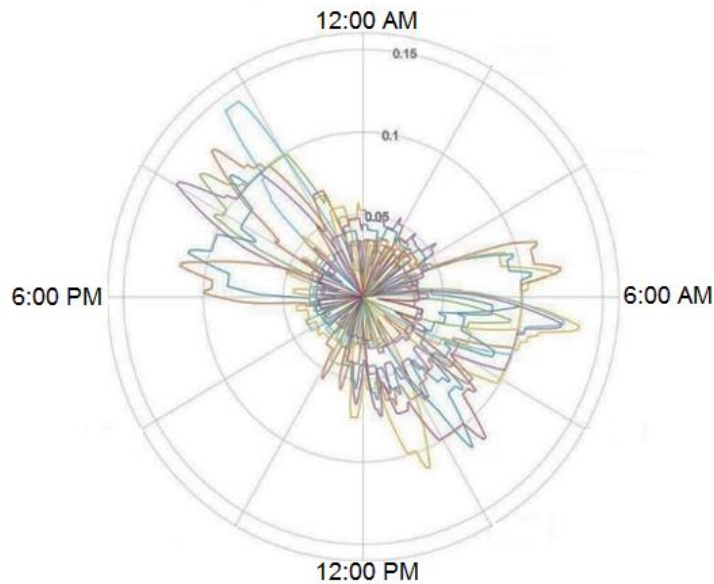


# Pump Monitoring Apparatus (PuMA)

Alana Vilagi, Research Assistant



# Background: Home Heating

- How do you heat your home?
- What kind of heater do you use?
- How much fuel do you use in a day?  
A month? A year?
- Do you use auto, economy, or setback?



Photo Credit: Amanda Byrd



# Types of Heaters in Study

## Toyostove

- Laser 73/730



- Laser 56/560



## Monitor

- MPI 2400



- M41



# Who was involved?

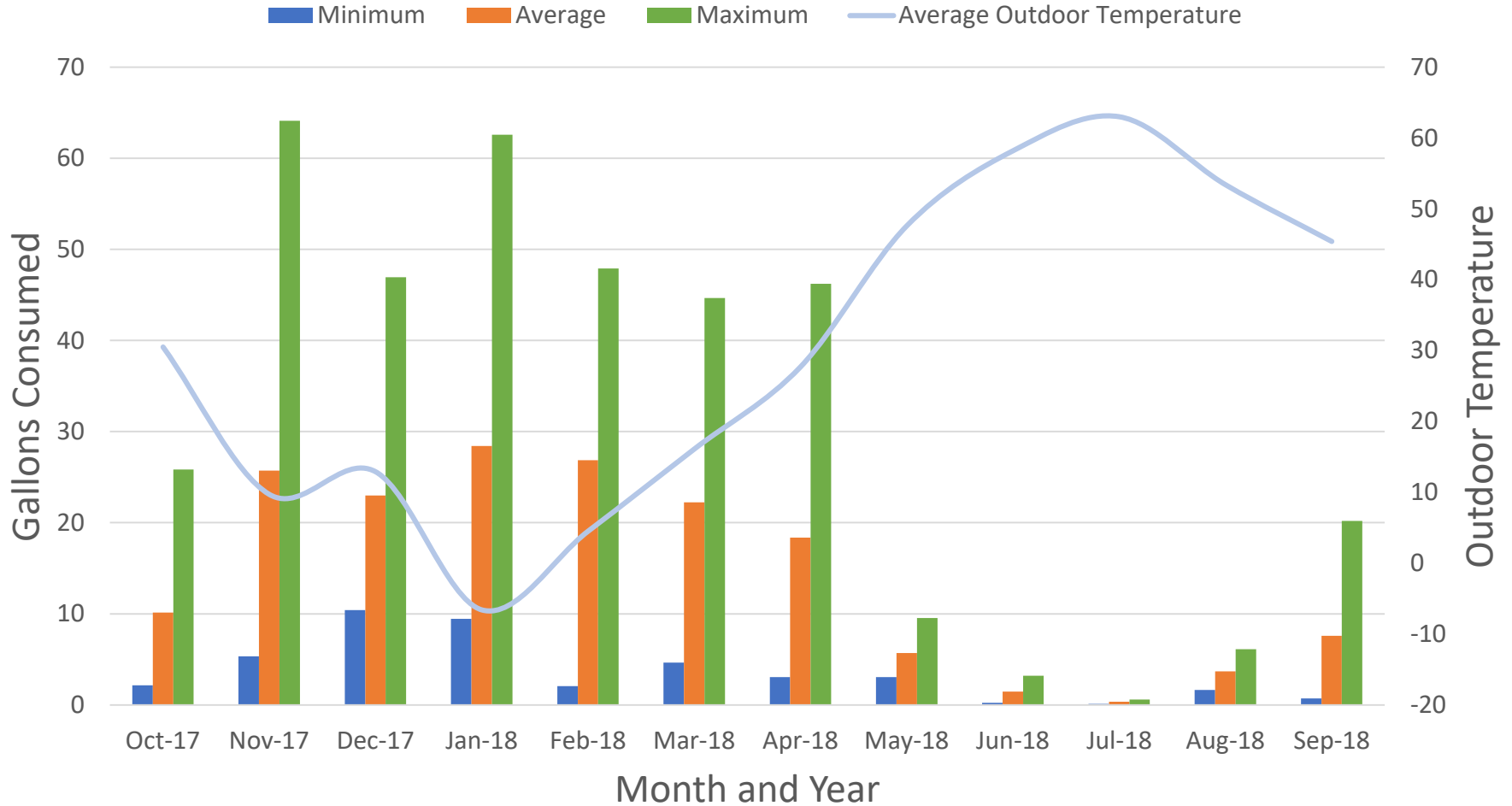
- 12 Meters installed
  - 11 households
  - 1 business
- This dataset considers 9 of these heat loads
  - All households
- What happened to the others?
  - 2 homes not in service
  - 1 heater never turned on
  - 1 sensor came loose



Photo Credit: Amanda Byrd



# Household Fuel Use per Month



## Annual Costs (at \$4.25/gal):

Based on July 2017 prices  
Alaska Fuel Price Report

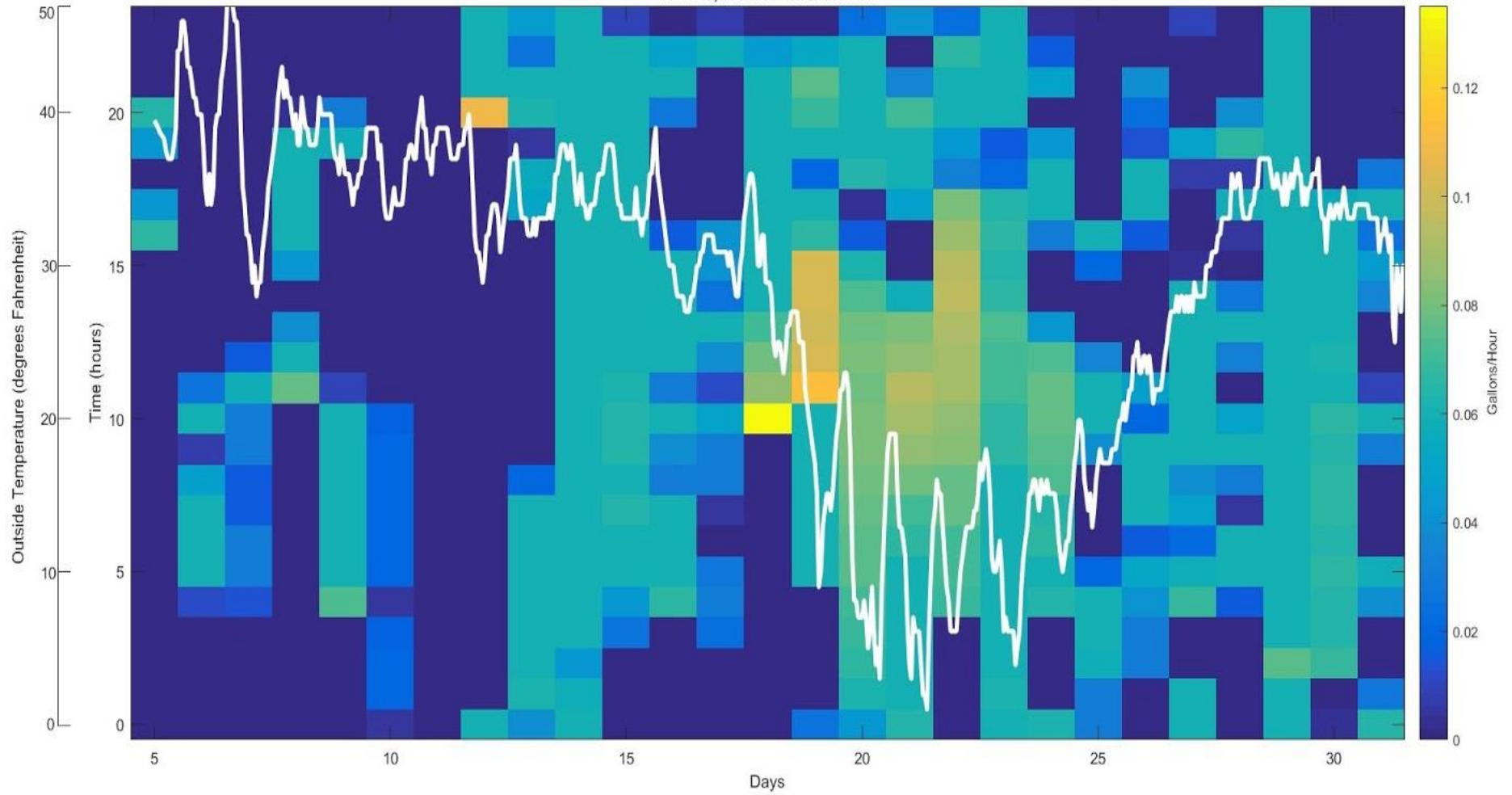
**Minimum: \$182**

**Average: \$738**

**Maximum: \$1,606**



Dual Heat Source Home Fuel Consumption  
Tanana, Alaska - October 2017



# Daily Fuel Use by Season

- Winter ( $T_{\max}$ :33°F  $T_{\min}$ :-51°F)
  - Min: 0.0 Gallons
  - Avg: 0.8 Gallons
  - Max: 4.5 Gallons
- Summer ( $T_{\max}$ :86°F  $T_{\min}$ :32°F)
  - Min: 0.0 Gallons
  - Avg: 0.2 Gallons
  - Max: 0.8 Gallons
- Spring ( $T_{\max}$ :70°F  $T_{\min}$ :-25°F)
  - Min: 0.0 Gallons
  - Avg: 0.6 Gallons
  - Max: 3.0 Gallons
- Fall ( $T_{\max}$ :65°F  $T_{\min}$ :-17°F)
  - Min: 0.0 Gallons
  - Avg: 0.5 Gallons
  - Max: 3.5 Gallons

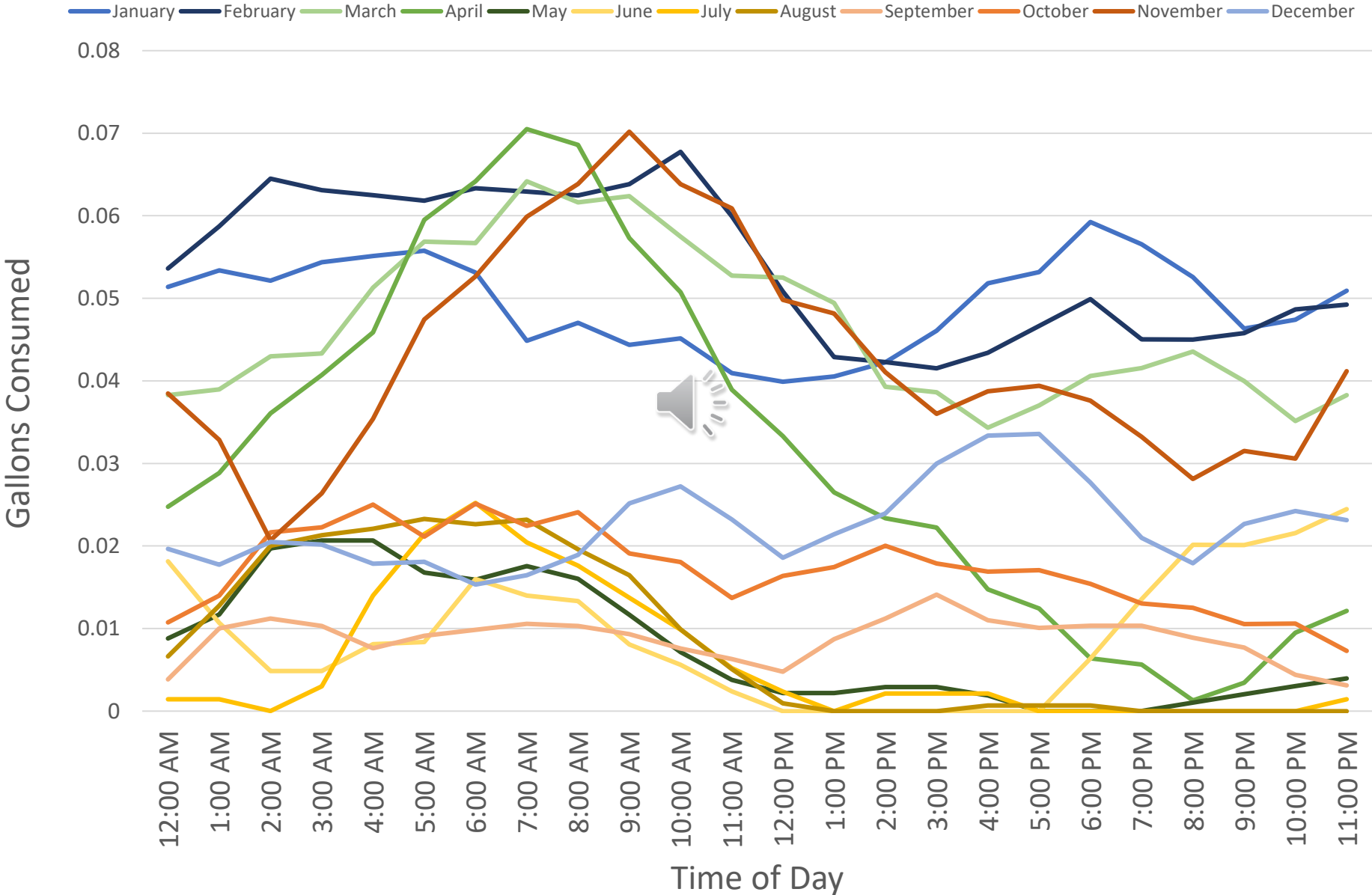
Months of Highest Avg Fuel Use:  
November and February (1.00 G/day)

Months of Lowest Avg Fuel Use:  
June-August (Off or <0.18 G/day)



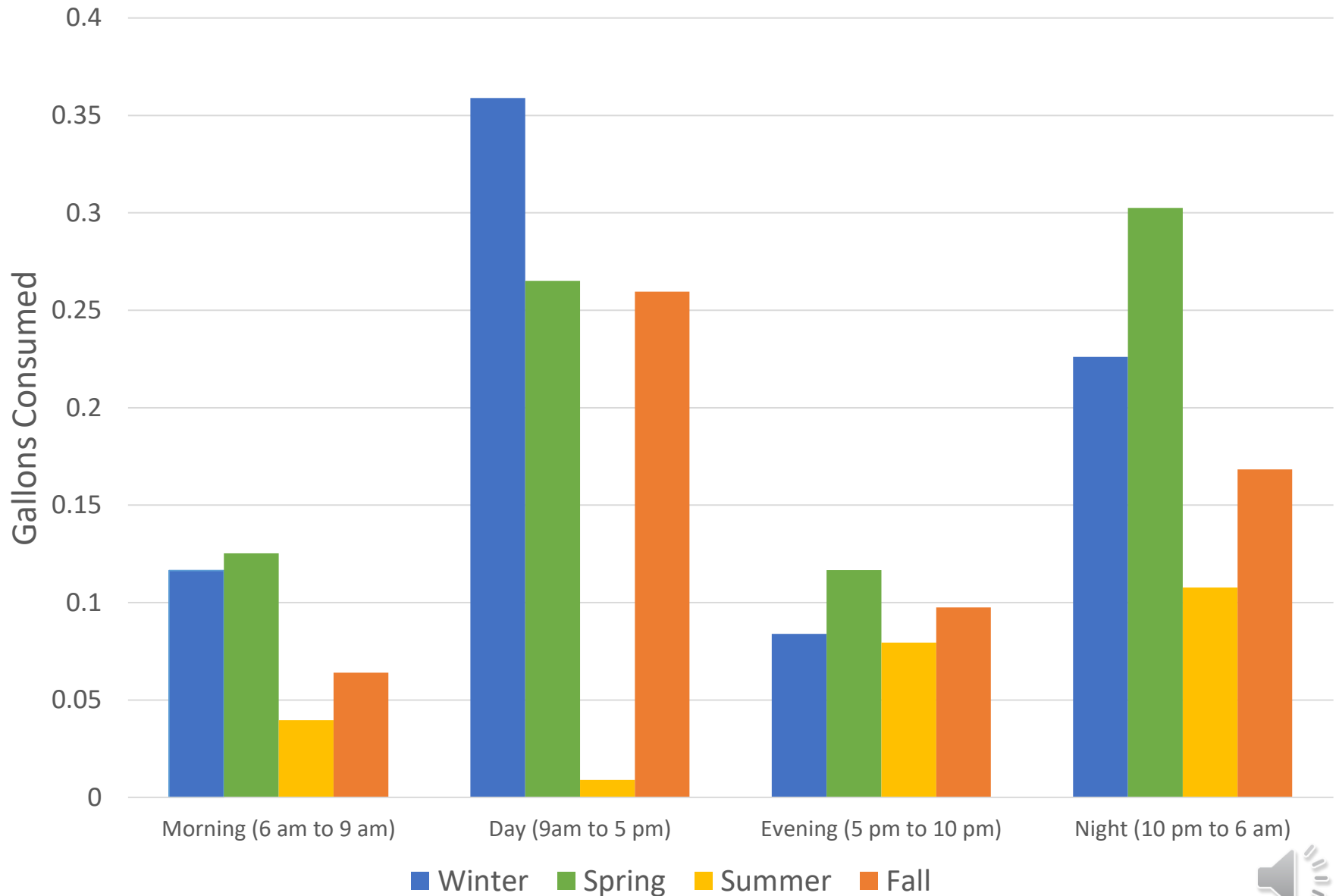


# Average Hourly Fuel Consumption per Month

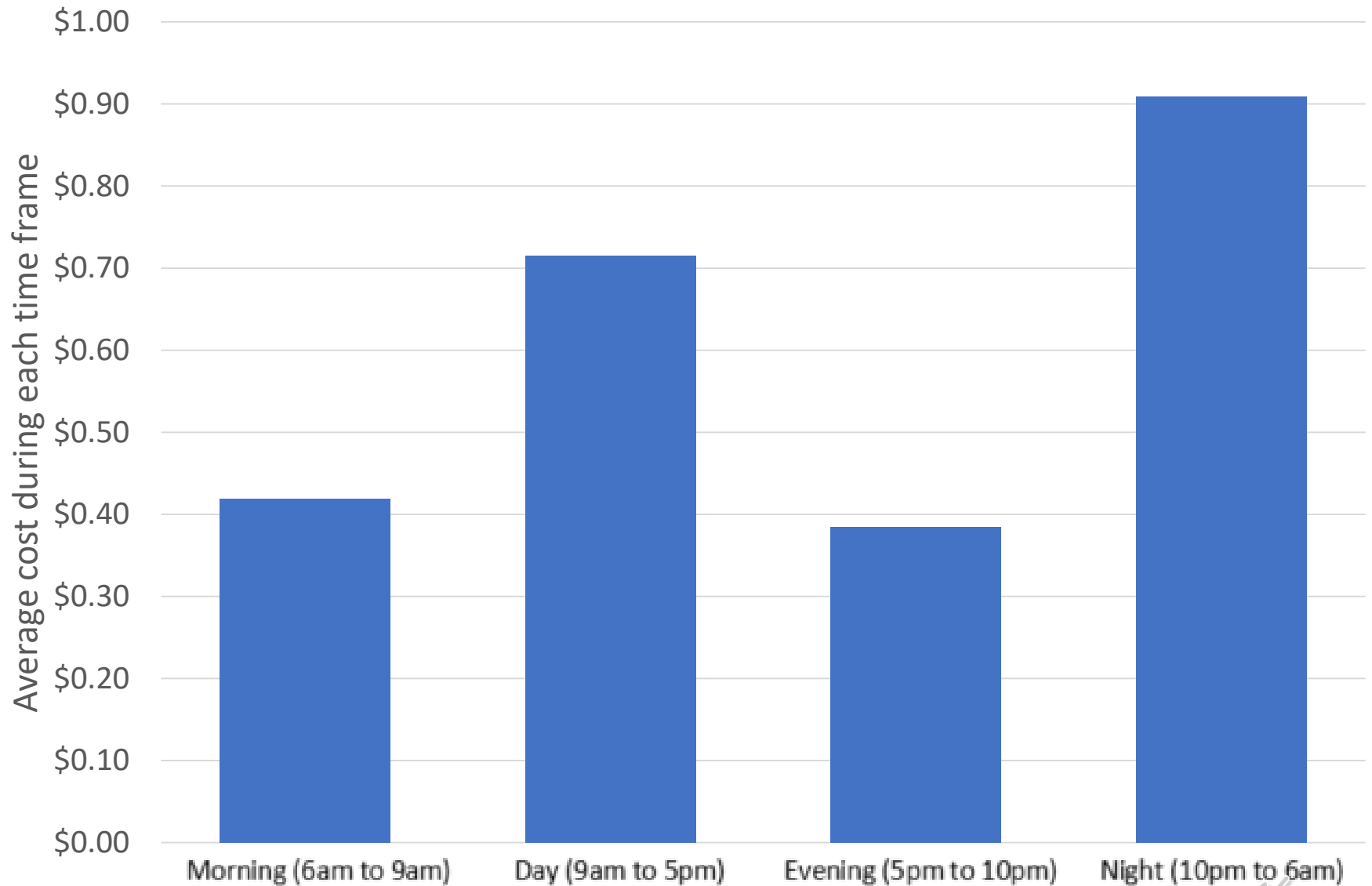




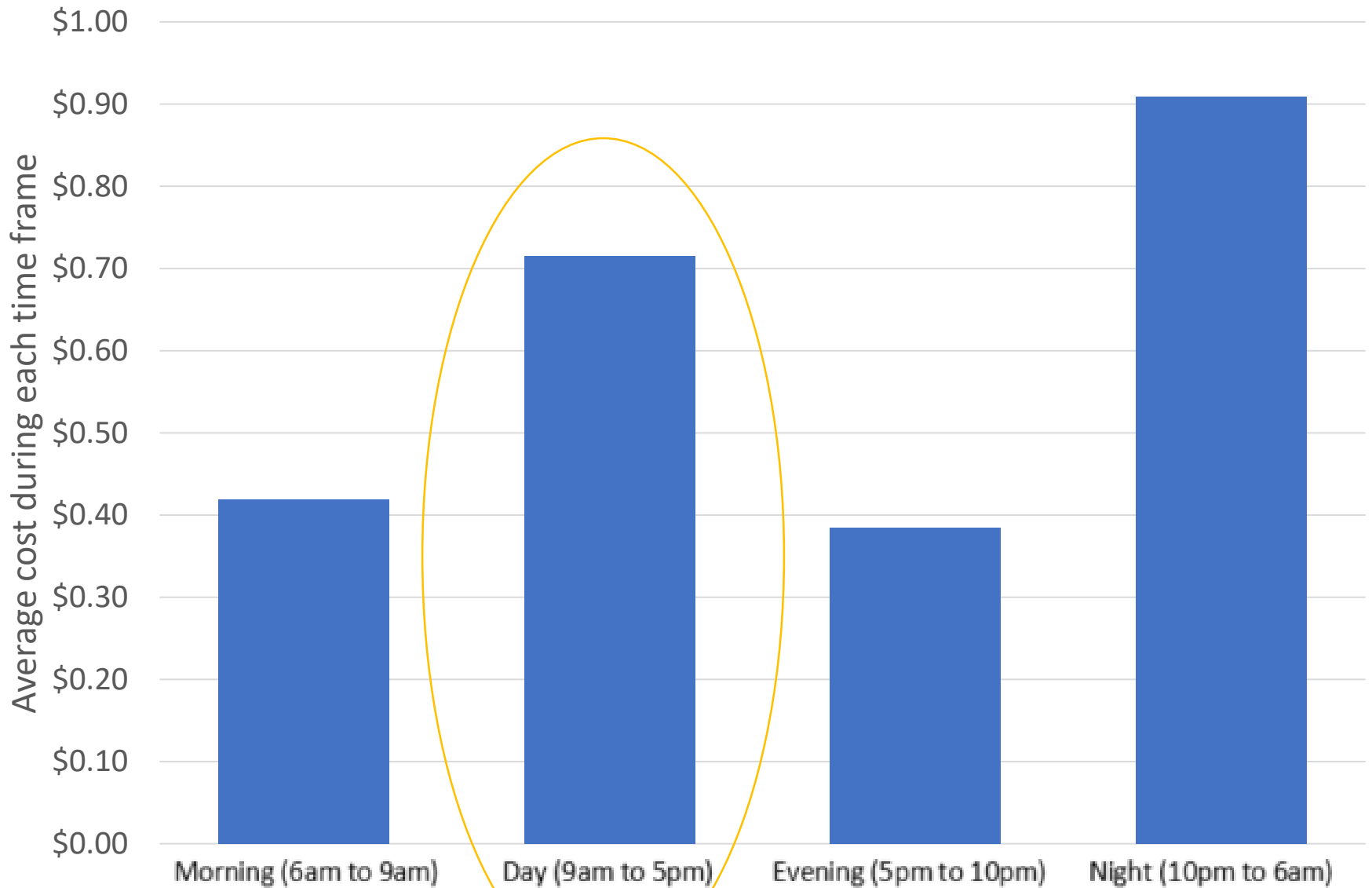
# Fuel Use with Time of Day



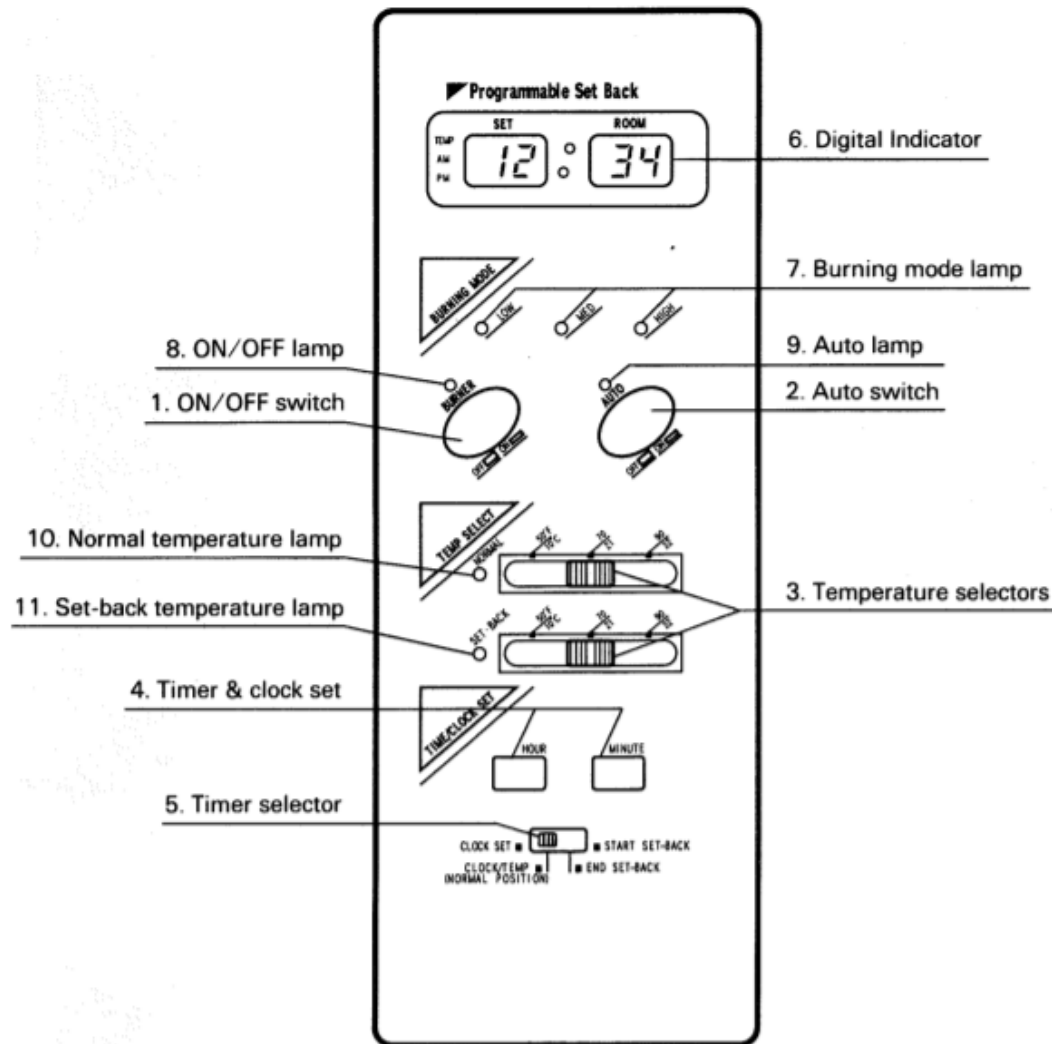
# Cost of Fuel with Time of Day



# Cost of Fuel with Time of Day



# Setback Feature: Laser 73/ Laser 56

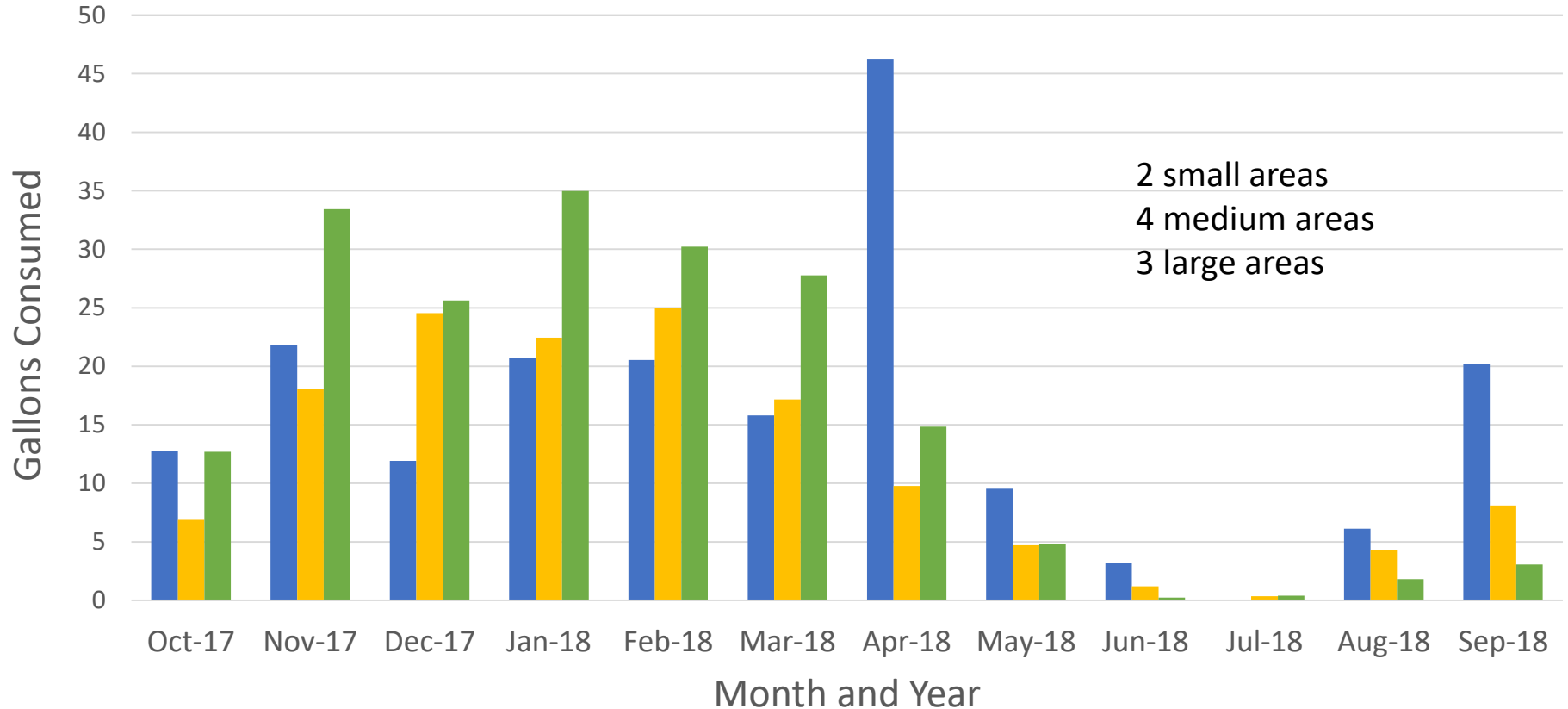


# Fuel Consumption per Month by Heating Area Size

■ Small (100-200 sq.ft.)

■ Medium (250-300 sq.ft.)

■ Large (400-550 sq.ft.)



**Annual Costs (at \$4.25/gal):**

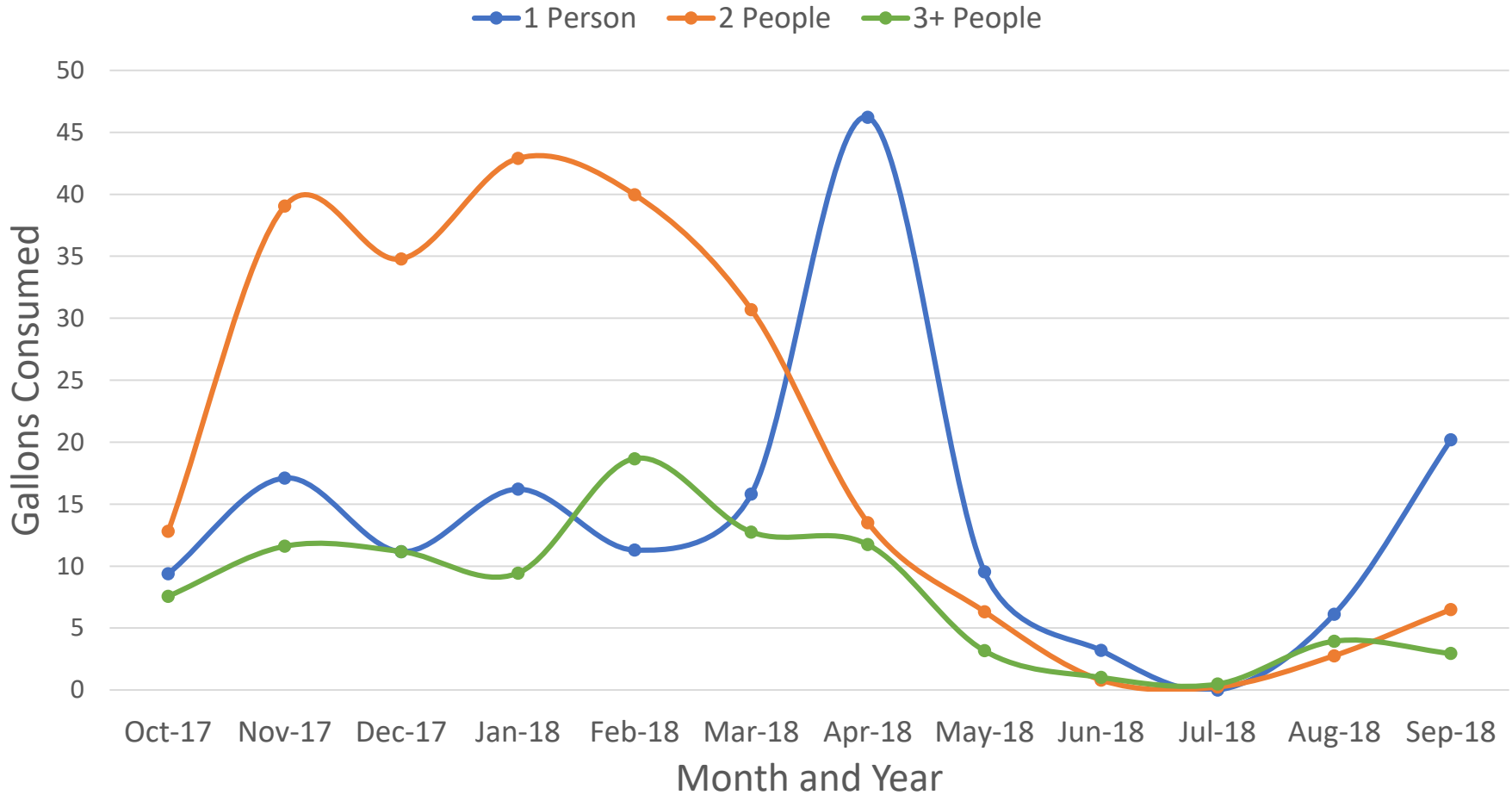
**Small: \$803**

**Medium: \$606**

**Large: \$807**



# Monthly Fuel Consumption by Household Size



**Annual Costs (at \$4.25/gal):**

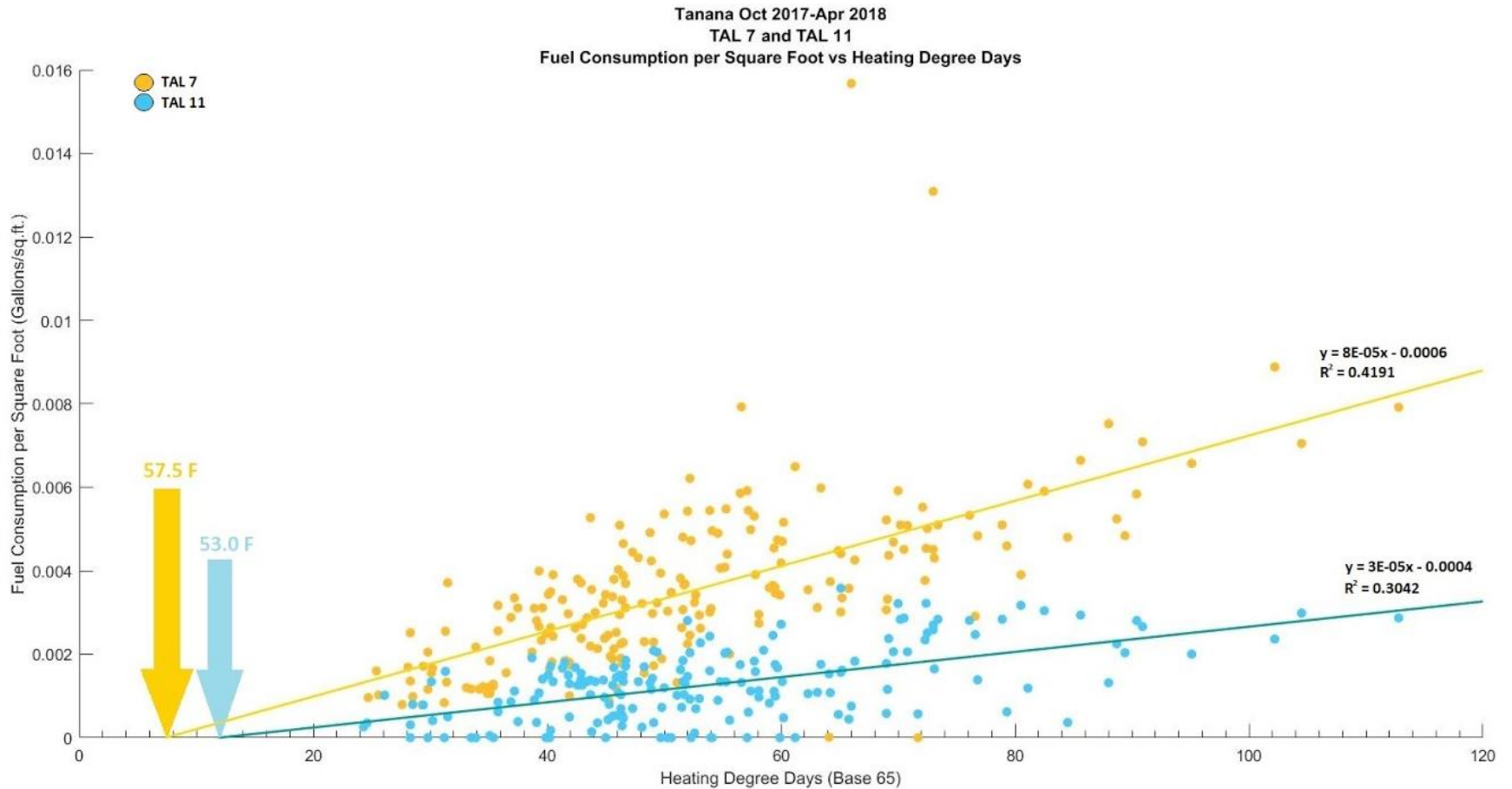
**1 Person: \$707**

**2 People: \$979**

**3+ People: \$402**

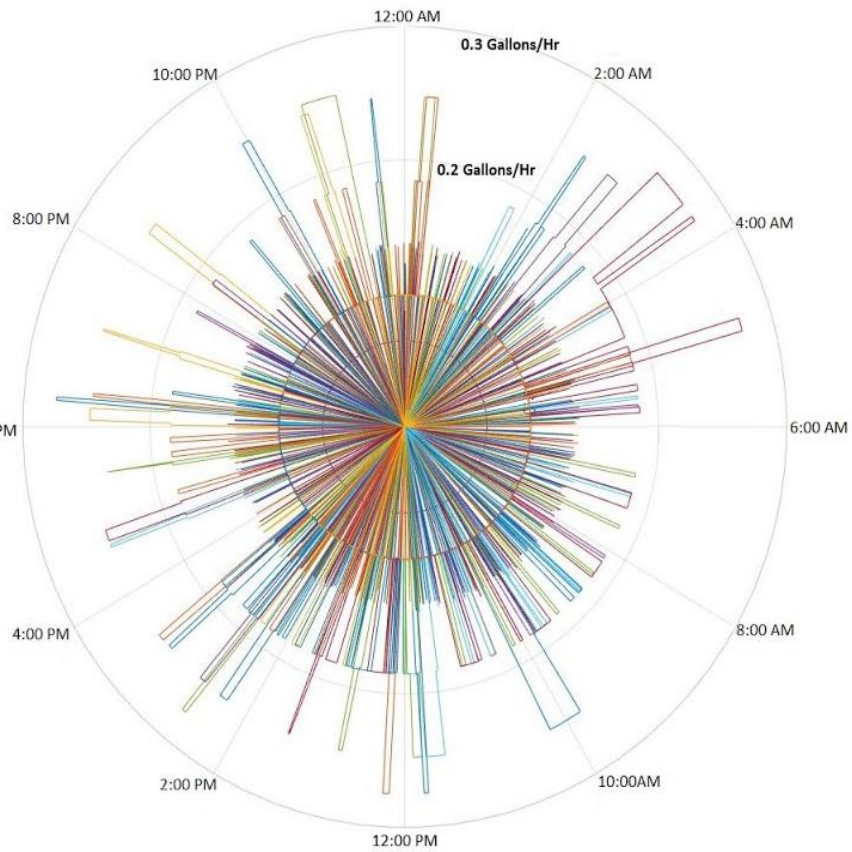


# Comparison of two similar households



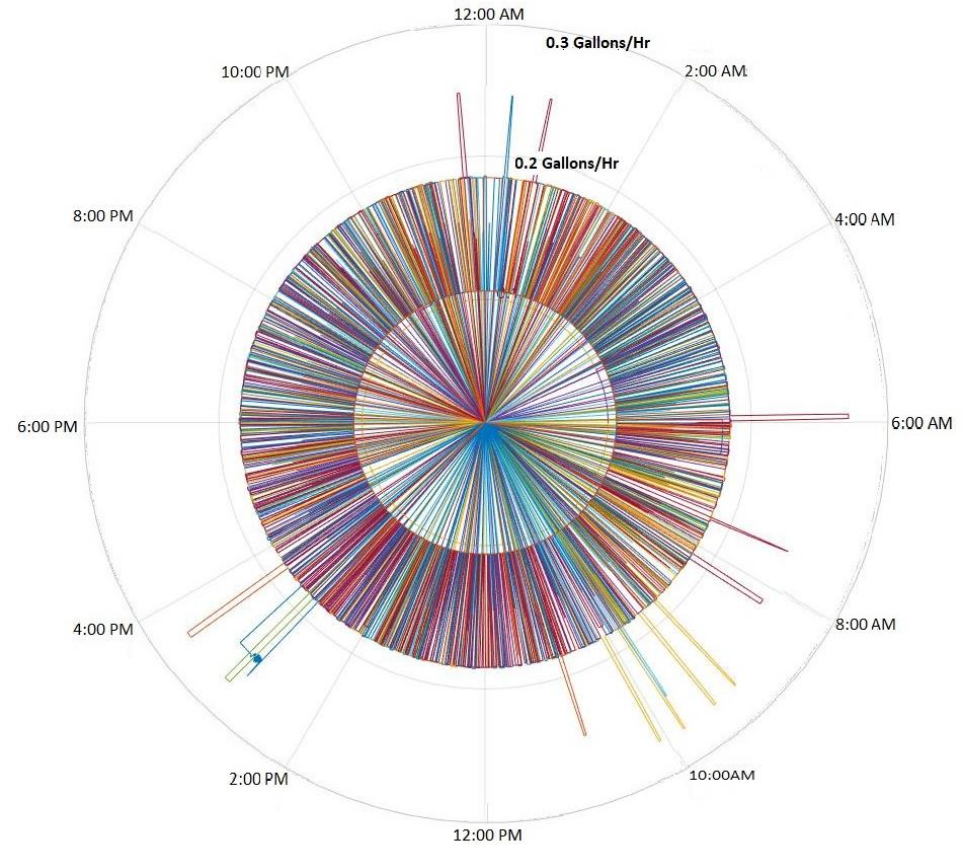


**TAL 11 January Flowrate Patterns**



**33 Gallons**

**TAL 07 January Flowrate Patterns**

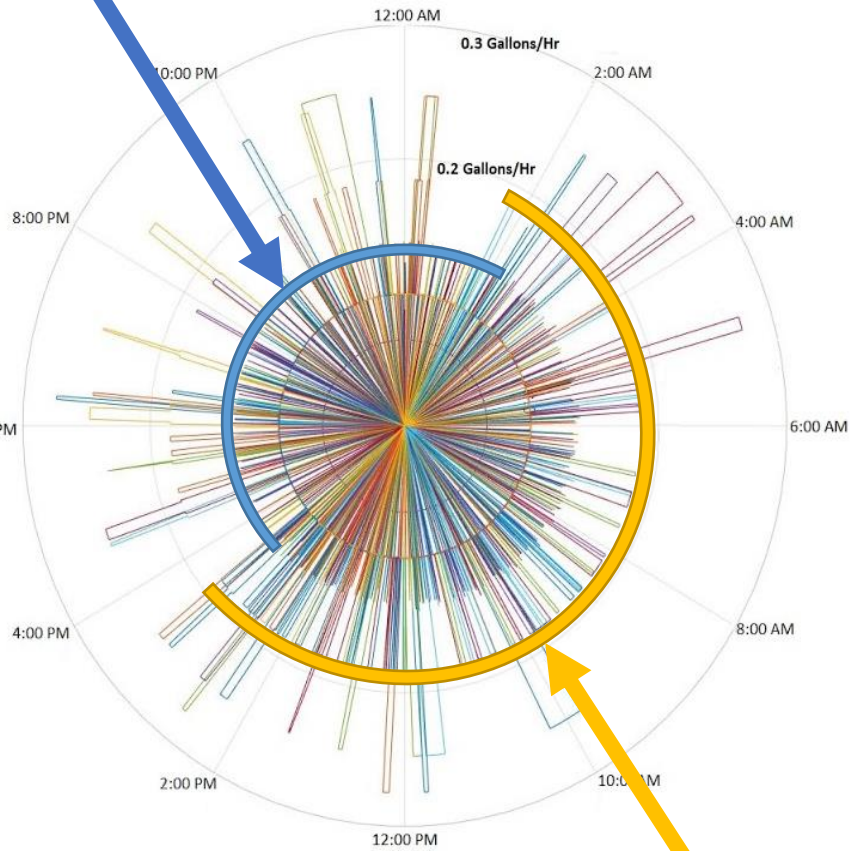


**63 Gallons**



**EVENING**

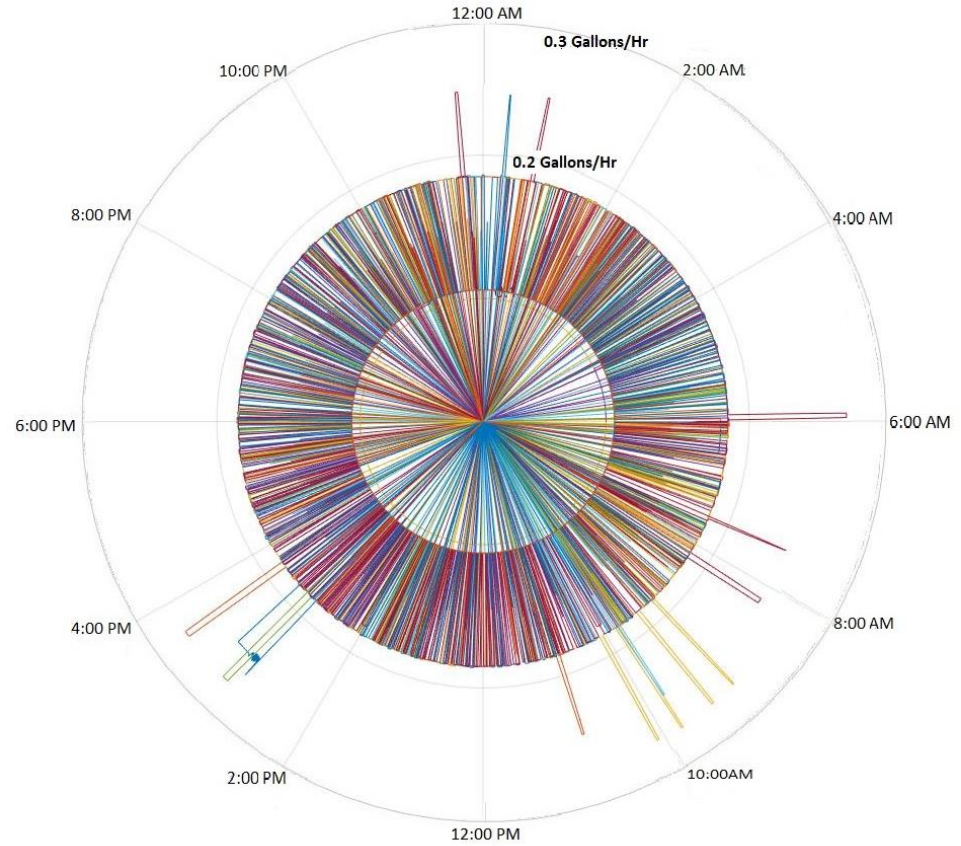
**TAL 11 January Flowrate Patterns**



**33 Gallons**

**MORNING**

**TAL 07 January Flowrate Patterns**



**63 Gallons**



# What will the new program update do?

- Take regular temperature samples
  - Allows us to compare wood use to fuel use
- Live feedback on fuel use!
  - Does require home to be in service area
- Improve our ability to give feedback in this next year of the project (November 2020)



# Final Takeaways

- How do we reduce fuel use?
  - Set temperature lower when not in home
  - Starting a fire when you come home has great fuel savings
- Why is this useful?
  - Have a better understanding of daily fuel use
  - Know which months you'll likely use the most fuel



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