# Massachusetts Residential Building Use and Equipment Characterization Study

## Appendix B-9 - Space Temperature and Thermostat Setpoint Results Plots

December 22, 2023

Prepared for:

Prepared by:

Guidehouse

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# 1 Terminology

Throughout this report, the research results are referenced with various terminology, including:

- **Population:** These results are scaled by saturation and show the overall impact to the system on average by home, but do not represent the impact from an individual appliance.
- **For Homes with End Use:** These results only include homes with the relevant end use installed, irrespective of the saturation of that end use in the population.
- **Weather-Normalized:** Metered data was used from the period of April 1, 2022 - March 31, 2023. Regression models were then used to estimate typical year (weather-normalized) results, using TMYx weather data for energy and on-peak demand results, and actual weather data from 2009-2023 (choosing the year that resulted in the median value) for other peak demand results. All data shown is weather-normalized, unless specifically labeled “metered”.
- **Summer:** To calculate summer-only results, the team has used the weather-normalized data from June, July, August, and September.
- **Summer System Peak:** For the purposes of this report, summer system peak is defined as the 2-hour period on a non-holiday weekday in June-September with the highest average ISO-NE system load.
- **Summer On Peak:** Summer on peak demand is defined as the period from 1-5 PM on non-holiday weekdays in June, July, and August (consistent with the ISO-NE “On Peak” definition).
- **Summer Seasonal Peak:** Summer seasonal peak demand is defined as the hours on non-holiday weekdays in June, July, and August for which the real-time system hourly load is equal to or greater than 90% of the forecast summer system load (from the ISO-NE Capacity, Energy, Loads and Transmission (CELT) Report, used as a proxy for the most recent “50/50” system peak load forecast).
- **Summer Residential Peak:** Summer residential peak is defined as a forward-looking evening peak, set for 5-7 PM on the day of the summer system peak load.
- **Summer Peak Day:** These results include data only from the day of the summer system peak.
- **Winter:** To calculate winter-only results, the team has used the weather-normalized data from November, December, January, February, and March.
- **Winter System Peak:** For the purposes of this report, winter system peak is defined as the 2-hour period on a non-holiday weekday in November-March with the highest average ISO-NE system load.
- **Winter On Peak:** Winter on peak demand is defined as the period from 5-7 PM on non-holiday weekdays in December and January (consistent with the ISO-NE “On Peak” definition).
- **Winter Seasonal Peak:** Winter seasonal peak demand is defined as the hours on non-holiday weekdays in December and January for which the real-time system hourly load is equal to or greater than 90% of the forecast winter system load (from the ISO-NE Capacity, Energy, Loads and Transmission (CELT) Report, used as a proxy for the most recent “50/50” system peak load forecast).
- **Winter Residential Peak:** Winter residential peak is defined as a forward-looking evening peak, set for 7-9 PM on the day of the winter system peak load.
- **Winter Peak Day:** These results include data only from the day of the winter system peak.
- **Building Type:** Either Single-Family Detached, Single-Family Attached (2-4 units), or Multi-family (5+ units)
- **Number of Occupants:** number of permanent residents (adults and children) living in the home

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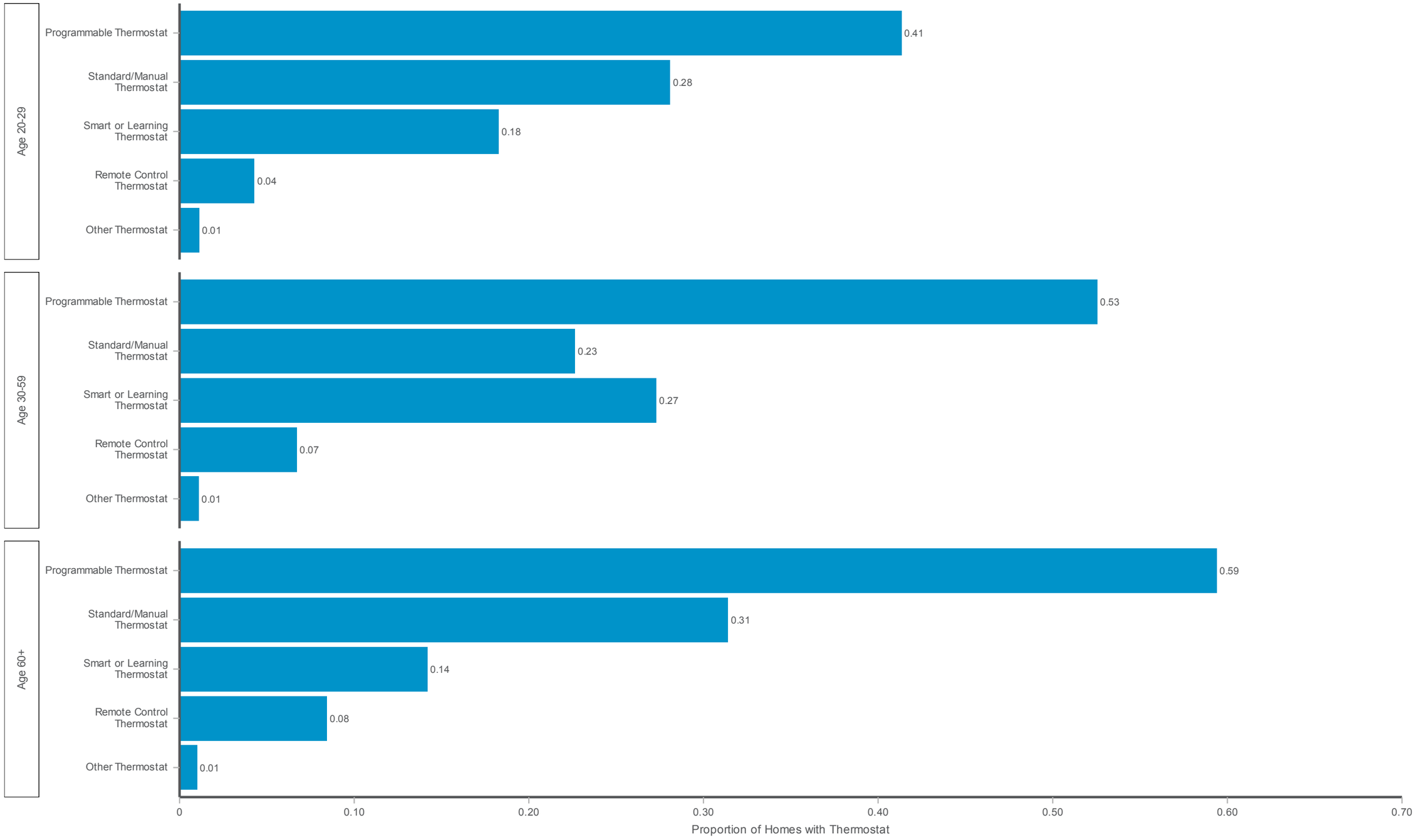
# 2 Plots by Age

## 2.1 Thermostat Saturation by Age

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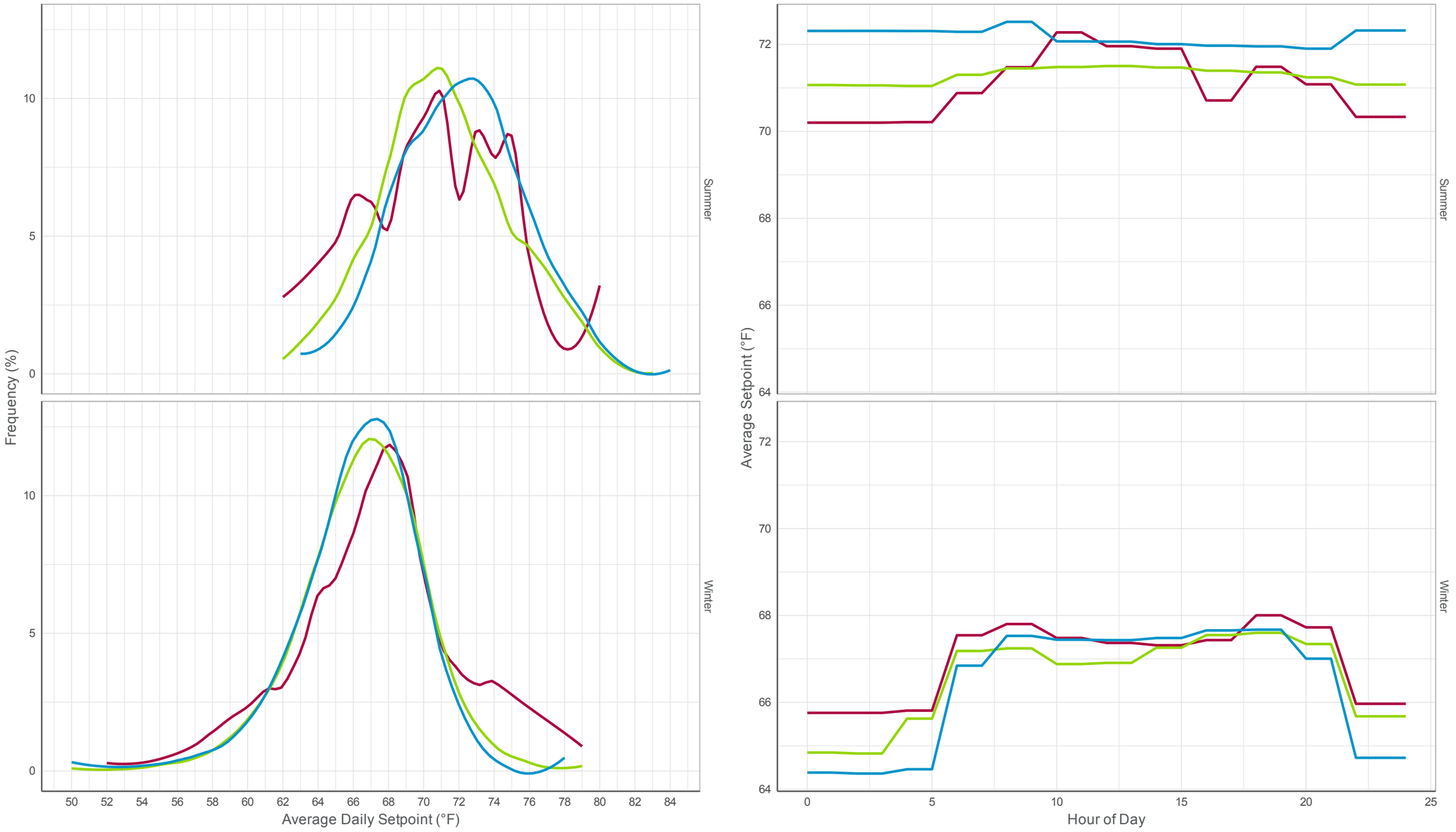
## 2.2 Reported Thermostat Setpoints by Age

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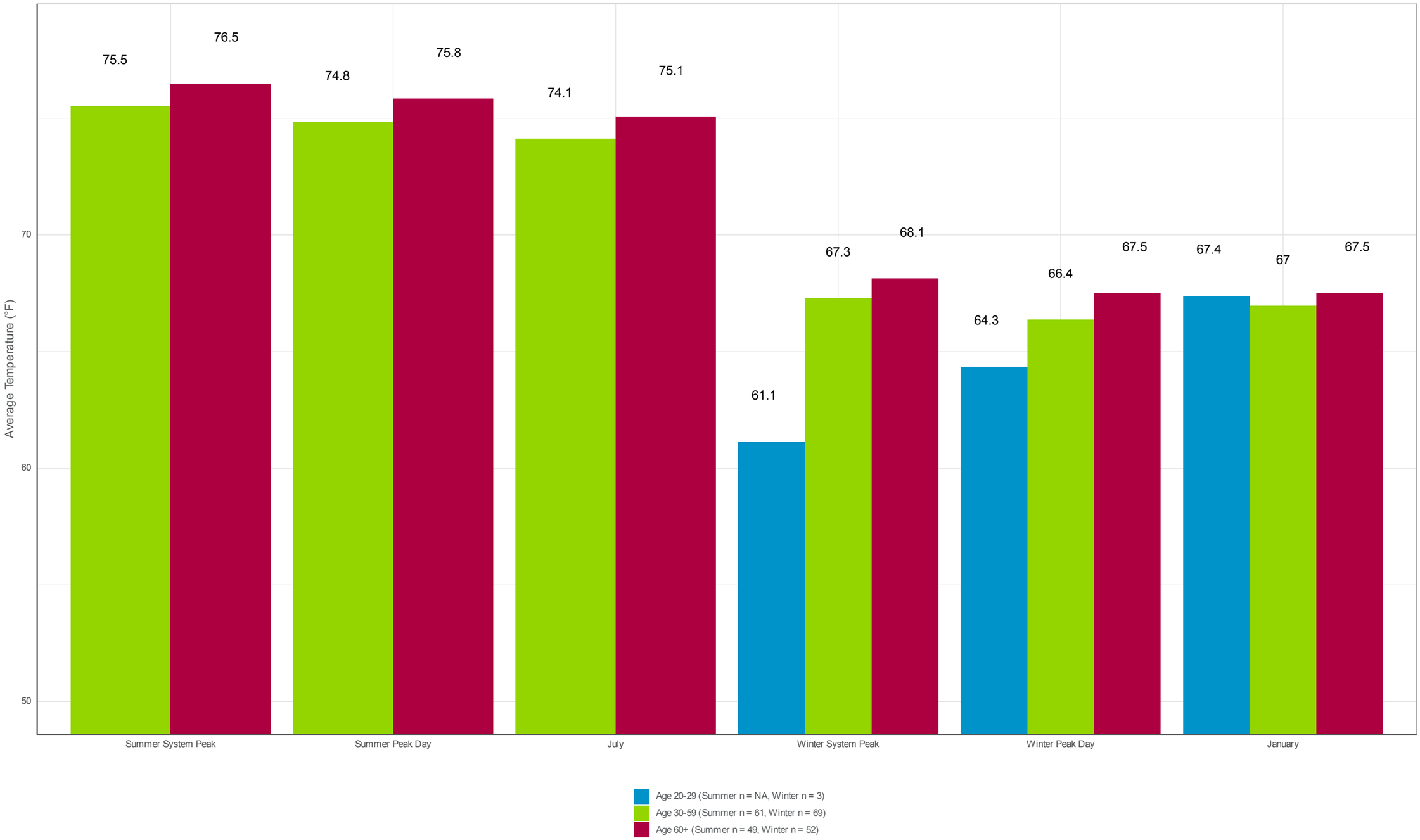
## 2.3 Metered Average Space Temperatures by Age

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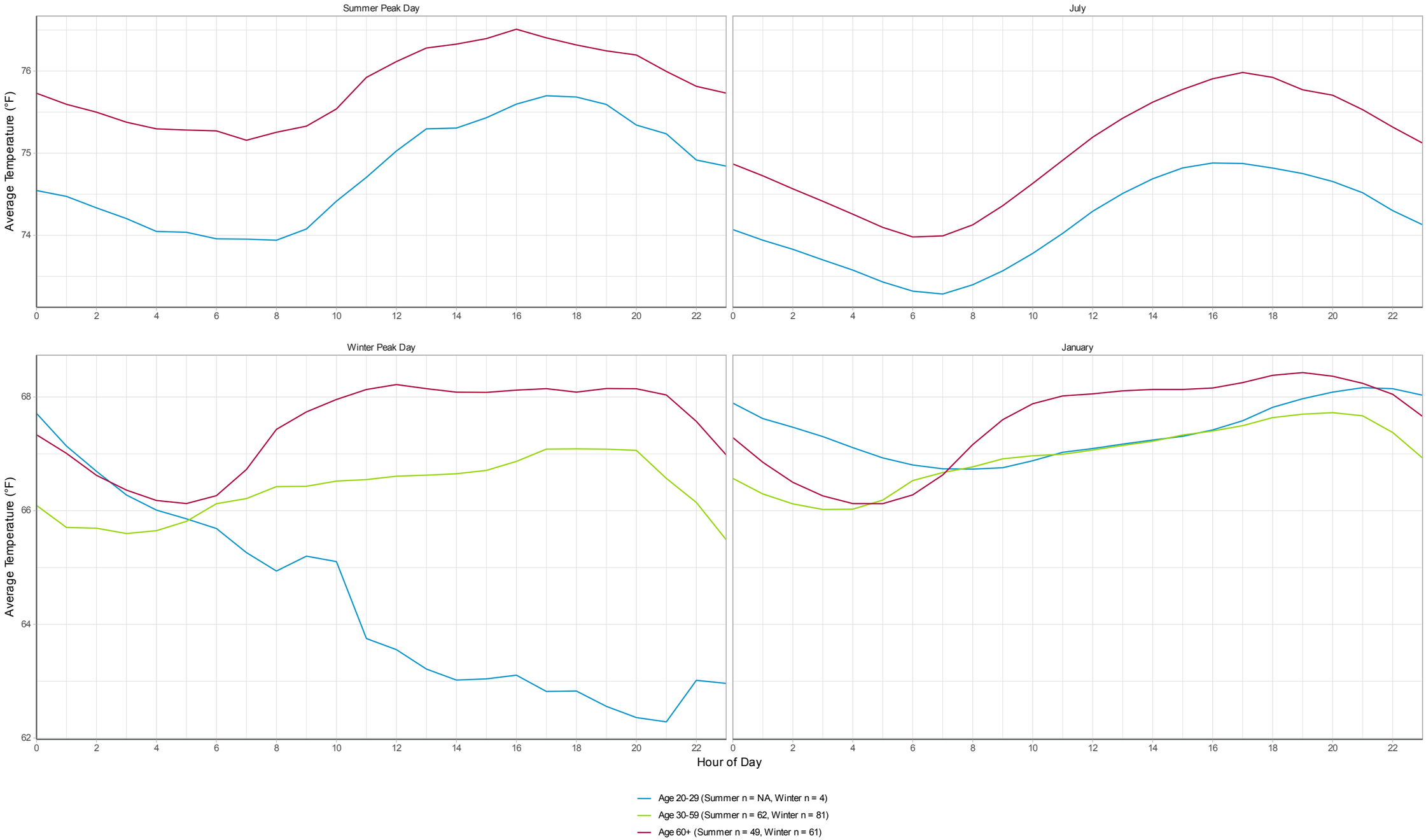
## 2.4 Metered Hourly Space Temperatures by Age

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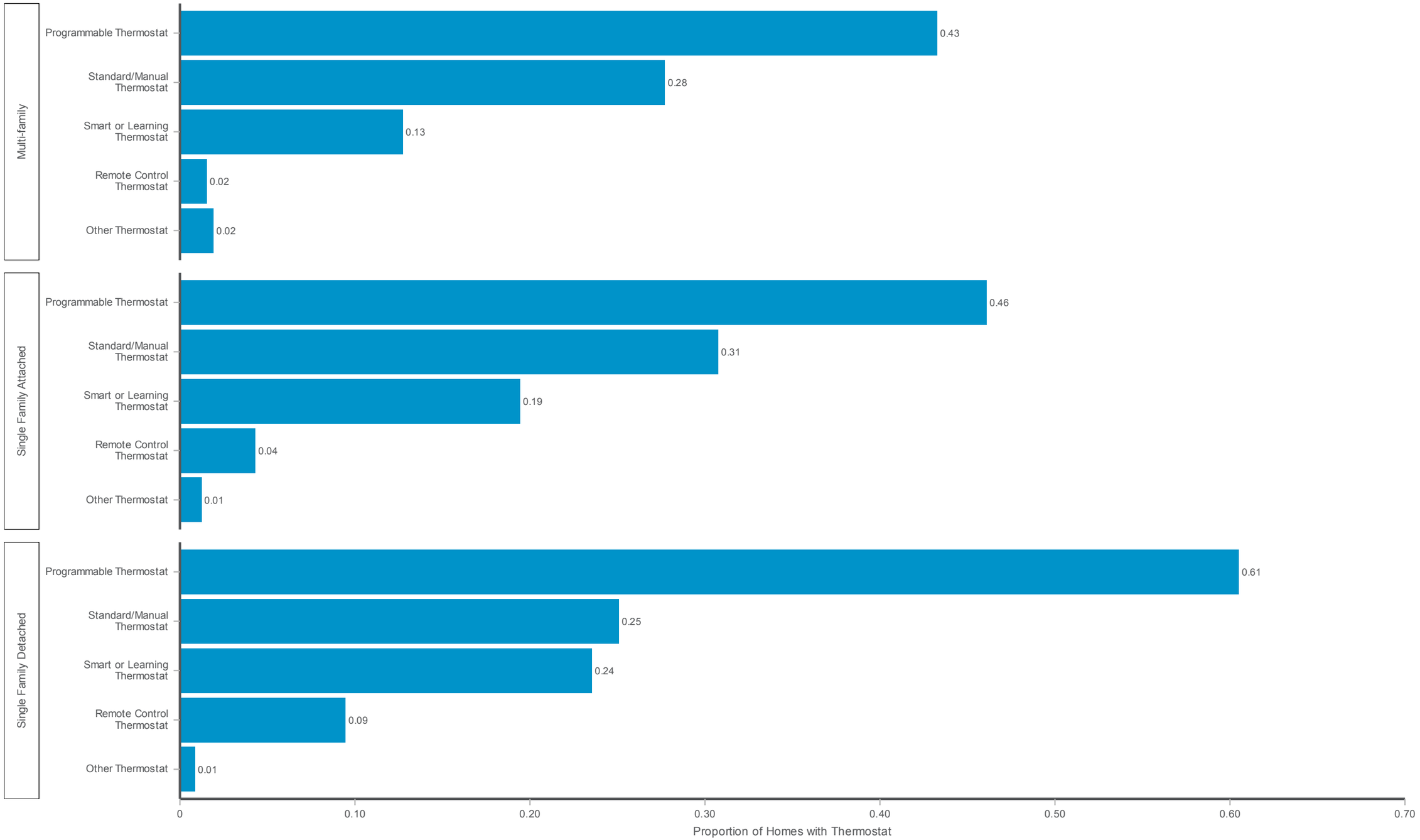
# 3 Plots by Building Type

## 3.1 Thermostat Saturation by Building Type

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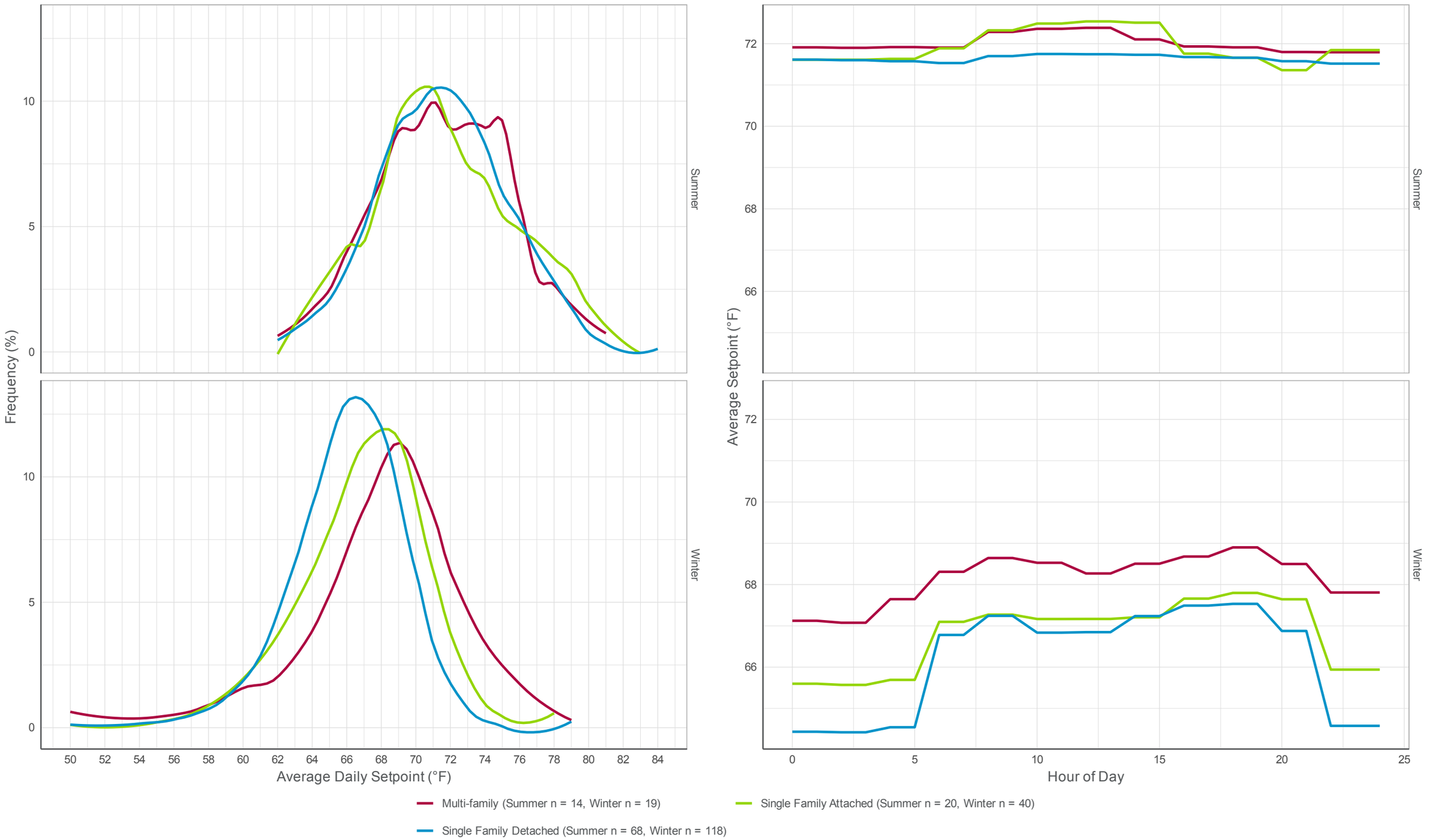
## 3.2 Reported Thermostat Setpoints by Building Type

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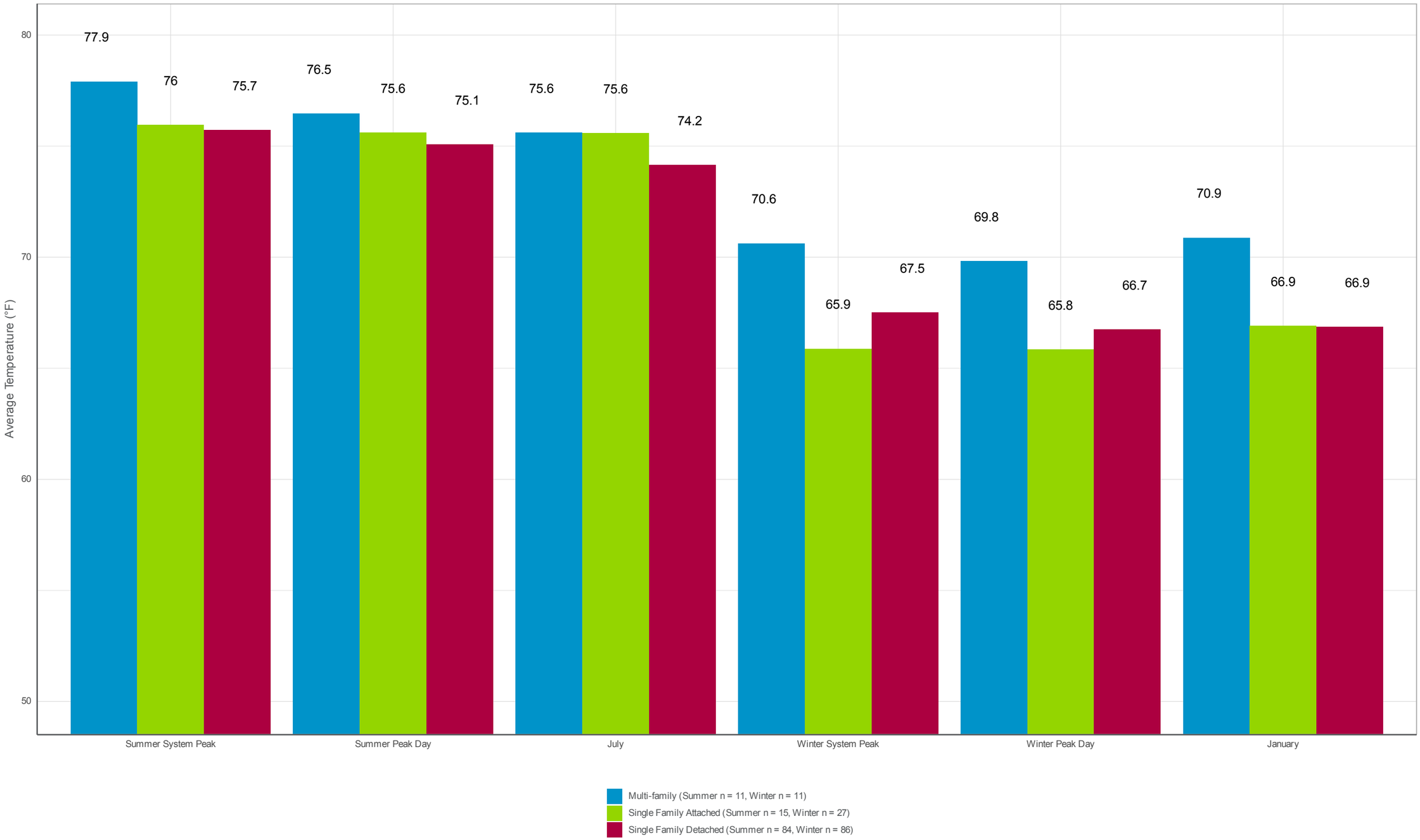
## 3.3 Metered Average Space Temperatures by Building Type

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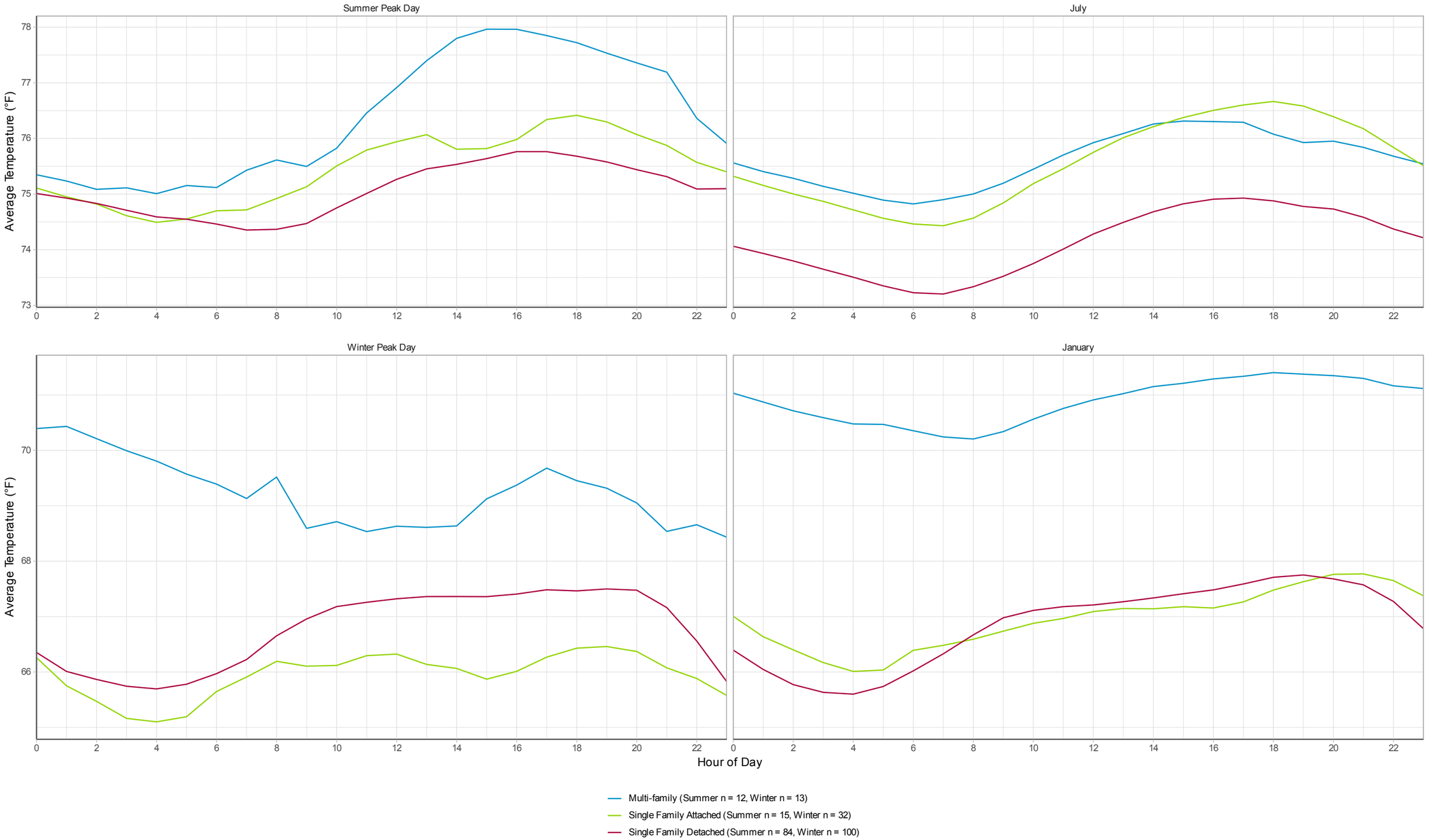
## 3.4 Metered Hourly Space Temperatures by Building Type

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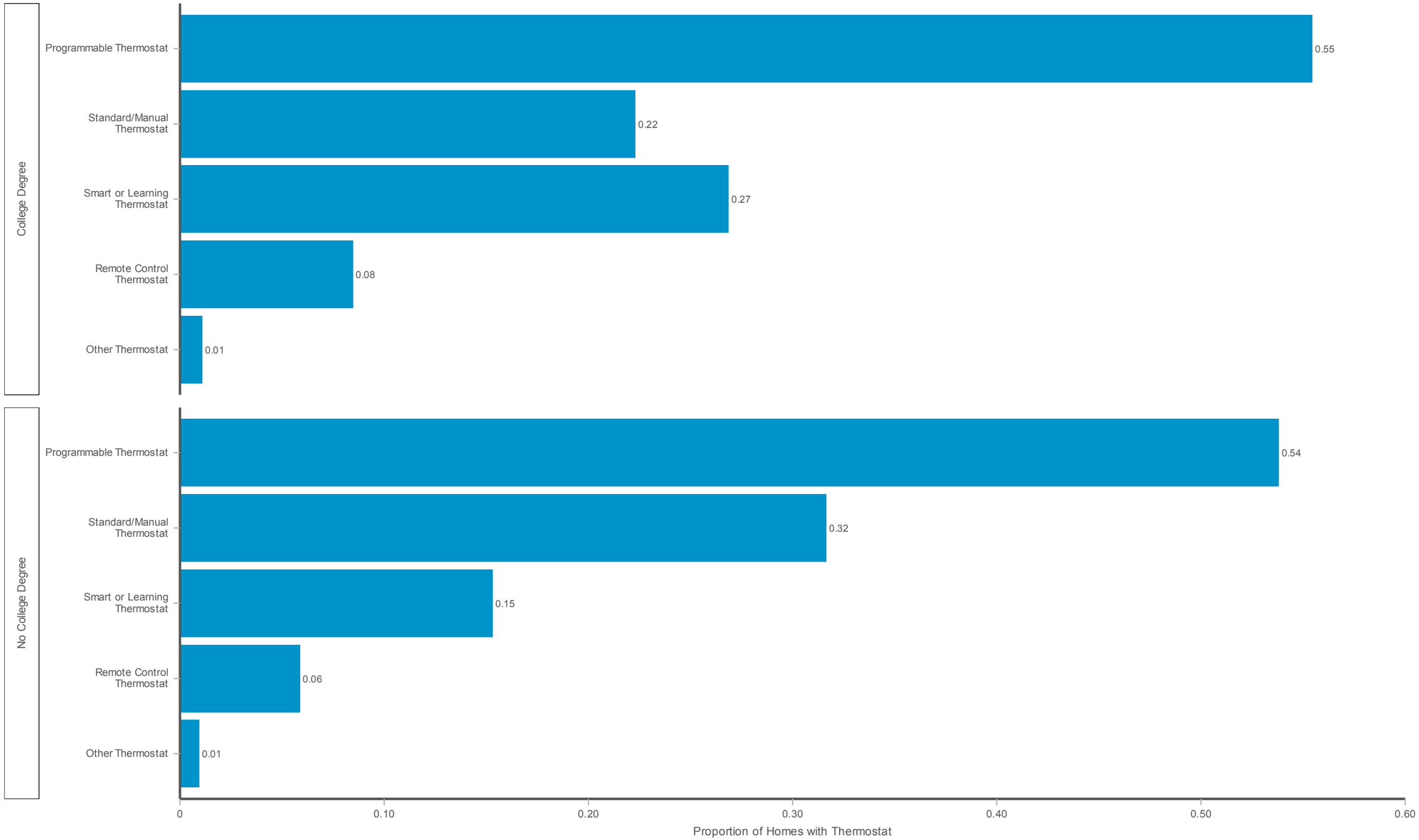
# 4 Plots by Education Level

## 4.1 Thermostat Saturation by Education Level

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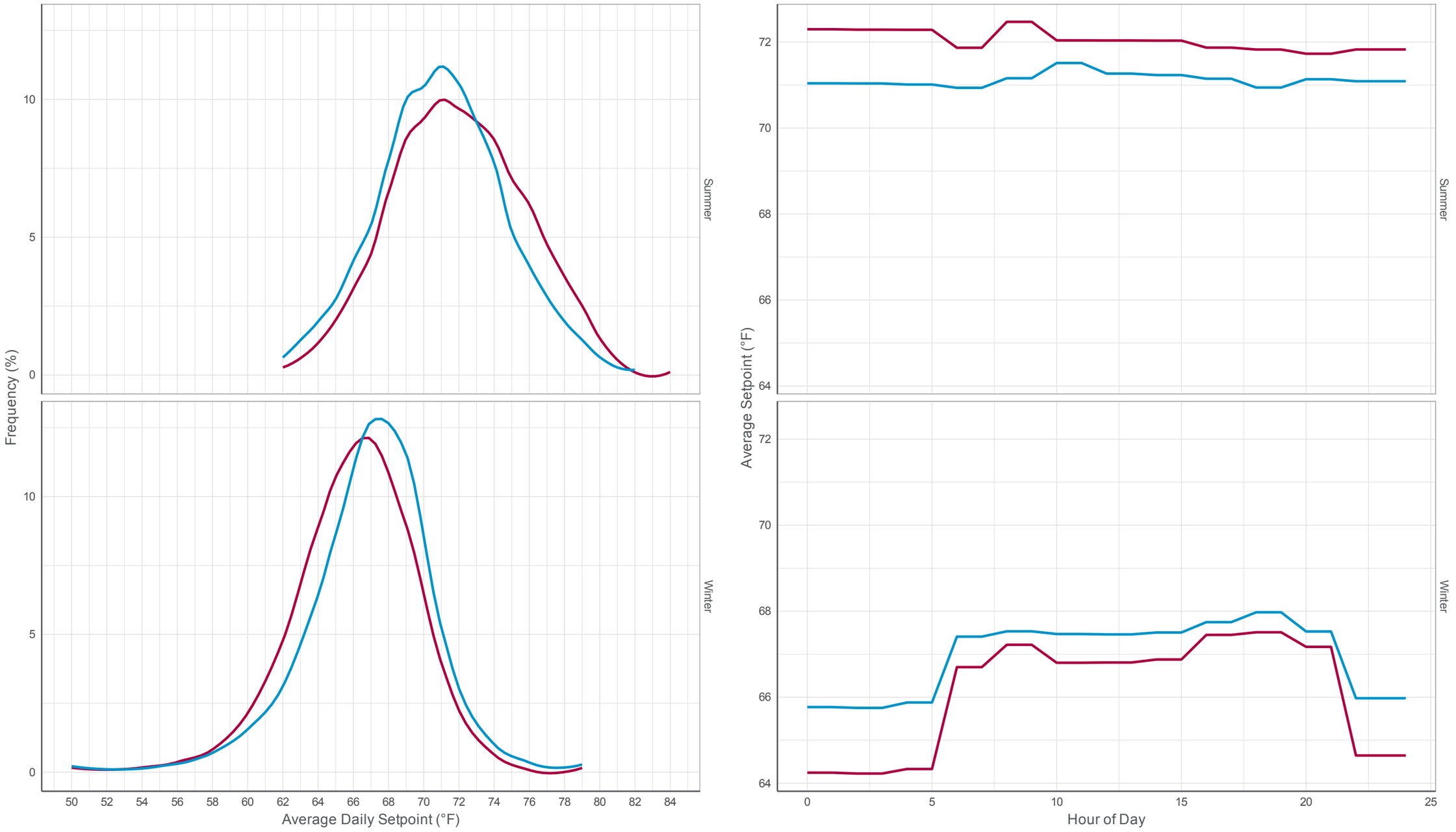
## 4.2 Reported Thermostat Setpoints by Education Level

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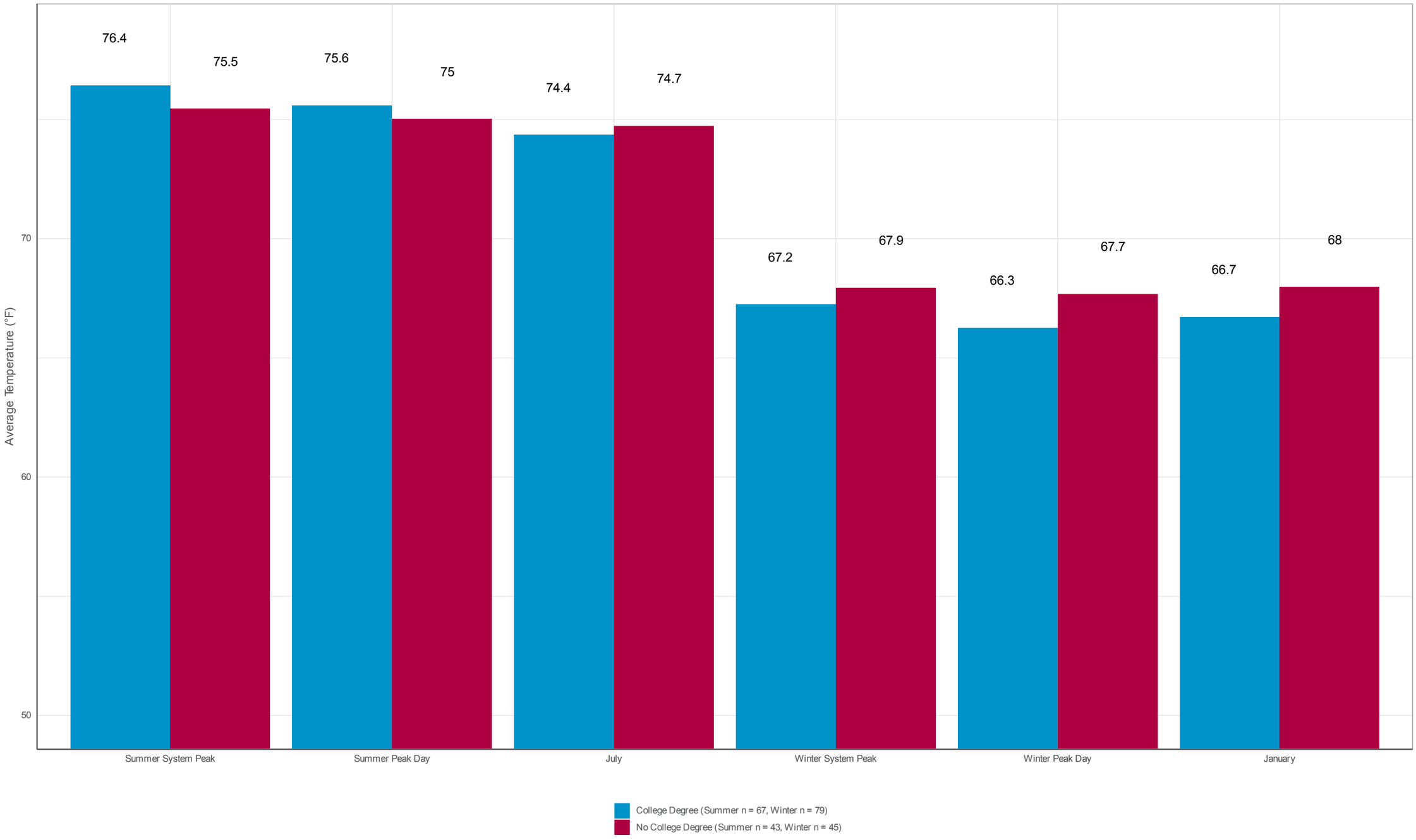
### 4.3 Metered Average Space Temperatures by Education Level

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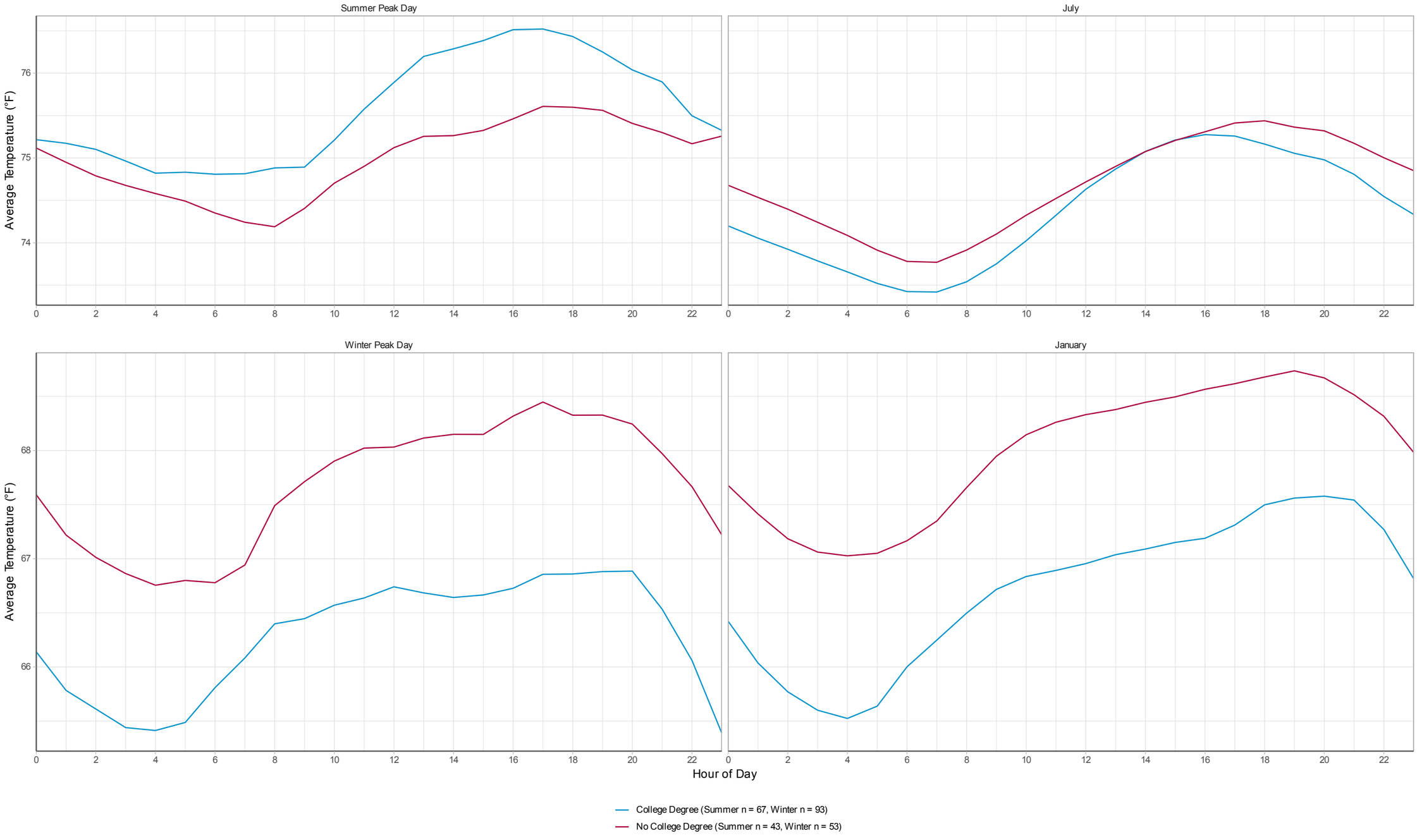
## 4.4 Metered Hourly Space Temperatures by Education Level

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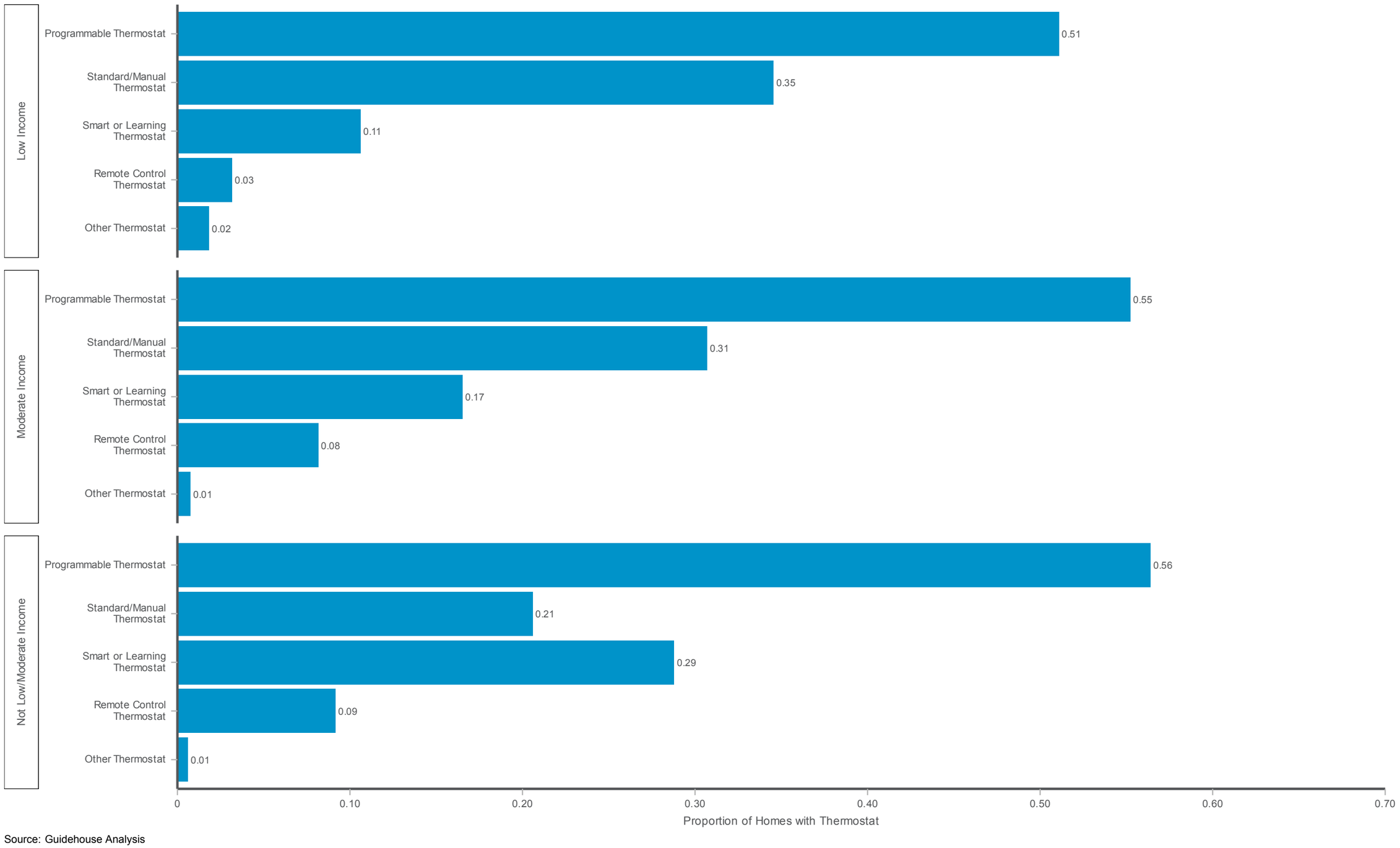
# 5 Plots by Income

## 5.1 Thermostat Saturation by Income

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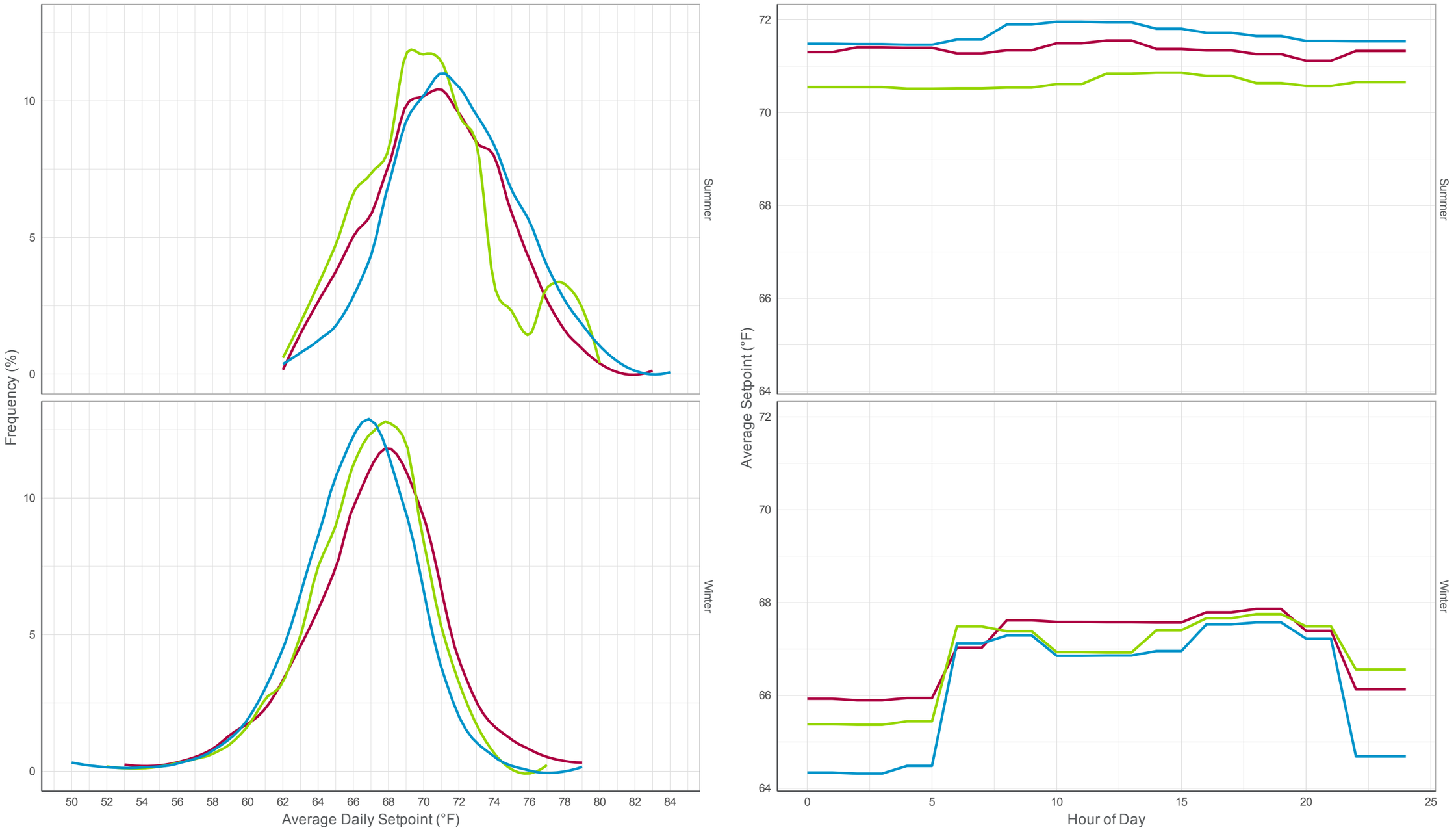
## 5.2 Reported Thermostat Setpoints by Income

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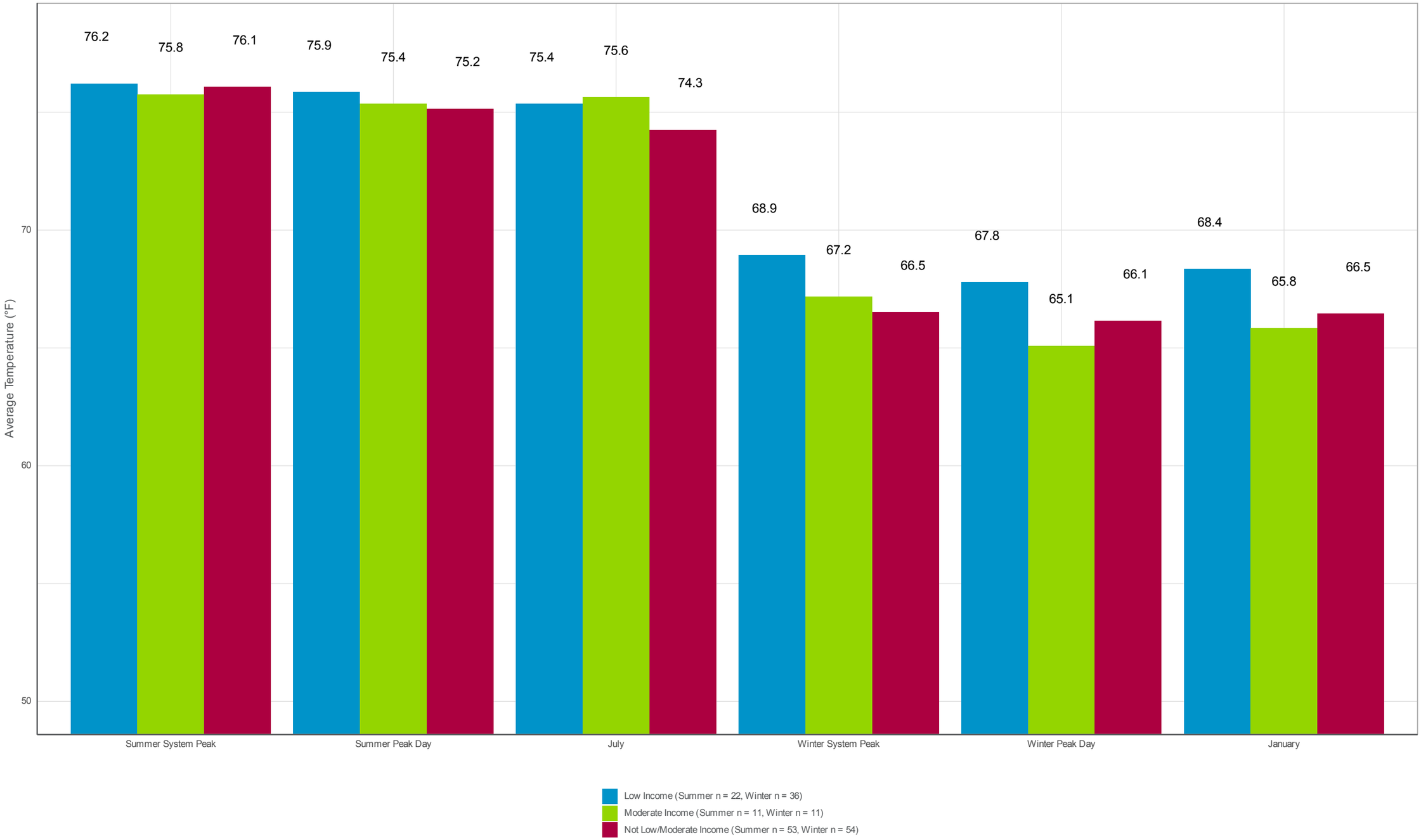
## 5.3 Metered Average Space Temperatures by Income

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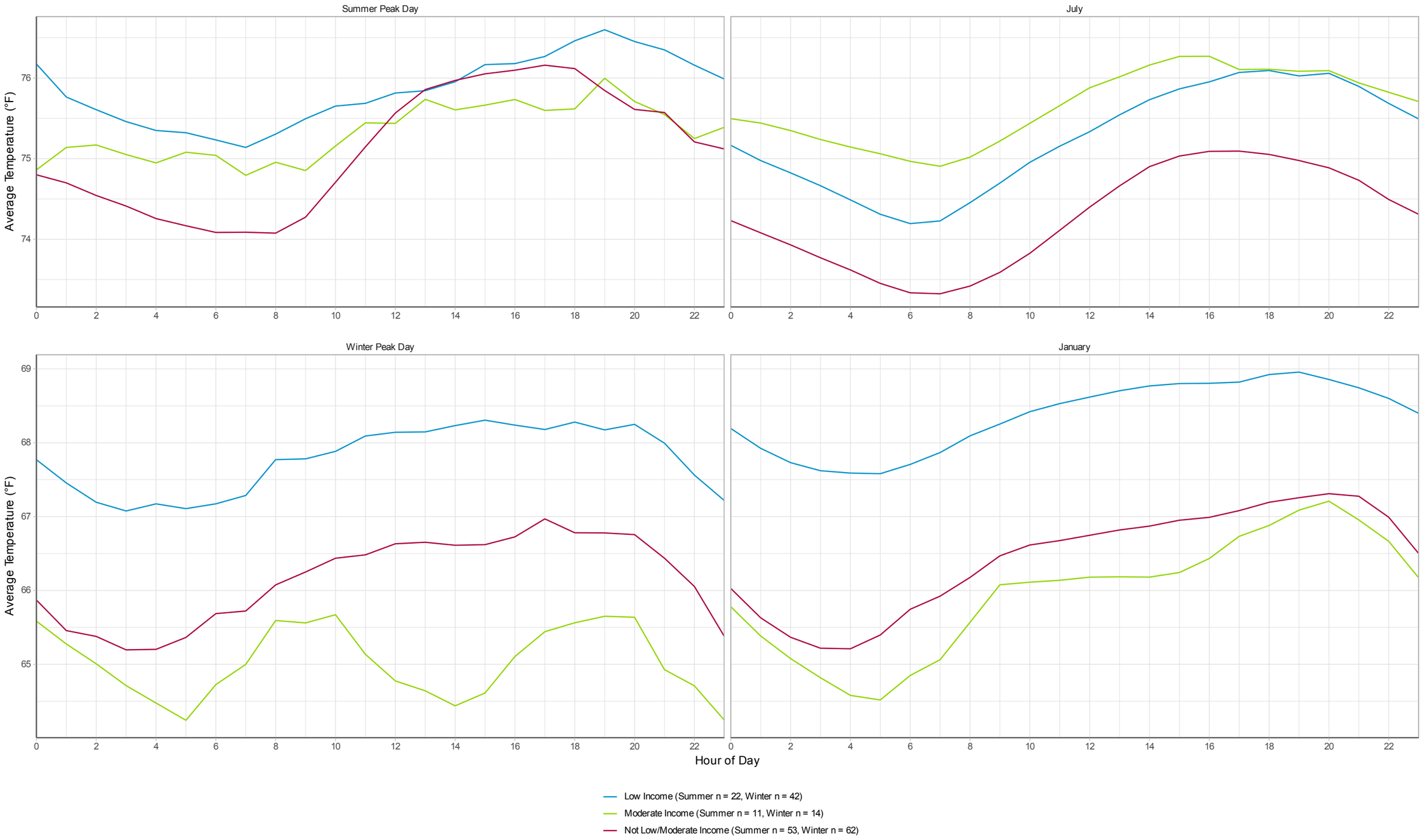
## 5.4 Metered Hourly Space Temperatures by Income

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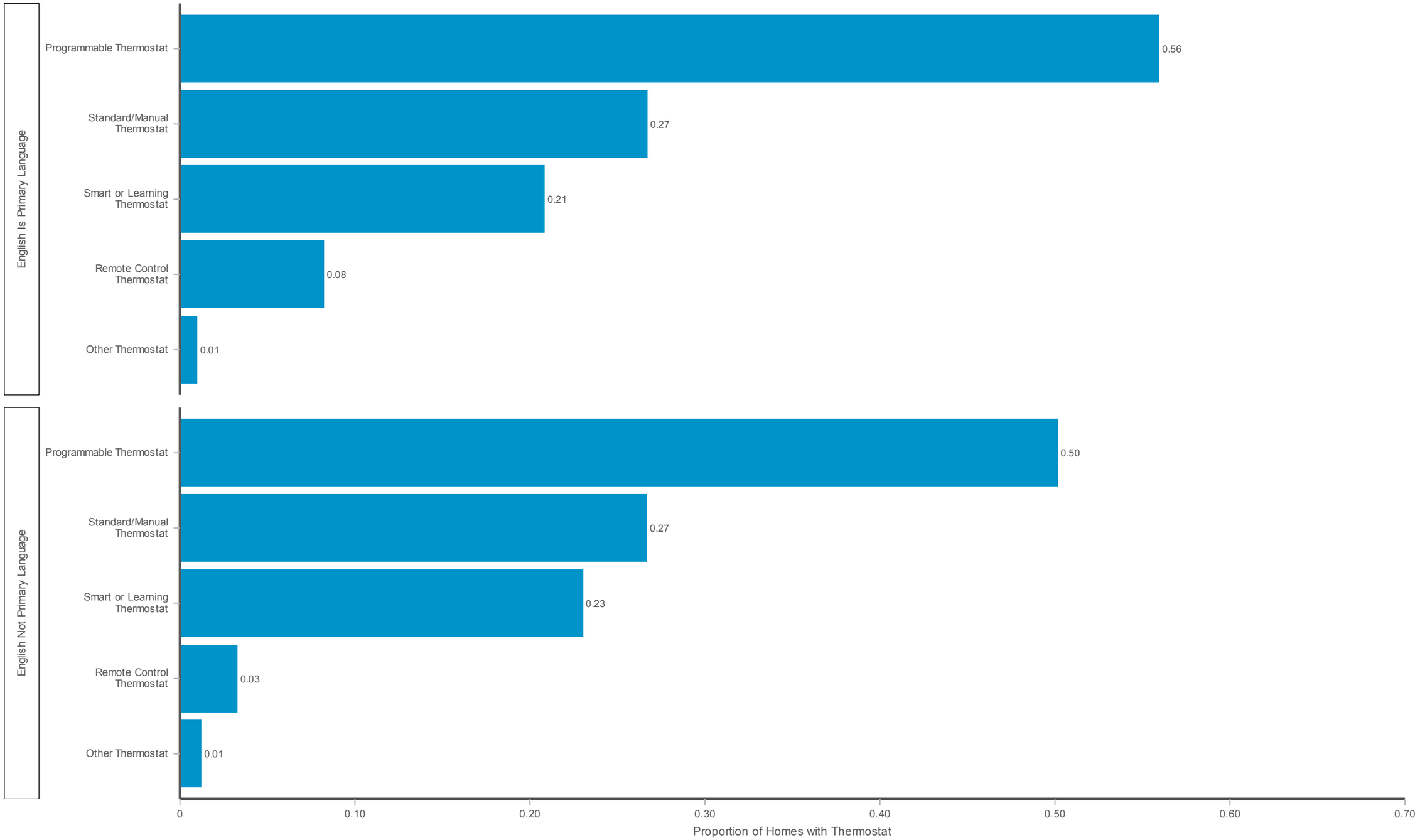
# 6 Plots by Language

## 6.1 Thermostat Saturation by Language

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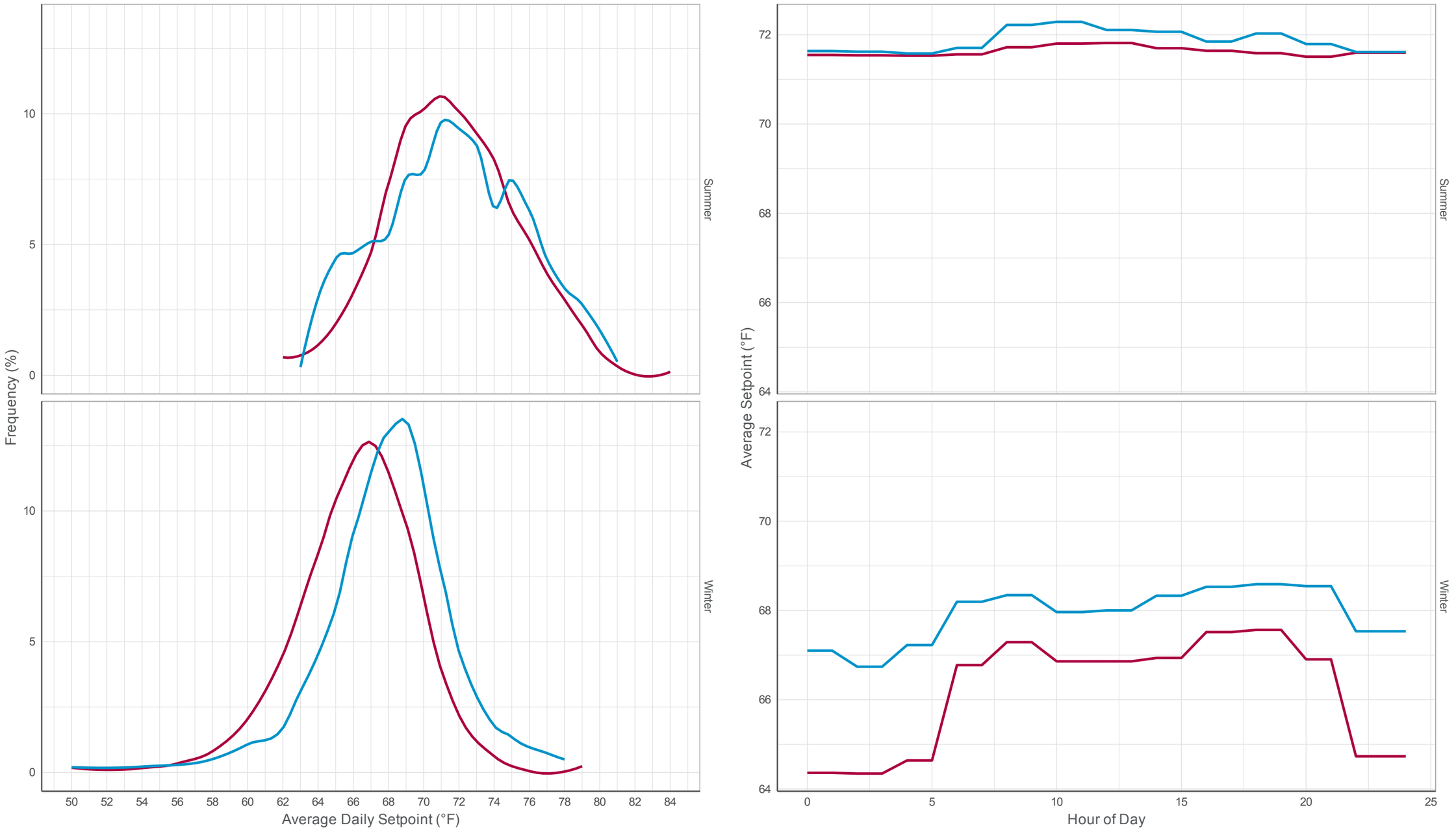
## 6.2 Reported Thermostat Setpoints by Language

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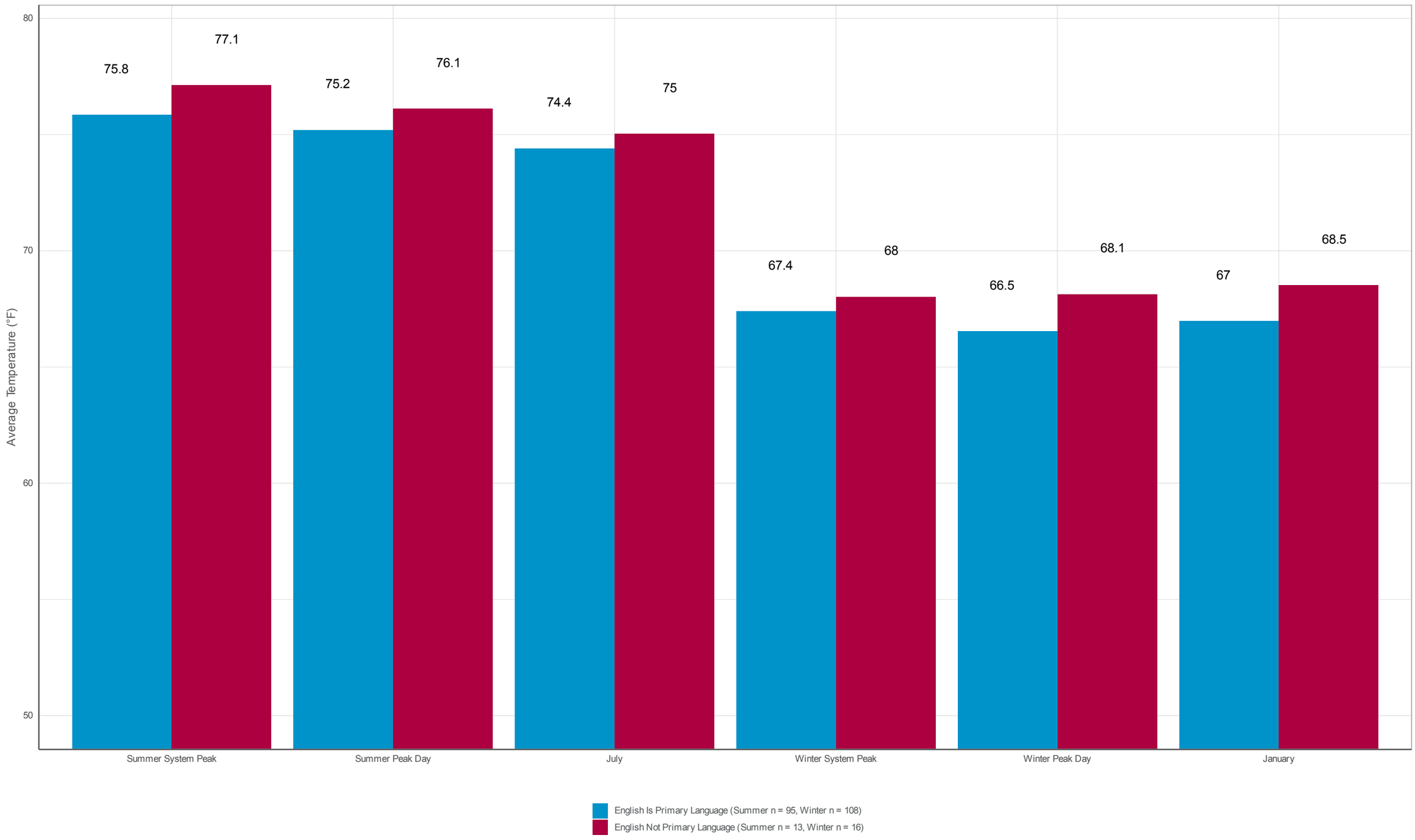
## 6.3 Metered Average Space Temperatures by Language

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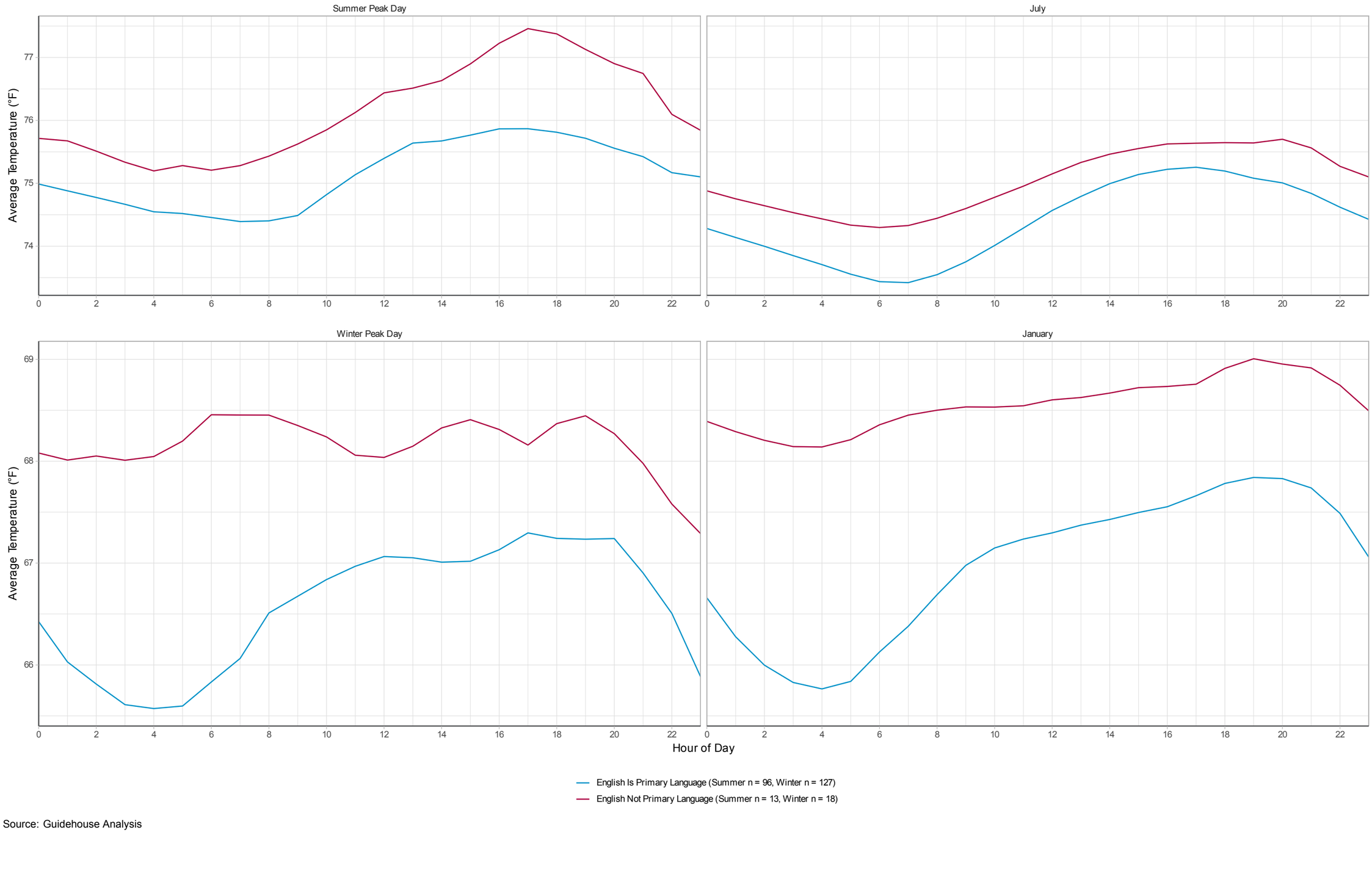
## 6.4 Metered Hourly Space Temperatures by Language

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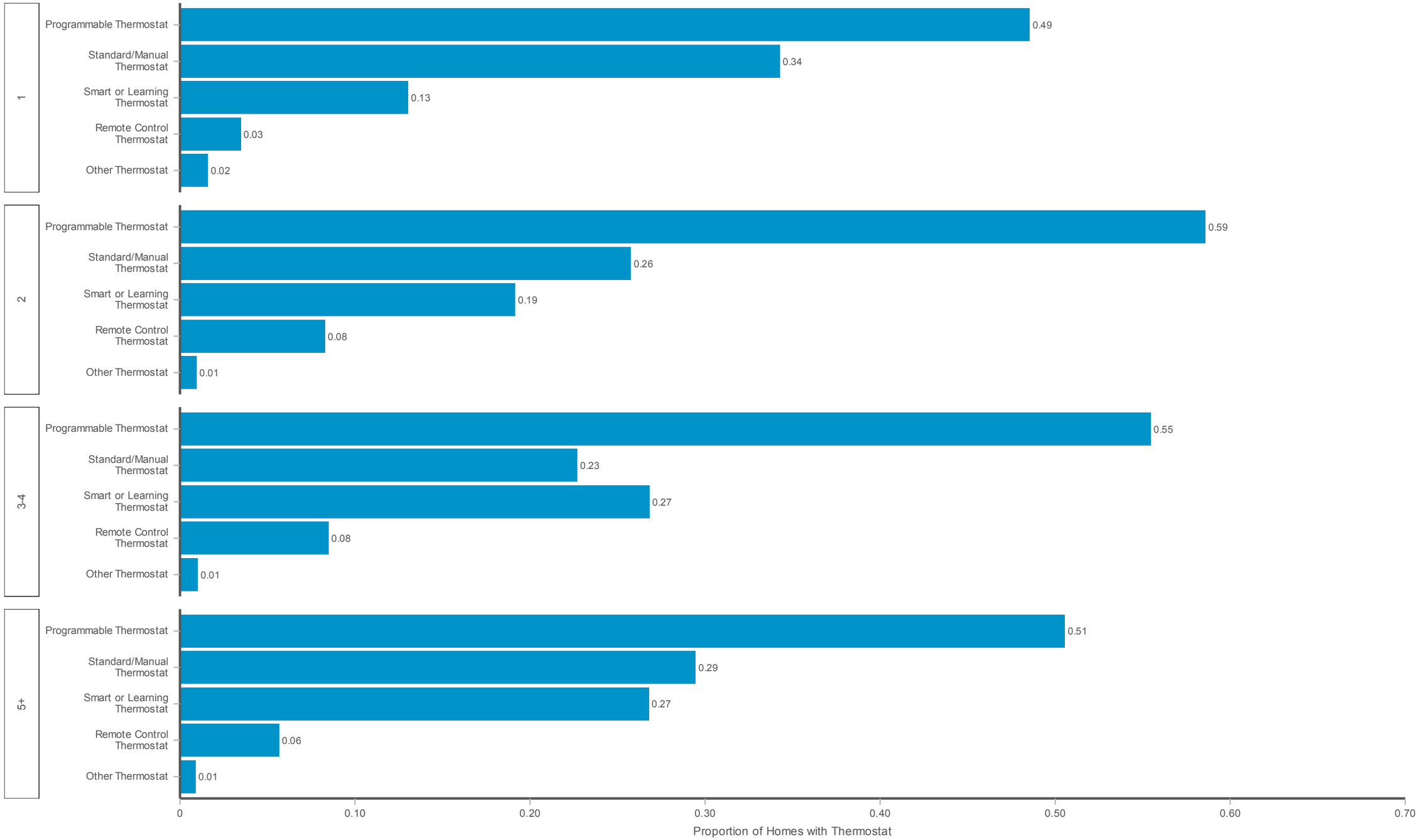
# 7 Plots by Number of Occupants

## 7.1 Thermostat Saturation by Number of Occupants

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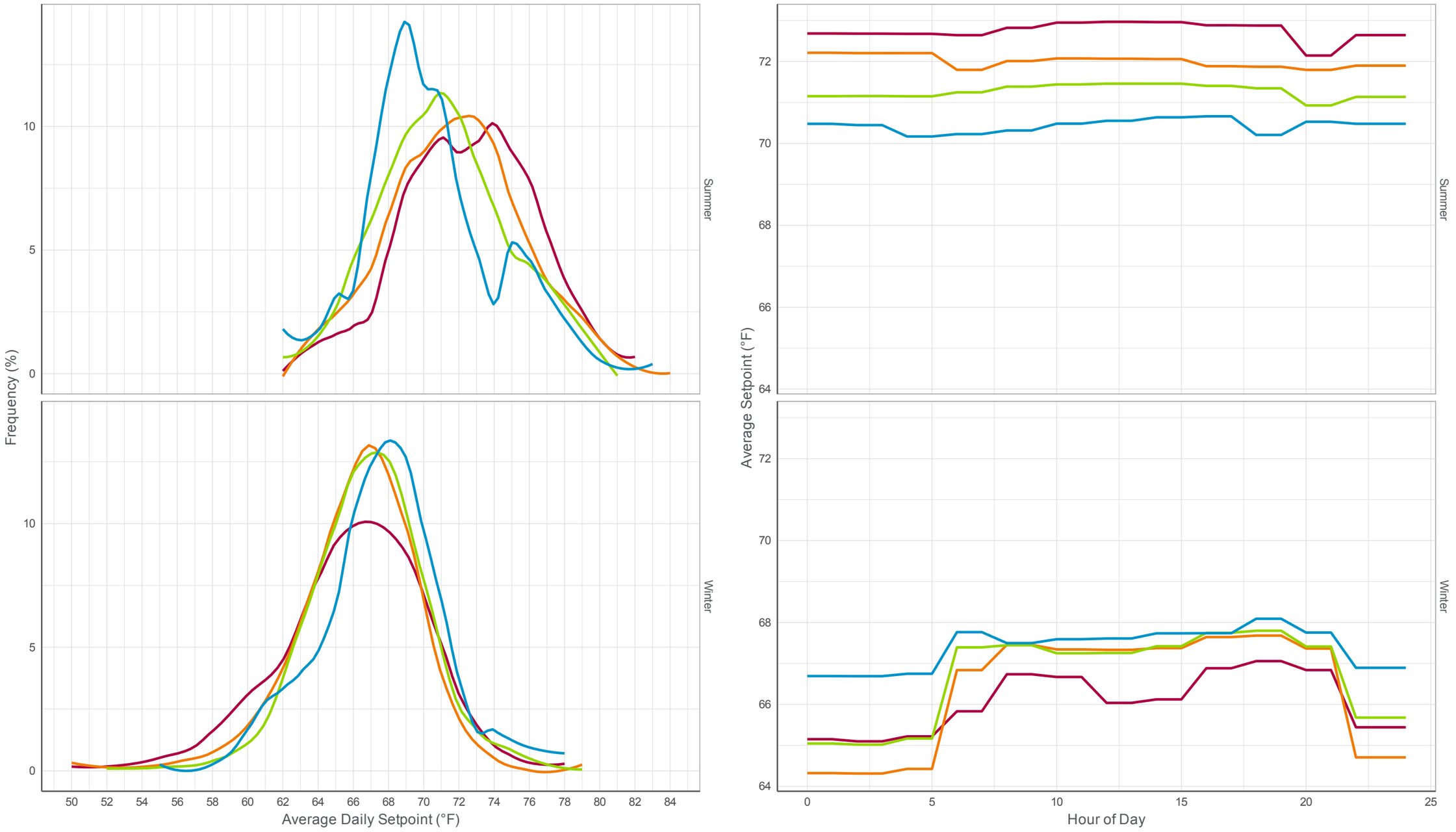
## 7.2 Reported Thermostat Setpoints by Number of Occupants

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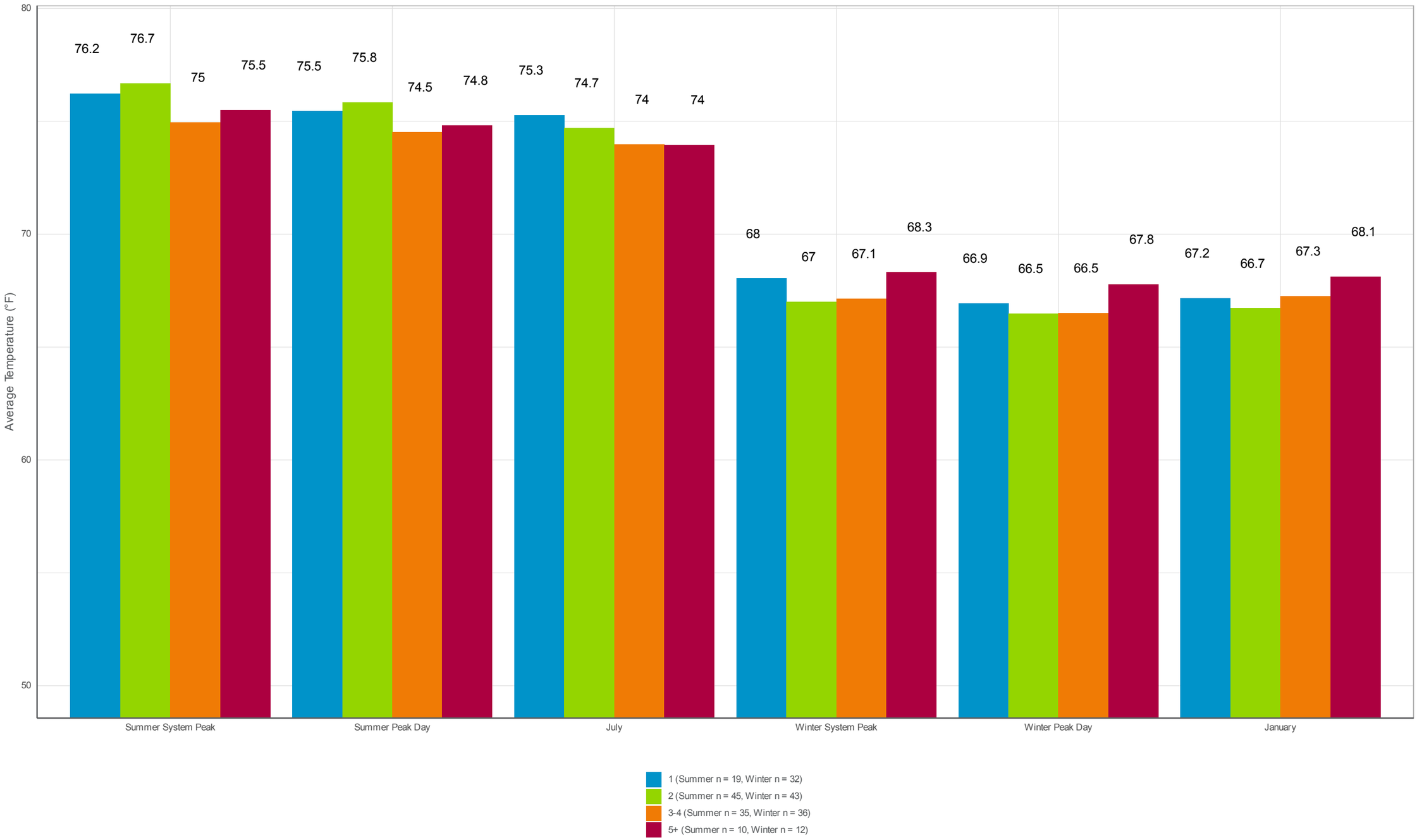
## 7.3 Metered Average Space Temperatures by Number of Occupants

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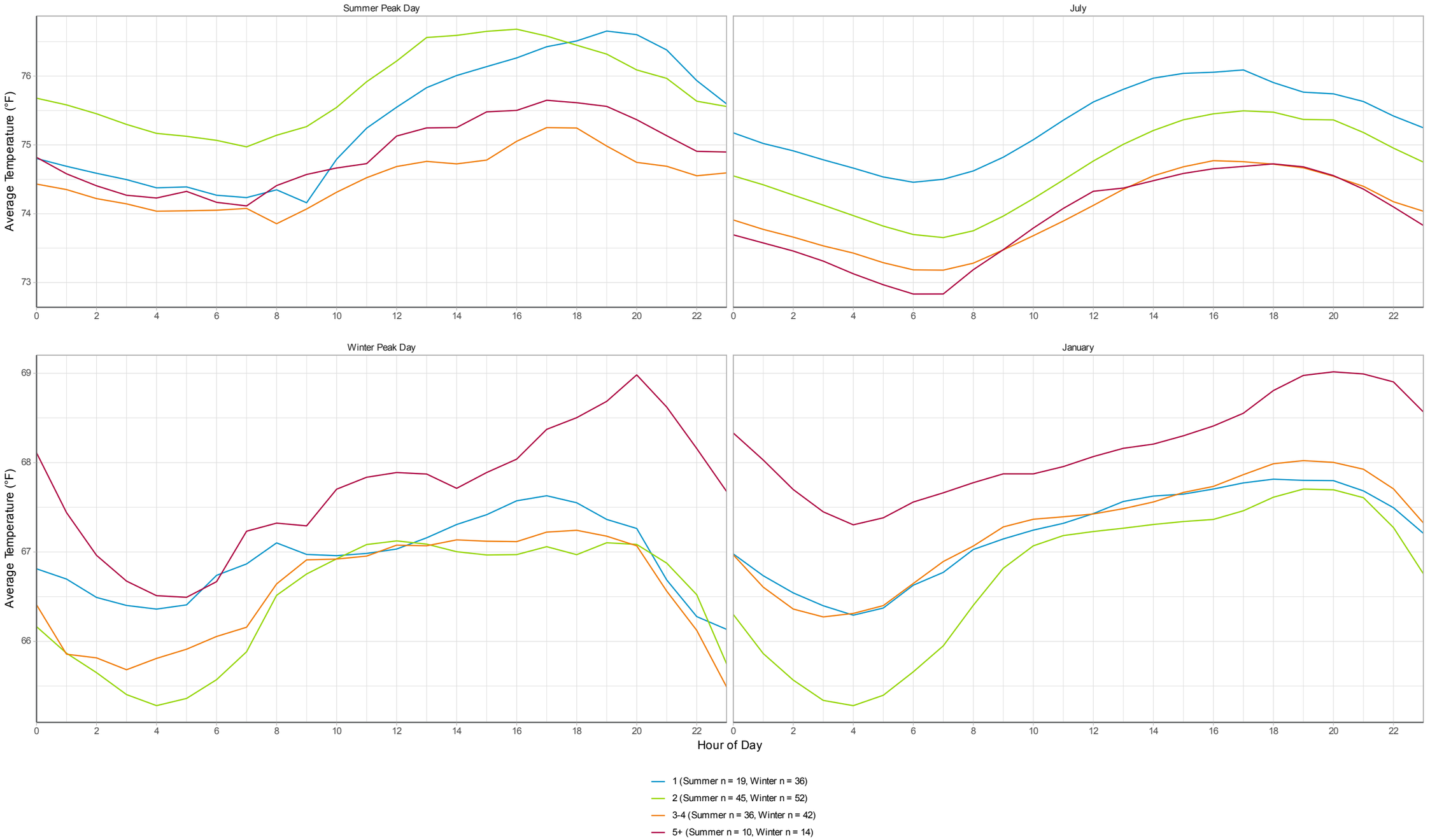
## 7.4 Metered Hourly Space Temperatures by Number of Occupants

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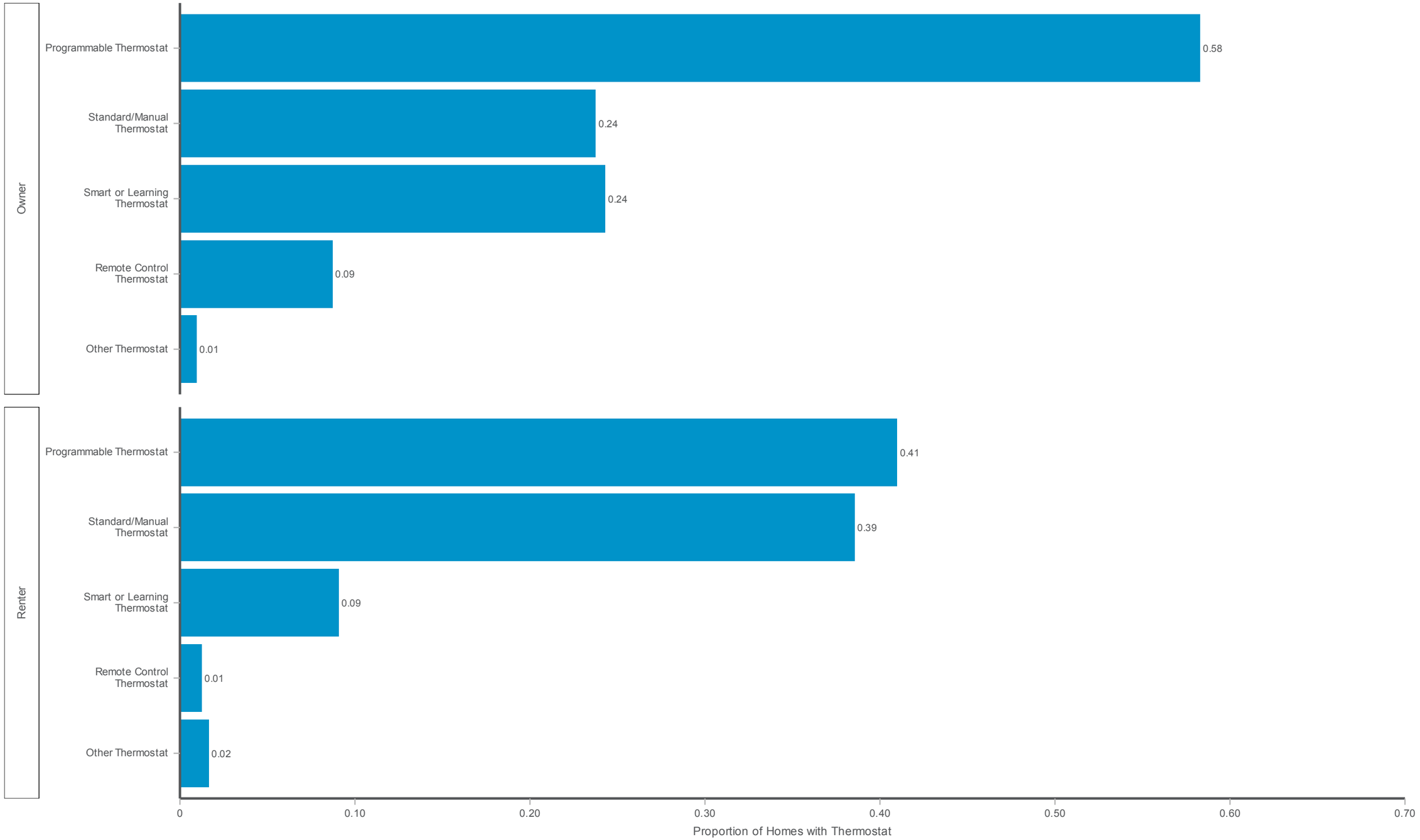
# 8 Plots by Occupancy Type

## 8.1 Thermostat Saturation by Occupancy Type

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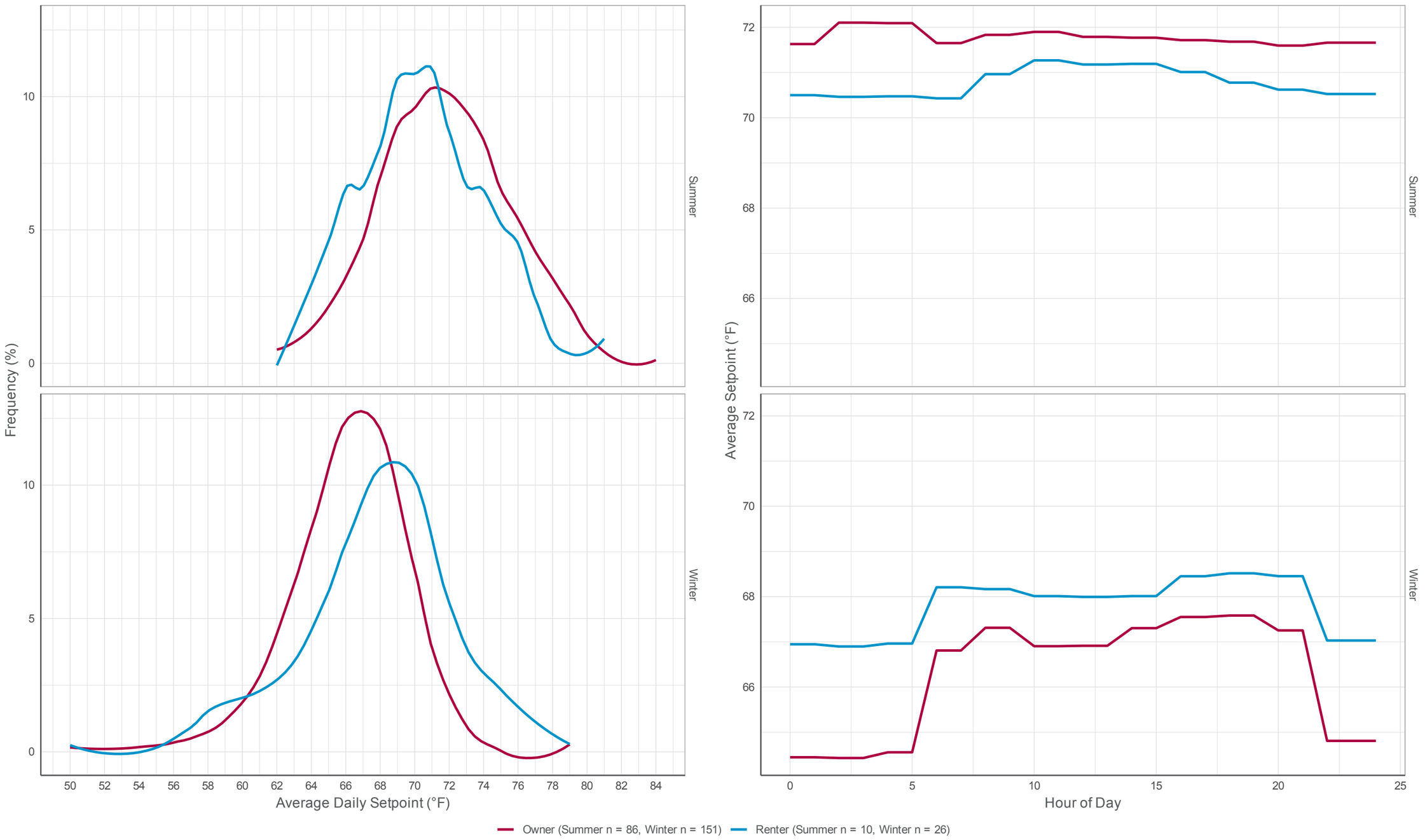
## 8.2 Reported Thermostat Setpoints by Occupancy Type

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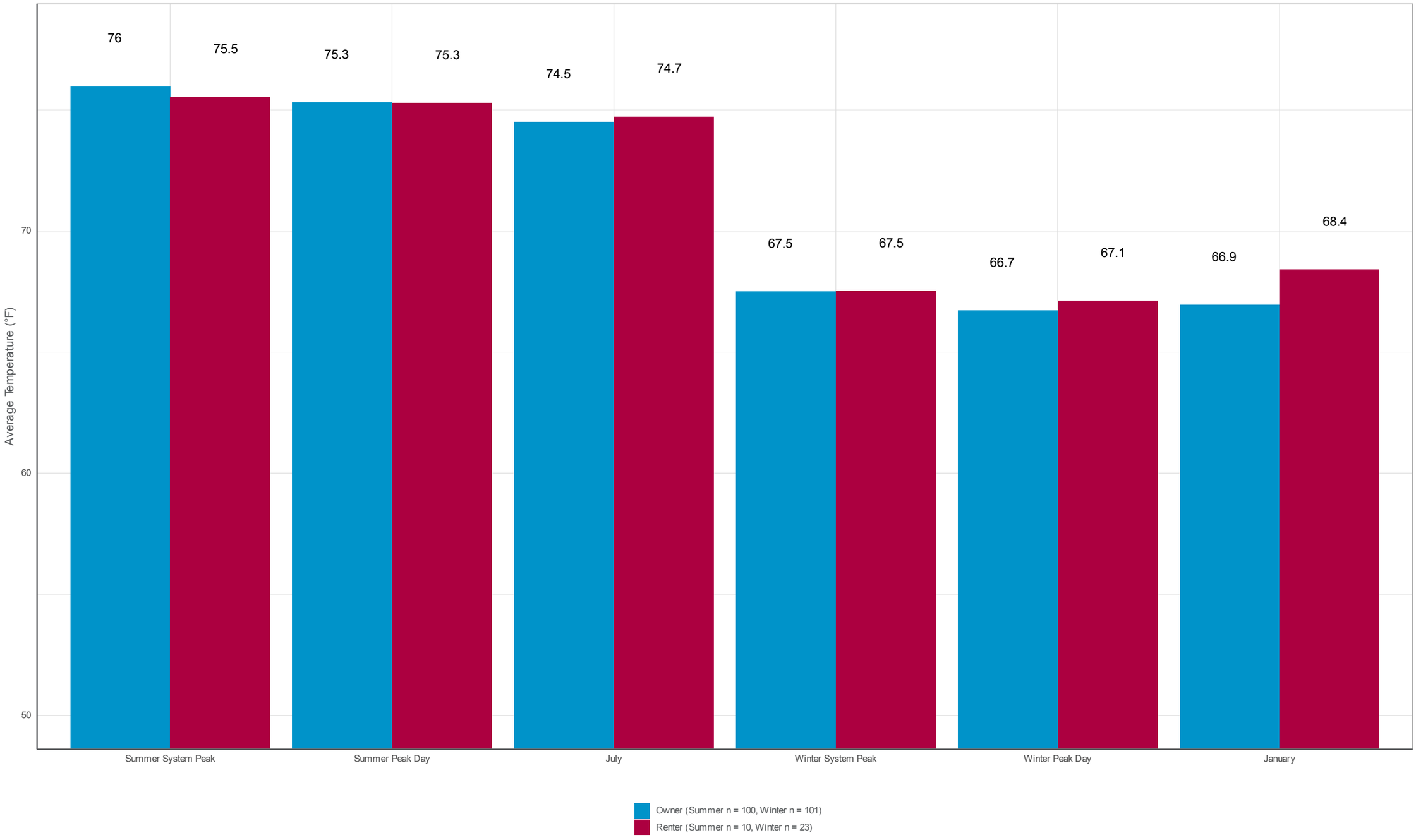
## 8.3 Metered Average Space Temperatures by Occupancy Type

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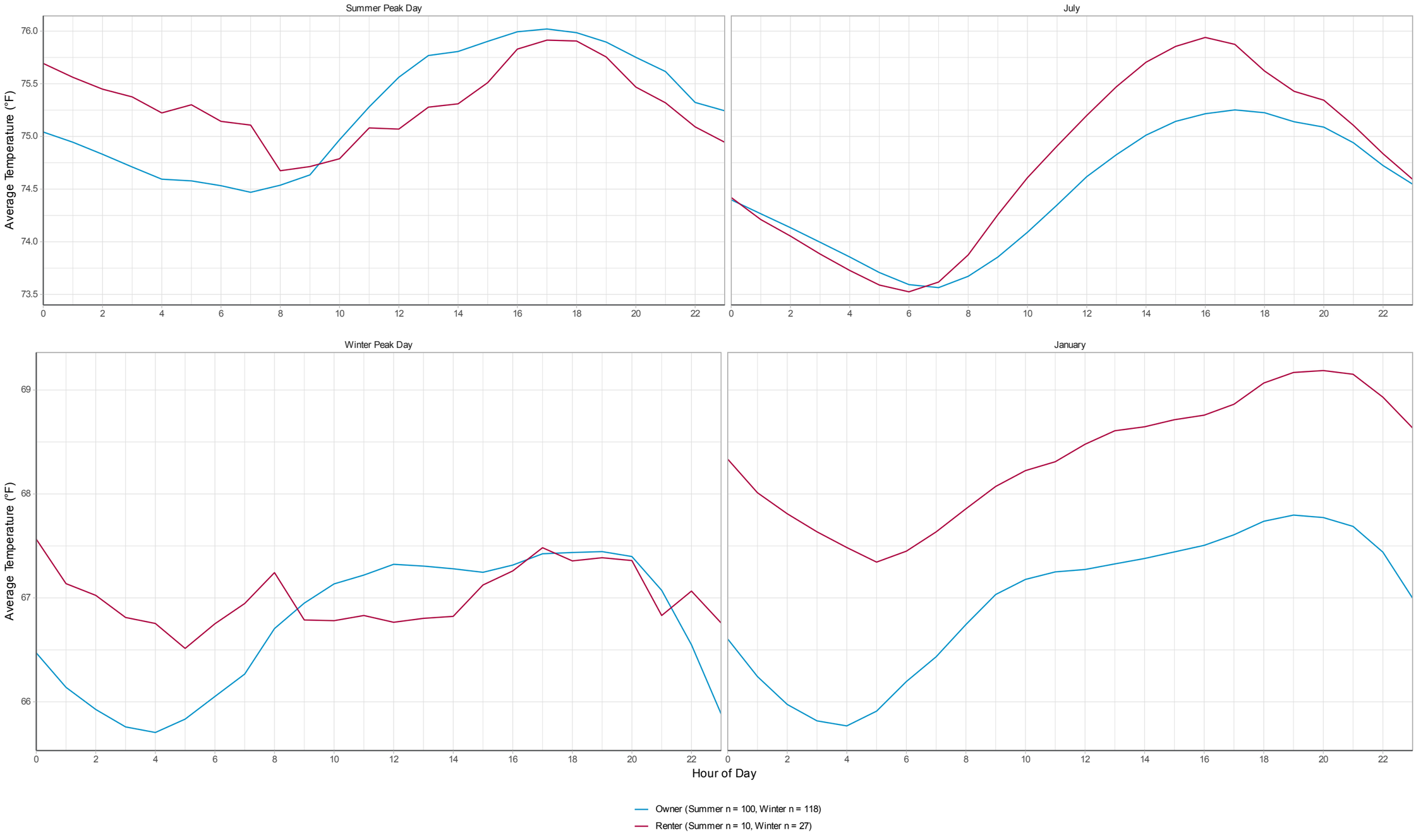
## 8.4 Metered Hourly Space Temperatures by Occupancy Type

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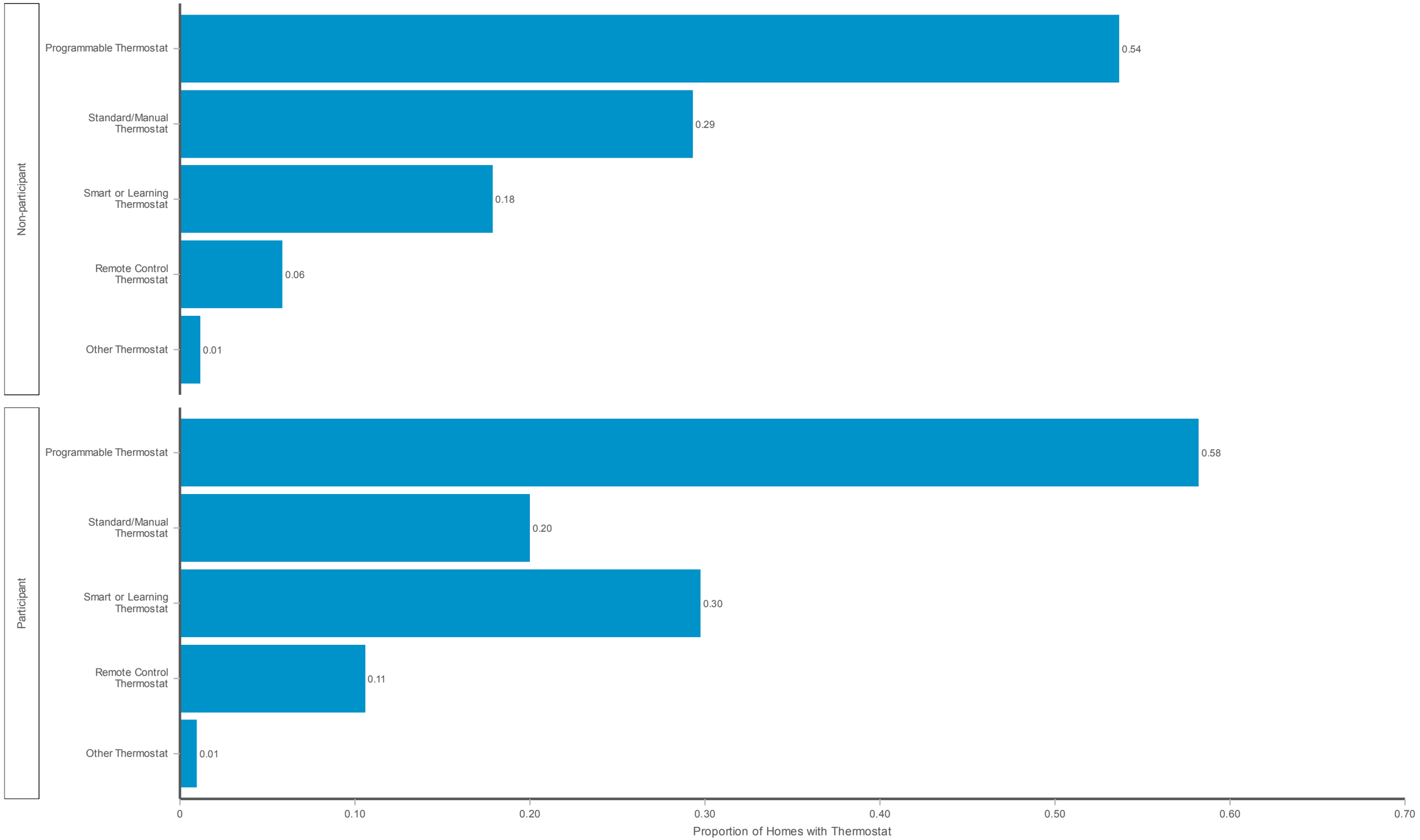
# 9 Plots by Program Participation

## 9.1 Thermostat Saturation by Program Participation

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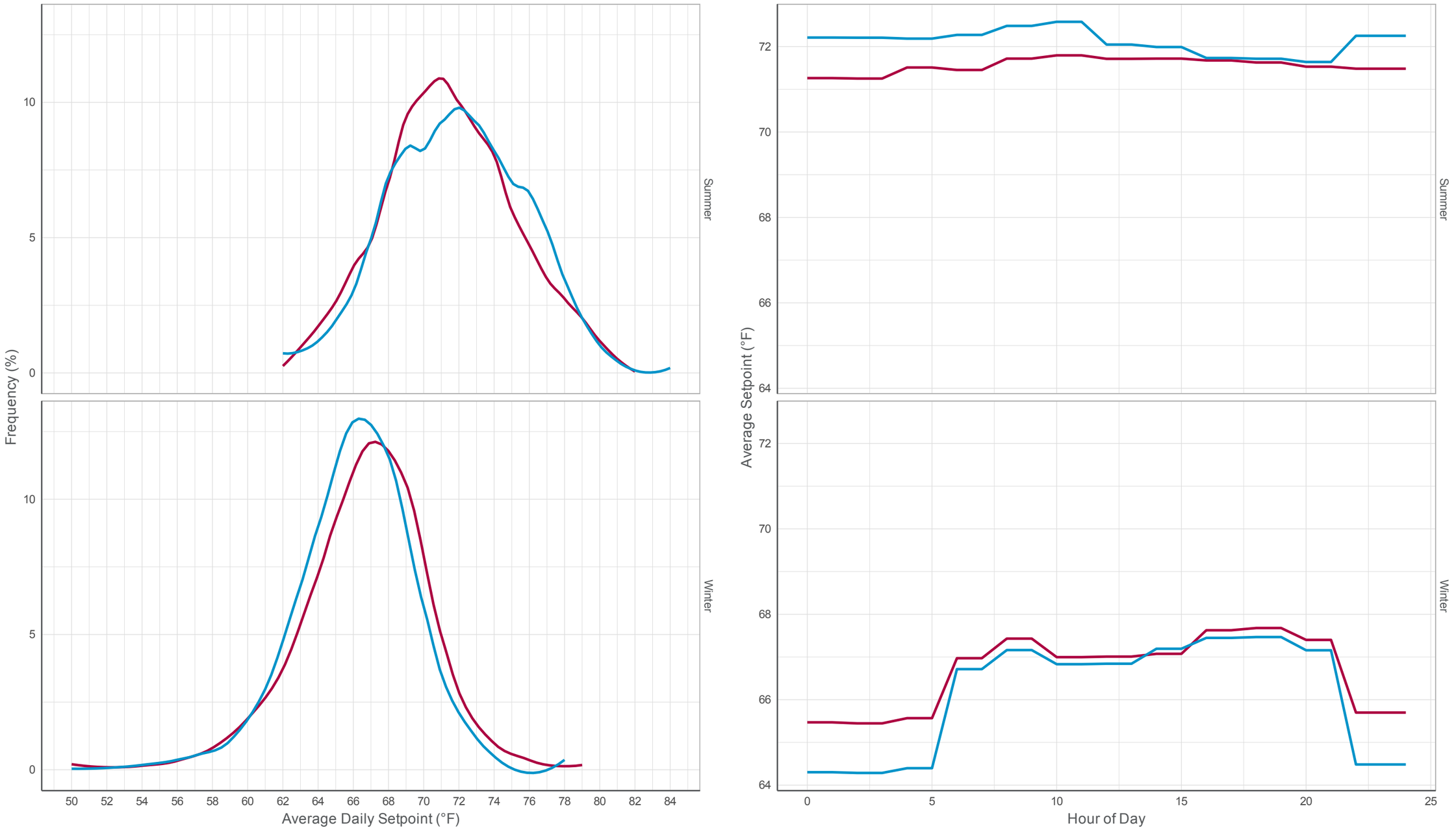
## 9.2 Reported Thermostat Setpoints by Program Participation

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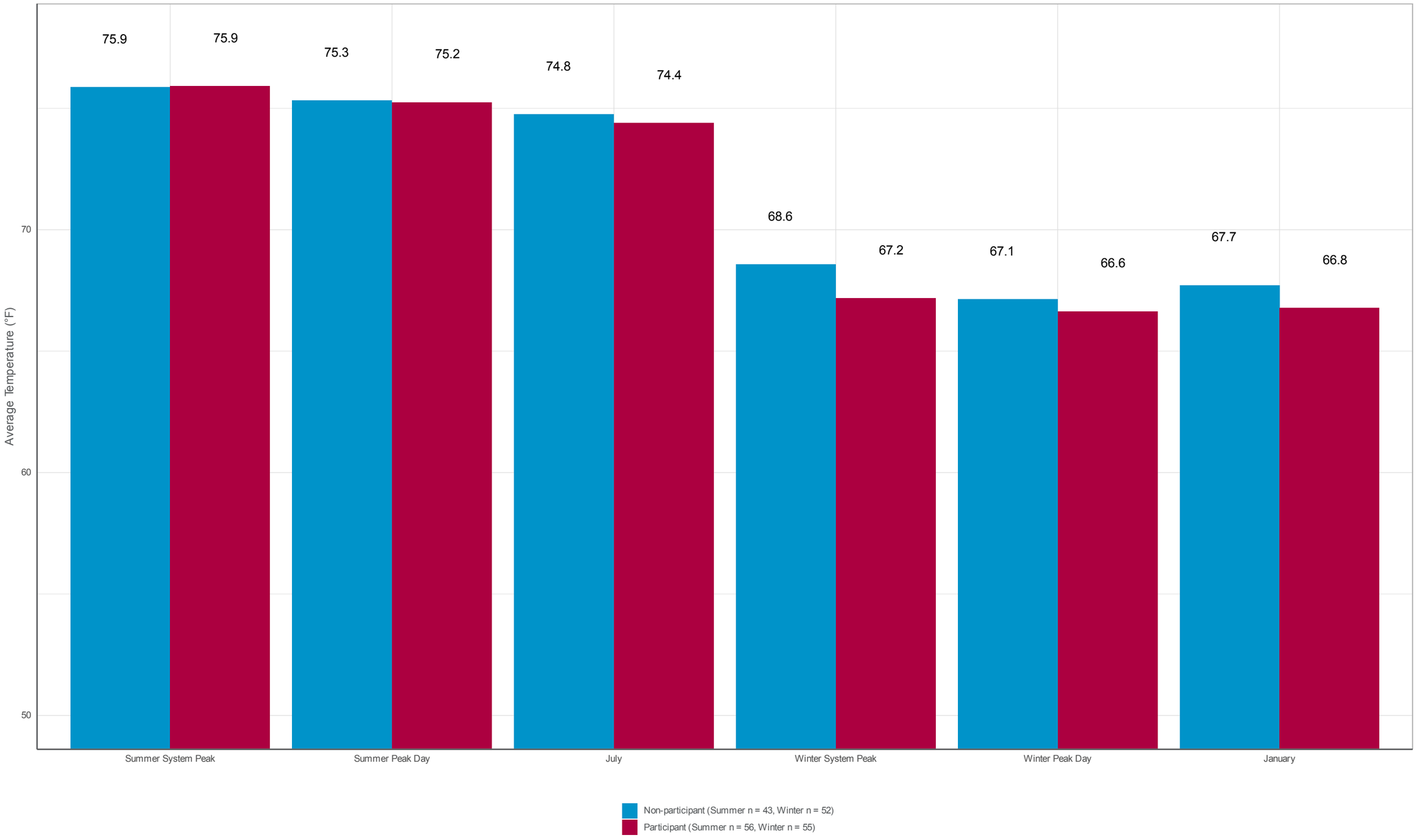
## 9.3 Metered Average Space Temperatures by Program Participation

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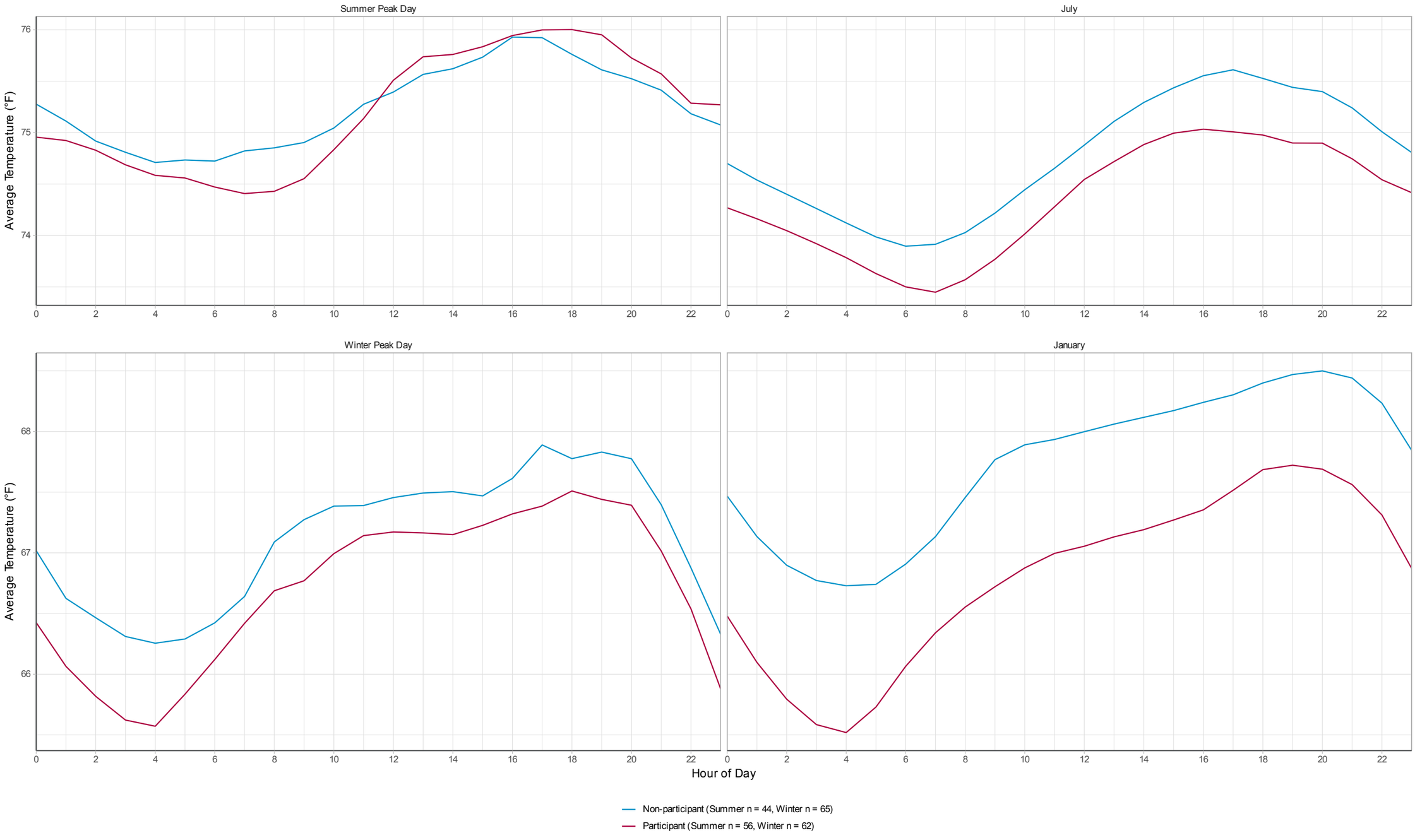
## 9.4 Metered Hourly Space Temperatures by Program Participation

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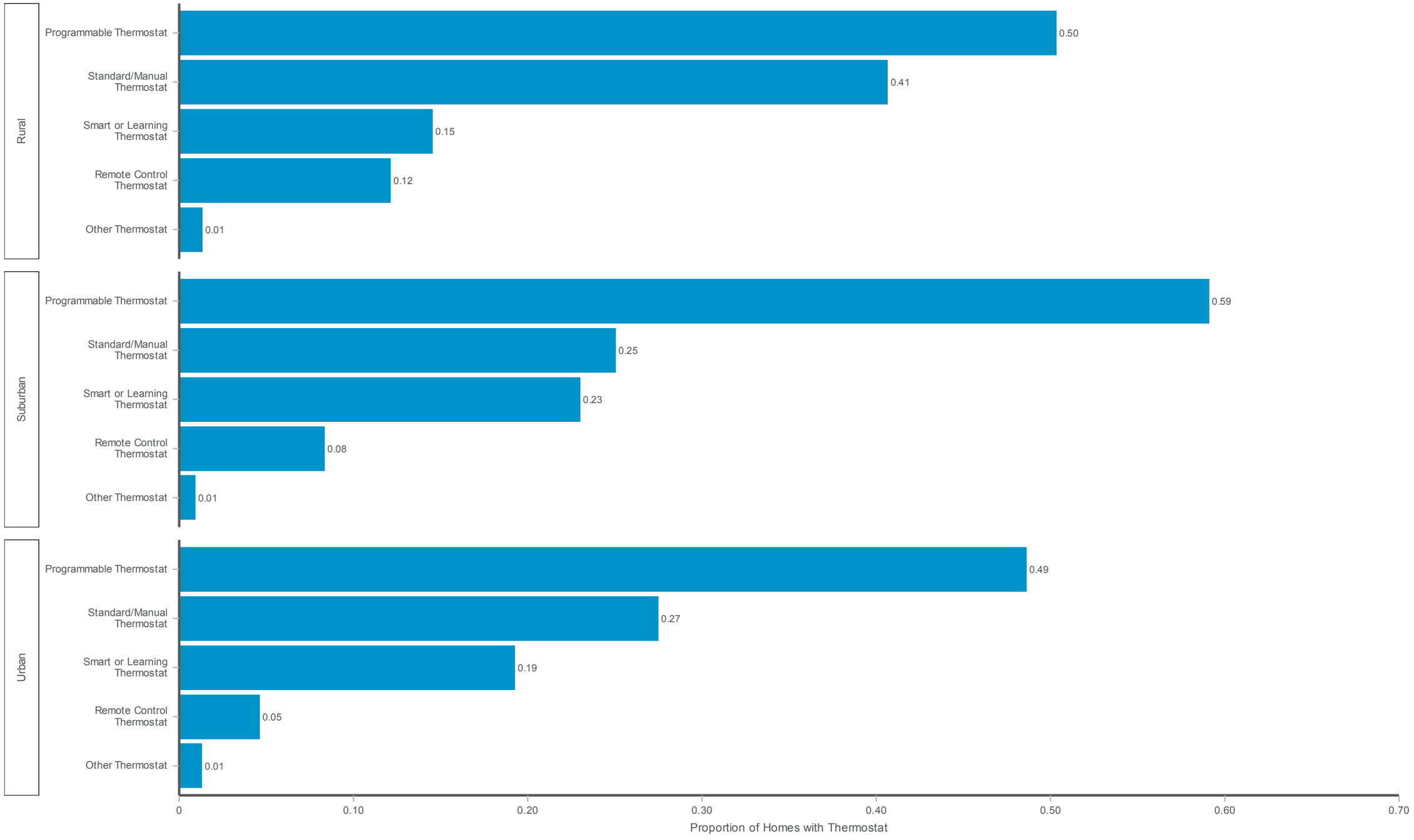
# 10 Plots by Population Density

## 10.1 Thermostat Saturation by Population Density

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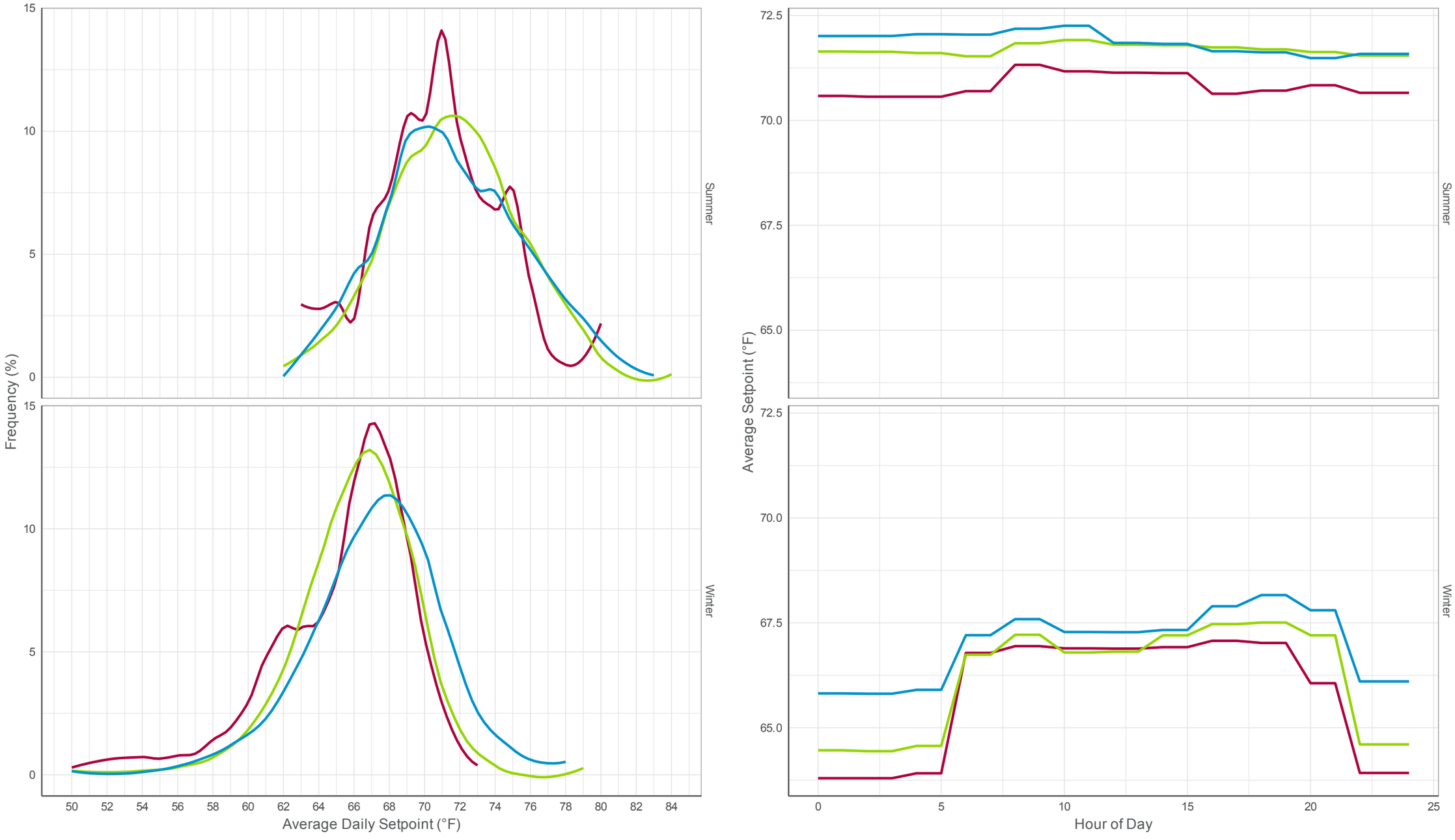
## 10.2 Reported Thermostat Setpoints by Population Density

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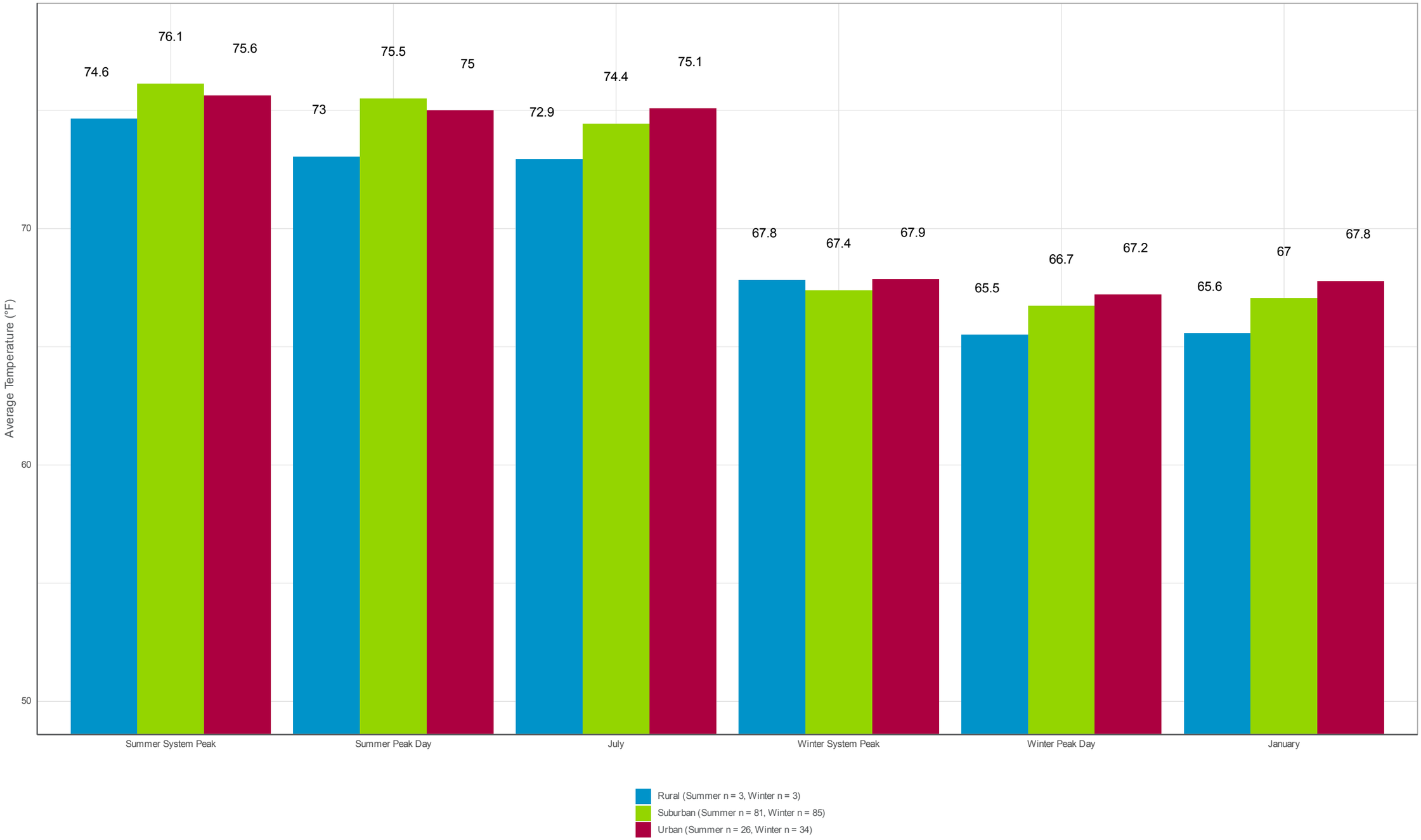
## 10.3 Metered Average Space Temperatures by Population Density




Source: Guidehouse Analysis

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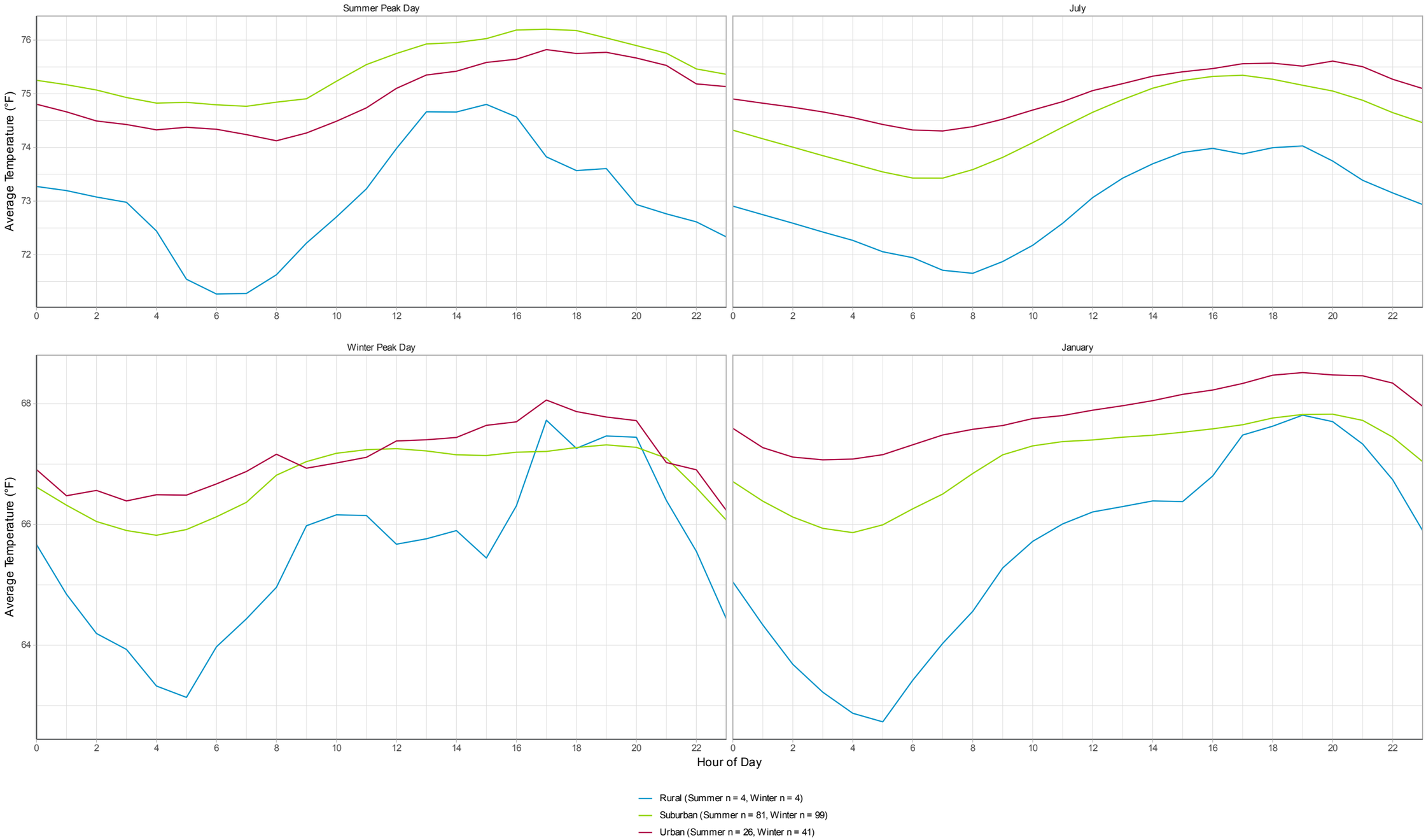
## 10.4 Metered Hourly Space Temperatures by Population Density




Source: Guidehouse Analysis

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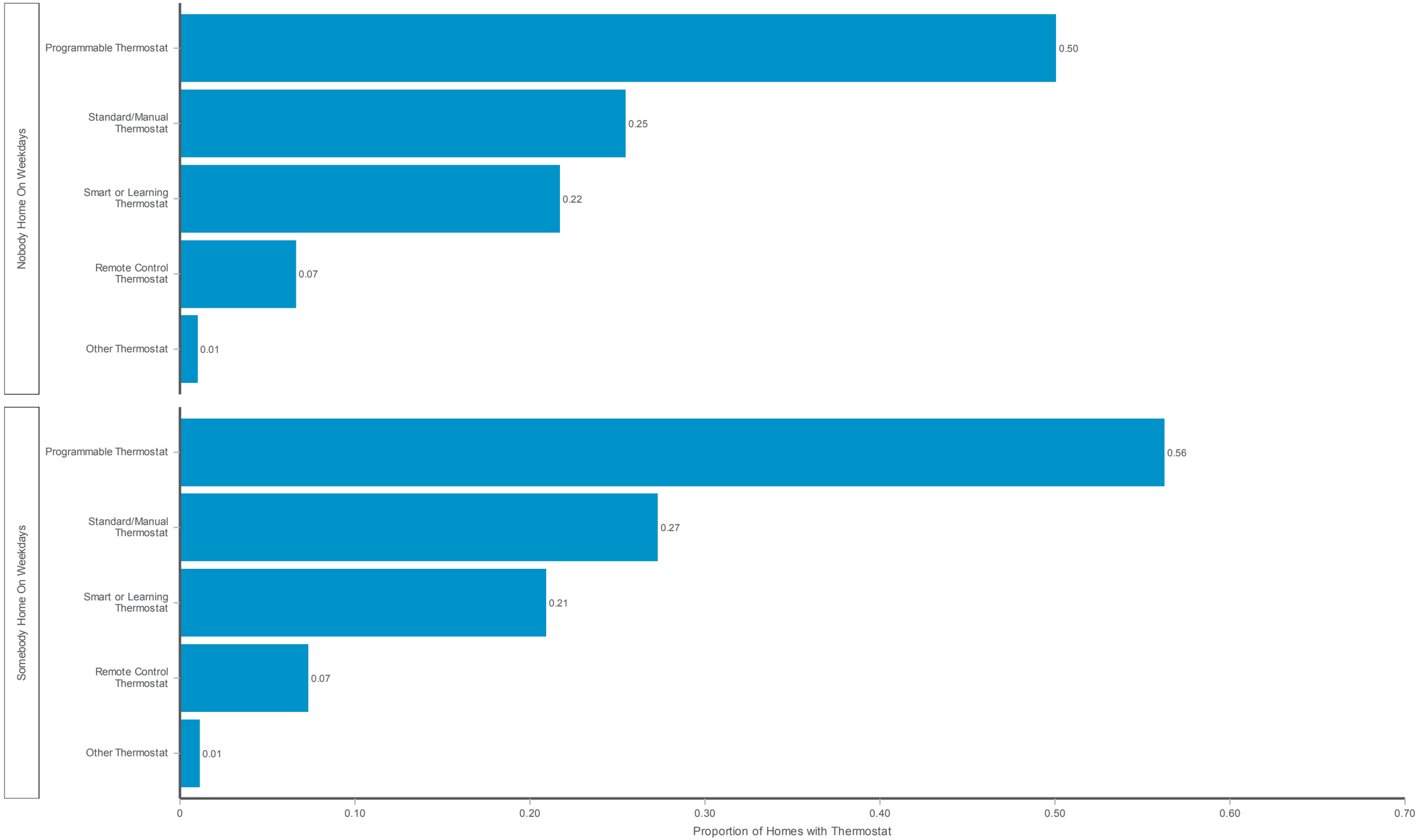
# 11 Plots by Weekday Occupancy

## 11.1 Thermostat Saturation by Weekday Occupancy

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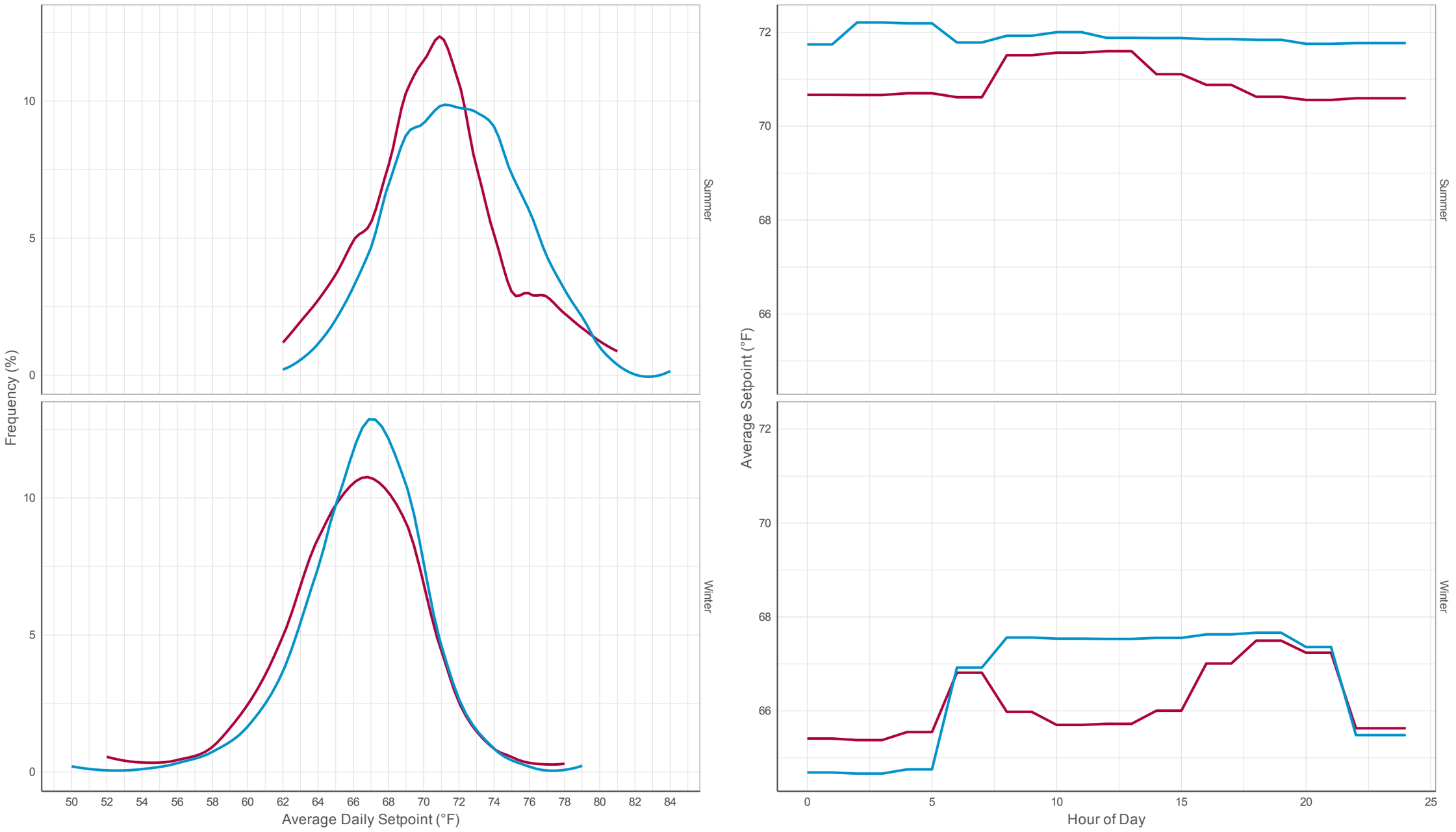
## 11.2 Reported Thermostat Setpoints by Weekday Occupancy

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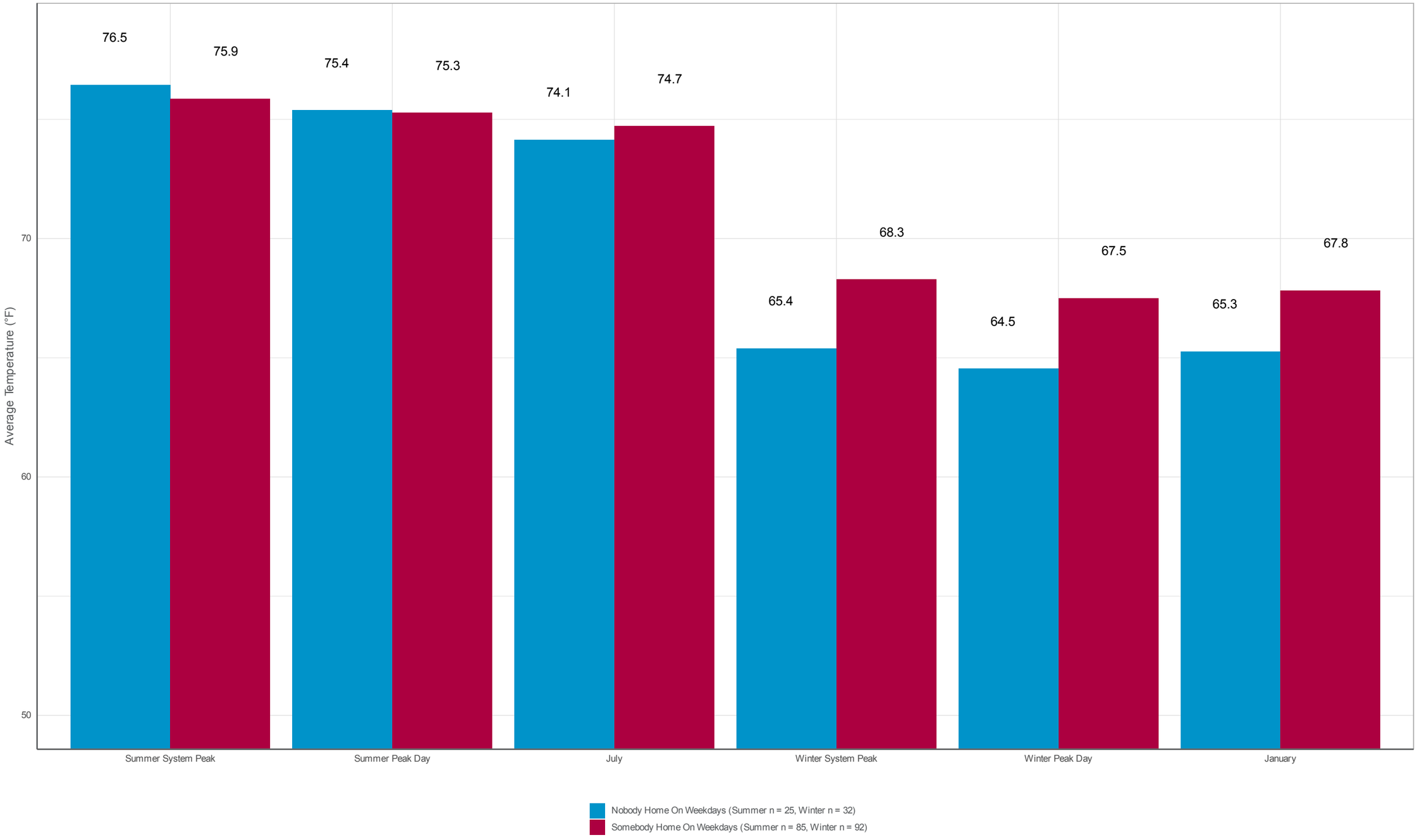
## 11.3 Metered Average Space Temperatures by Weekday Occupancy

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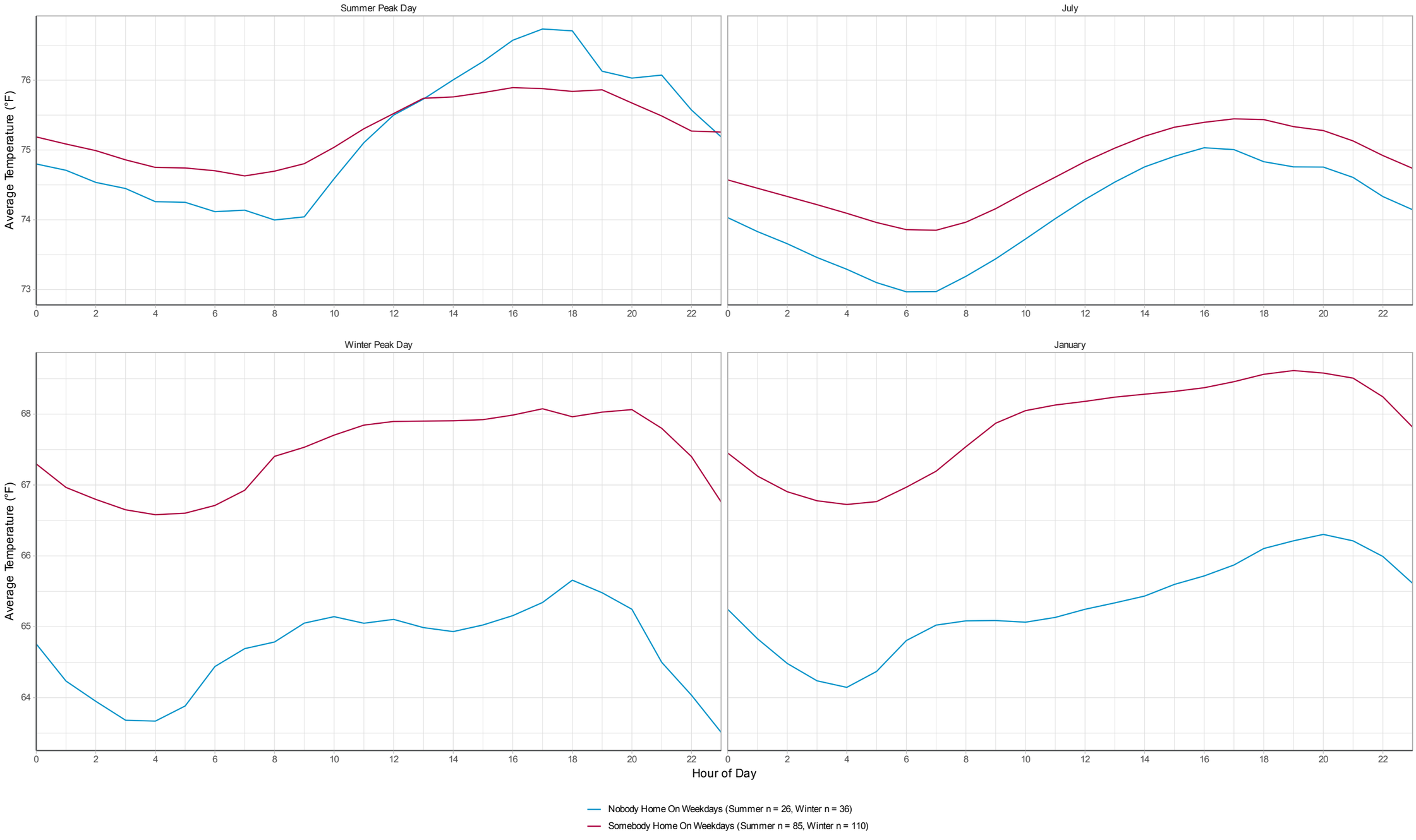
## 11.4 Metered Hourly Space Temperatures by Weekday Occupancy

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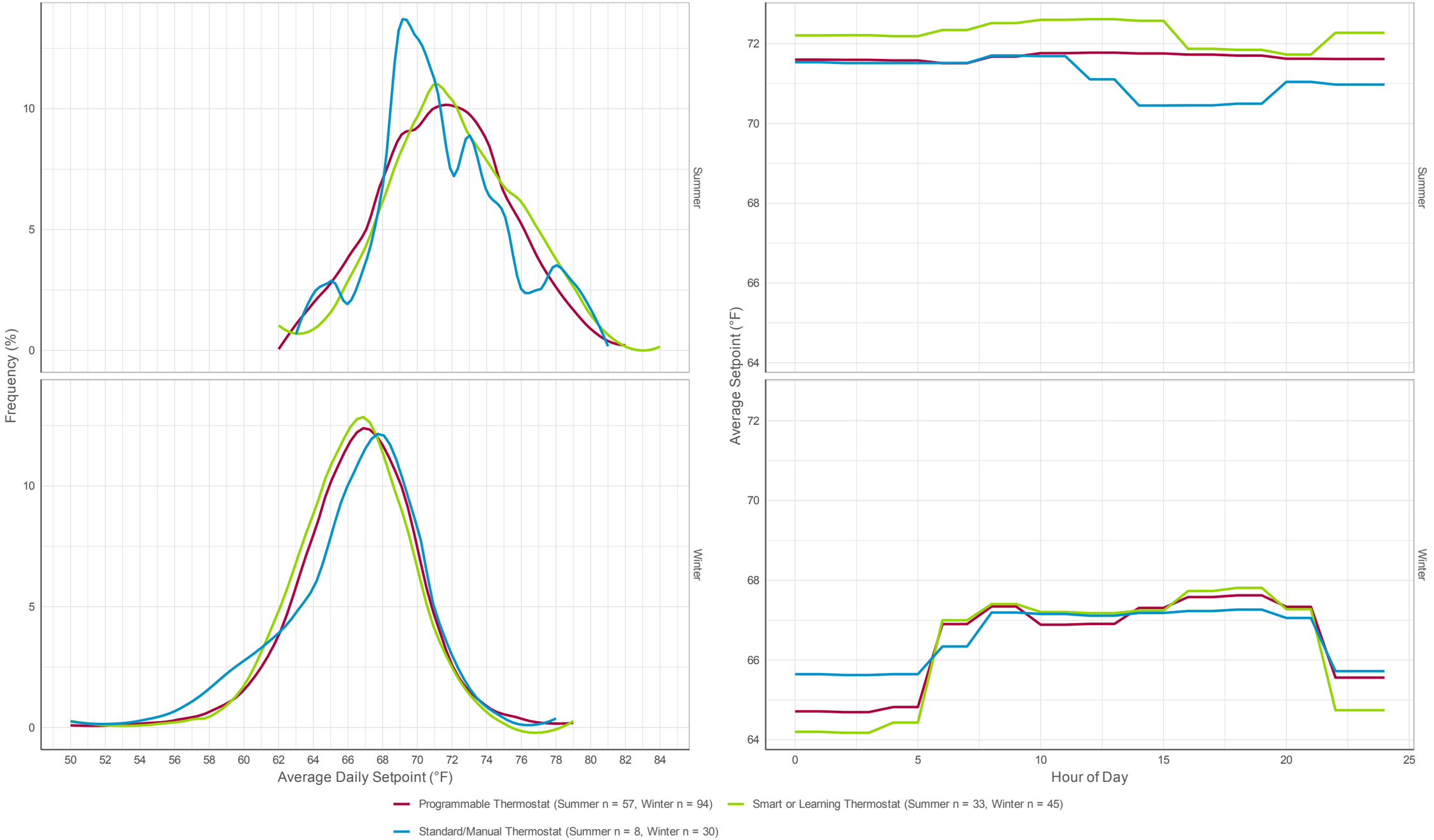
# 12 Plots by Thermostat Type

## 12.1 Reported Thermostat Setpoints by Thermostat Type

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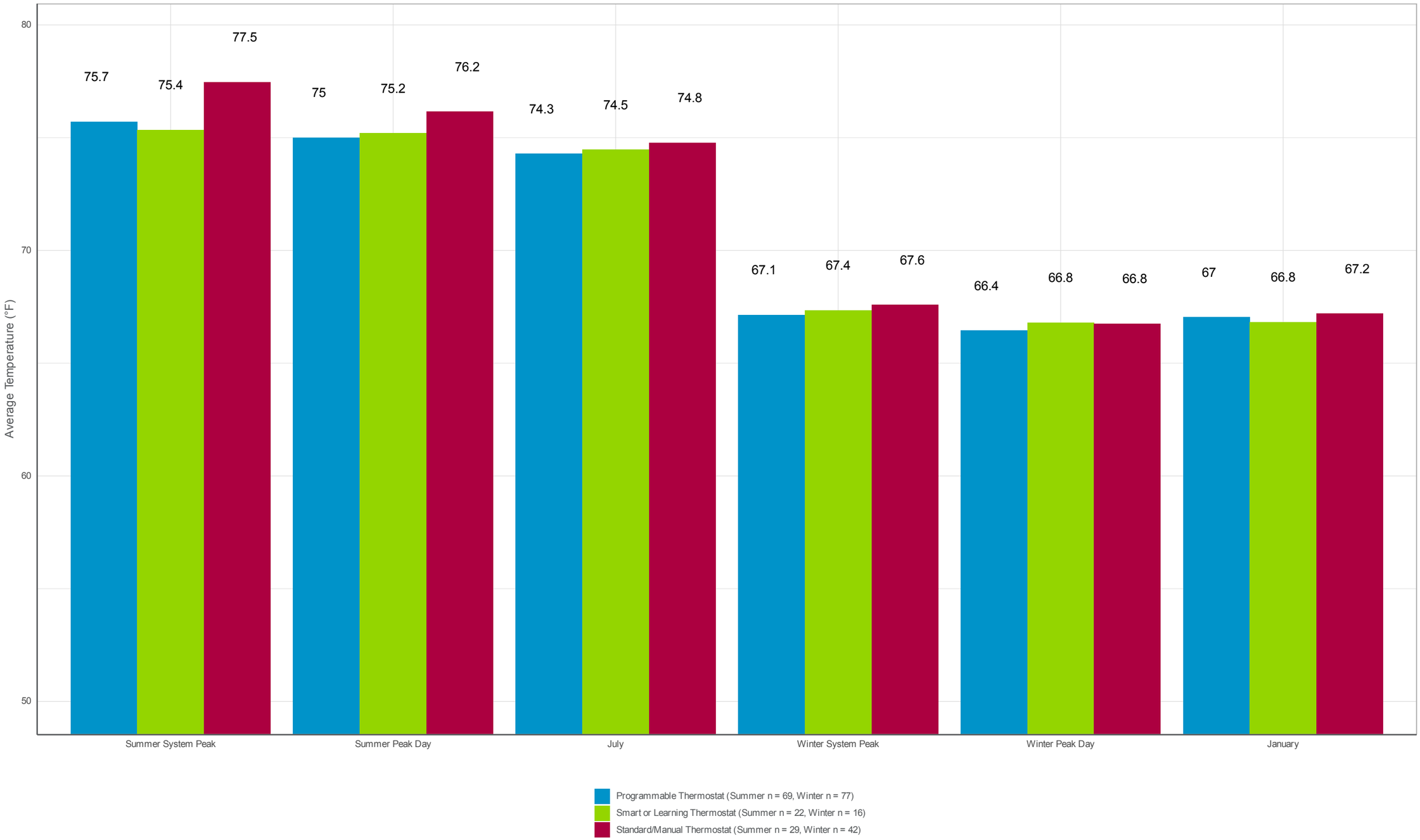
## 12.2 Metered Average Space Temperatures by Thermostat Type

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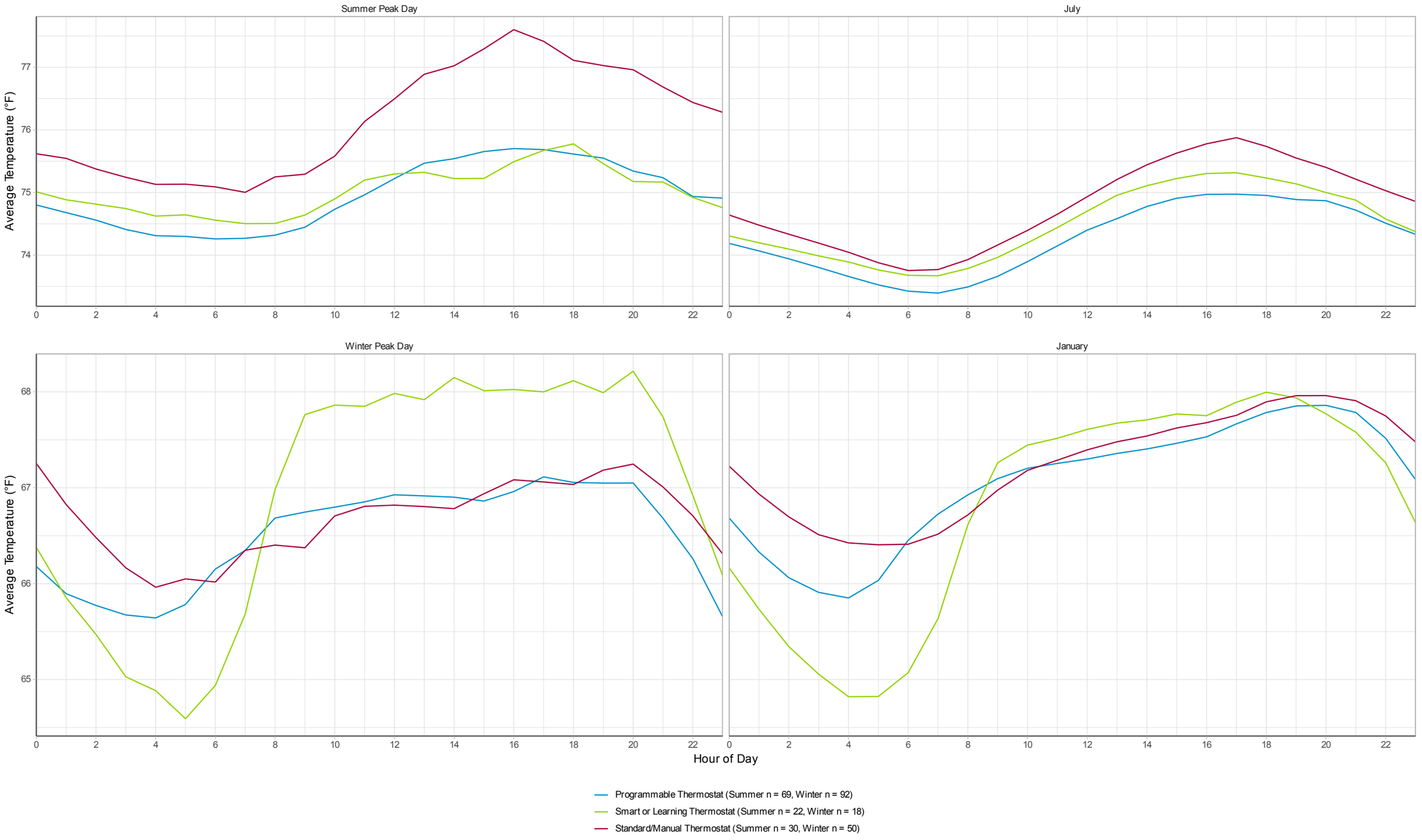
## 12.3 Metered Hourly Space Temperatures by Thermostat Type

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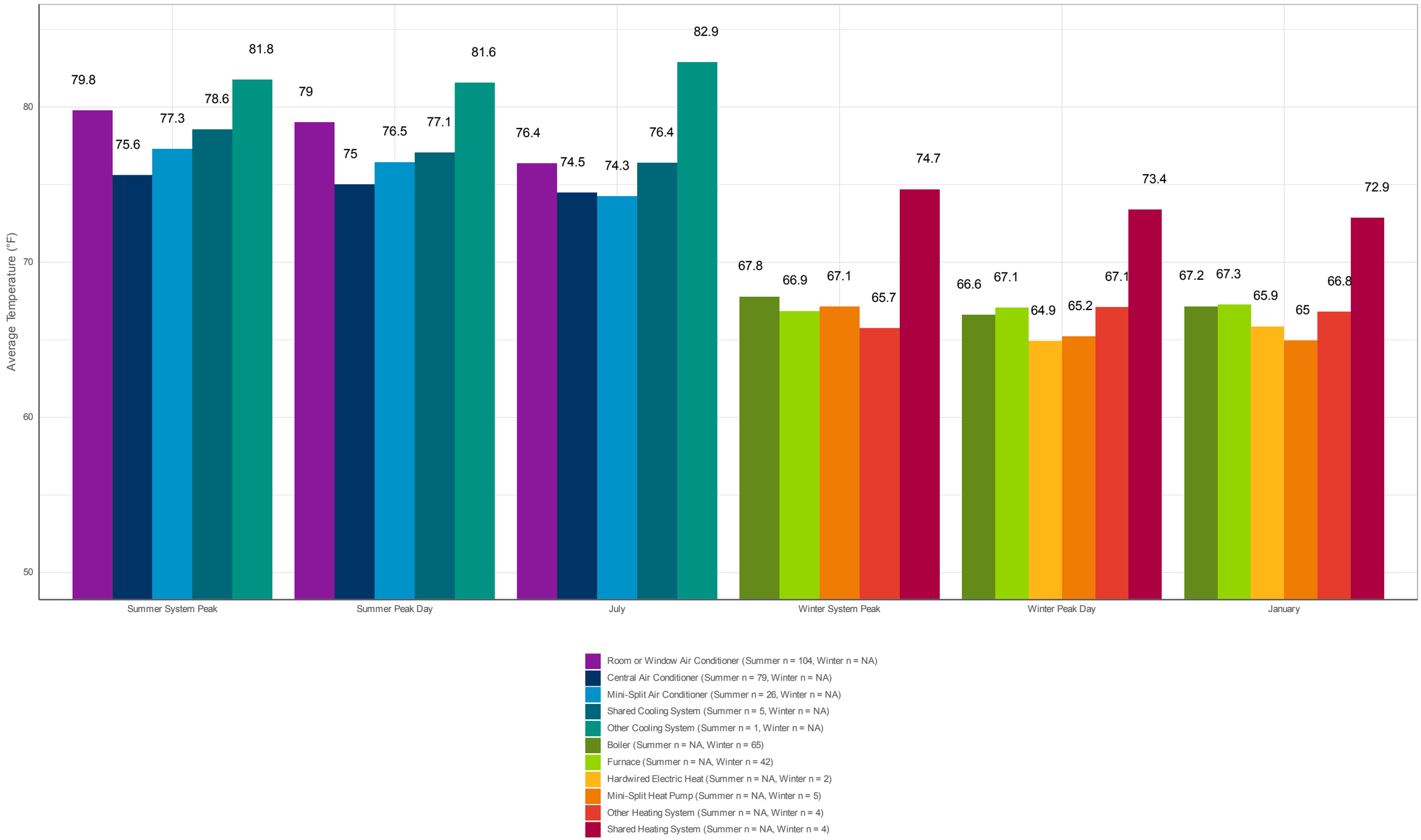
# 13 Plots by System Type

## 13.1 Metered Average Space Temperatures by System Type

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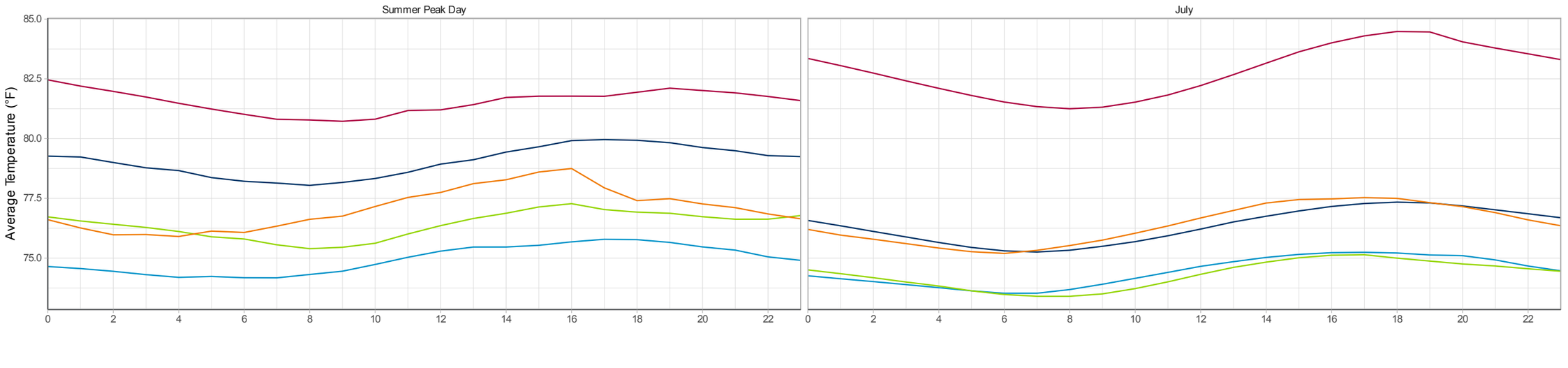
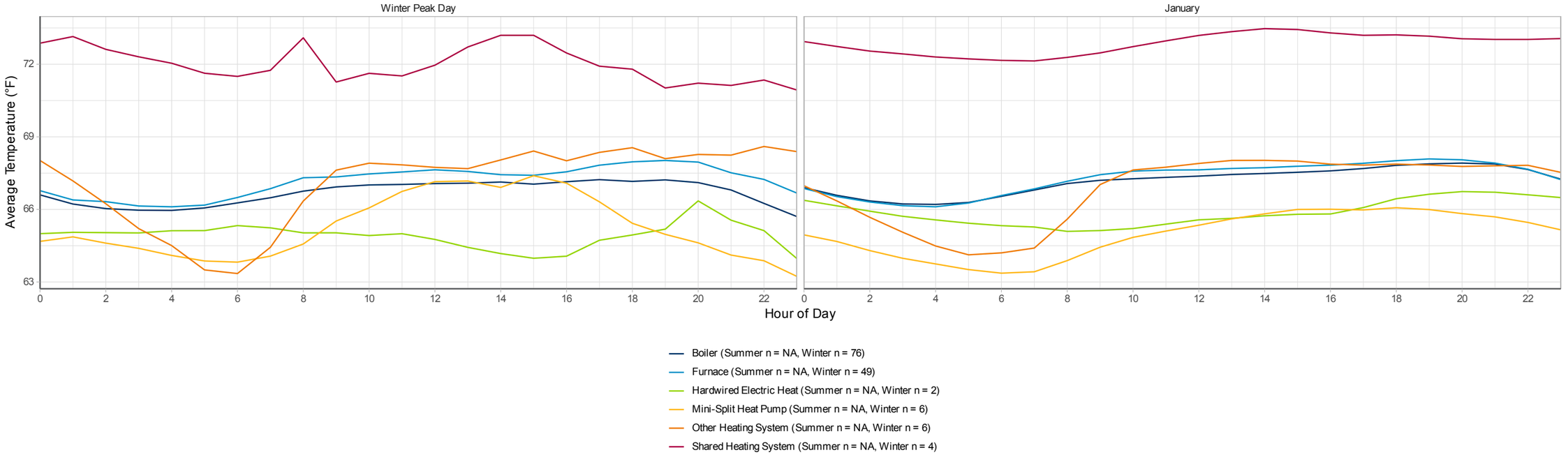
## 13.2 Metered Hourly Space Temperatures by System Type

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