

What is Standard 580.1

- It has been cited in over 120 publications.
- It has been used by teams in over 30 countries.
- S 580.1 is a voluntary consensus standard.

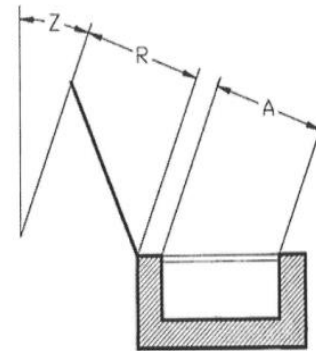


Figure 1 – Determining the intercept area. Reflector area is reflector width times its apparent height, R , and aperture area is aperture width times its apparent height, A . Apparent height is the shadow or projected height in the plane perpendicular to beam radiation of zenith angle, Z .

3.8 **load:** The mass of water being heated by the solar cooker.

3.9 **test:** All events and data comprising the measured solar heating of water in a device intended to cook food.

3.10 **tracking:** Rotating the cooker in the horizontal plane to compensate for azimuth angle changes (box-type) or following the sun in two dimensions (concentrating-type).

What is Standard 580.1

It is a test method:

- Specifies test conditions
- Specifies test procedures
- Specifies test reporting



580.1 specifies test conditions

$0 < \text{Wind} < 1 \text{ m/s}$	(a calm day)
$20 < \text{Air Temp} < 35 \text{ }^\circ\text{C}$	(most places ~ 6 months per year)*
$40 < \text{Water Temp} < 95 \text{ }^\circ\text{C}$	(above ambient, below boiling)**
$450 < \text{Insolation} < 1100 \text{ W/m}^2$	(within 65% of normal)
$10 \text{ min insolation} \pm 100 \text{ W/m}^2$	(no clouds)

*68 - 95 °F

**104 – 203 °F

Anemometer: \$45



580.1 specifies test methods

Thermocouples

(temperature sensors)



(\$28 each)



580.1 specifies test methods

Radiation Pyranometer (measures sunlight): \$202

Digital Scale: \$110



580.1 specifies test methods

Thermocouples	(temperature sensors)
Radiation Pyranometer	(measures sunlight)
Loading = 7 kg/m ²	(water in pots proportional to size)
Record every 10 minutes	(can be done by hand)
Tracking	(imitate consumer behavior)



580.1 specifies test analysis

Cooking Power in Joules per Second (Watts) found by:

$$\text{Power(W)} = \frac{\text{Mass(kg)} * C_p(4186 \text{ J/kg C}) * (T_2 - T_1)(\text{C})}{600(\text{s})}$$

Cooking Power normalized to “standard” insolation:

$$\text{Power(W)} = P(\text{W}) * 700(\text{W/m}^2) / \text{Insolation}(\text{W/m}^2)$$

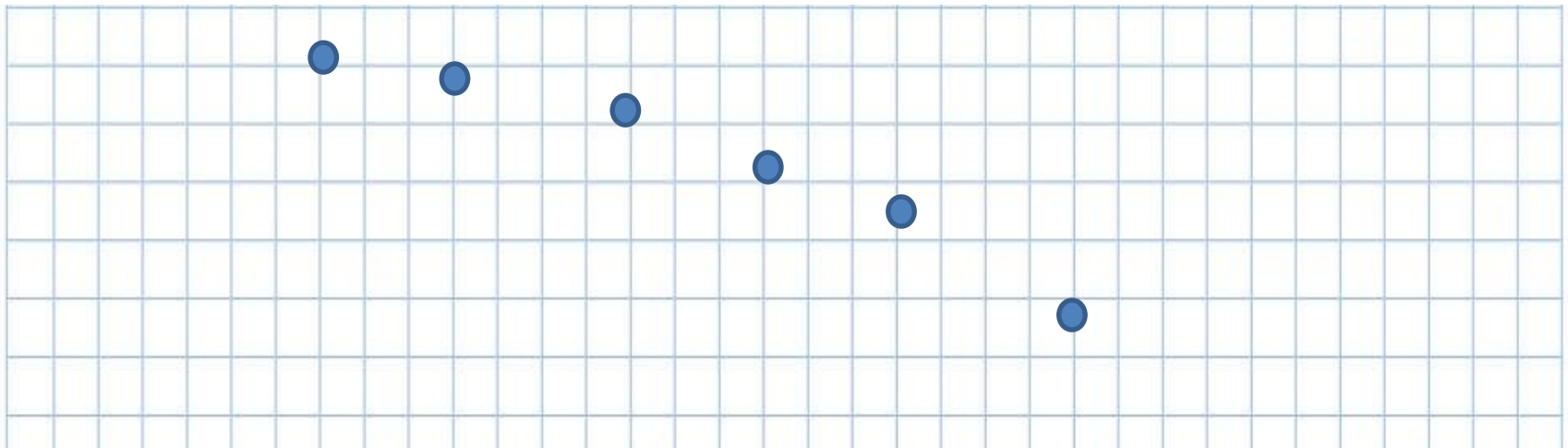
580.1 specifies test reporting

Cooking Power in Joules per Second (Watts)

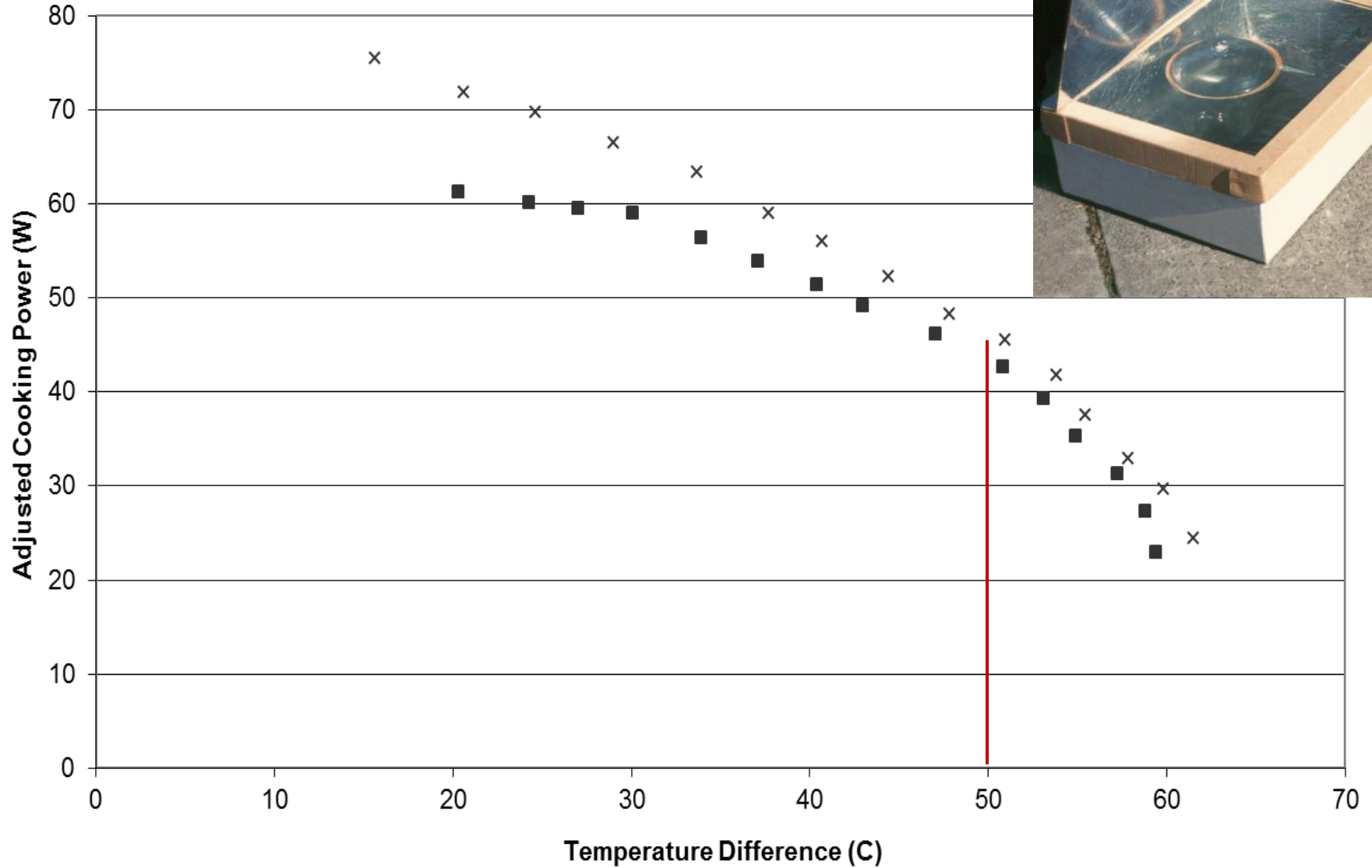
is plotted against temperature difference ($^{\circ}\text{C}$)

between ambient air and the water in the pots.

Performance = Cooking Power when $dT = 50\text{ C}$



International Test Standard Kerr-Cole Eco-Cooker



ASAE S580.1

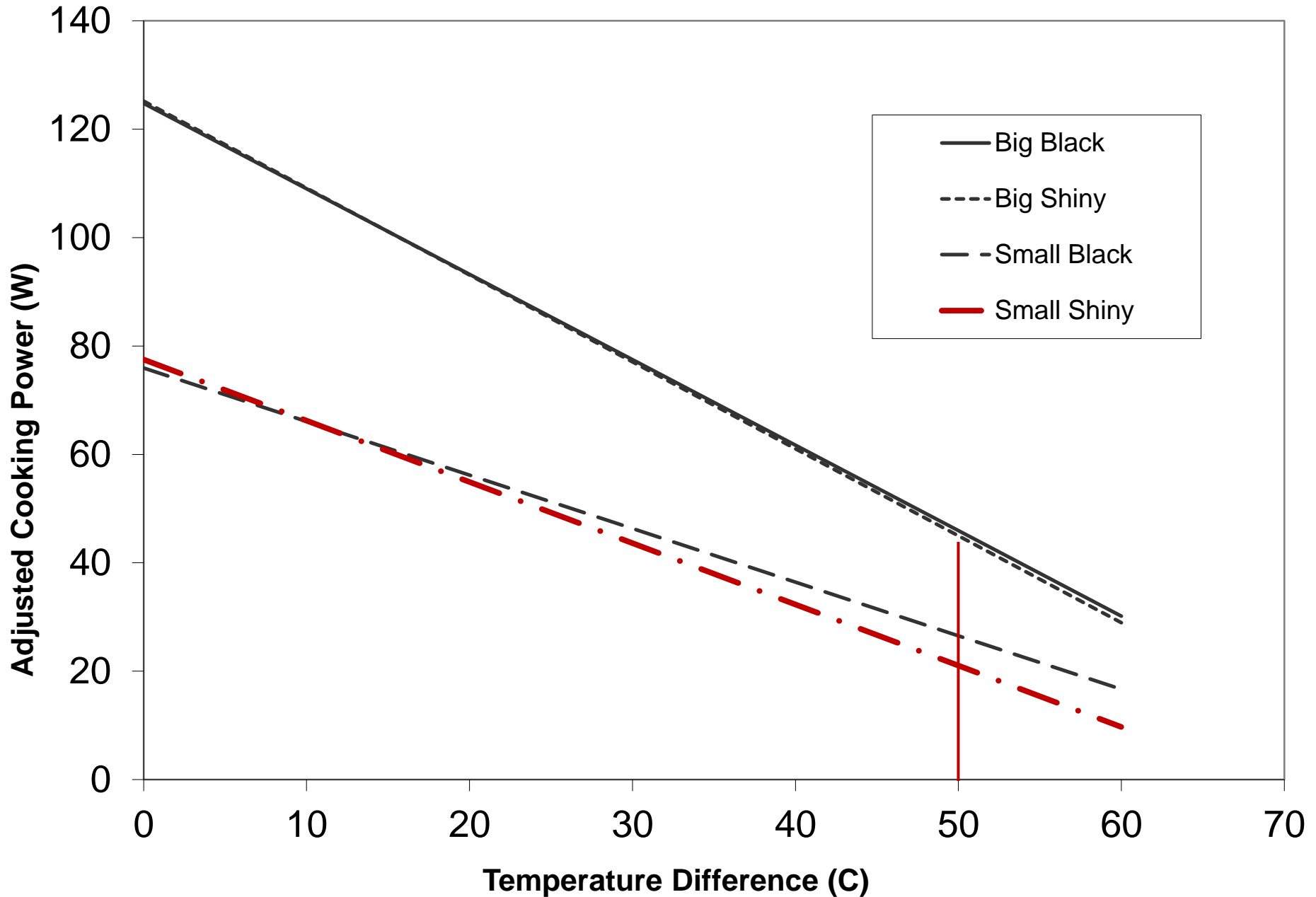
- Who is ASAE?
- Why a test standard?
- Where did it come from?
- What is the cooker standard?
- How does it benefit us?

Objectives Satisfied:

- Simple and cheap
(no training required, tools about \$500)



Comparing Interior Colors

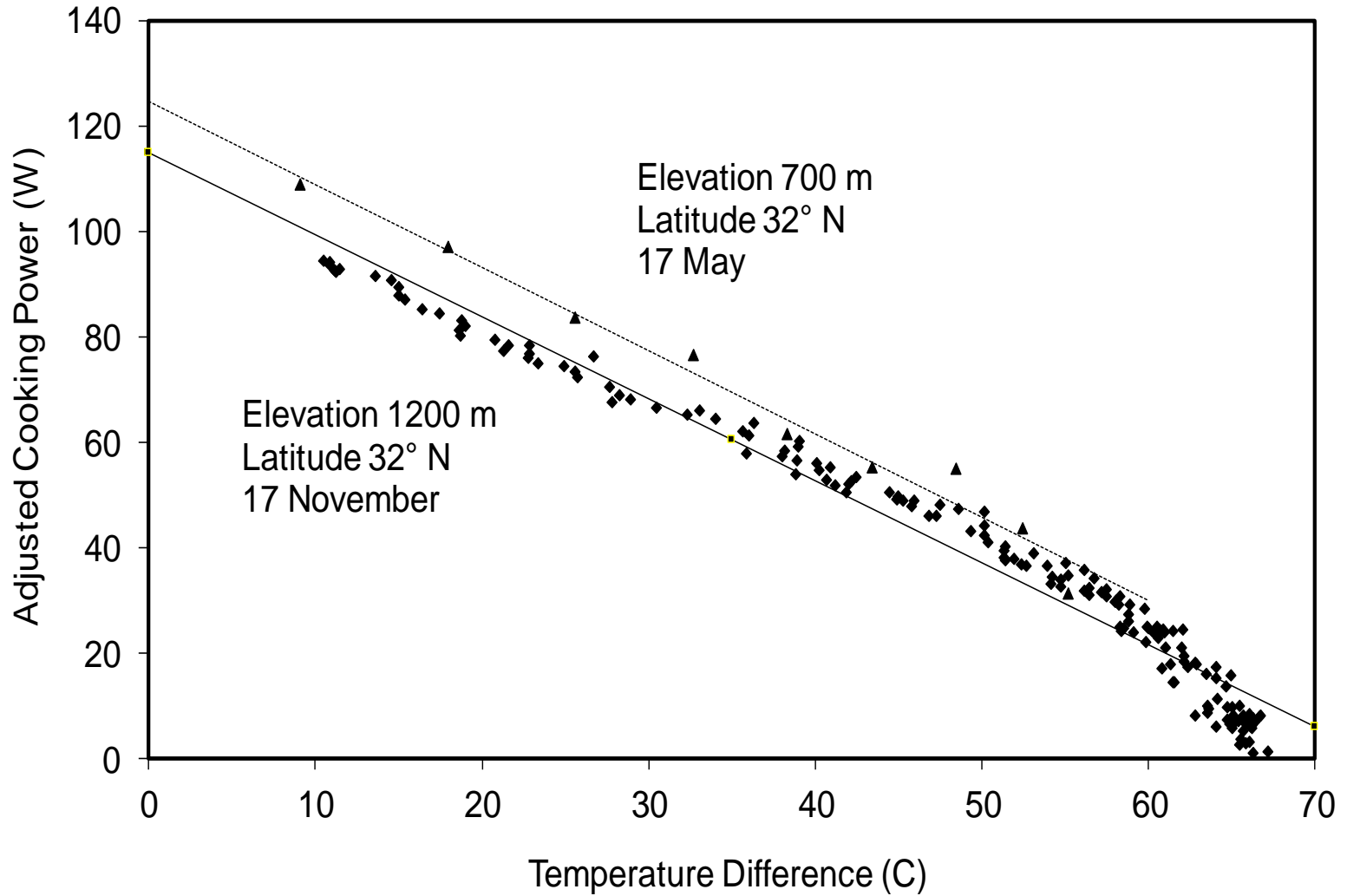


Objectives Satisfied:

- Simple and cheap
- Sensitive

(differentiate between subtle design modifications)

P v. dT for Same Cooker

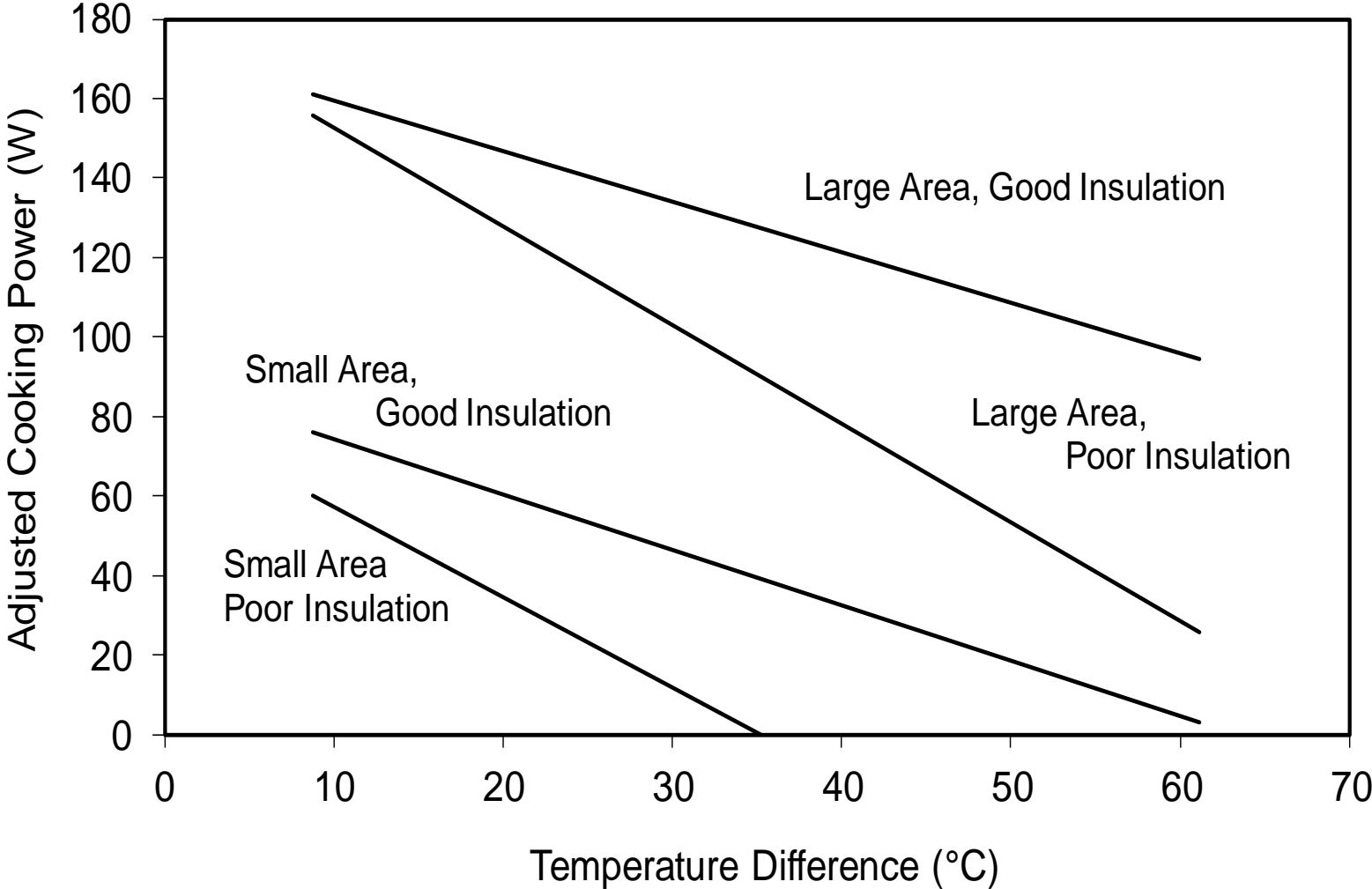


Objectives Satisfied:

- Simple and cheap
- Sensitive
- Repeatabile

(same answer at different location)

Power v. dT for Four Solar Cookers



Objectives Satisfied:

- Simple and cheap
- Sensitive
- Repeatable
- Easily understood

(same units as light bulbs, motors and other cooking appliances)



Conclusion

- Objectives agreed upon:
 - Balance predictive accuracy and simplicity
 - Balance repeatability and flexibility
 - Report cooking power in Watts

Conclusion

- Objectives agreed upon
- Objectives met
 - simple to use and understand
 - differentiates between small design changes
 - repeatable

Thank You

- Correspondence:

pfunk@nmsu.edu