

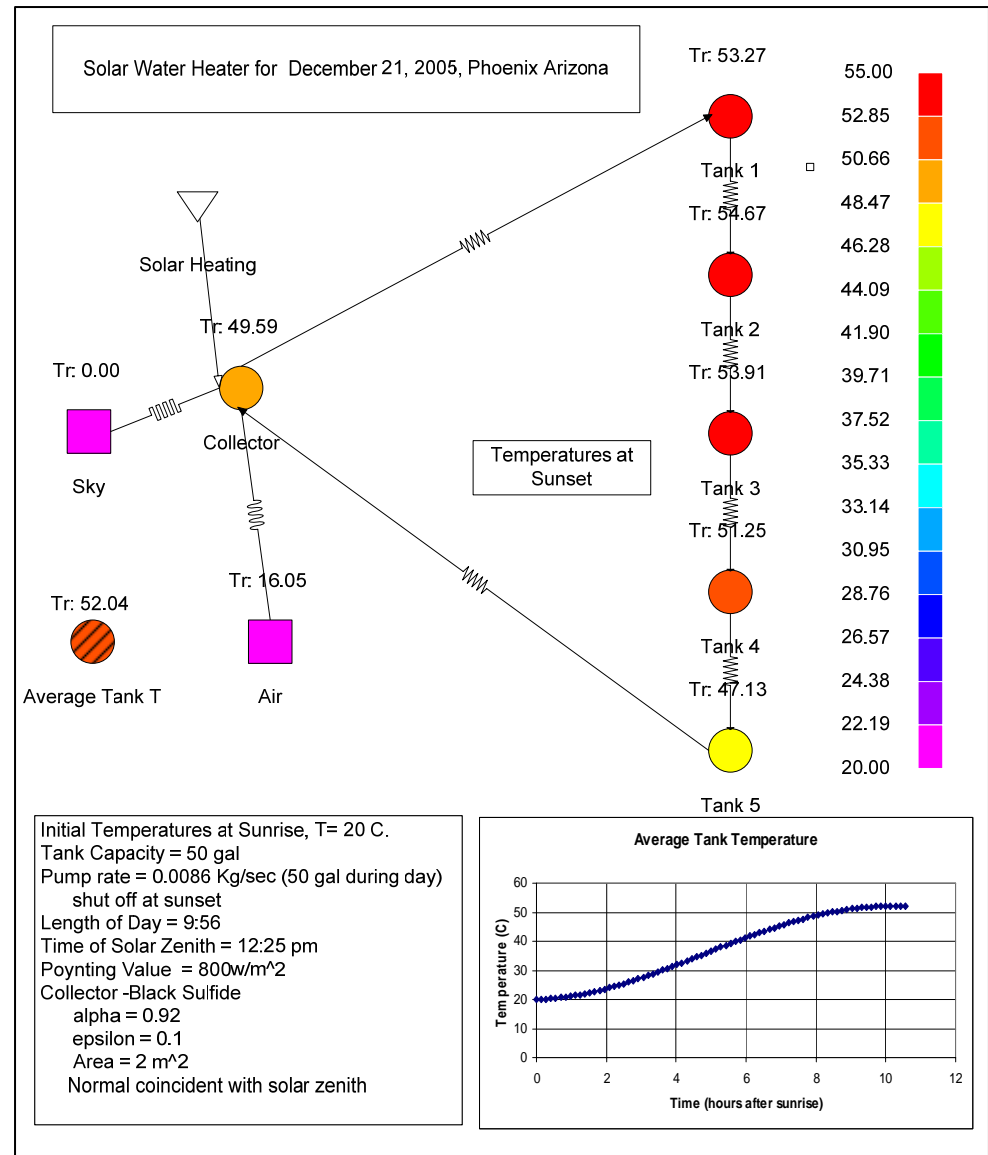
Solar Water Heater Study

- Day in the life of a solar water heater in Phoenix Arizona on Dec 21st.
- One-way conductors are used for water flow.
- Radiation to the sky and convection to ambient air is accounted for.

Pinckney Engineering International

pinckneyconsulting@yahoo.com

(480) 558-4986



**Convection Correlation
Used to Compute
Convection from Collector
to Air.**

Correlation ID = 707

Description

- Flat plate
- Inclined, hot side facing upward
- Natural convection
- Laminar or turbulent
- Constant wall heat flux

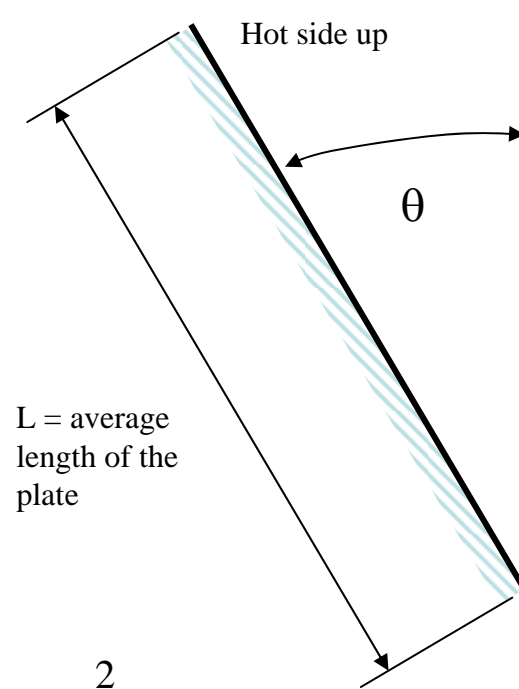
Gr_c as a function of θ

$$\theta = 15^\circ, Gr_c = 5E9$$

$$\theta = 30^\circ, Gr_c = 1E9$$

$$\theta = 60^\circ, Gr_c = 1E8$$

$$\theta = 75^\circ, Gr_c = 1E6$$

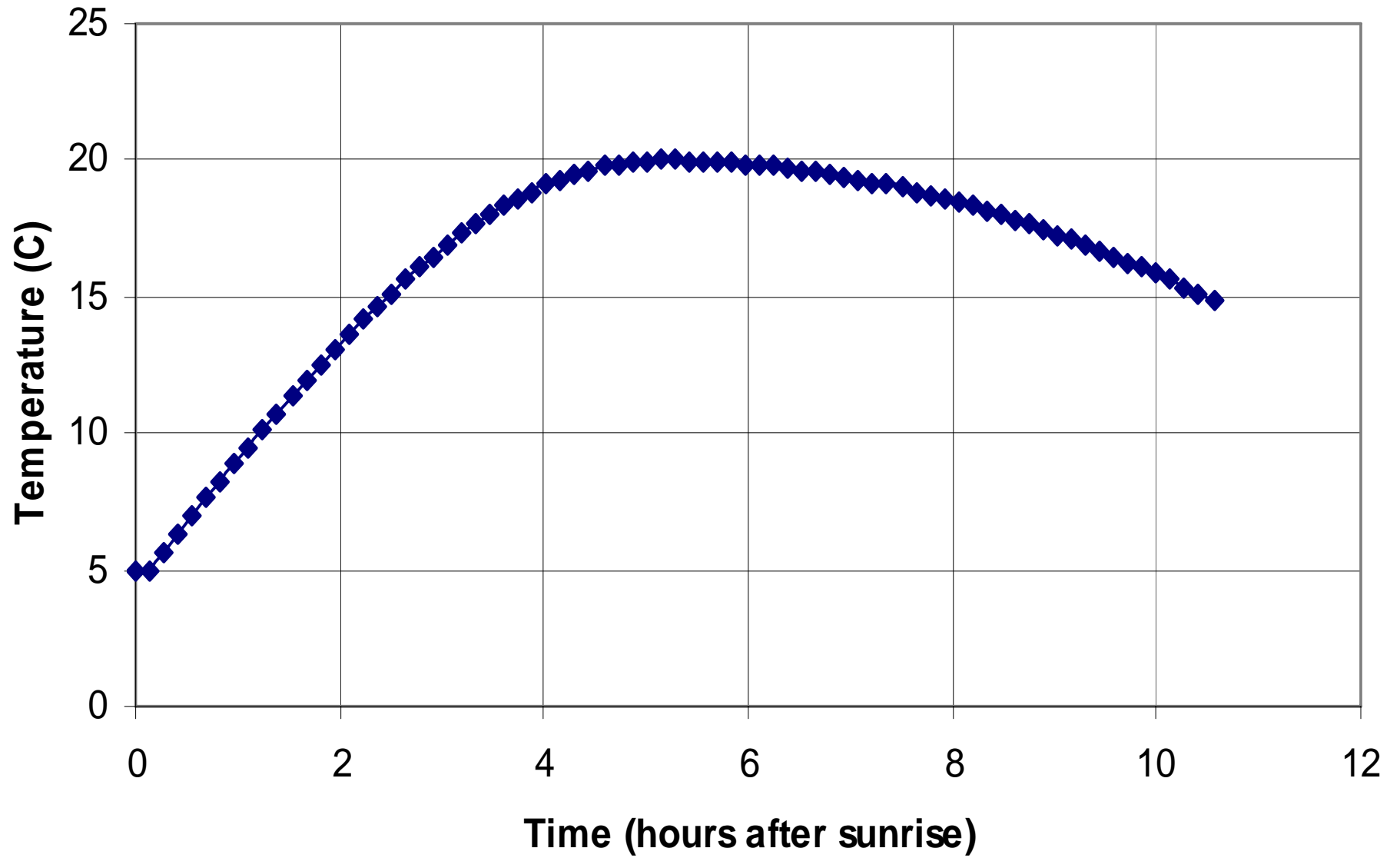


$$R_{aL} := \frac{g \cdot \beta \cdot L^3 \cdot \Delta T \cdot \rho^2 \cdot P_r}{\mu^2}$$

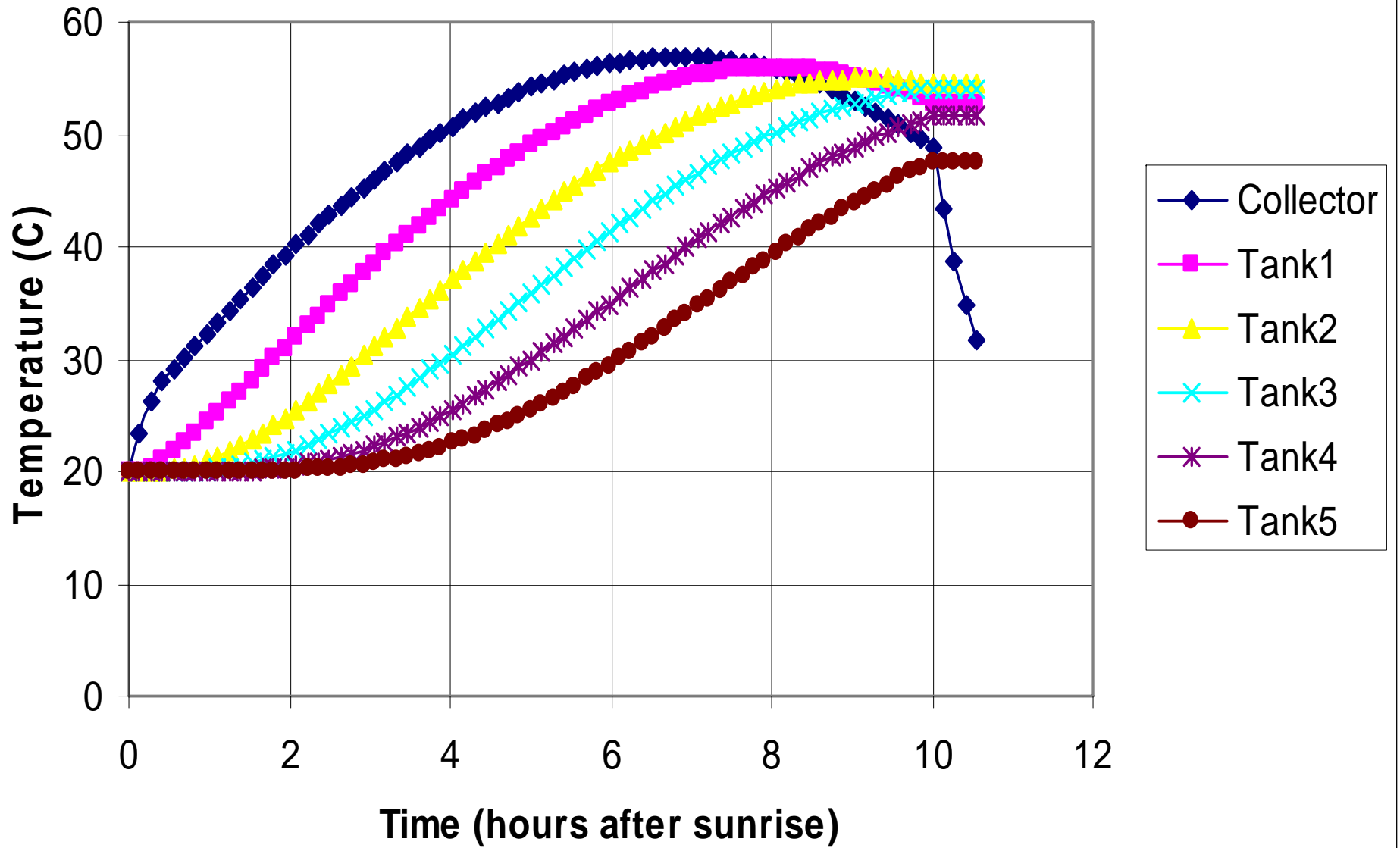
$$N_u := 0.145 \left[R_{aL}^{\frac{1}{3}} - (Gr_c \cdot P_r)^{\frac{1}{3}} \right] + 0.56 \left(Gr_c \cdot P_r \cdot \cos(\theta) \right)^{\frac{1}{4}}$$

$$h := \frac{k}{L} \cdot N_u$$

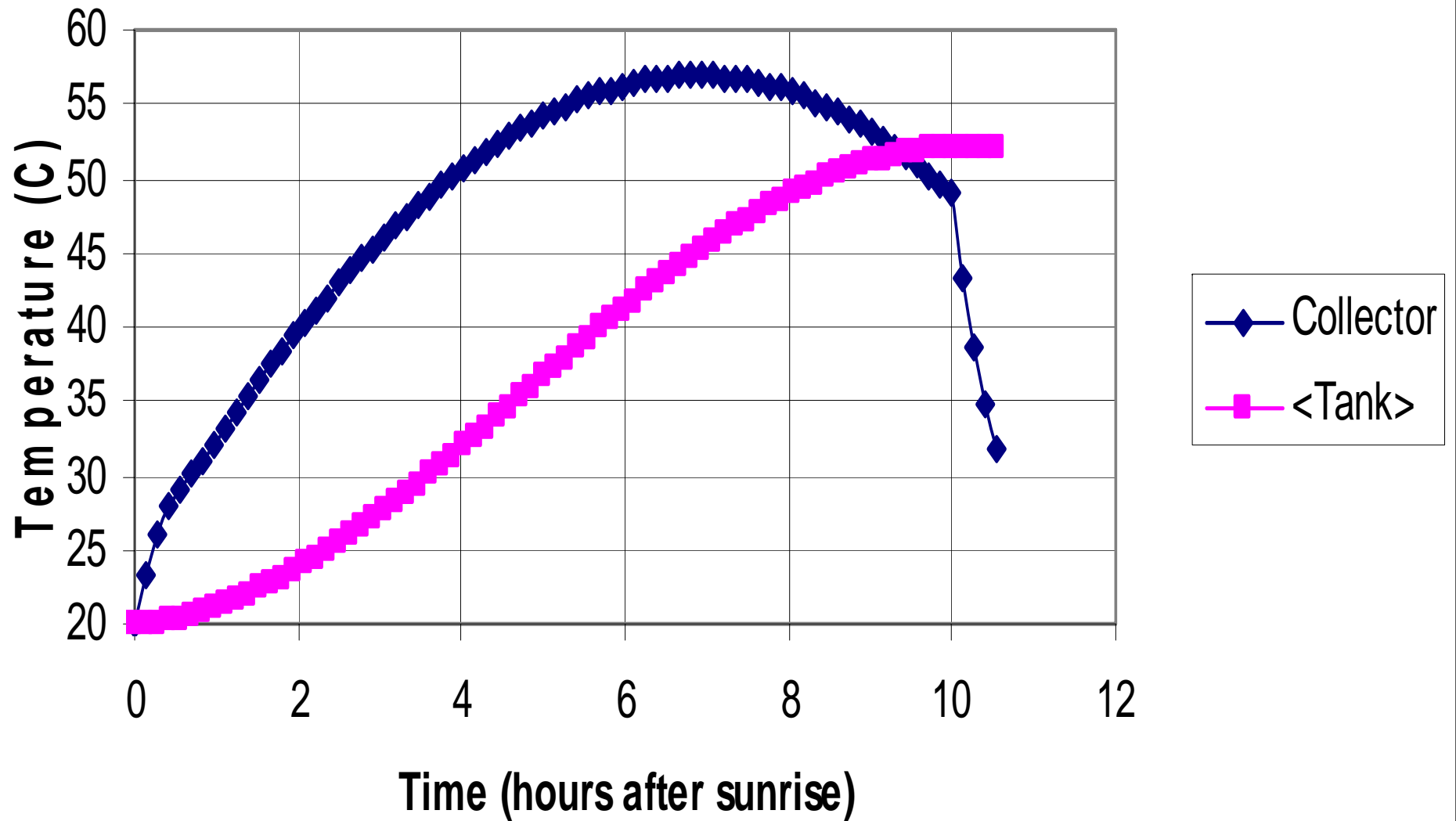
Ambient Air Temperature



Collector & Tank Temperatures



Collector & Tank Average Temperatures



Average Tank Temperature

