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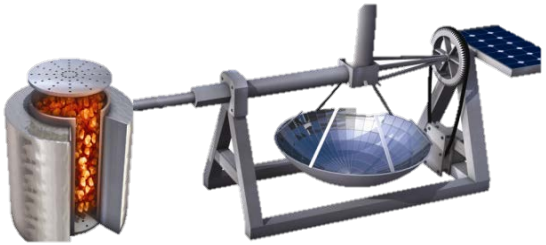
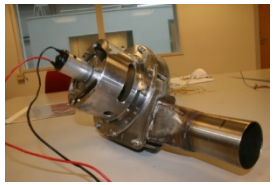
Air/Rock bed systems





- Hot air circulates through an absorber in the focal area of a reflector
- The hot air deposits heat in a rock bed heat storage
- Thermocline in the rock bed and heat recovery by reversed flow

Thermal stratification tests with 8m horizontal and 3 m verical rock bed

(Denis Okello, Habtamu Bayea, Amos Veremachi)

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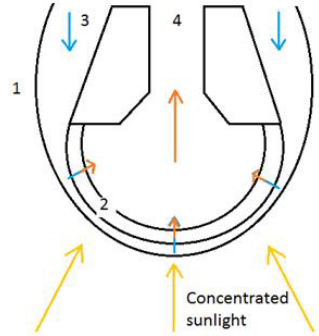
Air/Rock bed system: absorbers

- High concentration ratios are needed to reach high temperature air (up to 400 deg. C) in the absorbers
- Silicon carbide honeycomb absorber gives less risk for cold spots than stainless steel wire mesh absorbers

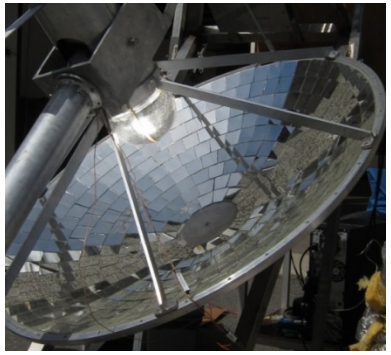


Volumetric absorber

Silicon carbid

Wire mesh

Tests with 300, 600, 900 concentration ratios in dual axis tracking system



(Habtamu Bayera, Amos Veremachi, Trygve Veslum)

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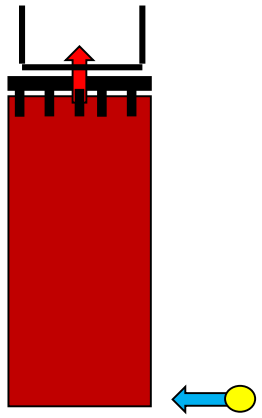
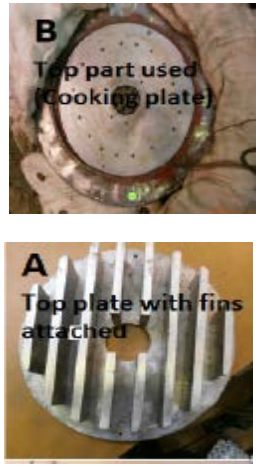
Air/Rock bed system: heat recovery

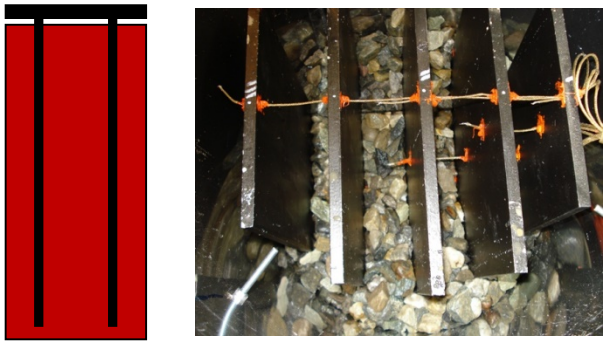
- Heat extration to top plate on heat storage:
  - Reversed air flow through the bed and through the plate to the cooking pot is very efficient, and controllable
  - Heat extraction to short fins on top plate is poor, insufficient internal air circulation in bed
  - Heat transfer with fins extending through the bed is feasible, but short-cuts the stratification



Reversed fan for controlled cooking



Top plate with hole under cooking pot



Conducting fins to top cooking plate

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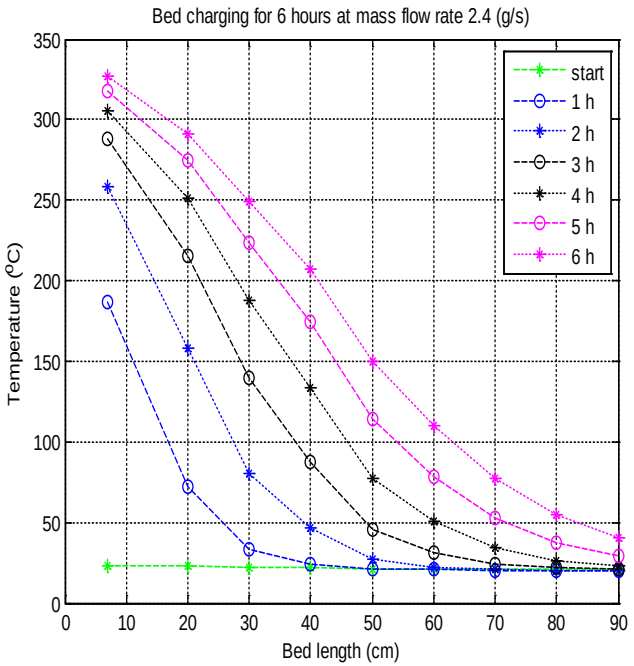
Air/Rock bed system: thermoclines

- A high temperature tolerant fan is needed
  - It is a challenge to avoid air leakages
- The thermal stratification is rather weak.
  - Improves with smaller rock sizes
  - Improves with vertical bed length
  - Horizontal case has poor performance



0.3 m I.D., 0.9 m height rock bed

- Homogeneous storage options have been tested with PCM cylinders: rock bed then acts as heat exchanger in an air/PCM system

- Tests with
  0.4 m I.D. and 0.4 m height (Habtamu Bayera)
- 0.3 m I.D. and 0.9 m height (Dennis Okello)
- 0.18 m I.D. and 3-8 m length (Amos Veremachi)