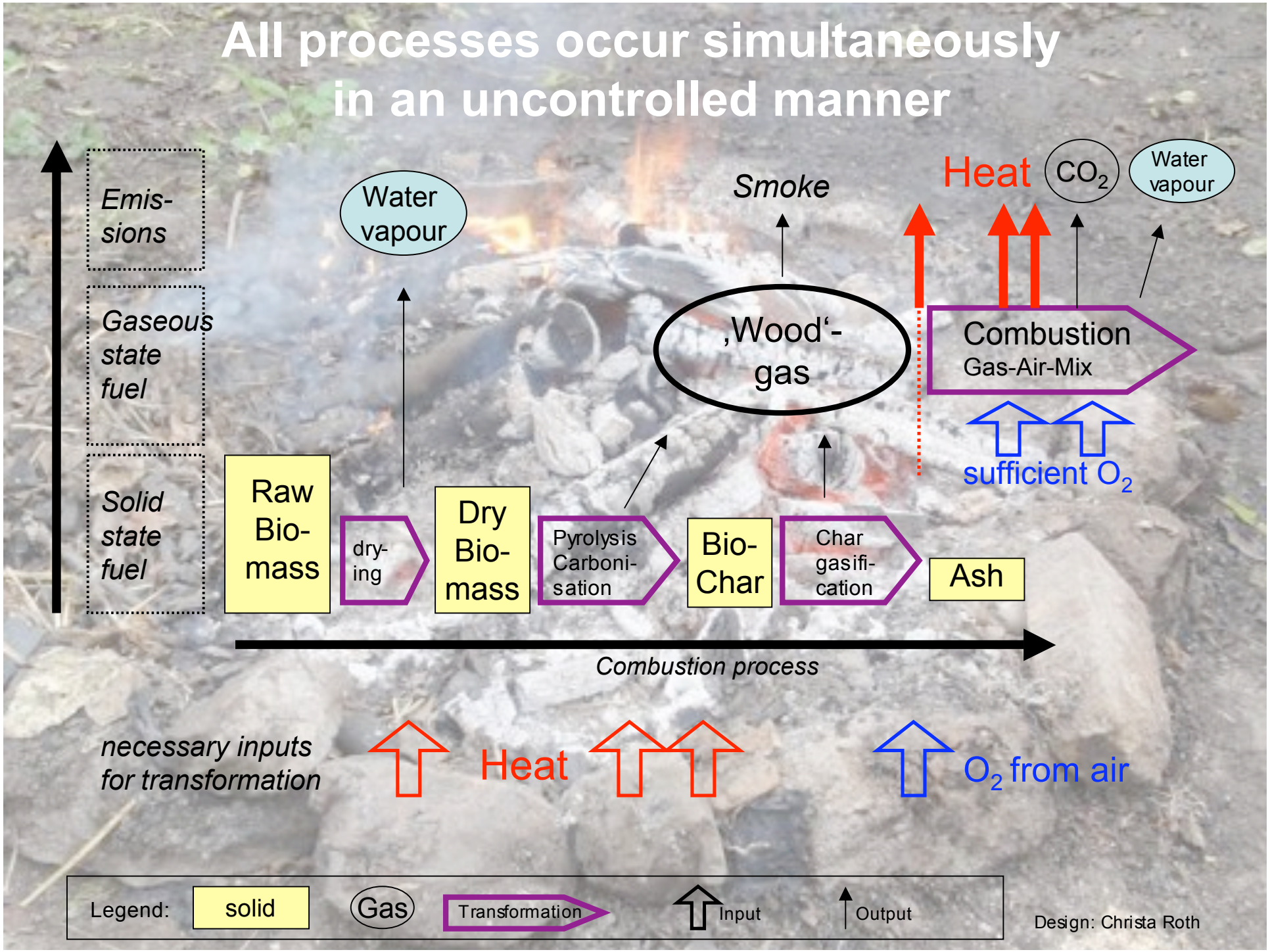
What other conditions influence the performance of a fire?

What happens when biomass is burnt?



necessary inputs for transformation

Design: Christa Roth


All processes occur simultaneously
in an uncontrolled manner
Emis-
sions
Gaseous
state
fuel
Solid
state
fuel
Water
vapour
Smoke
Heat
CO2
Water
vapour
‚Wood'-
gas
Combustion
Gas-Air-Mix
sufficient O2
Raw
Bio-
mass
dry-
ing
Dry
Bio-
mass
Pyrolysis
Carboni-
sation
Bio-
Char
Char
gasifi-
cation
Ash
Combustion process
necessary inputs
for transformation
Heat
O2 from air
Legend:
solid
Gas
Transformation
Input
Output
Design: Christa Roth

What can we do
to make this fire safer
for the users
and their children?


contain and shelter
the fire from wind

How can we save energy?

- Using improved stoves and fireless cookers - ***technologies***
- Keeping a lid on the pot, soaking legumes, using less water, cooking for less time etc. - ***techniques***

How can we get more firewood?

- Cut the branch and not the tree
- Plant trees or just let them grow
- Plant woody shrubs e.g. pigeon peas that provide both food and fuel

What do we call a ‚stove‘?

‚stove‘ = combination of

Heat-Generator +

Heat-Transfer- structure

Form of a ‚stove‘ depending on fuel and cultural factors e.g. cooking task (type of meal), type of cooking (one-handed or two-armed-full-upper-body-motion needed), pot-shape and size etc.

Benefits of energy saving technologies

Mud stove
With clay liner

Clay stove

Food warmer
or fireless cooker

Rocket Stove

Saving up to 80% firewood

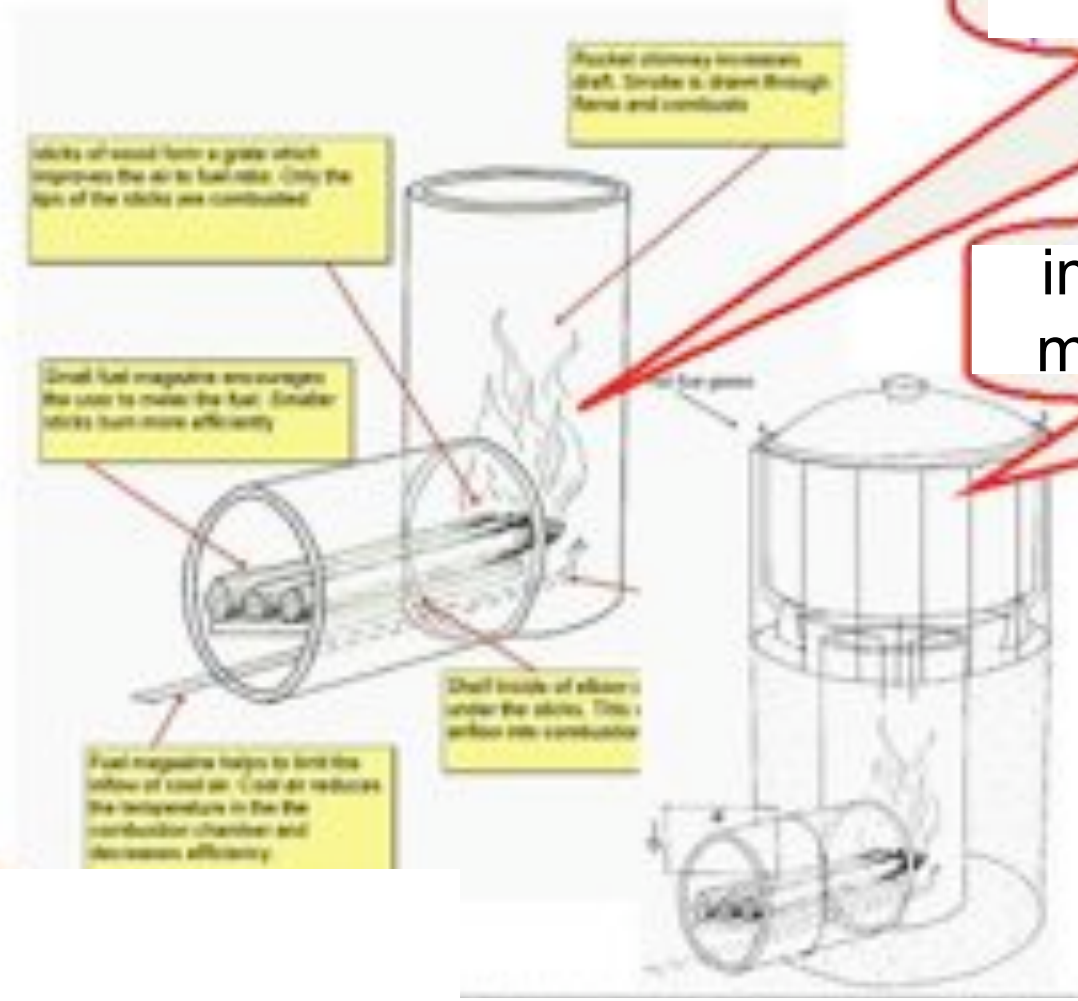
Small twigs can generate enough heat for cooking

Smoke reduction

Fast cooking, less time

Sheltered fire, less heat exposure

Rocket stove principle



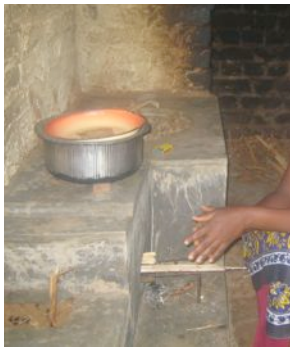
improved combustion: burn the smoke and get more heat from fuel

improved heat-transfer: more cooking from heat

A range of cookstoves to suit different needs and means

1 USD

8 USD



15 USD

20 USD

30 USD

50 USD

80 USD

50-100 USD

200 USD

300 USD

Institutional Rocket stoves

170 kg

with open fire

14 kg

with Rocket stove

School feeding programme Mary‘s Meals Blantyre

How to get stoves out there: Implementation approaches

Rural Low- income Households		Urban Low- income Households
portable clay stove	fixed mud-stove	portable HH Rocket stove
		
Social marketing by implementing partners i.e. for ‘food&fuel’	Difficult to find suitable strategy	Local product too expensive, imports competitive

Implementation approaches

Smallholder contract farmers		Staff in company housing
Portable clay stove	Fixed (insulated) 'Changu' stove	Fixed (solid) 'Esperanza' stove
		
Social marketing by contractor to encourage fuel-saving	Promotion by Agro-industry, refinancing through produce e.g. Tea, Tobacco, Sugar	**C**orporate **S**ocial **R**esponsibility: company builds stoves in staff houses as CSR activities

New focus on emissions:

- WHO waking up to the fact that every year over 1.5 Mio people, mainly women and children, die from diseases attributed to or aggravated by exposure to smoke.
  ‚Smoke' claims more victims than breast cancer or malaria!
- Global Alliance for Clean Cookstoves by the UN Foundation tries to address the problem by promotion of ‚clean' cookstoves, that reduce emissions by 90% and save 50% of the fuel compared to an open fire. Their ambitious aim is to disseminate 100 Mio clean cookstoves by 2020.

When do we get smoke?

Mainly from solid biomass fuels:

Emissions= CO_2, H_2O, but also CO and PM

Wood => ‚smoke'

(perceivable)

charcoal => CO

(not perceivable)

Smoke = incomplete combustion

even ‚improved stoves‘ can smoke!

Factors:

fuelwood (too big, too wet,..)

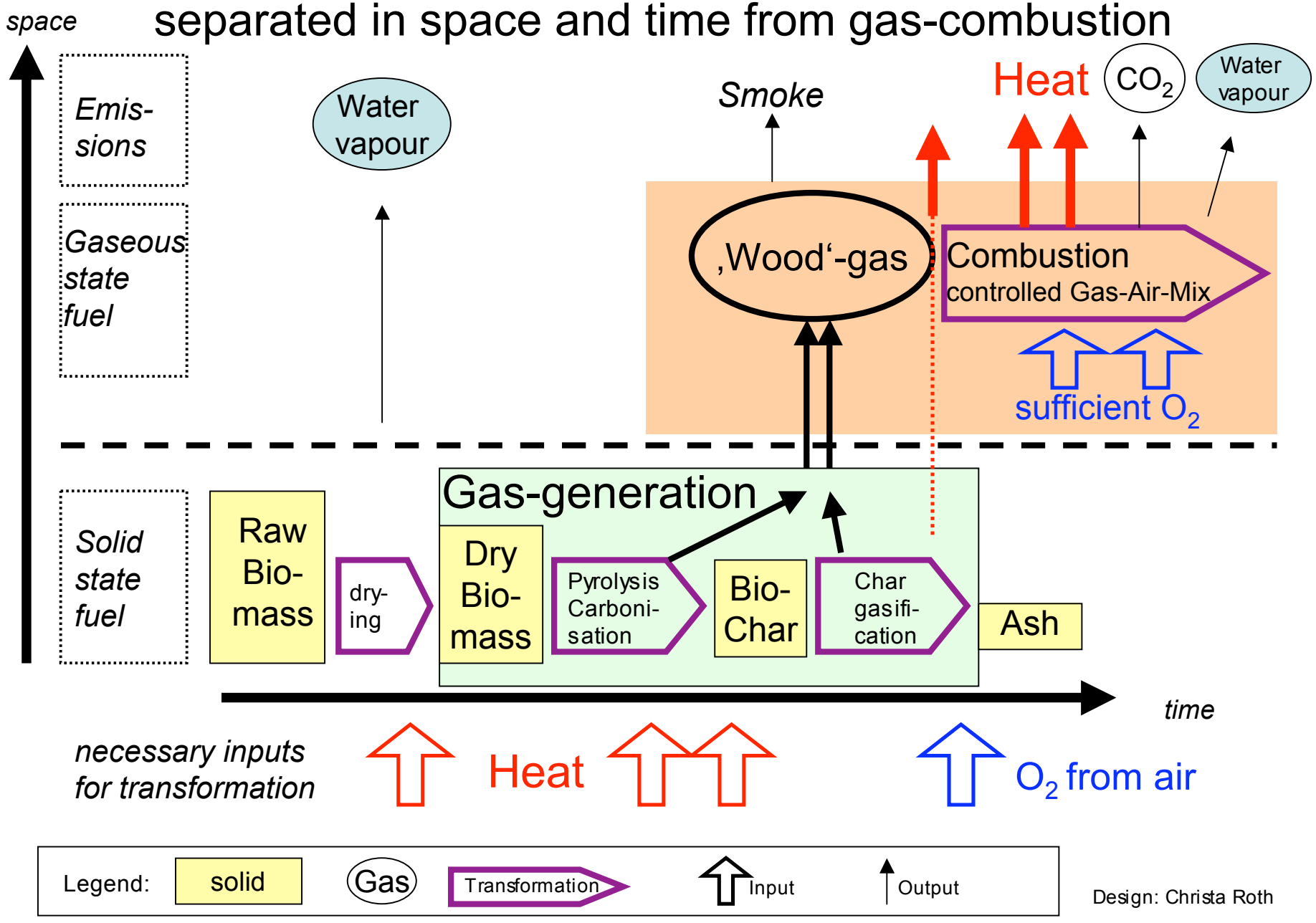
Air (not enough, too cold,...)

Temperature (too cold...)

User / human factor

...so do we have solutions for **‚clean‘** stoves?

Biomass gasification: Gas-generation controllably separated in space and time from gas-combustion



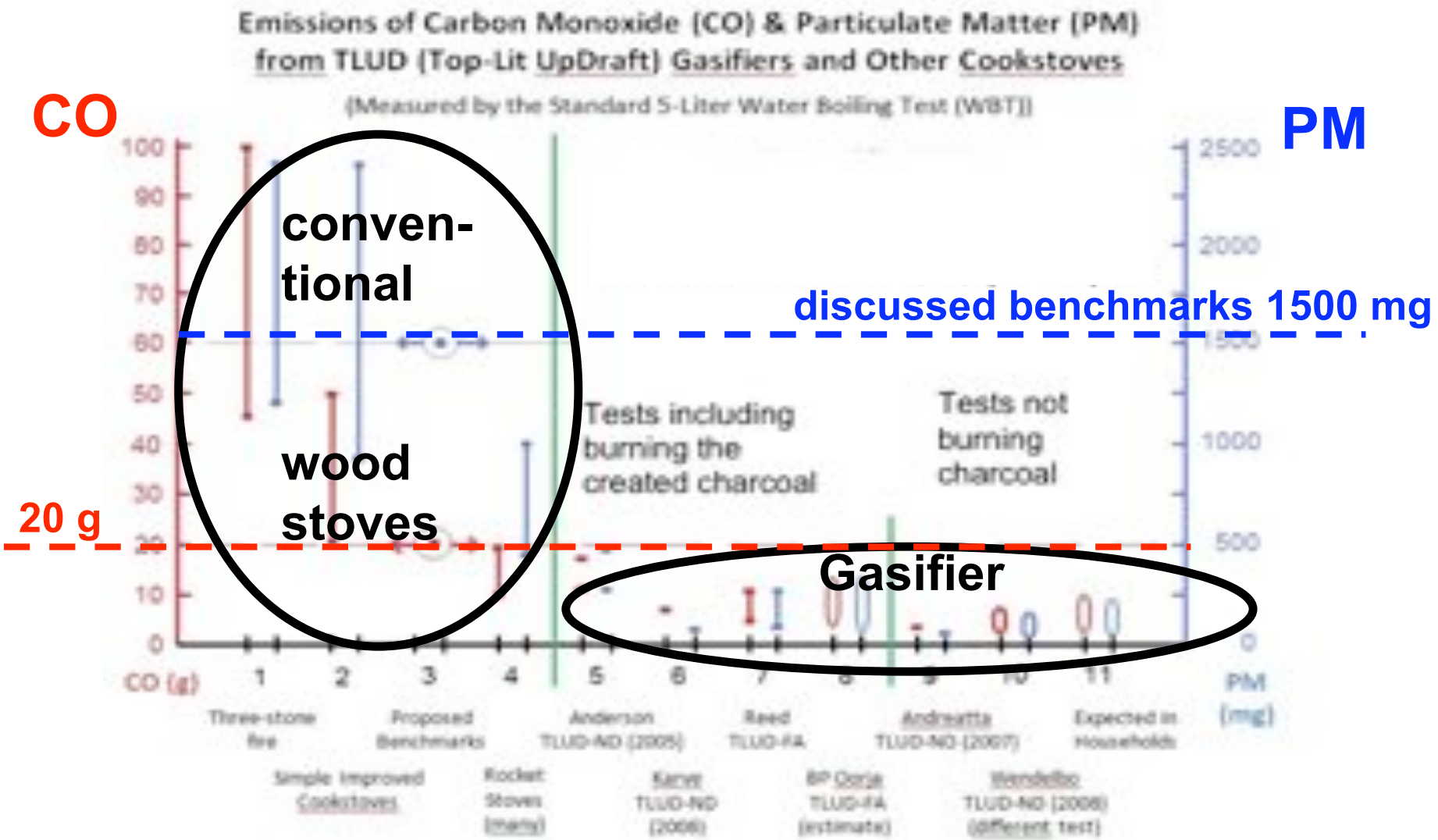
Gasifier - the new concept

Seperate control of **Generation** and **combustion of** gas from biomass with very simple means.

Air-controlled instead of fuel-controlled

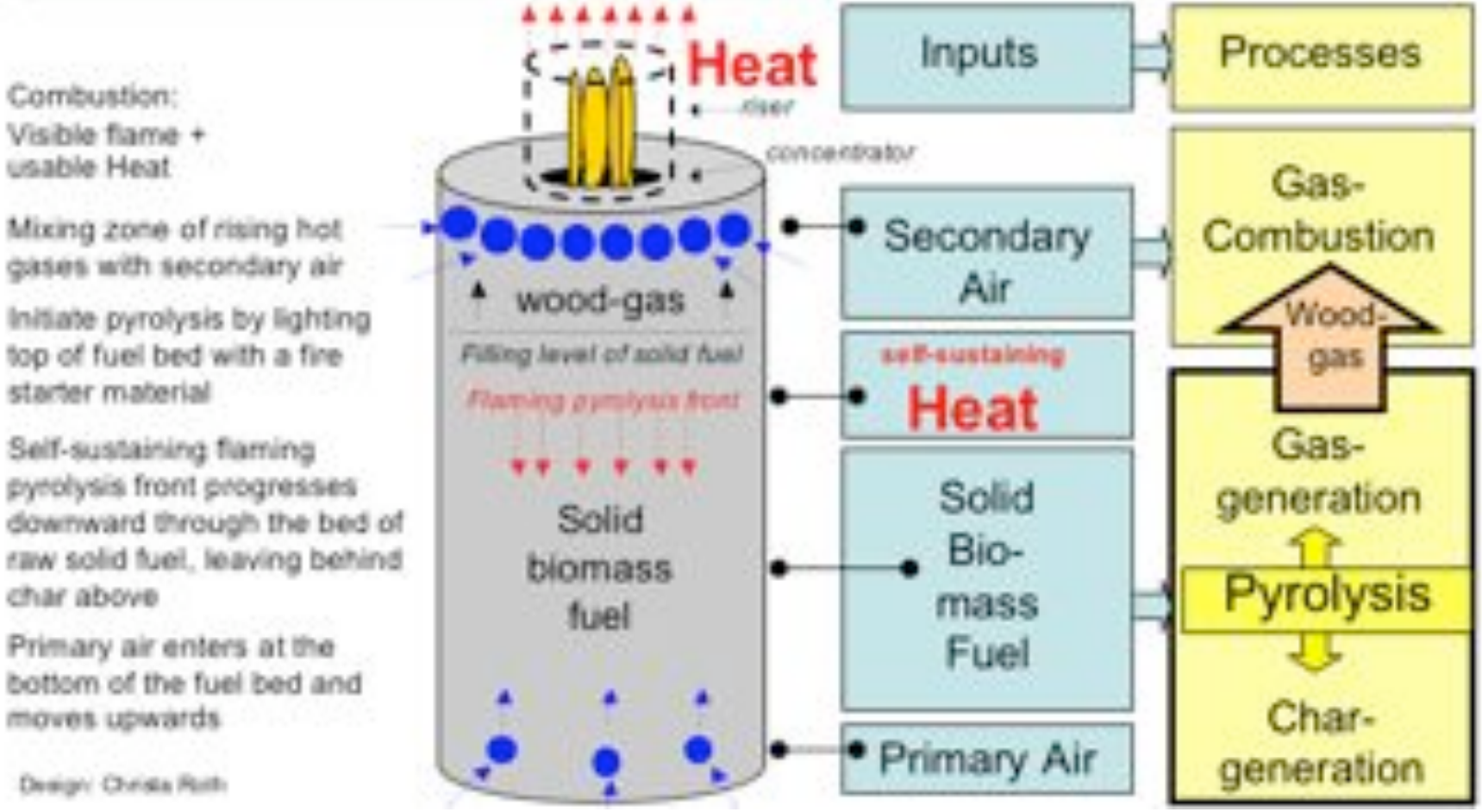
Gasifier: Batch-feeding of fuel, heat controlled by air regulation
conventional fires: constant feeding of fuel, unregulated air-supply

Gasifiers - an option for a quantum leap towards emission reduction



Basic Design principle of a pyrolytic TLUD gasifier

A single tin with separate entry holes for primary and secondary air as combustion unit. Thorough mixing of gaseous fuel and oxygen to ensure optimal combustion can be enhanced with a concentrator disk. A riser can increase draft and air flow.



Christa Roth: Stoves 101 - An introduction to biomass cookstoves on 28.1.2012 ETHOS Kirkland

Gasifier for cooking

depending on cooking task at hand

- application lower than < 75 cm
- Flame on top (no gas-conduct)

remember:

stove=
combination of **Heat-Generator**
+
Heat-Transfer- structure

Advantages of gasifiers compared to...

... conventional wood-fire:

- **complete combustion** (clean burning, less smoke, more useful thermal energy)
- **flexible use of a multitude of small-size renewable residues** (e.g. rice husks, nutshells, saw-dust etc.), no timber-based stick-wood or charcoal

... Biogas:

- Creation of gas from **dry biomass** with very simple inexpensive technology directly in the burner unit *(portable, no piping or special burner-head needed)*
- performance similar to biogas or LPG (but independent from water or digester)

... Solar cookers:

- cooking energy available on demand (independent from clear weather or daylight hours)

... fossil Gas and Electricity:

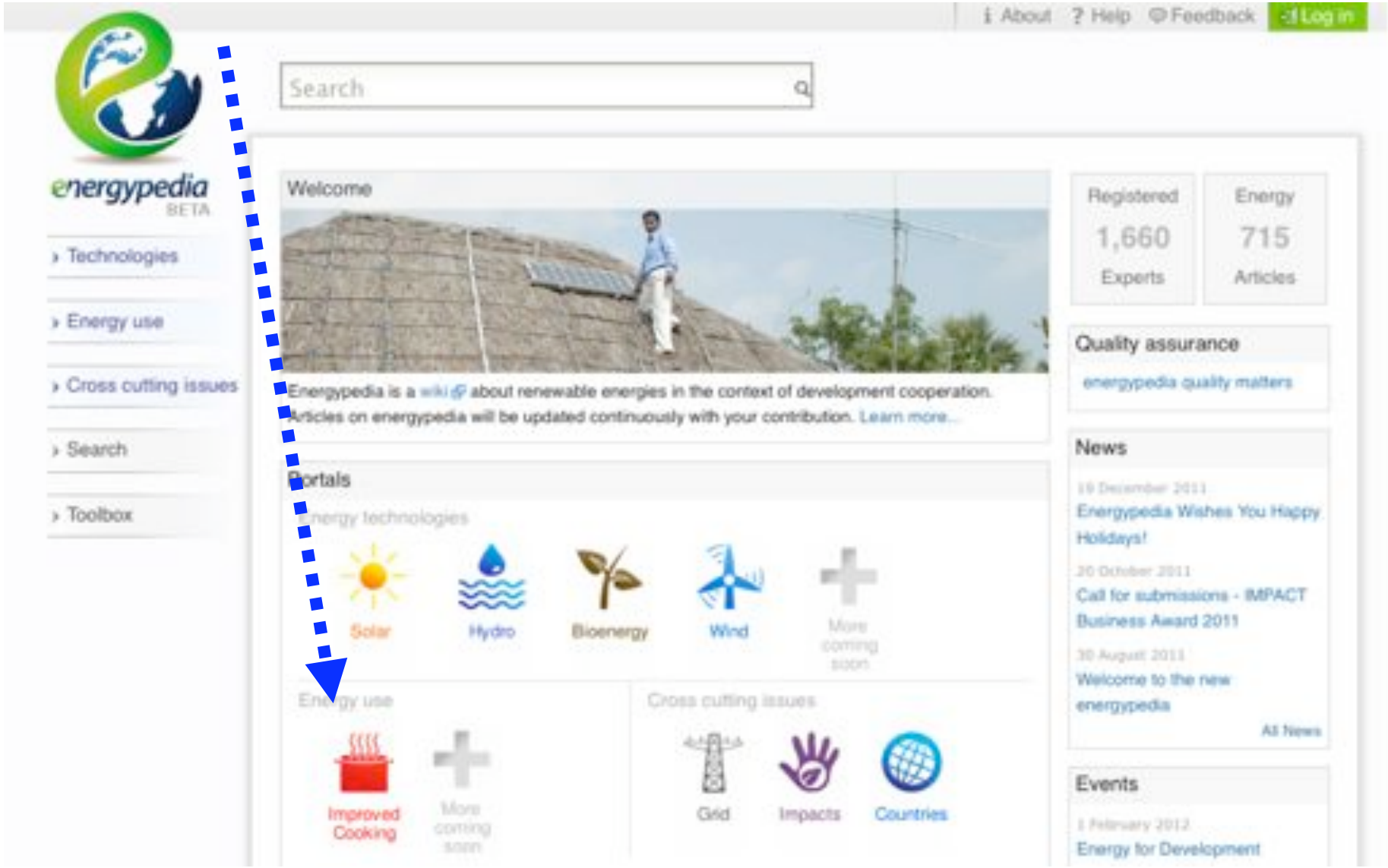
- generate their own gas independent from imports or national providers
- fuel can be collected or purchased at little cost and at own convenience

GIZ-HERA Manual
Micro-gasification: cooking on gas from biomass

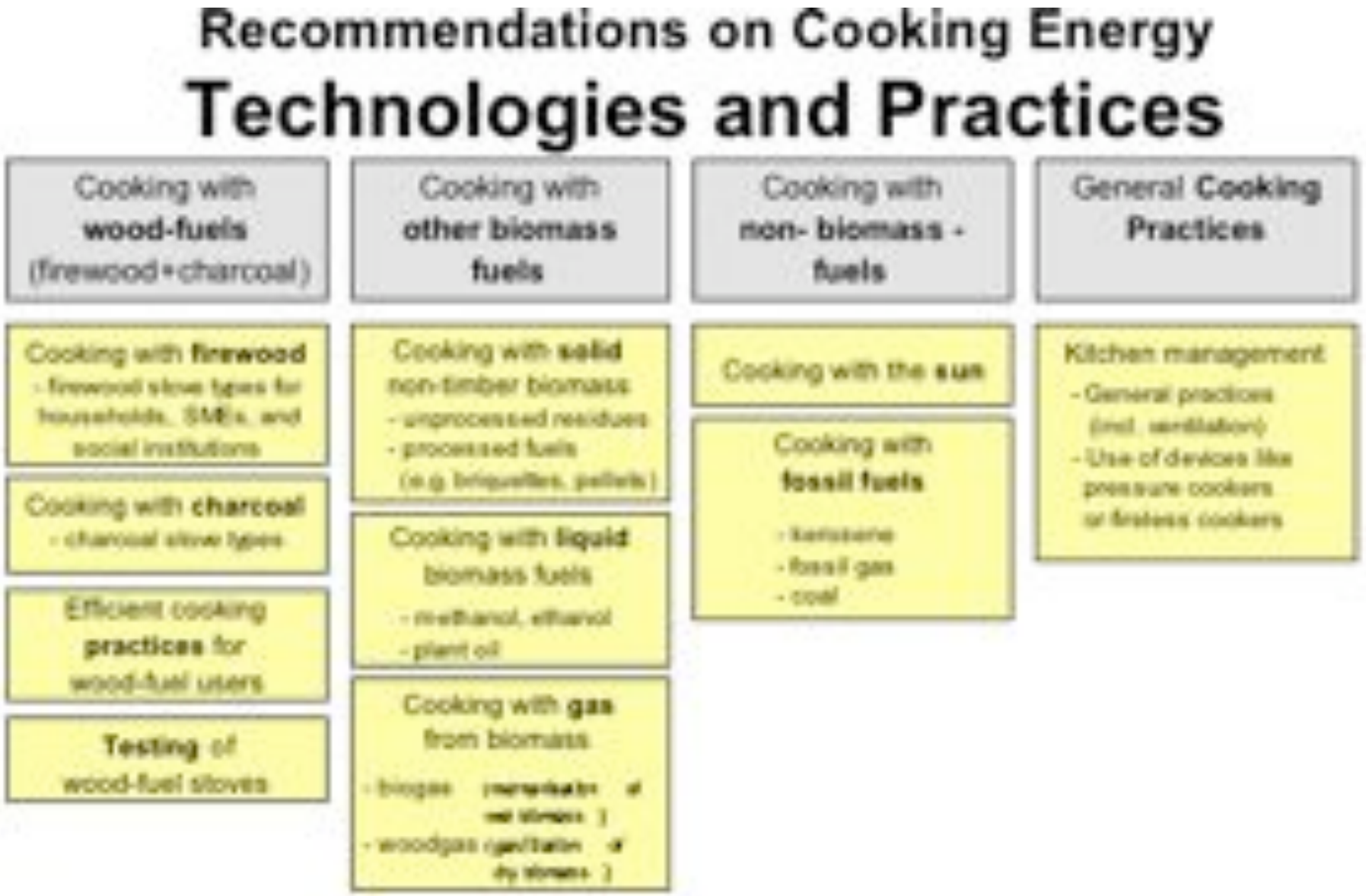
1) **‘Wood-gas’ from biomass and its application for cooking**
2) **Technologies and applications of micro-gasification to cookstoves**
3) **Feedstocks and fuels for micro-gasification**

http://www.gtz.de/de/dokumente/giz2011-en-micro-gasification.pdf

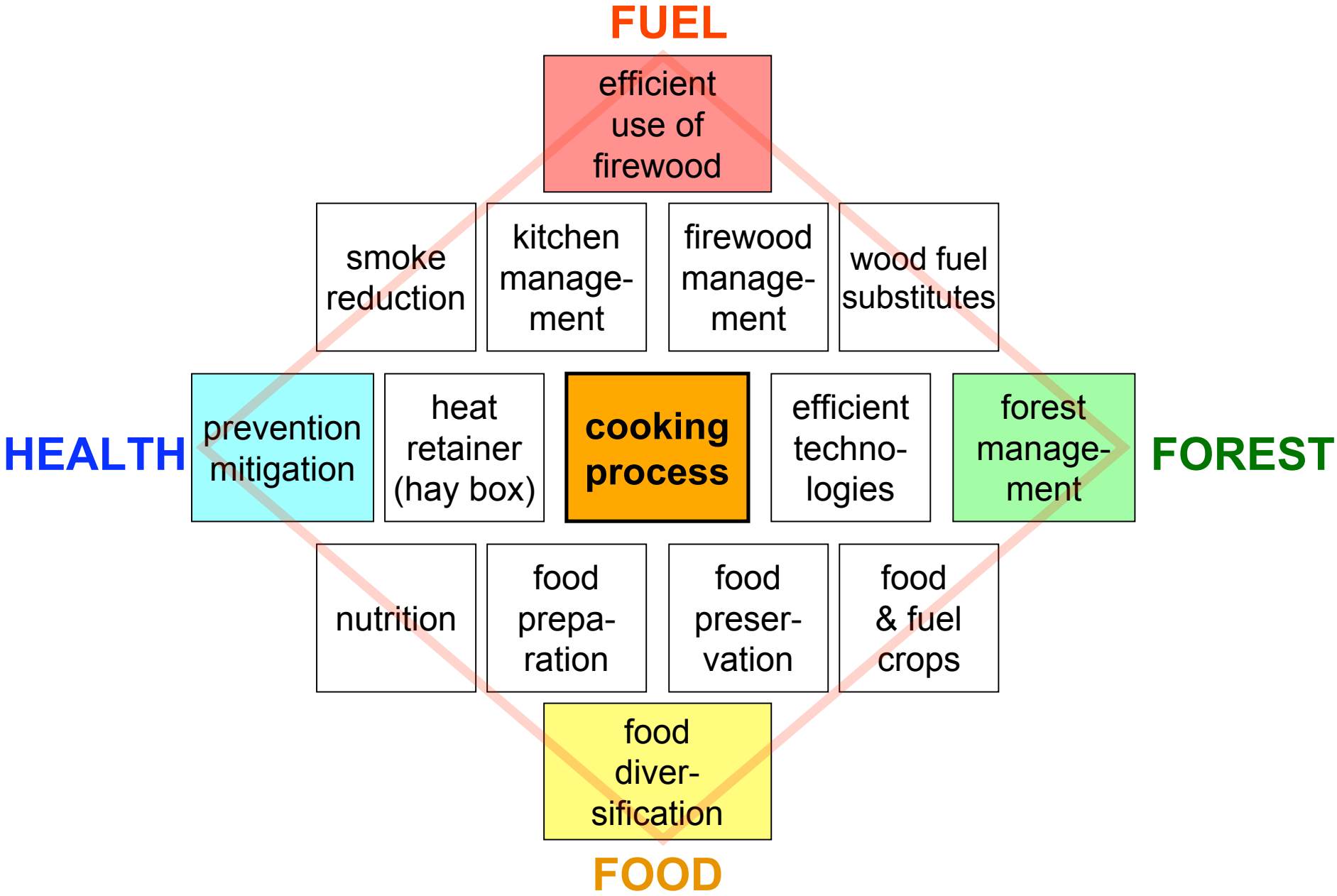
More information on Energypedia and the GIZ-HERA cooking energy compendium



Chapter from GIZ-HERA cooking energy compendium on



Cooking is central!



Thank you,

Please feel free to ask
MANY questions