



**Sun2Steam PTY LTD**

*Solar Thermal Systems*

# **Solar Steam Cooker**

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# Agenda

- What is solar cooking
- Solar cooking for whom and where
- Benefits of solar cooking
- How solar cooking works
- Traditional solar cookers
- Solar steam cooker
- References/Outlook

# Solar cooking

- uses solar energy for cooking of food
- is a small solar application with the potential to cause a positive change
  - to our global carbon footprint
  - to the quality of life for many people

# Importance of firewood

## World energy demand outlook ( EJ )

Fuel	Year				
	2000	2005	2010	2015	
Coal	106.47	122.12	137.24	153.62	IEO, 1999.
Oil	171.99	196.56	224.60	254.42	IEO, 1999.
Natural Gas	98.28	127.47	156.35	191.31	IEO, 1999.
Nuclear	26.36	27.62	28.67	27.83	IEO, 1999.
Hydro	30.33	33.82	37.70	42.04	IEO, 1999.
Biomass generation	7.00	9.59	13.14	18.00	synthesis of IEA, 1998; WEC, 1998; Hall, 1997.
Wind	0.33	1.01	3.07	9.38	24 TWh(e)/yr in 1999 (BTM, 1999) and 30% growth since Stefansson and Fridleifsson, 1998
Geothermal	0.62	0.91	1.34	1.97	based largely upon 7 million solar DHW systems worldwide
Solar Heat	0.05	0.12	0.31	0.77	estimates of authors
Solar Elect.	0.0196	0.06	0.18	0.56	synthesis of IEA, 1998; WEC, 1998; Hall, 1997.
<u>Firewood</u>	38.00	38.00	38.00	38.00	
<b>TOTAL</b>	479.44	557.27	640.59	737.88	
<b>IOE incl Renewables</b>	477.01	555.55	634.51	721.34	
<b>Difference</b>	2.44	1.72	6.08	16.54	

Table 1: Estimated global energy demand in 2000.

Introducing Renewable Energy - The Importance of Education, David Mills

<http://solis.lappeenranta.fi/arkisto/ISREE2000/homepage/programnew.htm>

# Biomass fuel (firewood and dung)

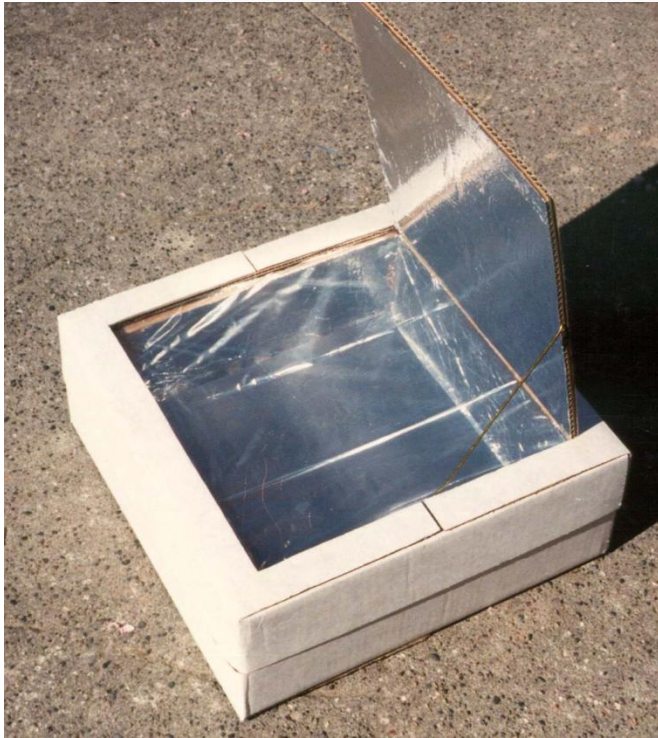
- is the primary fuel for 2.4 billion people for cooking and heating
- affects the health of 2.4 billion people by indoor air pollution



International Energy Outlook 2004 (eia, US government)

[http://www.eia.doe.gov/oiaf/archive/ieo04/special\\_topics.html](http://www.eia.doe.gov/oiaf/archive/ieo04/special_topics.html)

# Examples of solar cookers



# Solar Cooking is the solution for:



**expensive fuel**

+

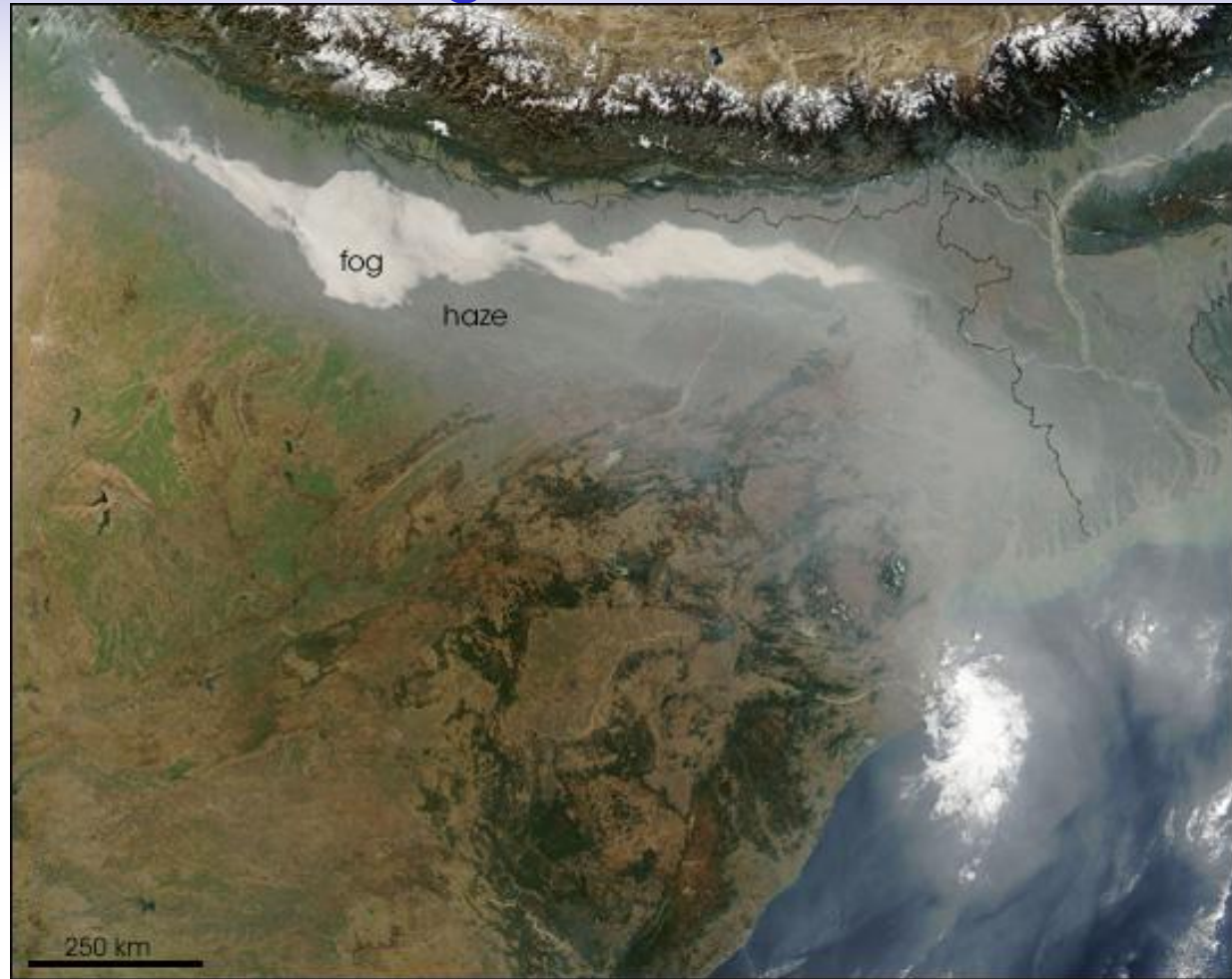


**firewood issues**

# Benefits of Solar Cooking

- Consumes no fuels
- Reduces work
- Reduces risky wood gathering for women
- Reduces cost
- Provides new business opportunities
- No air pollution
- No CO<sub>2</sub> emission
- No health risk by smoke inhalation

# Haze caused by agricultural fires and cooking fires



Credit to NASA's Earth Observatory

# Solar cooking works by

- concentrating solar energy
- providing insulation



# More examples of solar cookers



from simple

to complex

# More examples of solar cookers



**from flimsy**

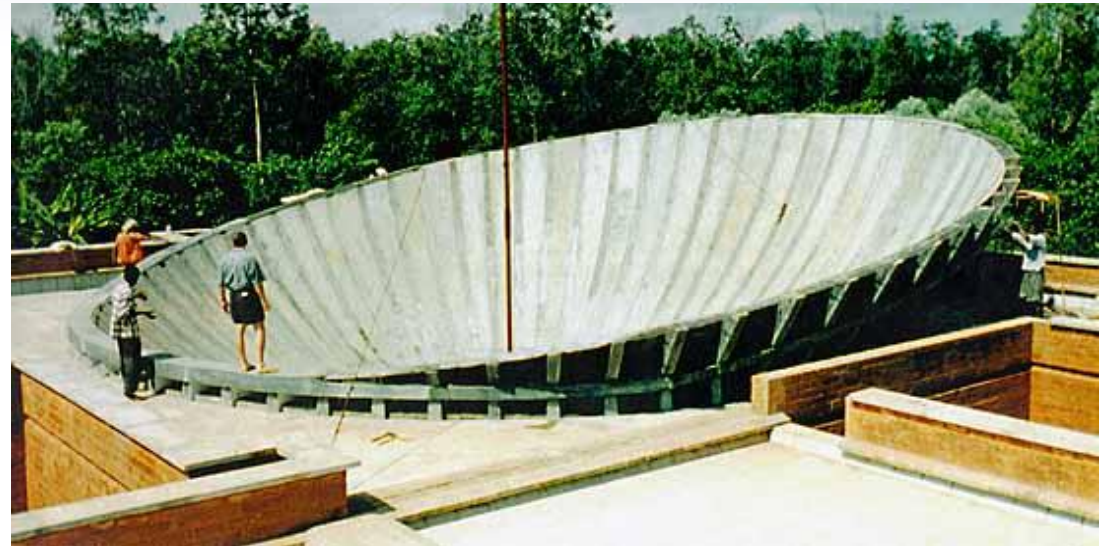


**to rock solid**

# More examples of solar cookers



from small



to huge

# Limitations of solar cookers

- Rely on sunshine
- Must be compatible with culture
- Difficult to stir
- Cooking outside the house
- Must track the sun
- Usually only for small pots
- Usually not suitable for frying
- Reflectors tend to degrade
- Reflectors can be dangerous



# Limitations of solar cookers

- Rely on sunshine
- Must be compatible with culture
- ~~Difficult to stir~~
- ~~Cooking outside the house~~
- ~~Must track the sun~~
- ~~Usually only for small pots~~
- Usually not suitable for frying
- ~~Reflectors tend to degrade~~
- ~~Reflectors can be dangerous~~



# The Solar Steam Cooker

based on evacuated tube collectors



- No reflectors
- No need to track the sun
- Large quantities of food (>5 kg per day)
- Split system:
  - cooker can be several metres away from solar collector
- Can be used like conventional cooking

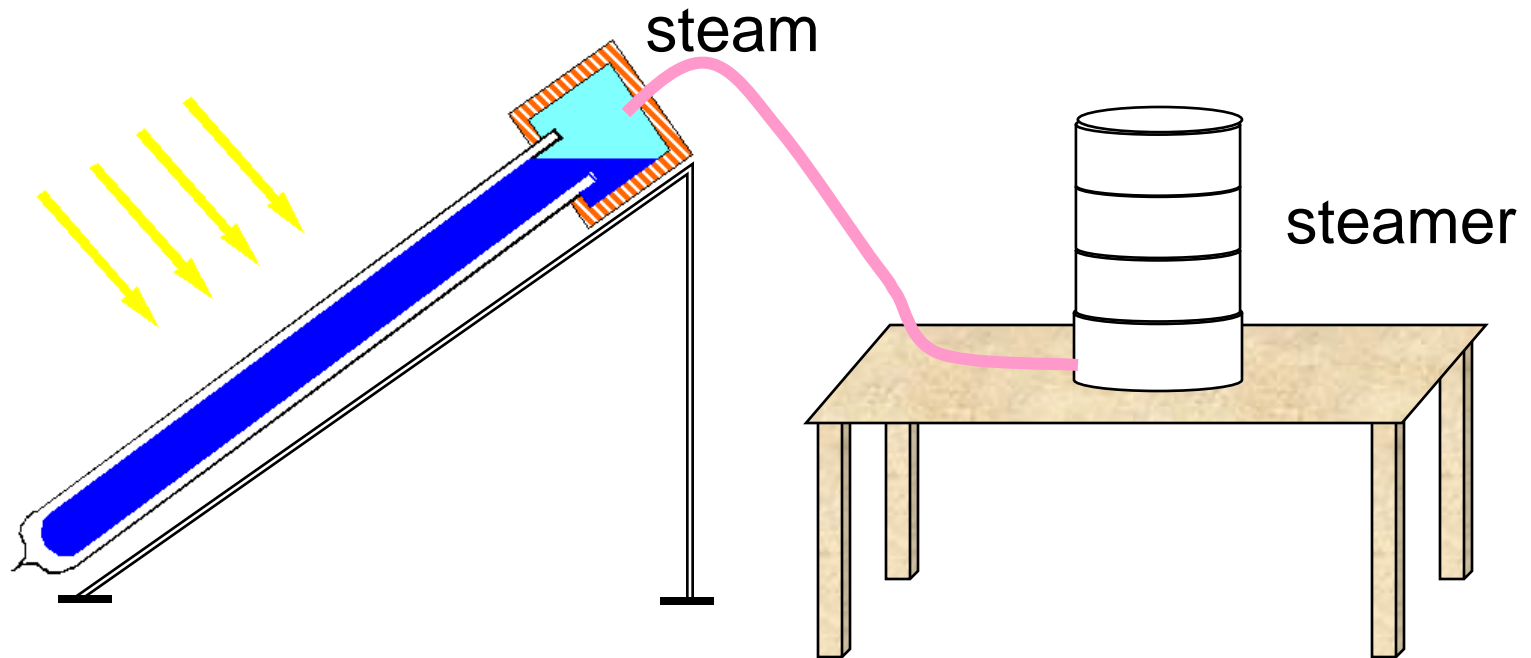
# Evacuated glass tube collector the “Sydney collector”



Length	1800 mm
Outer tube diameter	58 mm
Inner tube diameter	47 mm
Weight	2.2 kg
Resist hail stone	25 mm
Absorptance	>93%
Emittance	<8%
Insolation temperature	> 200°C
cost	< AU\$6

# The Solar Steam Cooker

simple batch setup



# The Solar Steam Cooker

continuous setup by adding:



- Steam separator
- Continuous water supply
- Pressure protection
- Heat recovery

# The Solar Steam Cooker



# The Solar Steam Cooker



# The Solar Steam Cooker



# Outlook

## other potential applications of solar steam:

- Distillation of drinking water (small quantities)
- Pasteurisation of drinking water (large quantities)
- Sterilisation
- Drying of food
- Weed control
- Power generation (see e.g. David Mills)

# Summary

- Solar cooking
  - is a small scale application with a huge potential
  - supplies multiple benefits
  - is an evolving technology with large variety systems
- Solar steam cooking
  - is easy to handle
  - does not need reflectors



# Thanks to

- [www.solarcooking.org](http://www.solarcooking.org) for granting permission to use photos from their web page
- NASA for impressive, free photos
- David Mills, whose papers always appeared when I was searching through literature
- my family for their loving and generous support

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