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)

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</thead>
<tbody>
<tr>
<td>Wind</td>
<td>0.33</td>
<td>1.01</td>
<td>3.07</td>
<td>9.38</td>
<td>24 TWh(e)/yr in 1999 (BTM, 1999) and 30% growth since</td>
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<tr>
<td>Geothermal</td>
<td>0.62</td>
<td>0.91</td>
<td>1.34</td>
<td>1.97</td>
<td>Stefansson and Fridleifsson, 1998</td>
<td></td>
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<tr>
<td>Solar Heat</td>
<td>0.05</td>
<td>0.12</td>
<td>0.31</td>
<td>0.77</td>
<td>based largely upon 7 million solar DHW systems worldwide</td>
<td></td>
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<tr>
<td>Solar Elect.</td>
<td>0.0196</td>
<td>0.06</td>
<td>0.18</td>
<td>0.56</td>
<td>estimates of authors</td>
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<td></td>
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<tr>
<td>Firewood</td>
<td>38.00</td>
<td>38.00</td>
<td>38.00</td>
<td>38.00</td>
<td>synthesis of IEA, 1998; WEC, 1998; Hall, 1997.</td>
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<tr>
<td>TOTAL</td>
<td>479.44</td>
<td>557.27</td>
<td>640.59</td>
<td>737.88</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>IOE incl Renewables</td>
<td>477.01</td>
<td>555.55</td>
<td>634.51</td>
<td>721.34</td>
<td></td>
<td></td>
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<tr>
<td>Difference</td>
<td>2.44</td>
<td>1.72</td>
<td>6.08</td>
<td>16.54</td>
<td></td>
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</tbody>
</table>

*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

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$_2$ 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
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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”

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Length</td>
<td>1800 mm</td>
</tr>
<tr>
<td>Outer tube diameter</td>
<td>58 mm</td>
</tr>
<tr>
<td>Inner tube diameter</td>
<td>47 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>2.2 kg</td>
</tr>
<tr>
<td>Resist hail stone</td>
<td>25 mm</td>
</tr>
<tr>
<td>Absorptance</td>
<td>&gt;93%</td>
</tr>
<tr>
<td>Emittance</td>
<td>&lt;8%</td>
</tr>
<tr>
<td>Insolation temperature</td>
<td>&gt; 200°C</td>
</tr>
<tr>
<td>cost</td>
<td>&lt; AU$6</td>
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</table>
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 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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