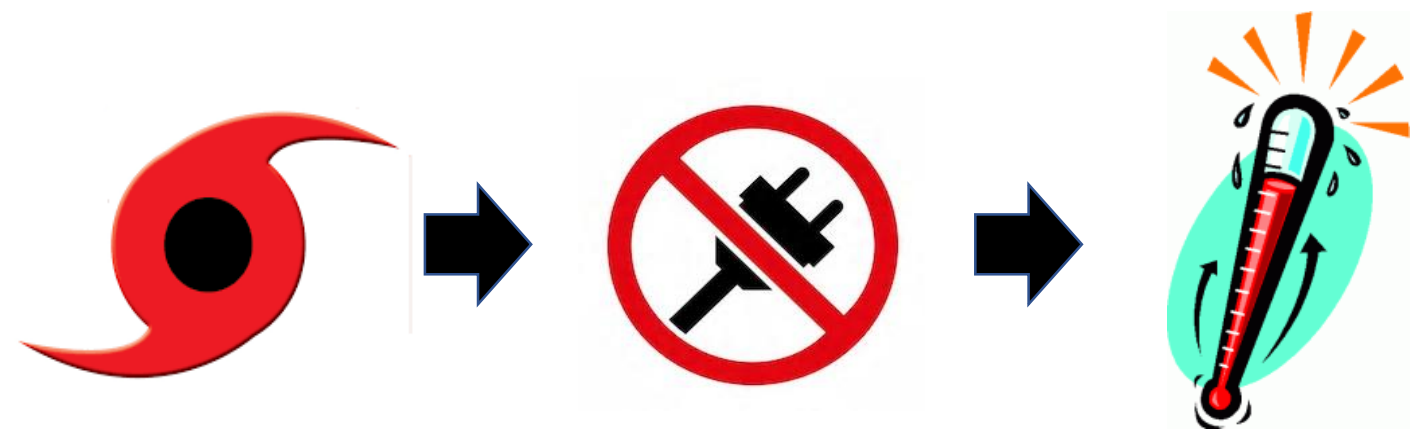


# Team 512: Temperature-Sensitive Medication Storage for Natural Disasters

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## Problem



- Following a hurricane event, loss of grid power results in an inability to keep temperature-sensitive medications cool by conventional methods.
- Spikes in medical mortality rates from such events have been recorded in recent storms.

## Theory

- Analyze heat transfer rate via surfaces by adding resistances from walls and convection

$$\dot{Q} = \frac{T_{\infty,1} - T_{\infty,2}}{R_{total}}$$

$$R_{total} = R_{conv,1} + R_{wall,1} + R_{wall,2} + R_{wall,3} + R_{conv,2}$$

- Gather data from TEC to determine cooling rate
- Determine heat transfer rate from TEC via fins

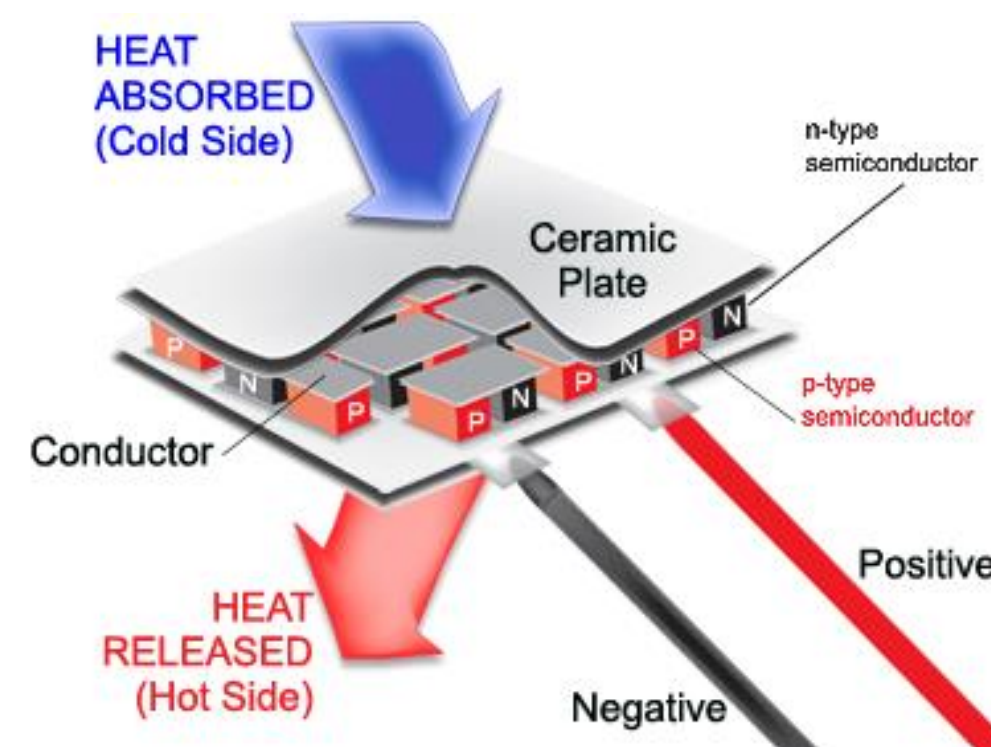


Diagram of Thermal Module Function

## Prototyping

### Slot Drawers

- Protects various medications while enabling sufficient heat transfer

### Cooler

- Store-bought cooler with additional insulation and sealing to improve performance

### Cold Plate

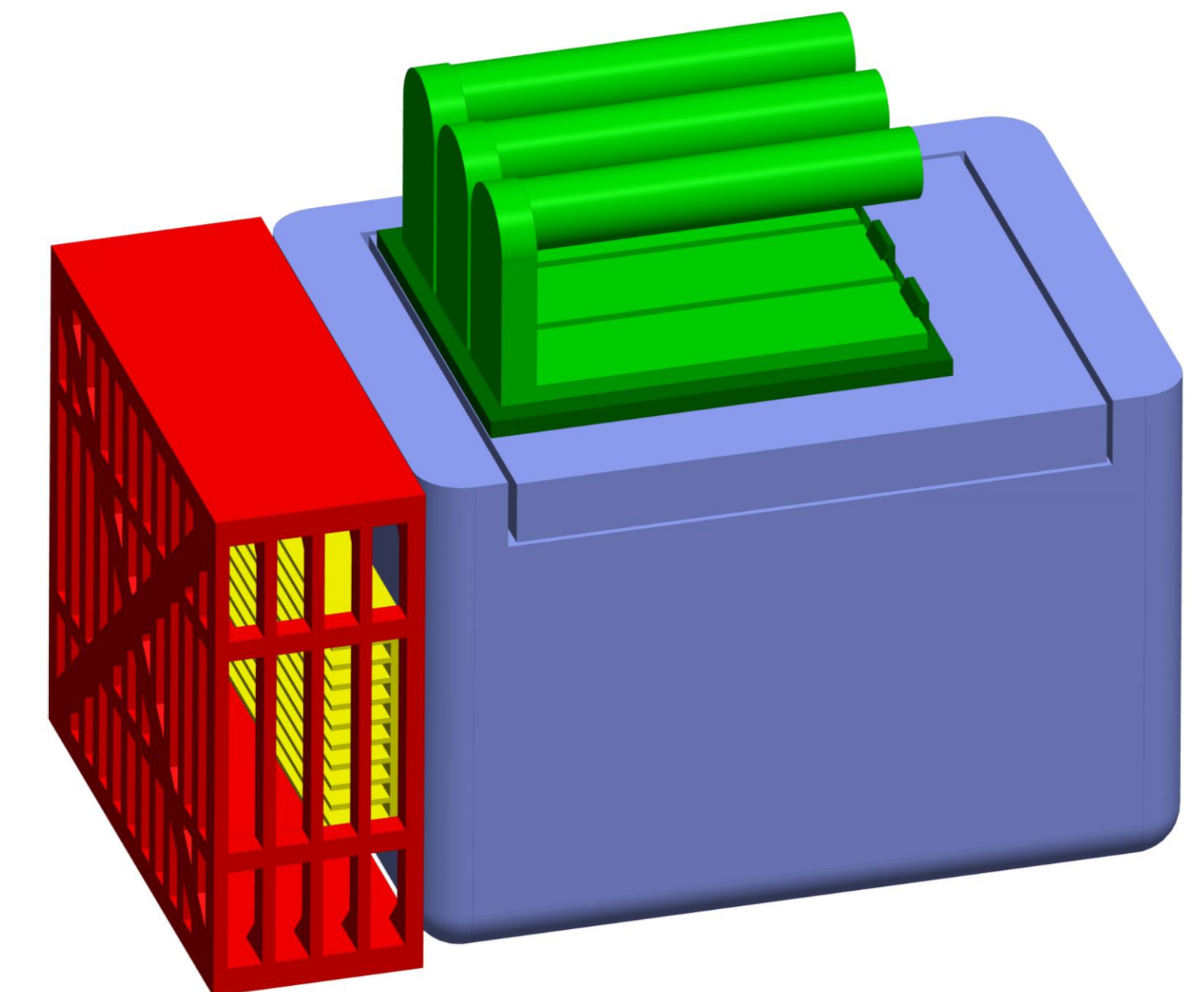
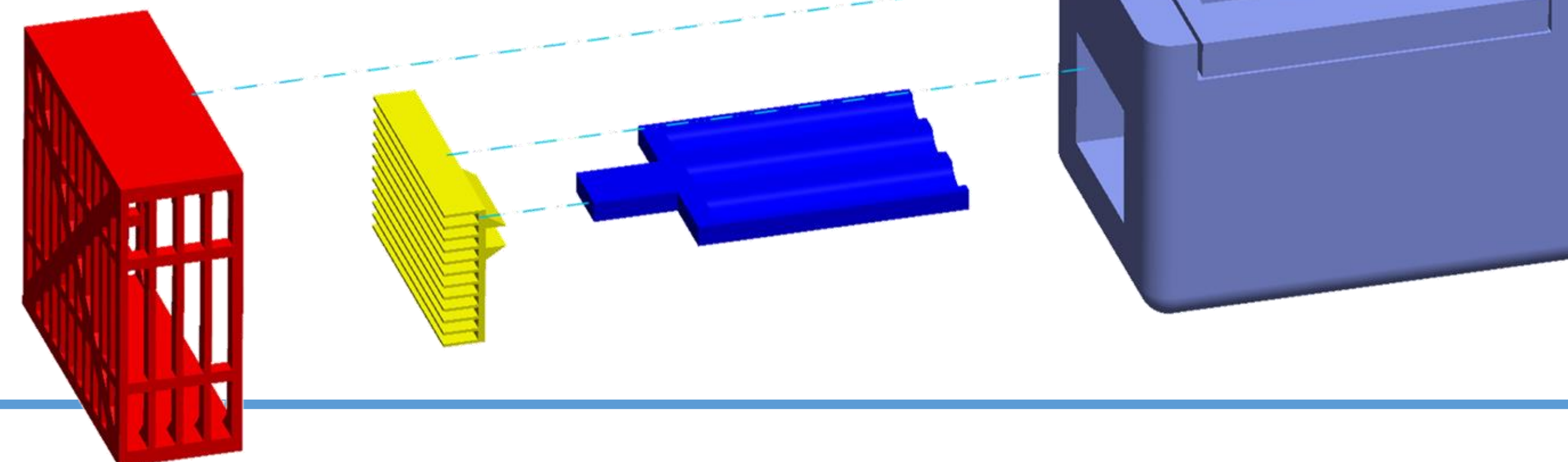
- Metal plate that transfers cooling power from TEC to medication

### Thermoelectric Cooling (TEC) Unit

- Assembly includes a large hot heat sink, smaller cold side heat sink, and a cold plate adapter

### Protective Ventilation Grate

- Protects the TEC and electrical components while providing excellent air flow



### Operating Temperature

Range:

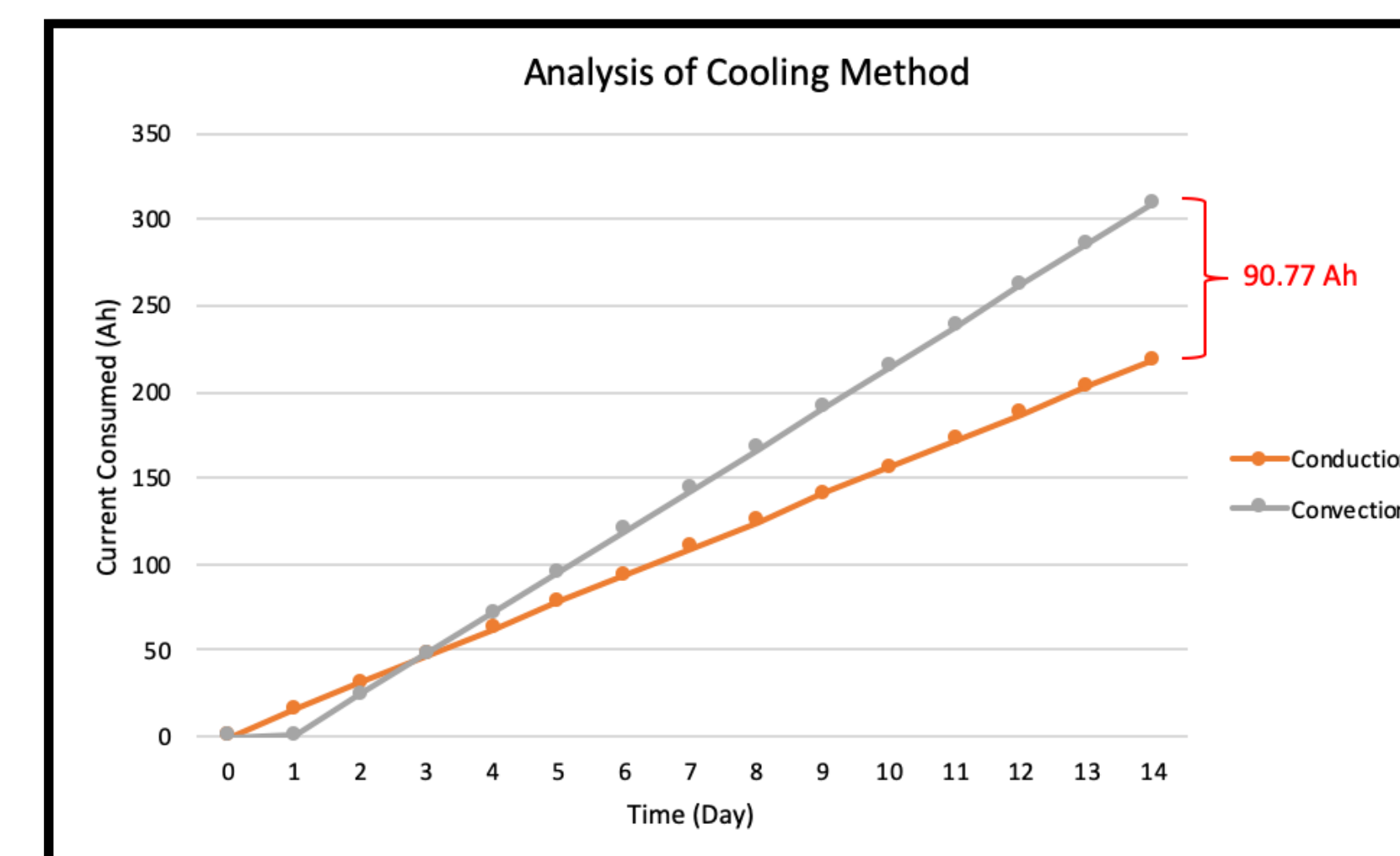
3.5 - 7°C

### Container Cooling Time:

<= 8 minutes

## Testing

- The graph to the right illustrates the effect heat transfer mechanism type has on current consumption of the device.
- Heat produced by the internal fan motor to induce convection heat transfer significantly increases required power to maintain the temperature range in the TEC.
- Conduction heat transfer eliminates the internal fan current load and heat resulting from its motor.



Power Required via Convection:

P = 3.74 kW

Power Required via Conduction:

P = 2.62 kW