Numerical simulations of evacuated-tube solar collectors

Gerardo Diaz
School of Engineering,
University of California, Merced
Configurations of Evacuated-Tube Solar Collectors

(a) U-Tube
(b) Counter-flow
(c) Heat-pipe
(d) All glass Dewar
Heat Input

A ray trace analysis was performed using TracePro optical modeling software
Thermal Analysis for each Configuration
Design #1 - All glass dewar: Direct Flow

Design #2 - All glass dewar: Indirect Flow -- Dewars filled with thermal fluid
Design #3 - Metal absorber with glass-to-metal seal

Glass-to-Metal Seal Tube
Blue: copper fin thickness of 0.2mm
Red: copper fin thickness of 0.6mm
Green: copper fin thickness of 1.2mm

Collector Inlet Temperature (°C) vs Collector Efficiency

- e = 0.05
- e = 0.10
- e = 0.05
- e = 0.10

Counter-flow heat exchanger
Model validation (U-tube)

160 g/s

140 g/s

120 g/s

100 g/s
Future Directions

Minichannel and microchannel-based solar collectors

Aluminum Minichannel Condenser versus RTPF Condenser

Equal Capacity: 7 kW
Q & A