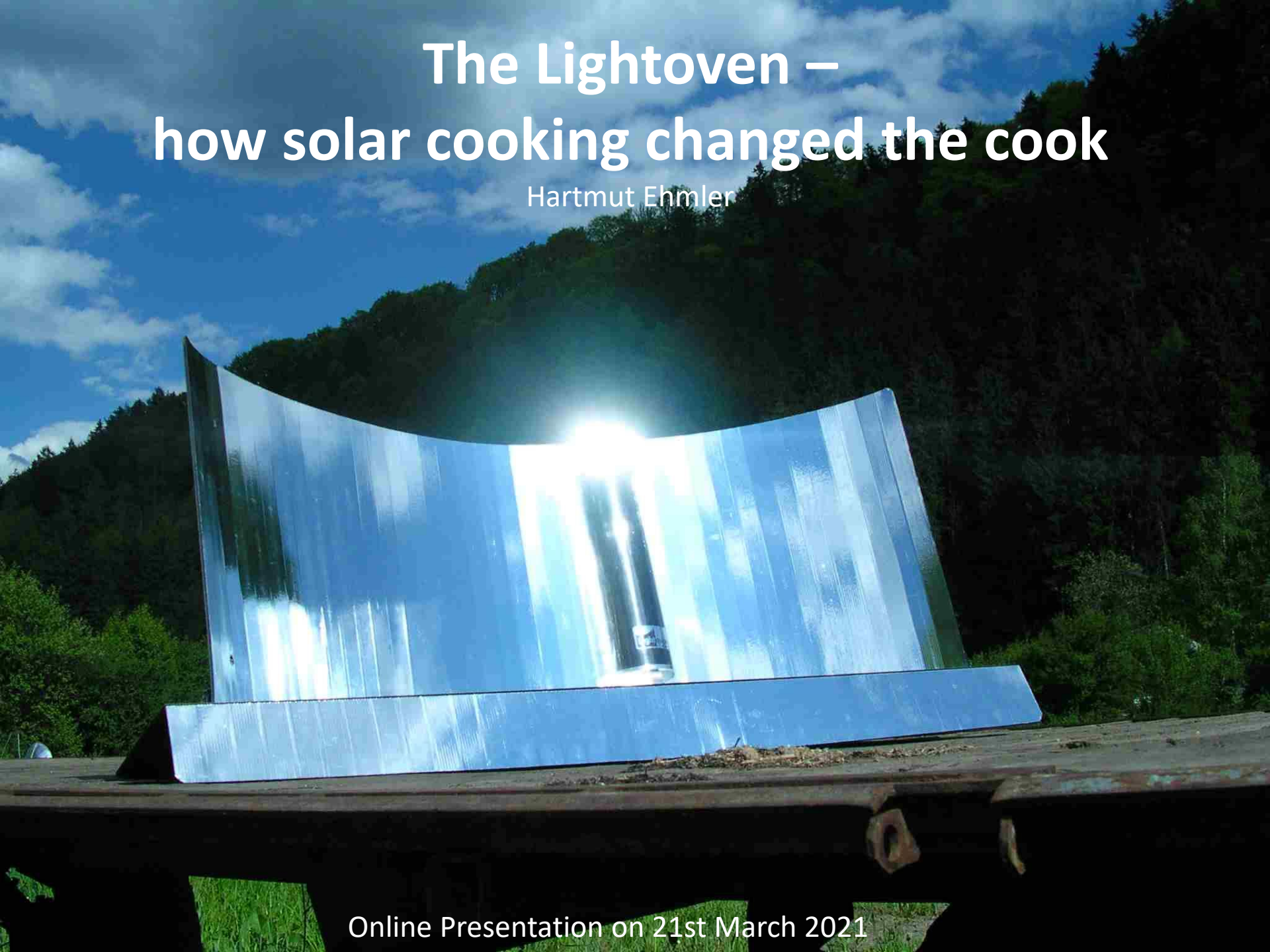


The Lightoven – how solar cooking changed the cook

Hartmut Ehmler



Online Presentation on 21st March 2021

Outline

- The different Lightoven models
- Cooker testing
- Solar cooking outreach
- Some thoughts on sustainability

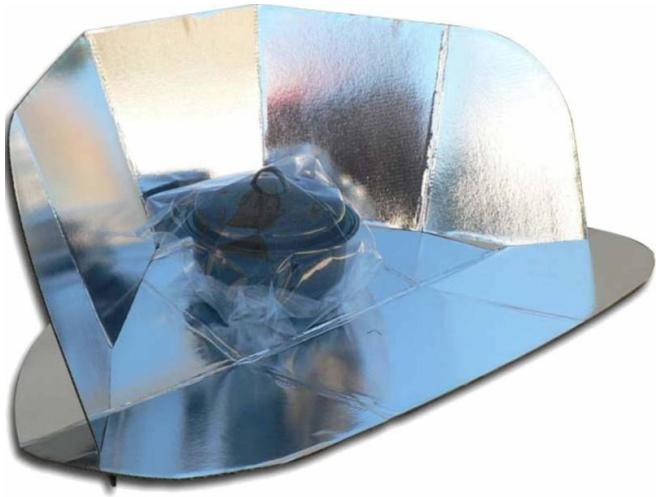
How the story began



What were my initial design goals?

- Efficient mobile solar cooker
- 1 liter boils in less than ½ hour
- lightweight
- Small packing dimensions
- High value for price

Inspired by



Cookit

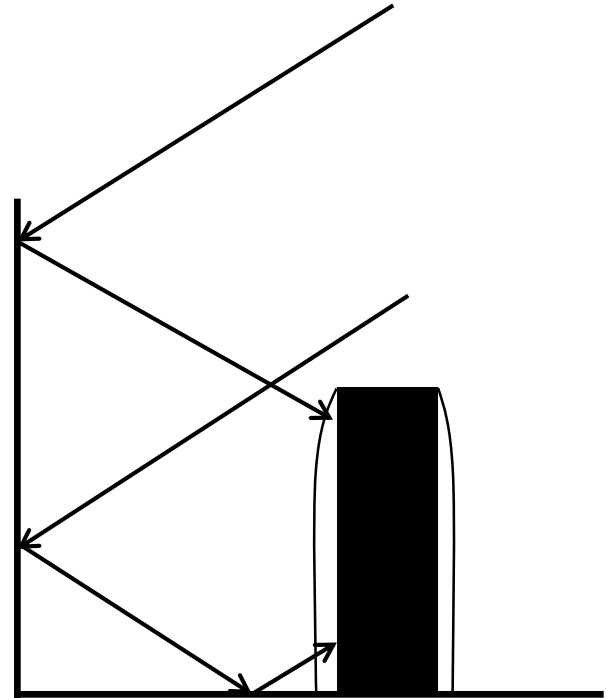
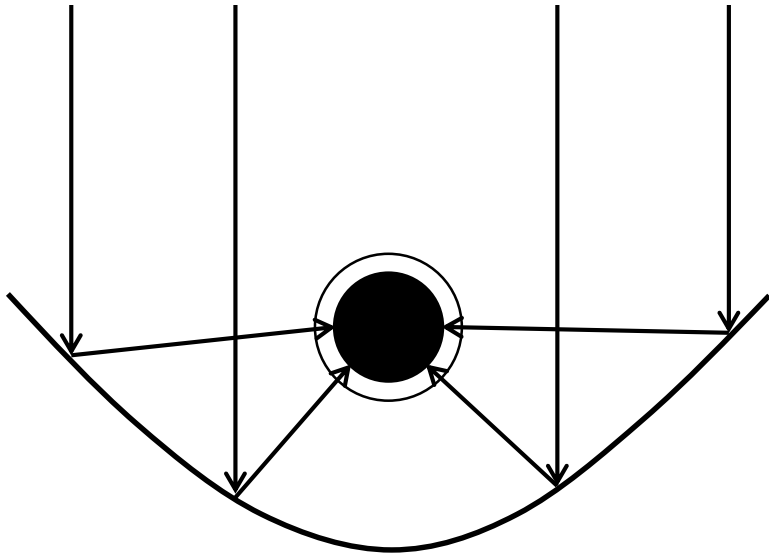


Götz Ultralight



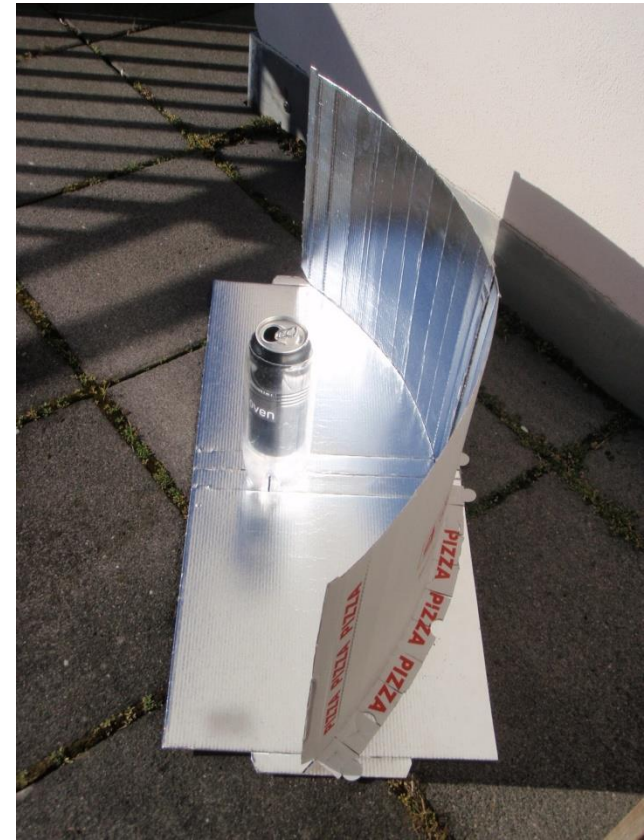
Kotowski

Concept





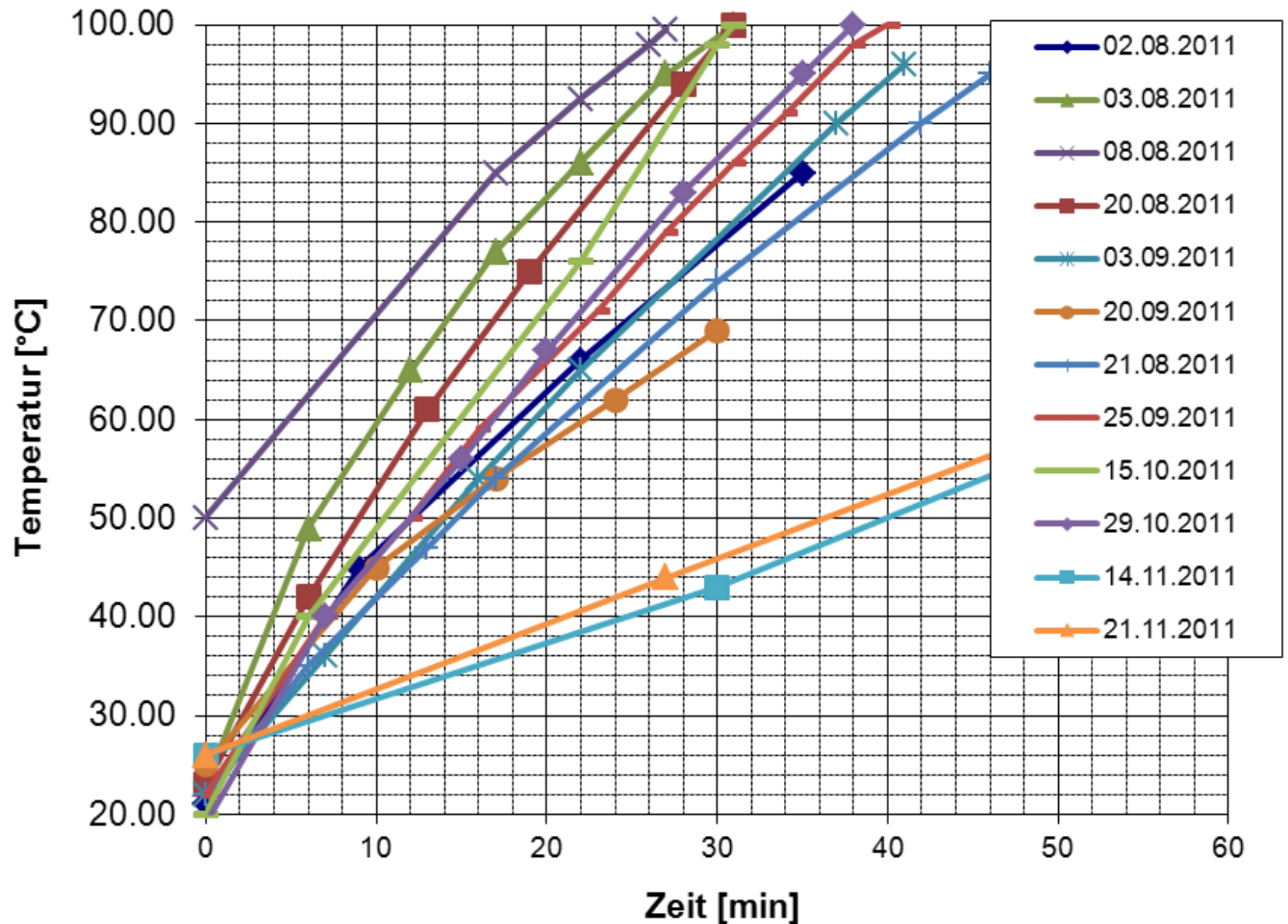
Development phase



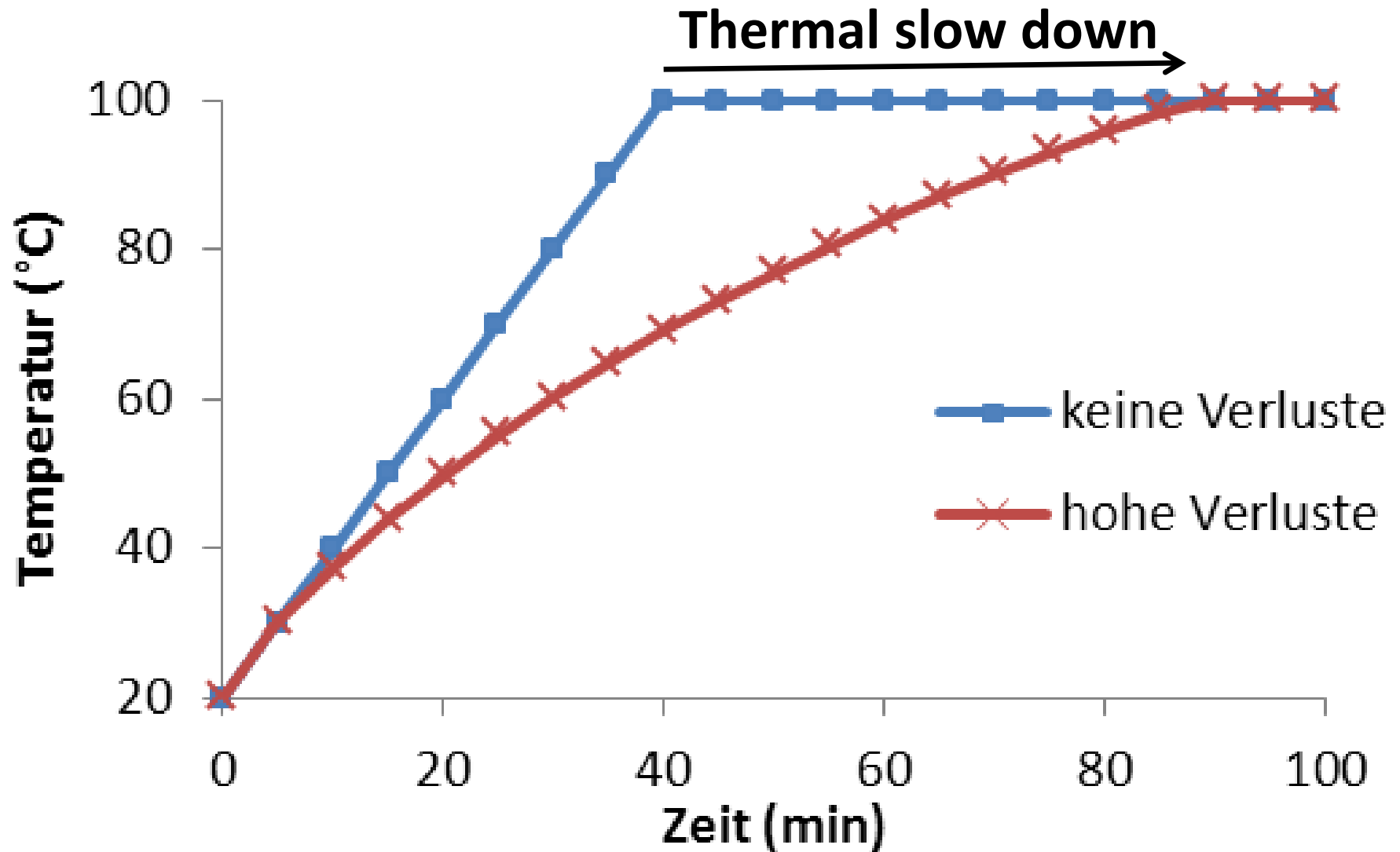




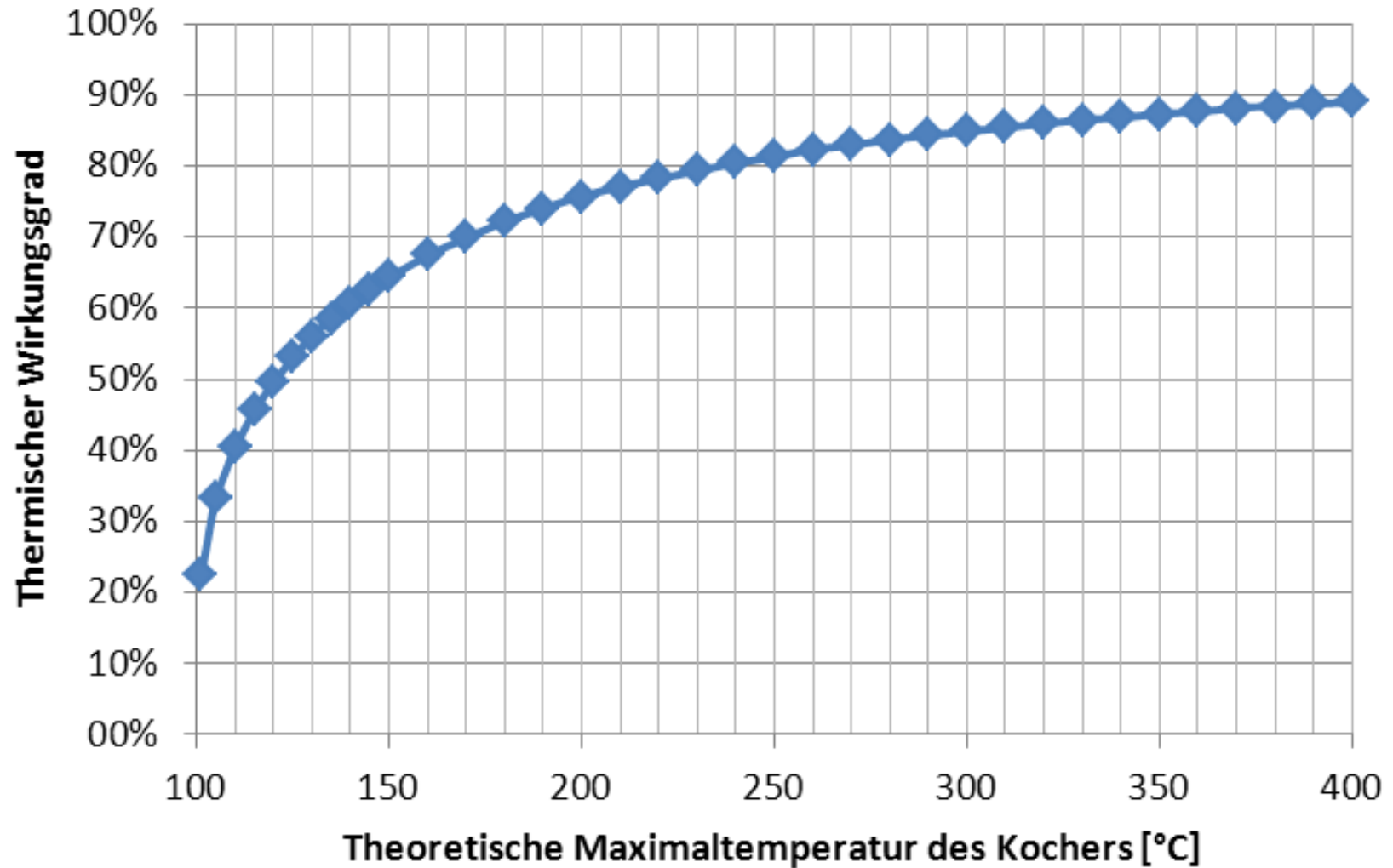
Measurements



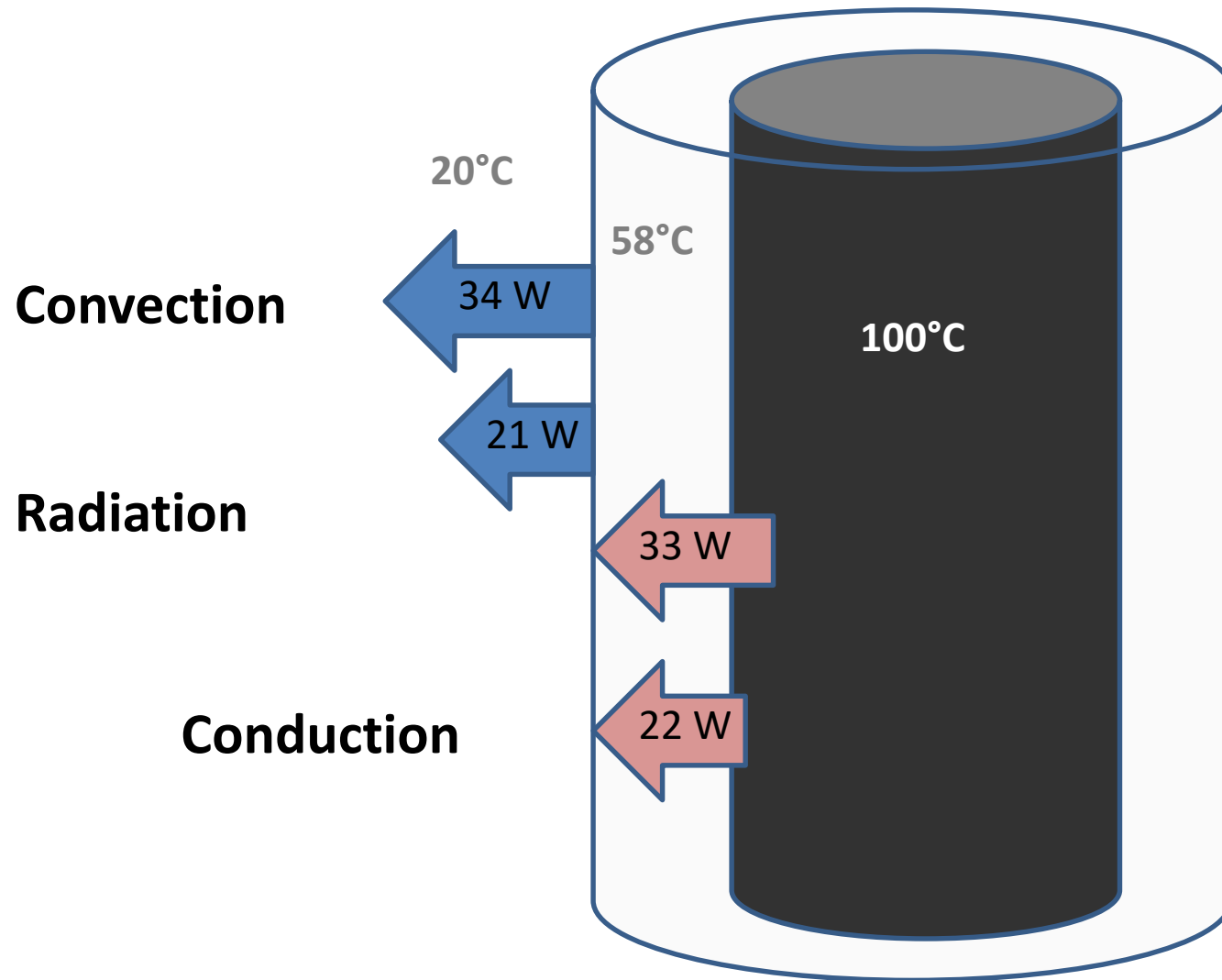
Heat Losses



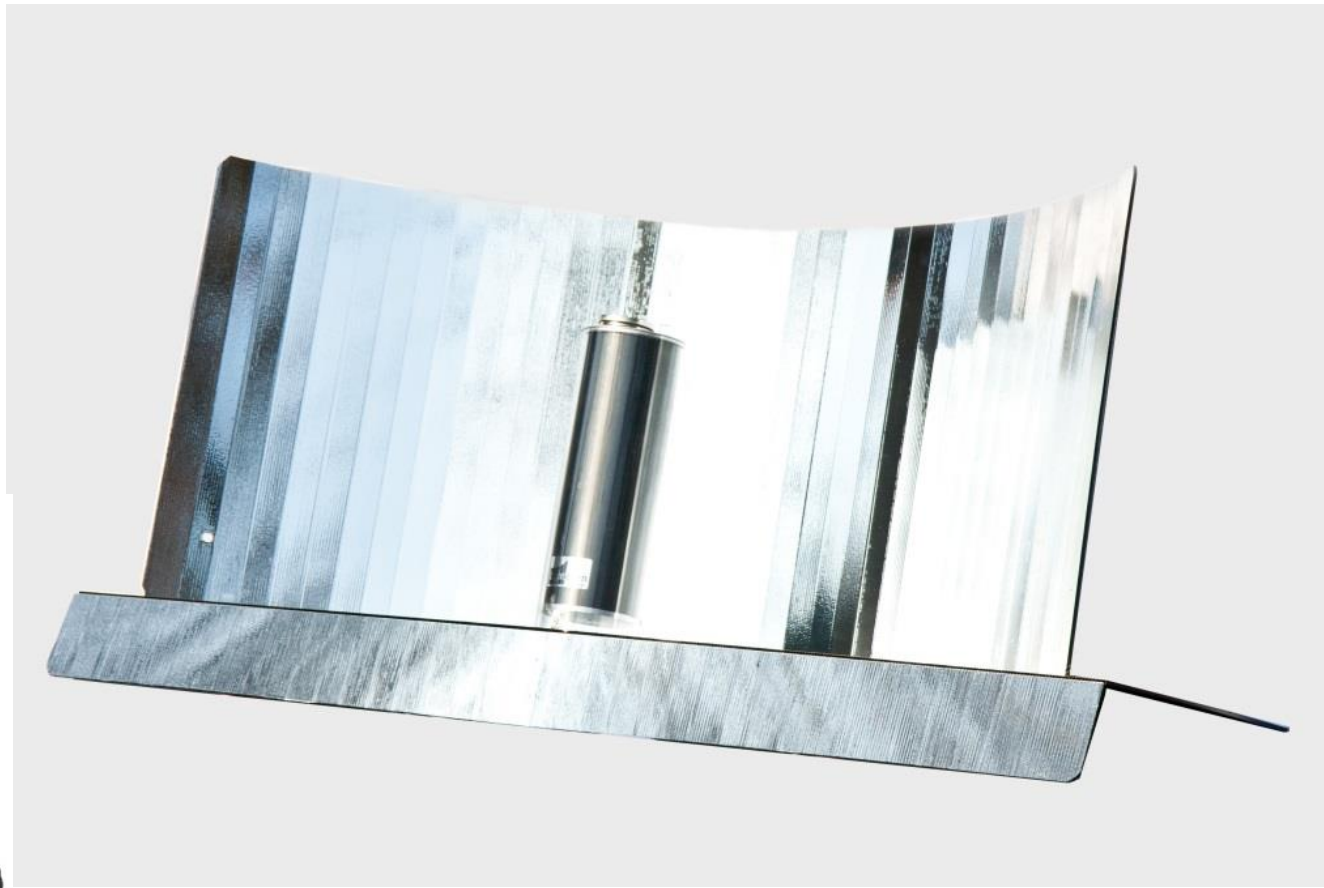
Thermal efficiency



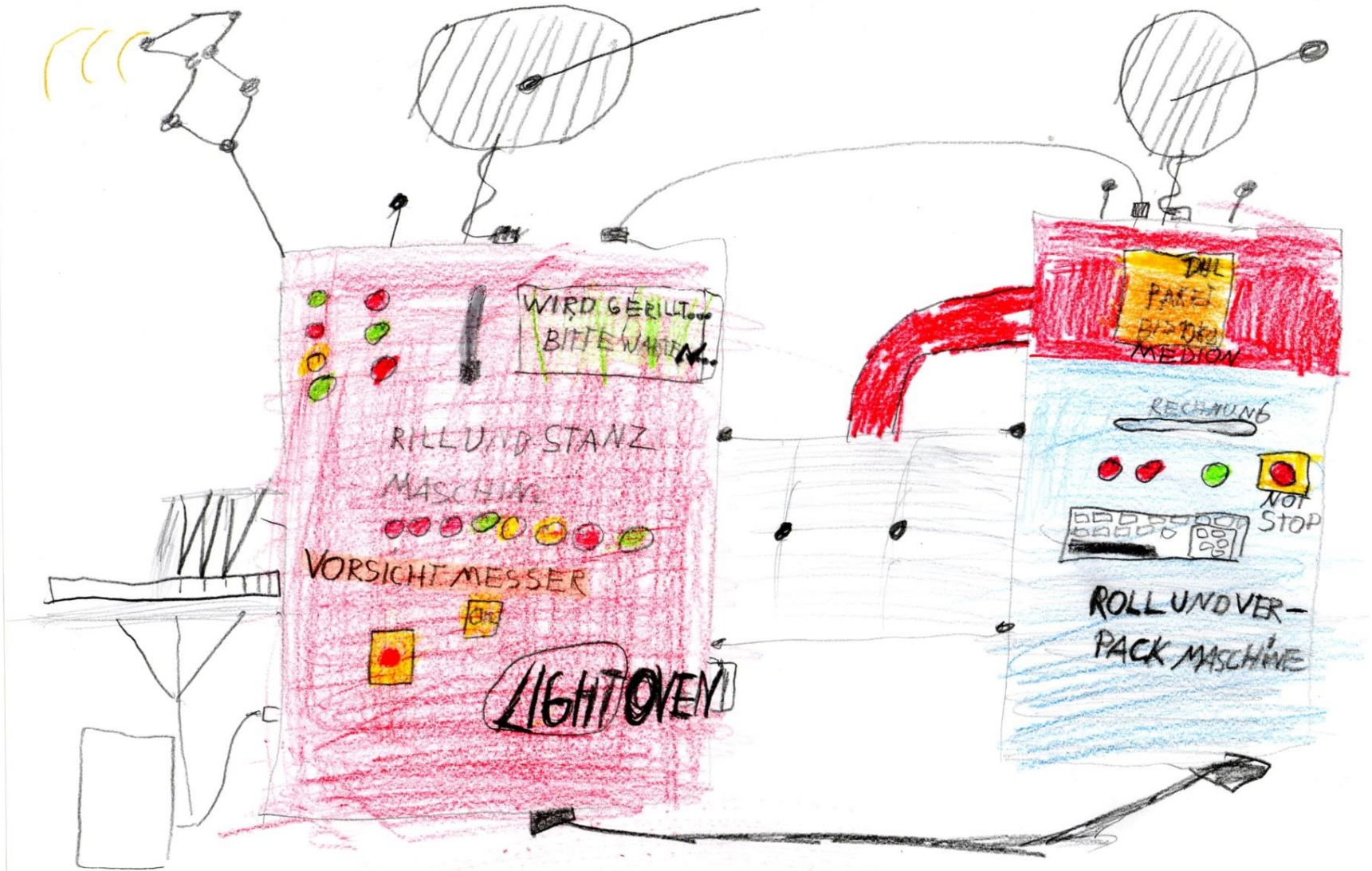
Model for heat losses



Lightoven I

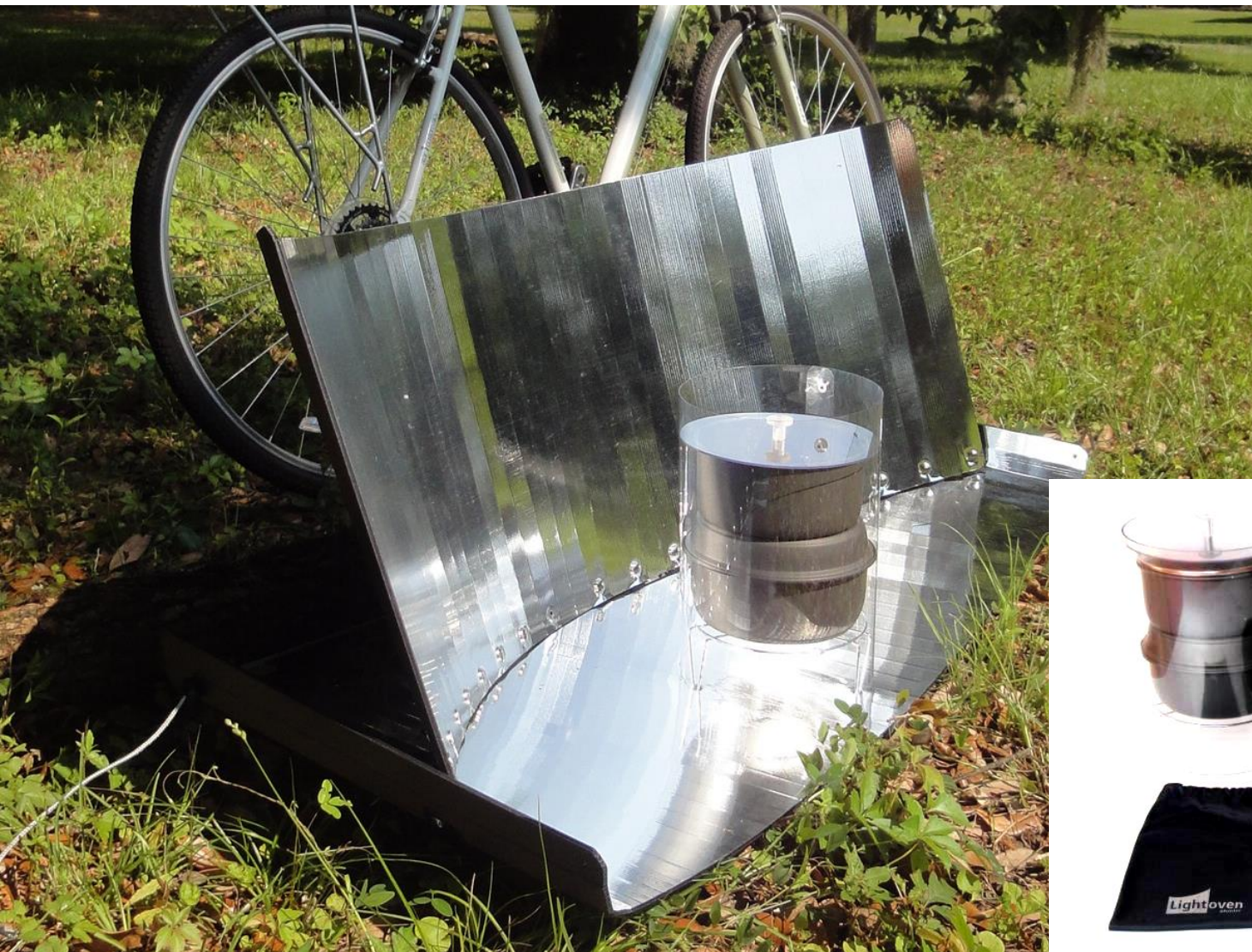


Mass production?



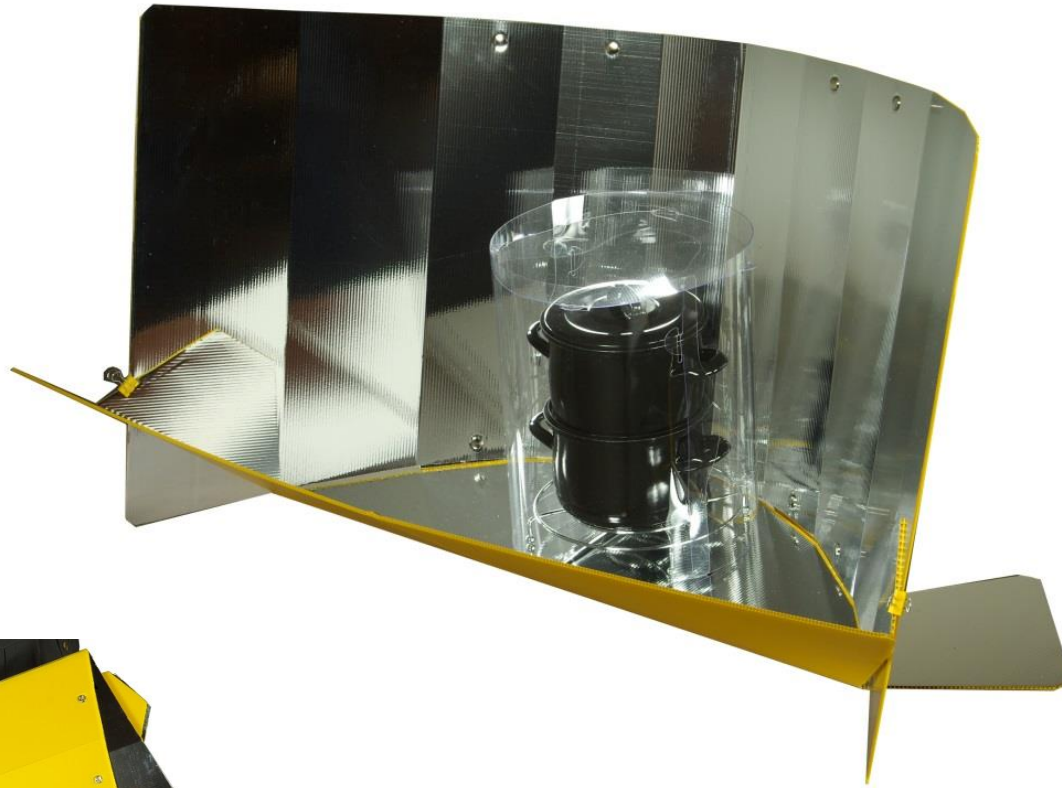
User Friendliness?

Lightoven II

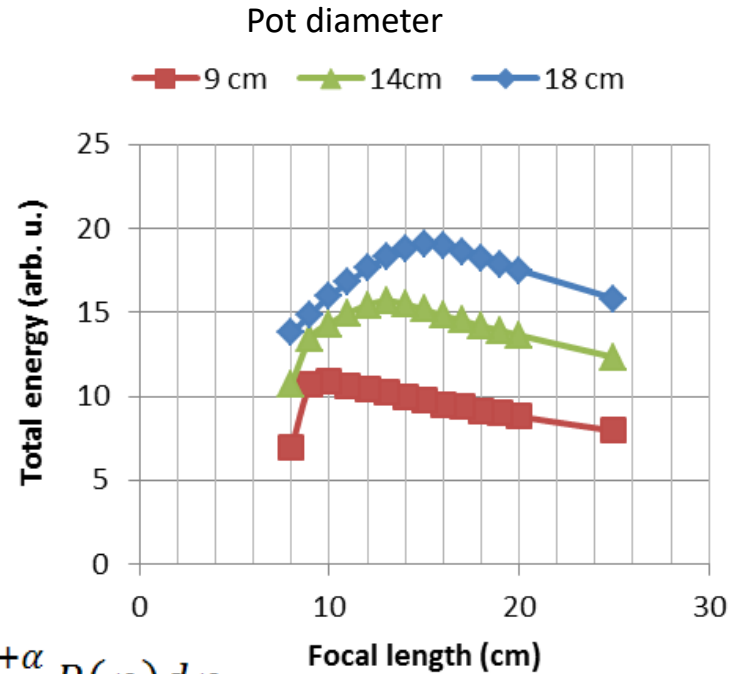
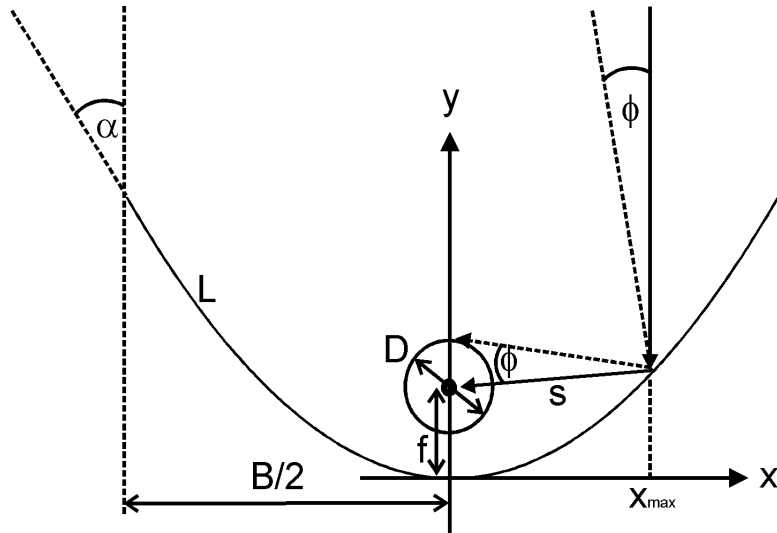


Simplicity?

Lightoven III



Optimizing focal length



$$E = \int_{-\alpha}^{+\alpha} P(\varphi) d\varphi .$$

Large focal length: reflector has to be adjusted frequently

Small focal length: More material for same aperture needed

Optimum: Focal length approximate equal to pot diameter

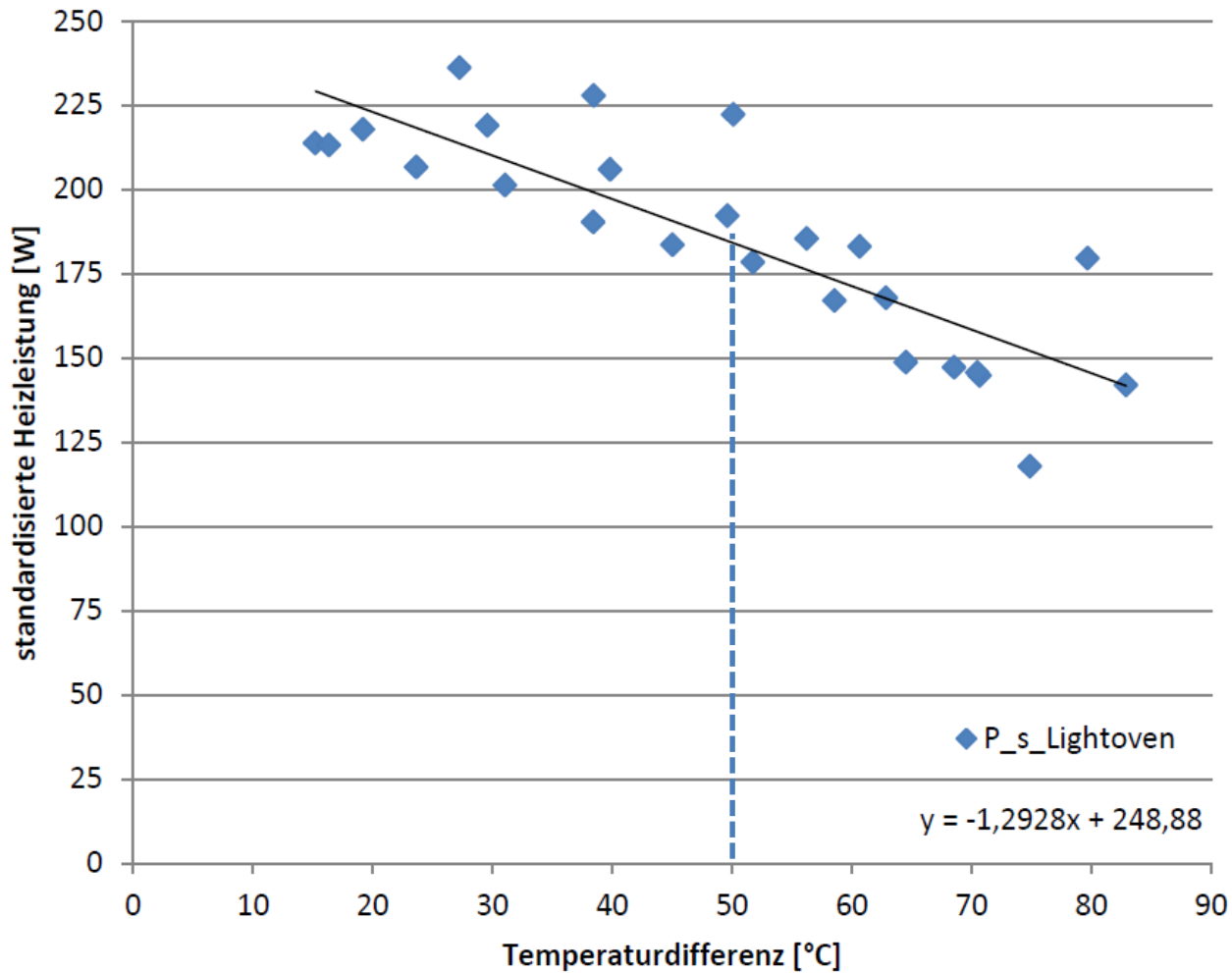
Solar cooking testing

Field testing Lightoven I



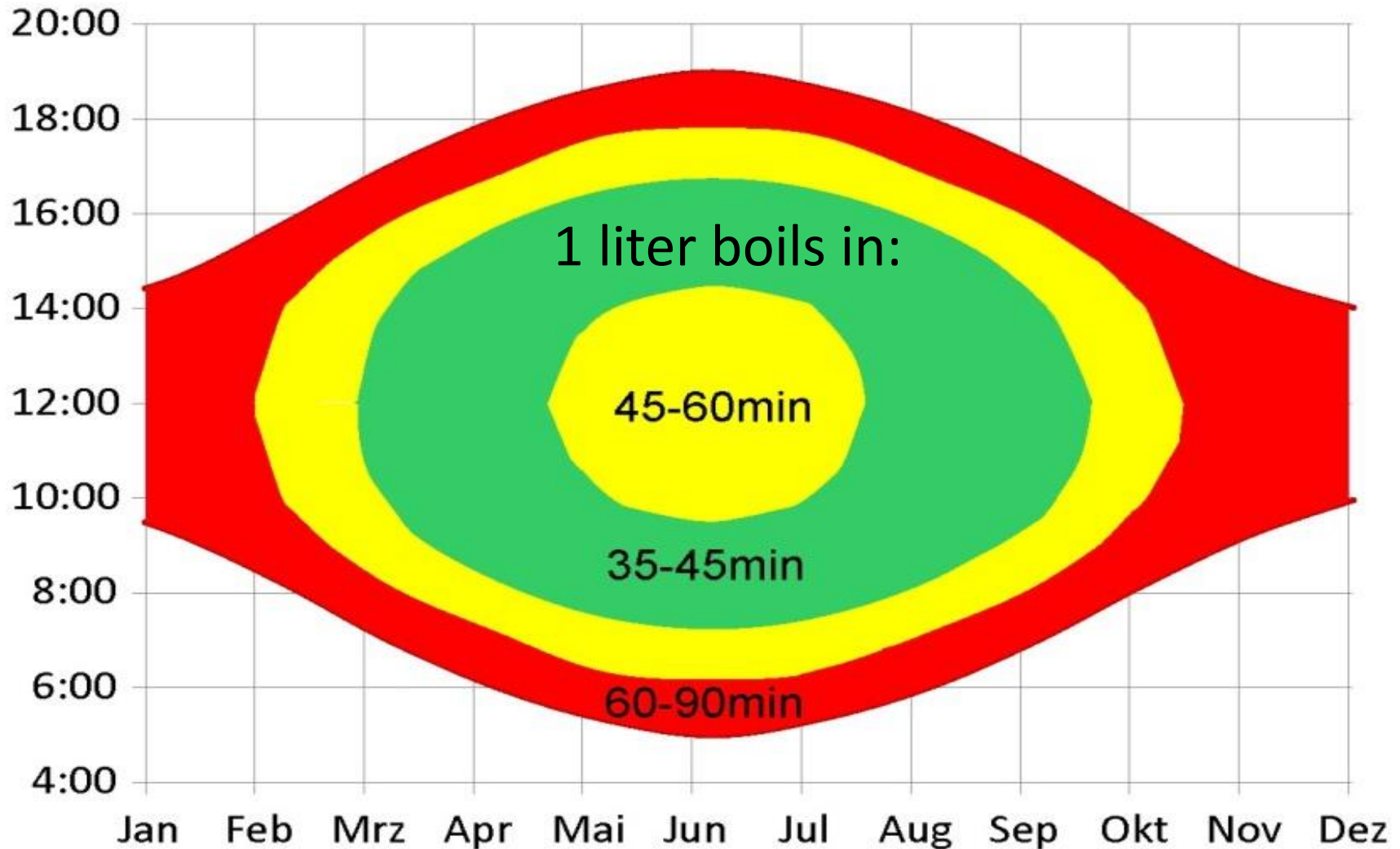
Fachhochschule Düsseldorf, Prof. Dr.-Ing Mario Adam,
E2 – Erneuerbare Energien und Energieeffizienz, Masterarbeit Jan Vermeegen

Field testing Lightoven I

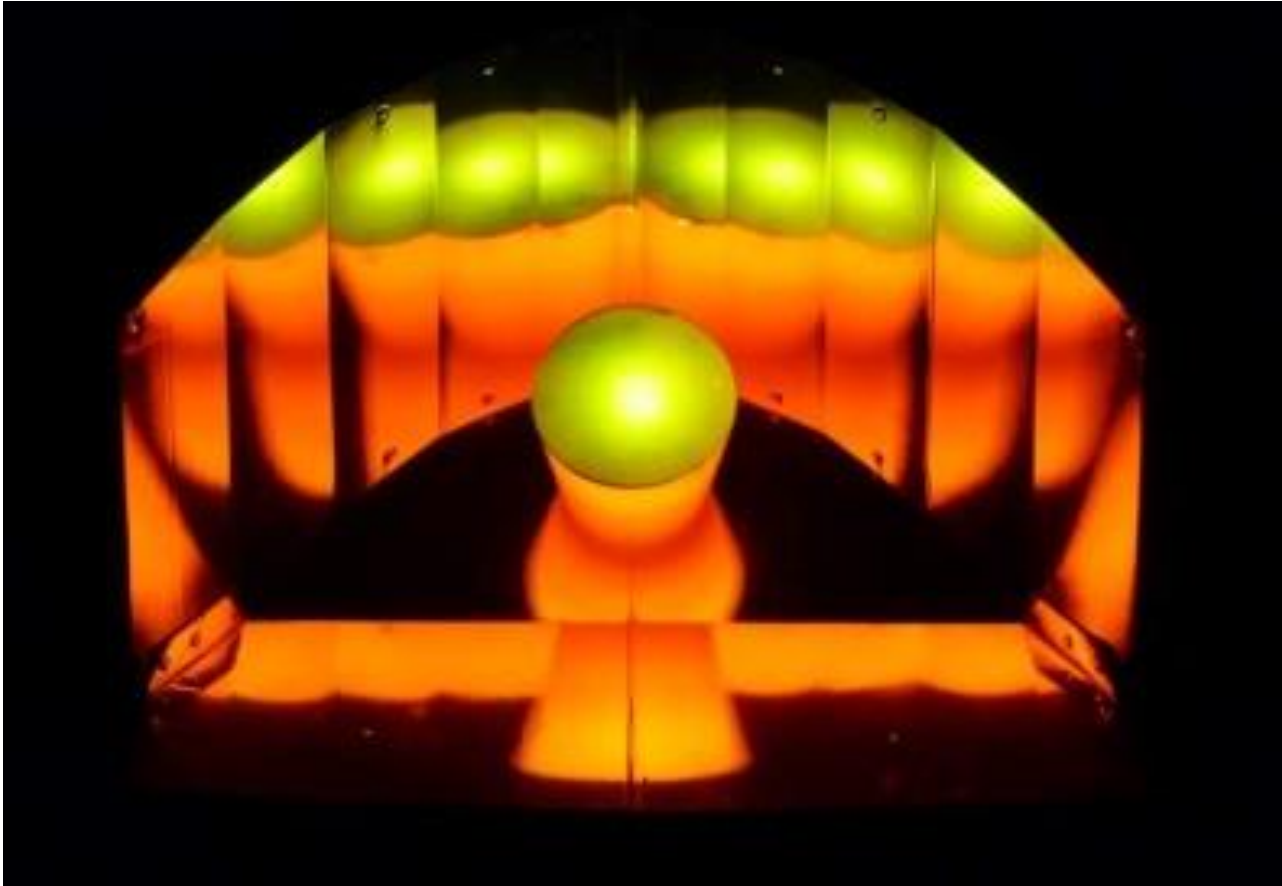


Test-Standard S280 of American Society of Agricultural Engineers
with 850 W/m² and 50°C temperature difference

Daily & seasonal usage diagram

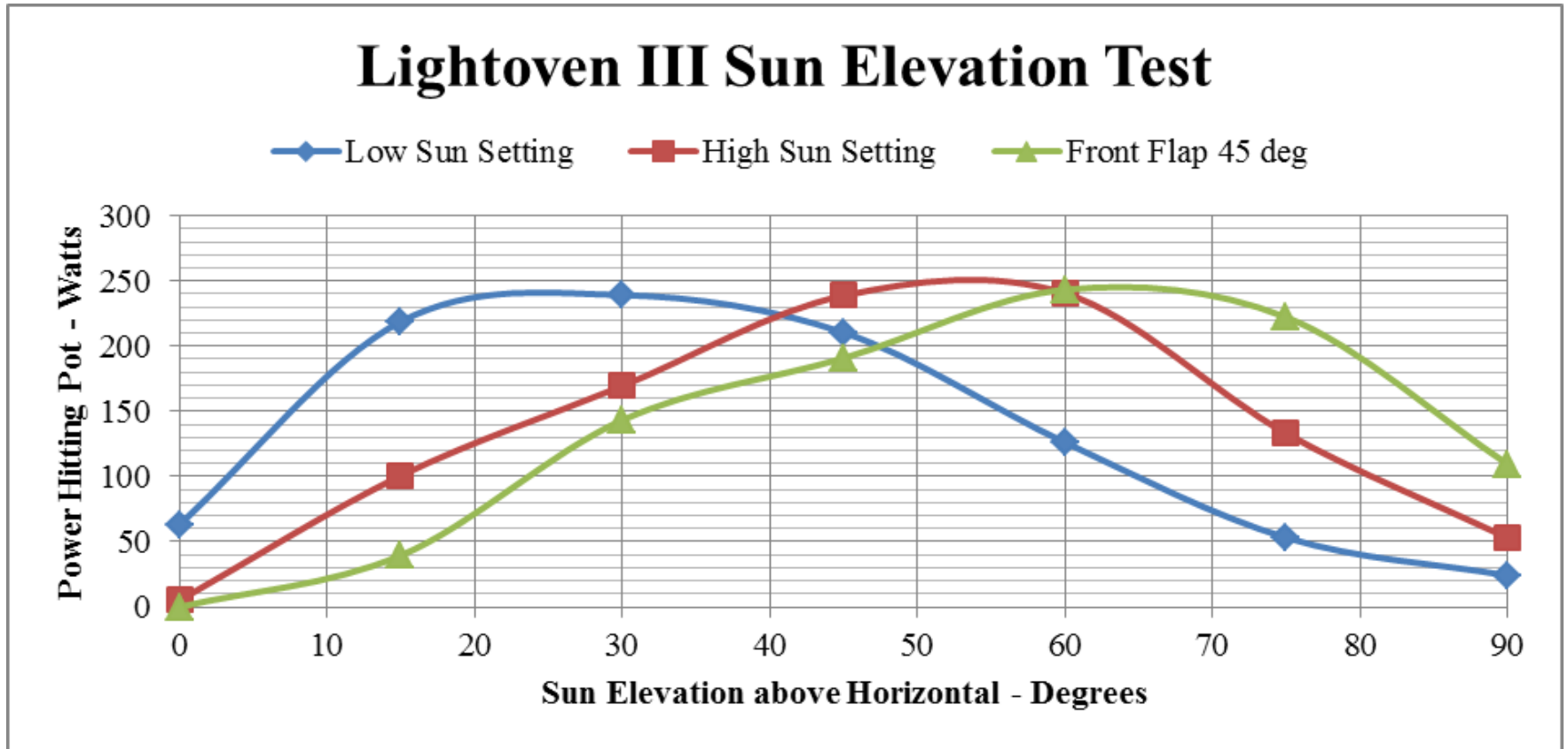


Reciprocal optical test



Courtesy by Dr. William Bradley
Prof. Emeritus Western New England University
<https://www.earthboundtech.com/optical-test>

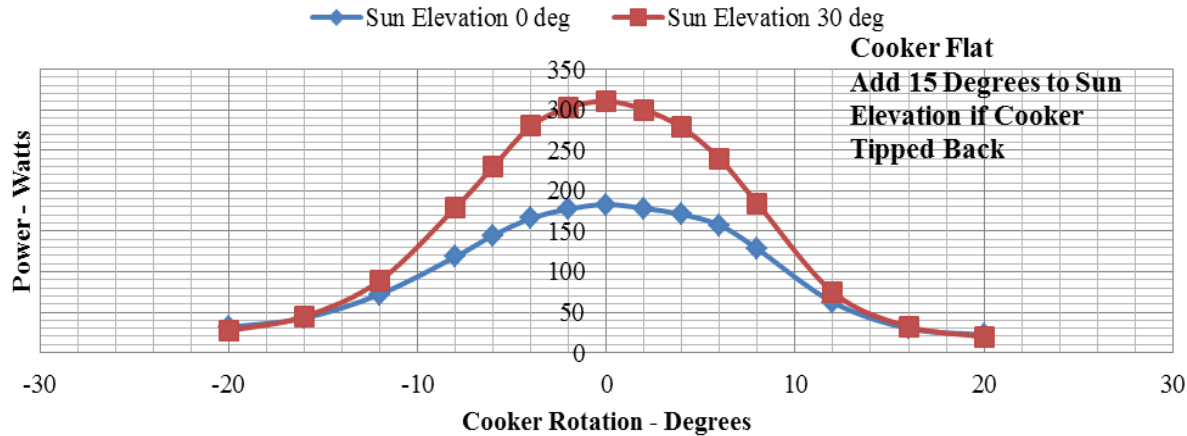
Optical test



Courtesy by Dr. William Bradley
Prof. Emeritus Western New England University
<https://www.earthboundtech.com/optical-test>

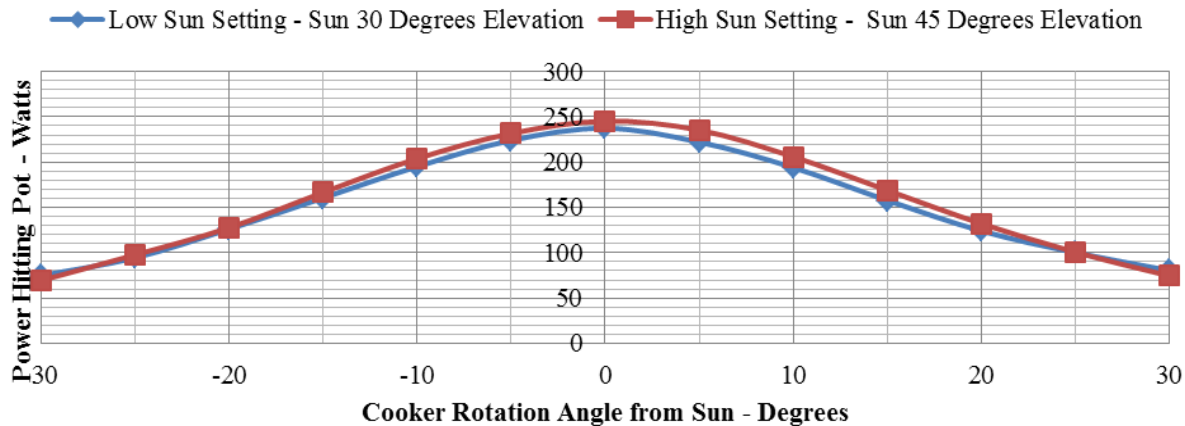
Optical test

Lightoven I: Rotation Test



Lightoven I:
Adjustment
every
20-40 min

Lightoven III Rotation Test



Lightoven III:
Adjustment
every
1-2 hours

Sun indicator



Photo: Christophe Vincentz

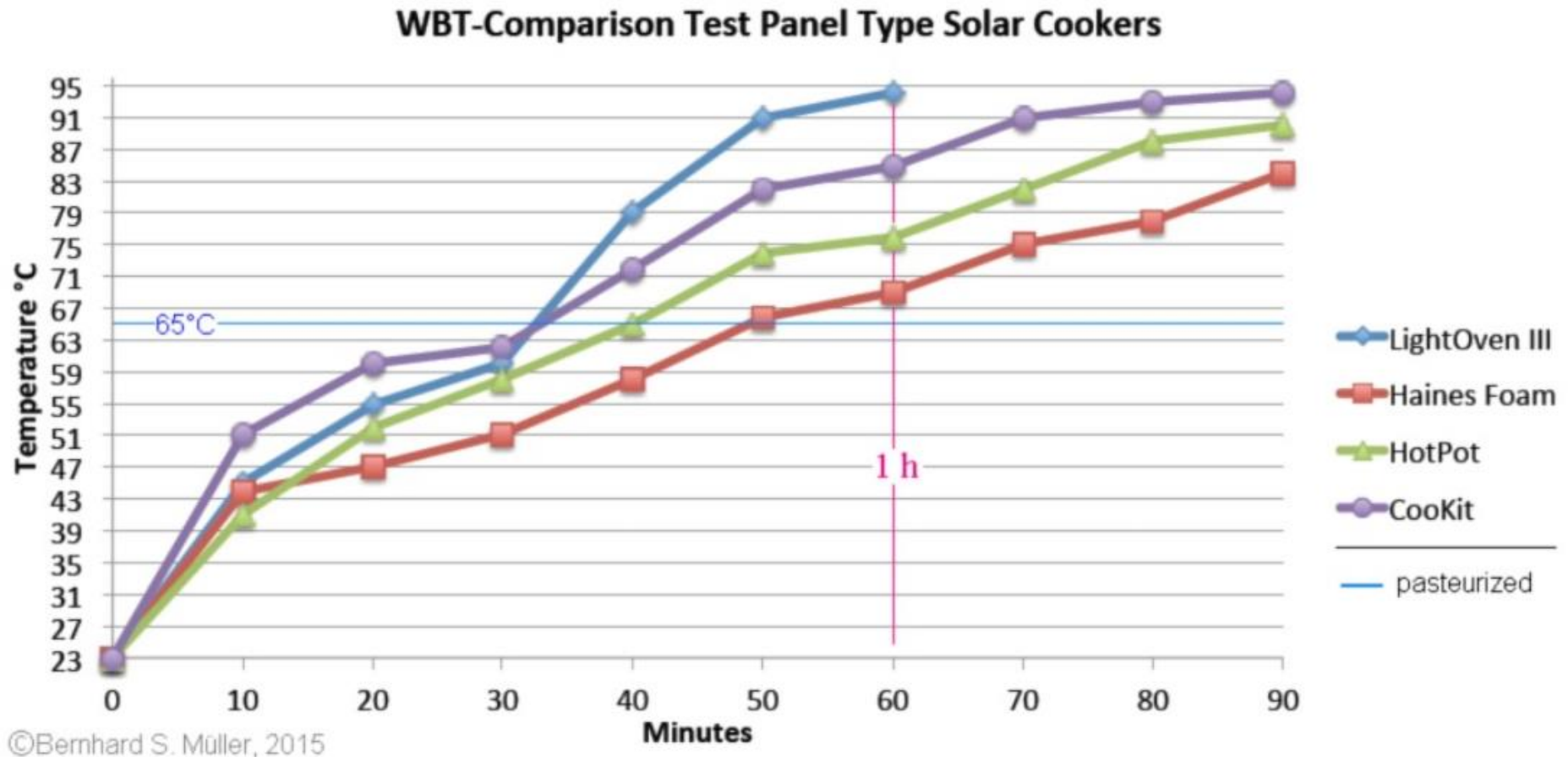
Field testing Lightoven III



Water boiling test

18th February 2015 (Bernhard Müller & Faustine Odaba)

Field testing Lightoven III



Water boiling test

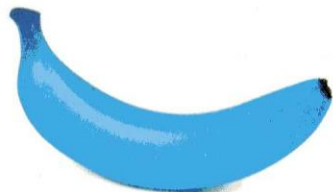
18th February 2015 (Bernhard Müller & Faustine Odaba)

Sustainability?

EINE WELT OHNE ABFALL

Autos aus Autos? Schuhe als Düngemittel für unsere Balkonblumen? Zukünftig gibt es nur noch zwei Arten von Produkten: Verbrauchsgüter, die vollständig biologisch abgebaut werden können, und Gebrauchsgüter, die sich endlos recyceln lassen. Die Devise lautet: Nicht weniger müssen wir produzieren, sondern verschwenderisch und in technischen und biologischen Kreisläufen. Eine ökologisch-industrielle Revolution steht uns bevor, mit der Natur als Vorbild.

»Der Wissenschaftler Michael Braungart gilt seit der Veröffentlichung des Buches ›Einfach intelligent produzieren‹ vielen als Retter der Welt.« FAZ



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intelligent
produzieren

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Lightoven upcycling





DIY instruction: <https://www.youtube.com/watch?v=soQfNe4pk1U>



DIY instruction: <https://www.youtube.com/watch?v=soQfNe4pk1U>

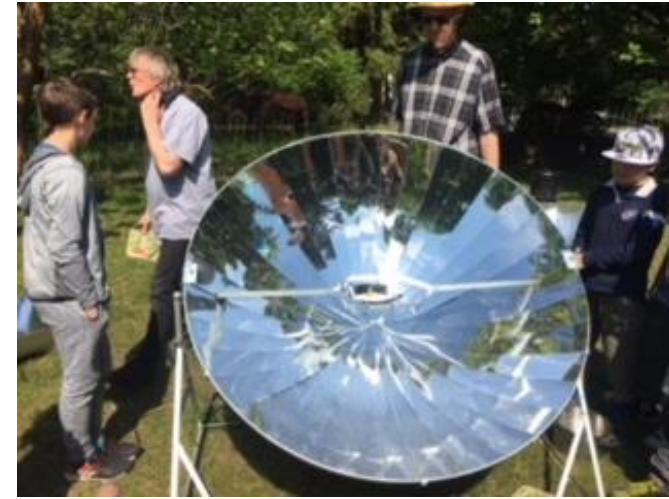
Solar Cooking with School Kids





Experiments
(Human Solar Cooker)

Program



Parabolic Cooker SK 14

Wood Saving Stove
Collect herbs for Kräuterquark



Box Cooker, Panel Cooker



Building Lightoven-Upcycling



Solar Lunch









Lessons Learned by myself when cooking with school kids

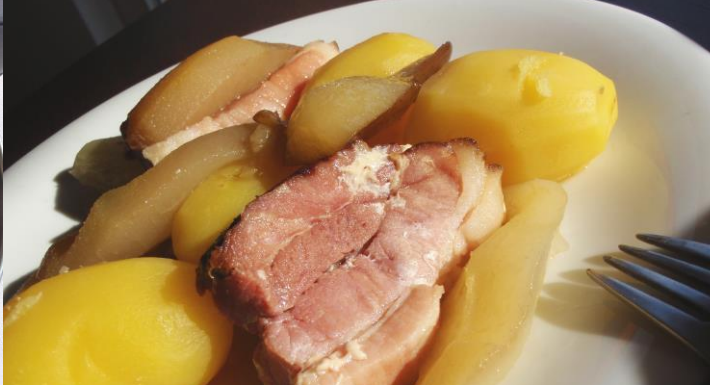
- Huge differences in knowledge / understanding / interest / patience / social behavior
- Sometimes very little is needed to fascinate
- Sometimes impossible to impress with anything
- My interpretation: present school education „mind-focused“, digital dementia at home
- If kids are interested: a very rewarding experience

Nice cooking events









Most frequently asked question (by adults):

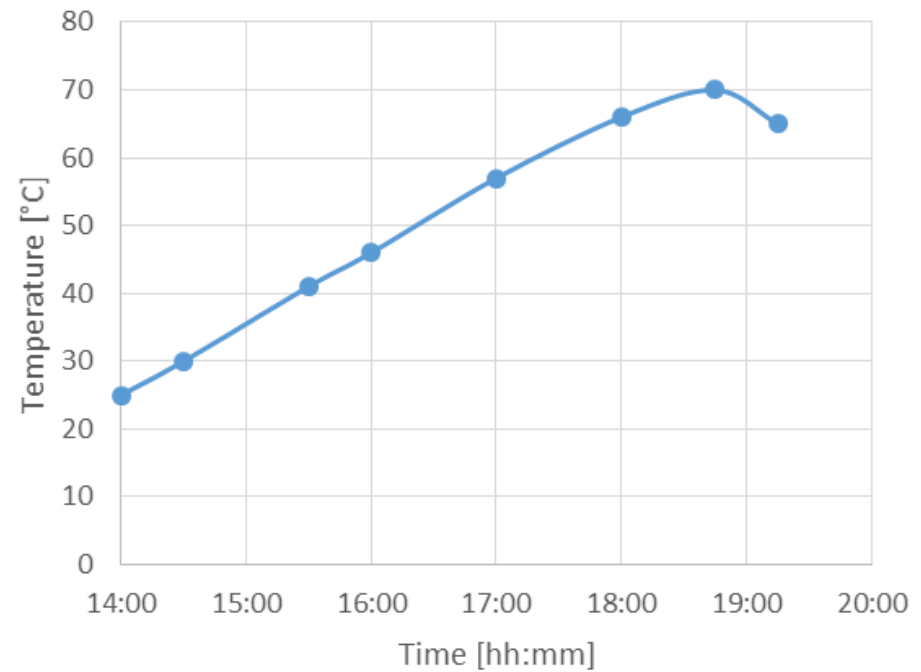
Hmm...and how long does it take?

Me (thinking): Why is that so important?

Window cooker



4,5 liter in window cooker (8 Aug 2020)



But... what's the bigger picture?

- Berlin's solar PV potential: 6.3 GW_p
- Up to now installed: 0.1 GW_p
- In 2019 : 8.2 MW_p

⇒ **will need another 755 years ...☹**



Photo: Stefan Müller (climate stuff) <https://www.flickr.com/photos/184802432@N05/>

DURING 10 YEARS OF SOLAR COOKING I LEARNED THAT

COMMONS COUNT MORE THAN PATENTS

EFFICIENCY AND SUSTAINABILITY ARE NOT THE SAME

WE DO NOT NEED ANOTHER GADGET

WAITING FOR HOURS IS OK BUT WAITING FOR YEARS NOT

WHAT “SUFFICIENT” MEANS DEPENDS ON YOU

IT’S NOT THE SUN WHICH IS THE PROBLEM - ITS OUR ATTITUDE

Send comments and requests to ehmler@lightoven.de

Thank you

Thermal efficiency

$$\eta_{\text{therm}} = \frac{t_{100}^*}{t_{100}} = -\frac{100^\circ\text{C} - T_0}{T_e - T_0} / \ln \left[1 - \frac{100^\circ\text{C} - T_0}{T_e - T_0} \right]$$

