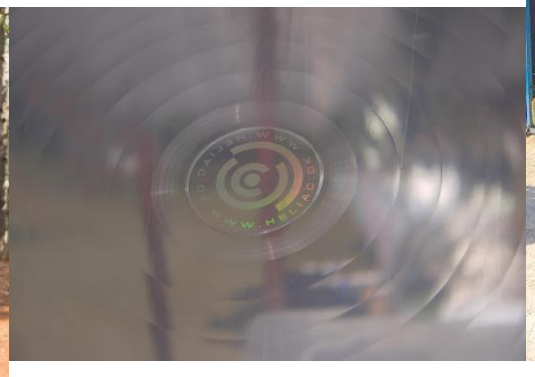
Heliac solar cooker

Solar cooker based on low cost polymer lens



Heliac and Heliac Solar Cooker

- Sedi Byskov, development engineer Solar Cooker, Heliac
- Karsten Dupont, Construction foreman, Heliac
- Low cost polymer fresnel lens
- District heating 6 people
- Solar cooker 1-2 people

Solar collector unit with 8 fresnel concentrator modules

Heliac

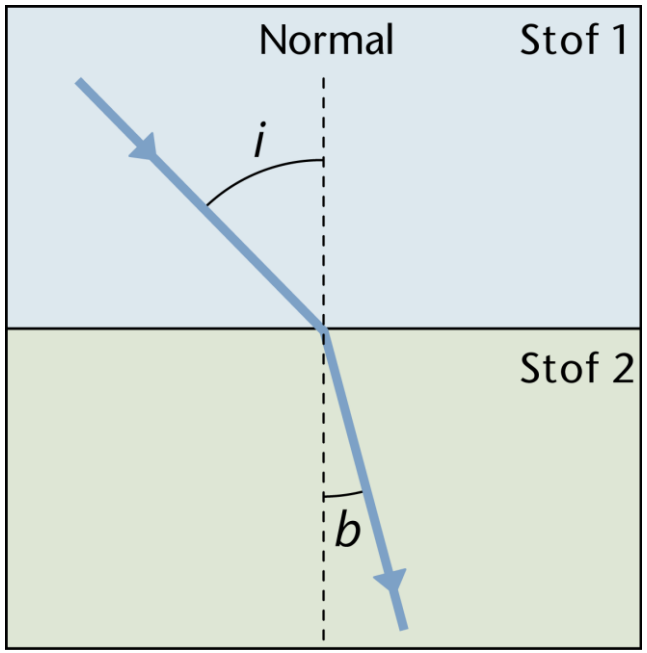
History solar cooker

Nepal 2016

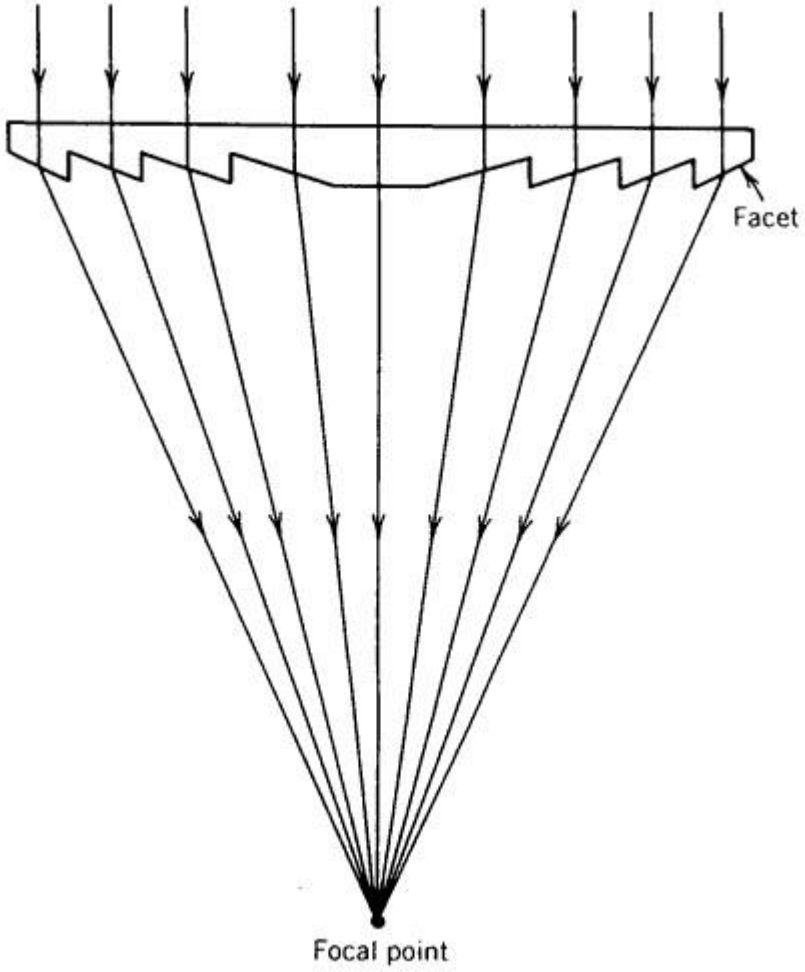
India 2018

Denmark 2016

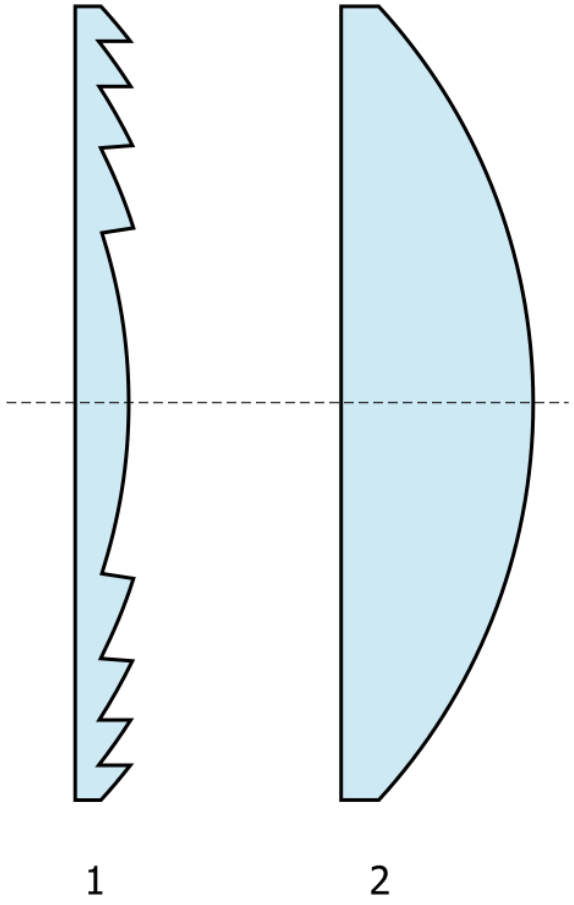
Refraction of light



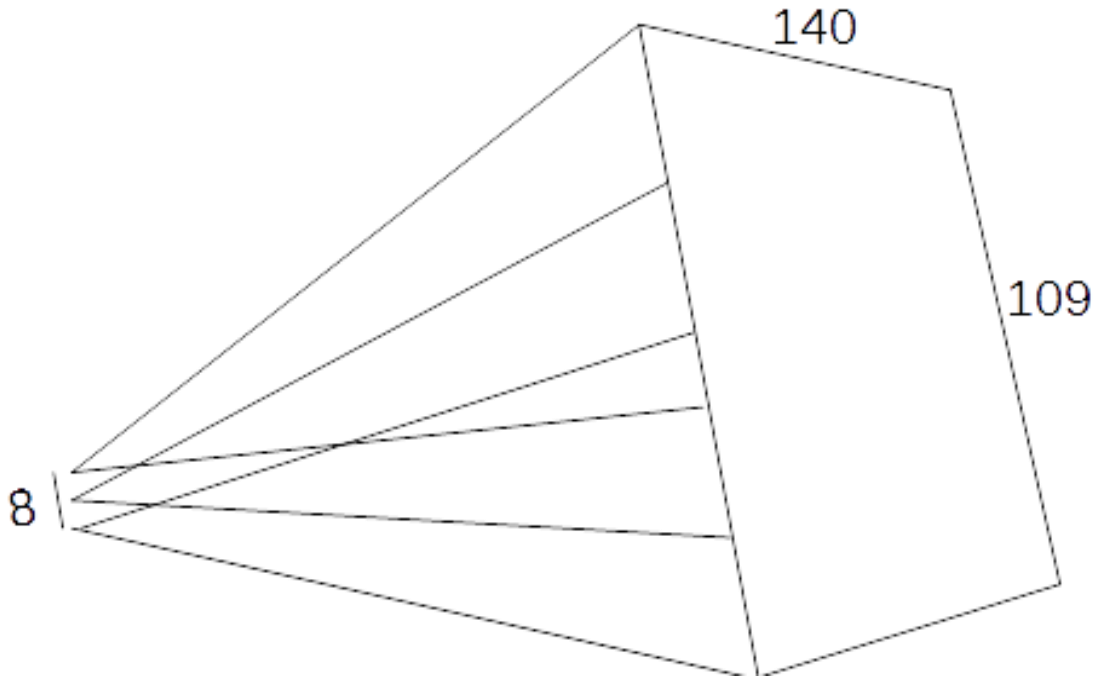
n1/n2 =sin(b)/sin(i)



Magnifying glass

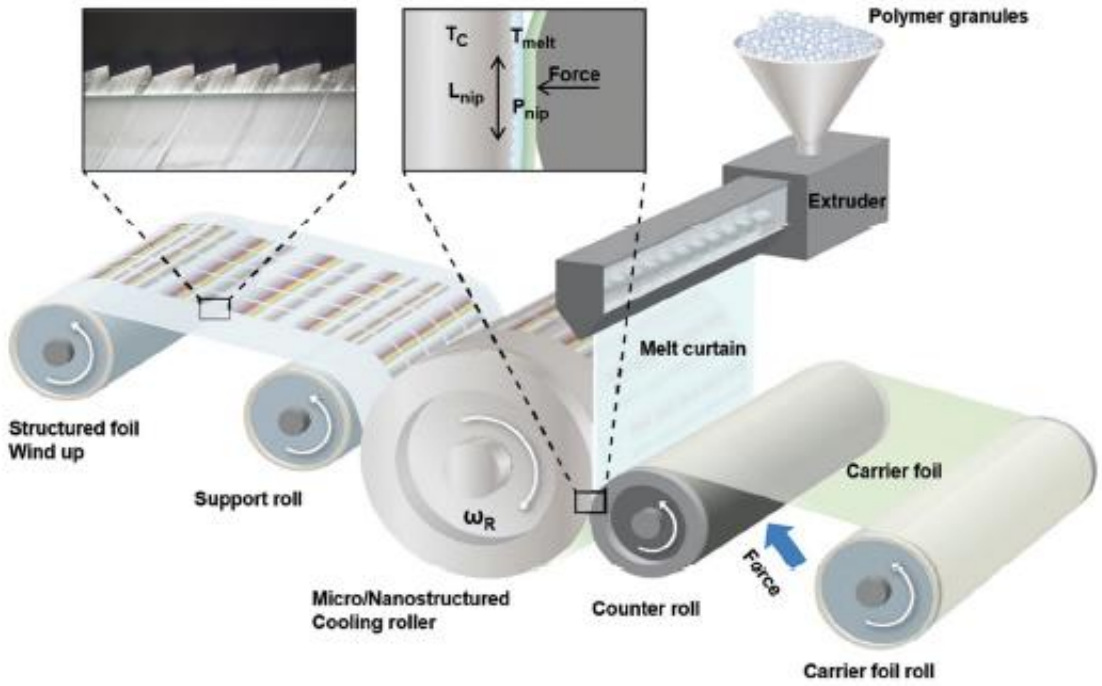


Heliac lens design

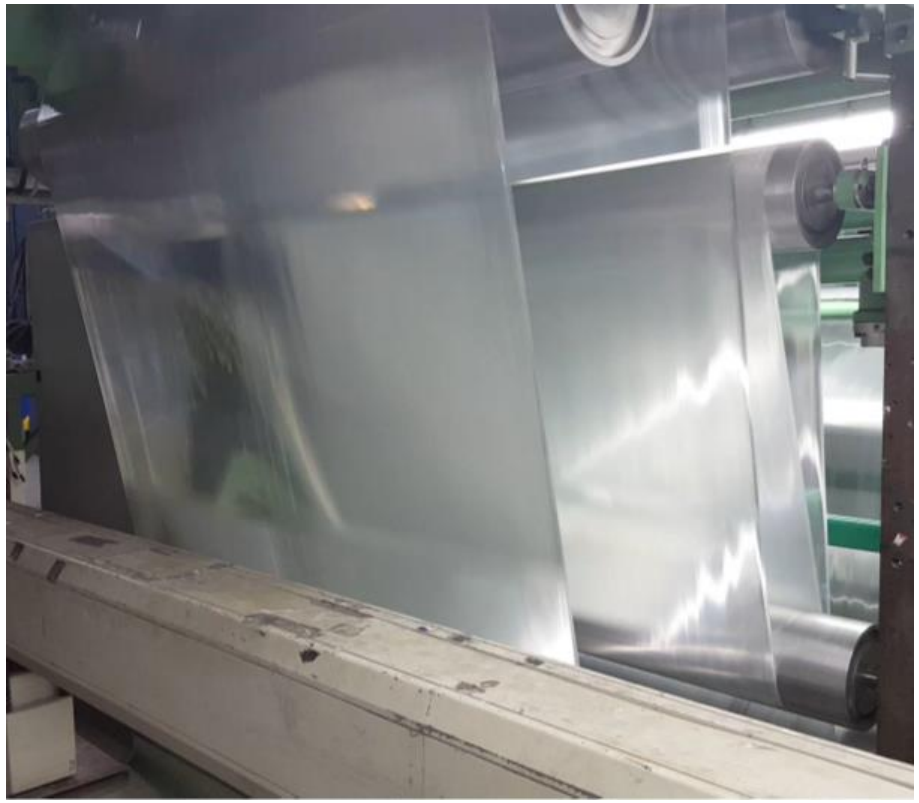


Production of lenses

- Extrusion coating
- Lenses produced at 1m/s
- 10GW/year ≈ 25% district heat



The lens



- New lens design ≈ €40.000
- A production run around 10km lenses.

Small range of lenses

Focal length (cm)	Spot size (cm)	Length (cm)	Width (cm)	Weight (g)	Cost (€)
200	8	140	109	300	10
73	1	82	48	70	5

Heliac solar cooker Spec

- Material cost metal small scale €150
- Open source design
- Double axis rotation
- Mirror rotation linked to lens rotation
- Stray light side covers
- For solar altitude 20-90 degrees
- 45% optical efficiency
- 250-370W cooking power(depend on DNI/GHI), dT = 50, GHI = 700W/m2

Demonstration of boiling time at DNI 910W/m2

- https://www.youtube.com/watch?v=V1W5I3muUdo&feature=youtu.behtmlfile\Shell\Open\Command

The cooker

Boiling eggs

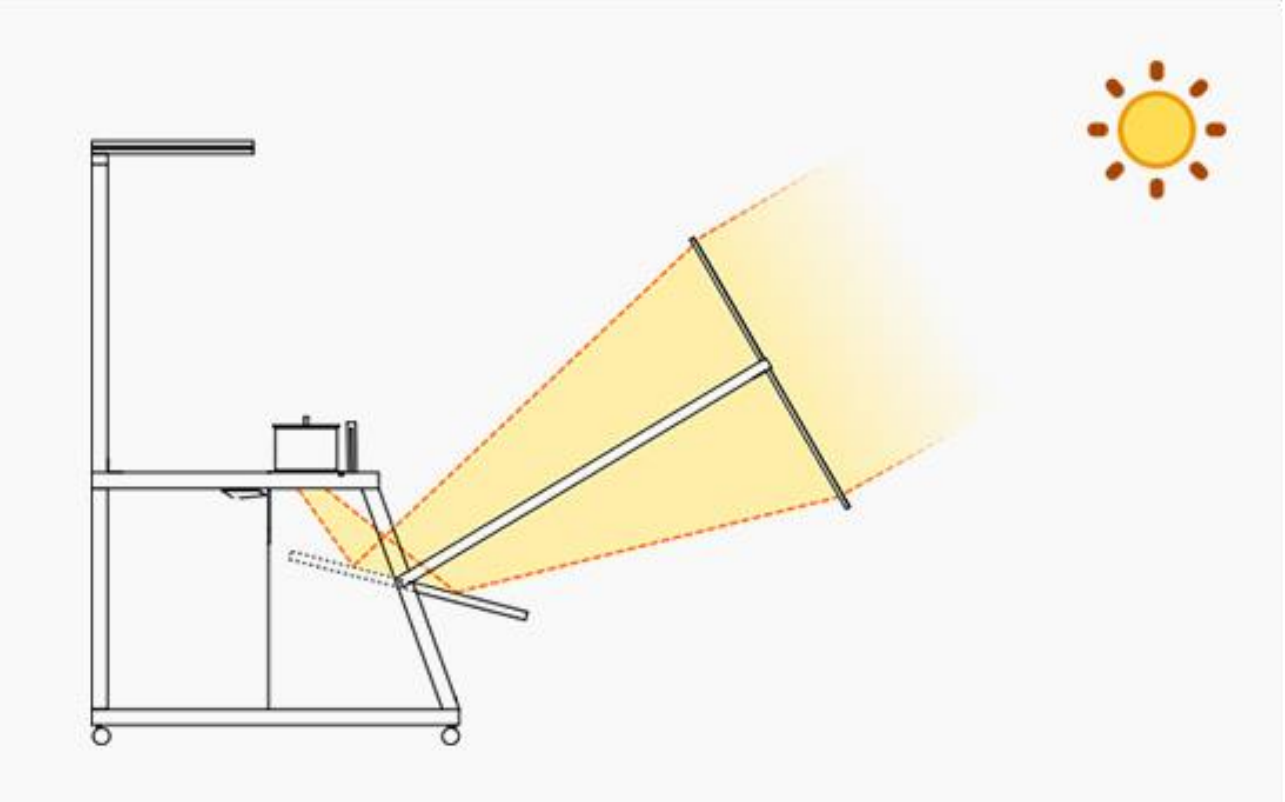
https://www.youtube.com/watch?v=gFbBwuGU1YY

Frying crisps

https://youtu.be/axz_bDJ-hSw

Working principle mirror and lens

- Uncoupled mirror and lens
- To coupled mirror and lens



The cooker

Mirror and lens coupling

θ, Solar altitude
b, Foil normal vs mirror plane

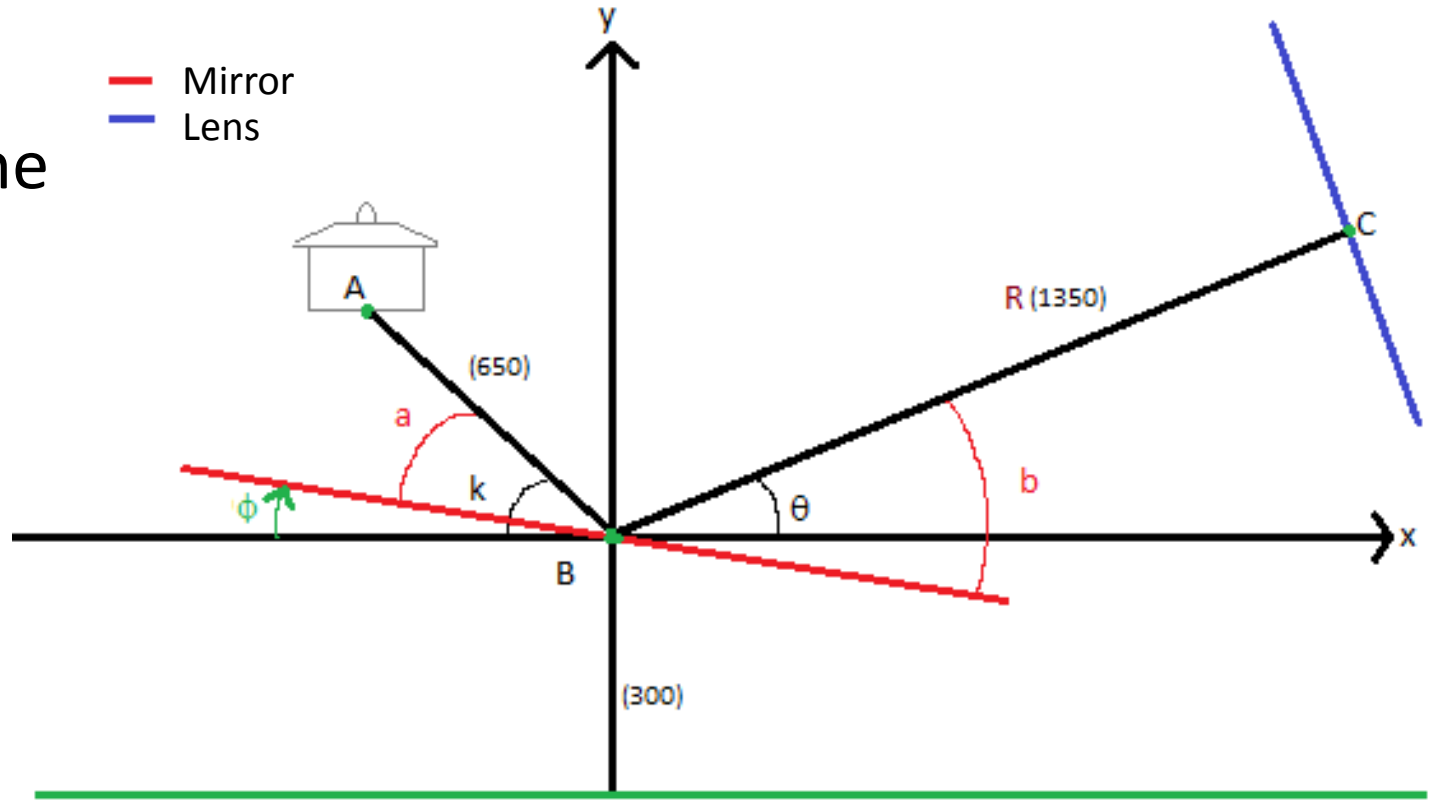
$a = k - \phi$

$b = \theta + \phi$, for $b = a \Rightarrow$

$2*b = k + \theta$

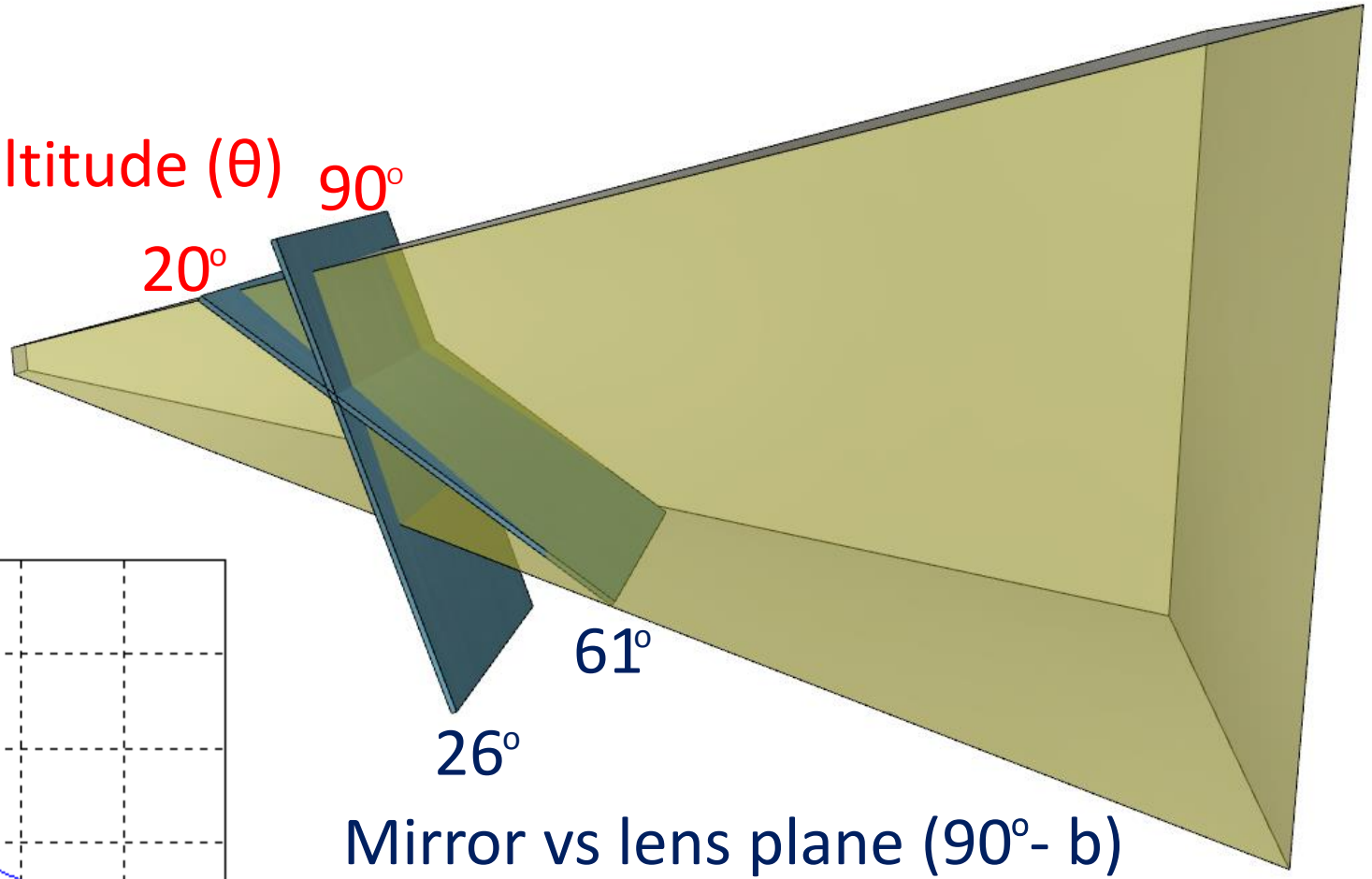
⇔

$b = ½ (k + \theta)$

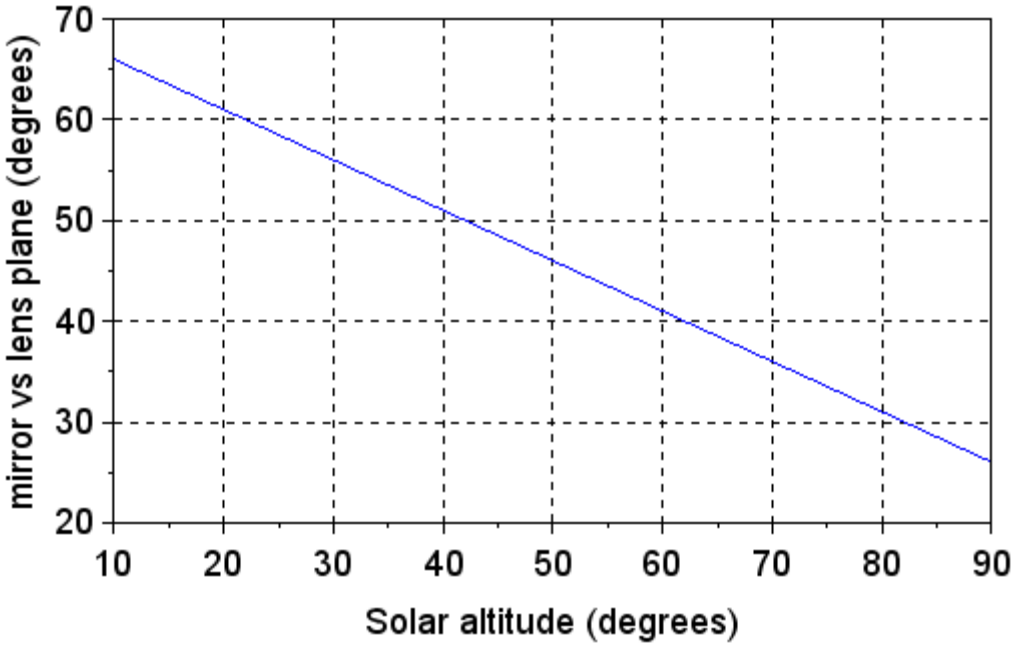


Mirror size

The cooker

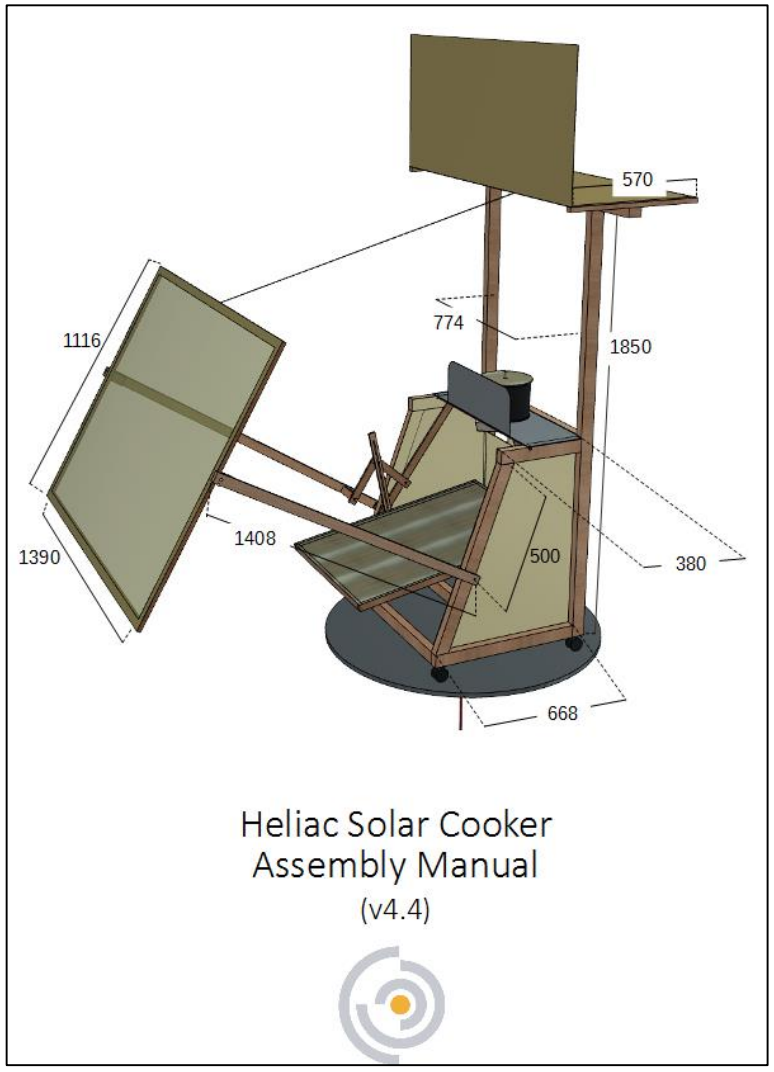


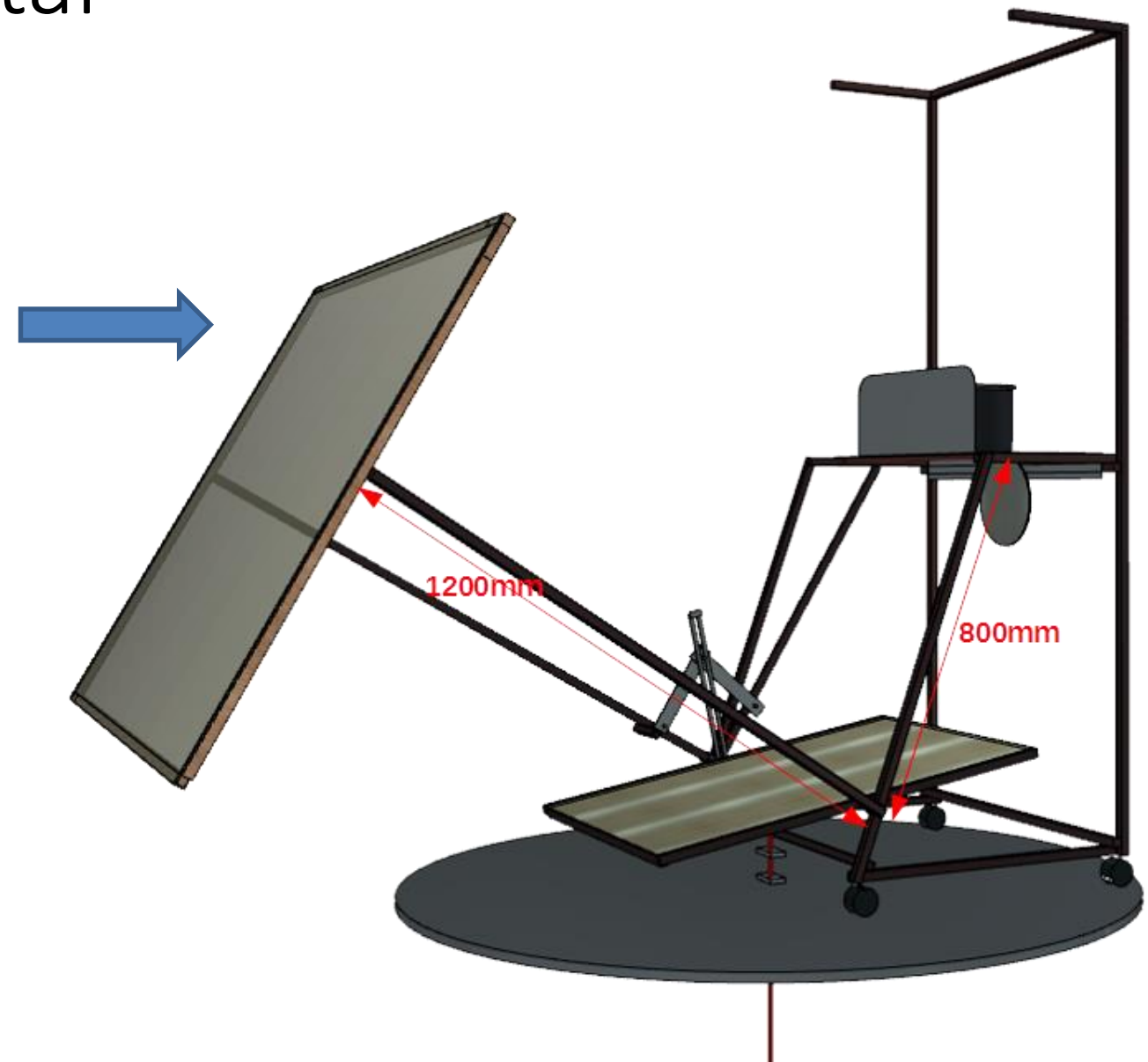
Mirror vs lens plane (90°- b)



From wood to metal

The cooker





Vision

Vision Heliac Solar Cooker

- Easy access to energy for cooking
- Substitute wood when direct normal irradiance >700W/m2
- High efficiency, durability and ease of use
- Solar cooker design kept open source

Execution

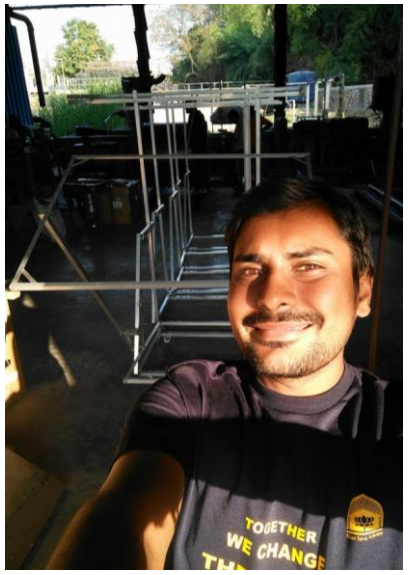
- Test prototype
- Test manufacturing options
- Develop prototype and manufacturing
- Certify product
- Identify distribution channels

Global manufacturing and user test

User test

Clement Musonda
Zambia

Kinarkumar Patel, India



Godfrey Mawira
Kenya

Juana María Hernández Jarquín
Mexico

Edward Sembajjwe, Uganda

User test

Rosa Lukonde Katuna cooking tomato soup, rice, potato fries, ugali and fried fish
Lusaka, Zambia

Partner

- Construction
- Find users and follow up

Heliac

- Supply lens and mirror
- Pay local material cost

User

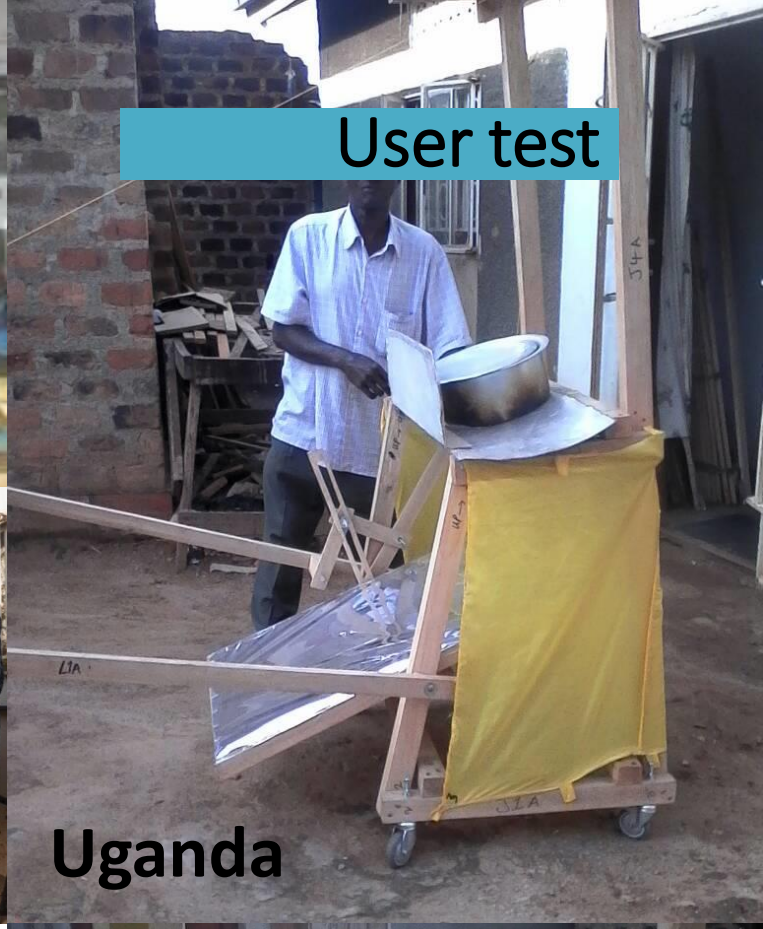
- Receive cooker for 2 months
- Take 50 images from 50 meals
- Receive USD 50 for the images
- Buy cooker for USD 50 or return


India


User test


Zambia
User test


Kenya


User test
Uganda

User test Feedback

Use

- Prepares local foods
- Bright sun = happiness and impression
- Clouds = demotivation and dissappointment.
- The longer it takes the lower becomes satisfaction
- Not powerfull enough for large household

Manfacturing

- Manual should be very clear and constructor has to have certain manufacturing skills.
- Training in construction is necessary for some.
- Material cost approx €150

Outlook

- Match to market
- Tracking
- Cost breakdown through simplification of design
- Improve durability of lens
- Certify, PEP, Solar cooker standards etc.
- Important to clarify expectations

- Market entry small scale business og refugee emergency aid.
- Sell lens and mirror foil, find central local manufacturers.

Contact

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