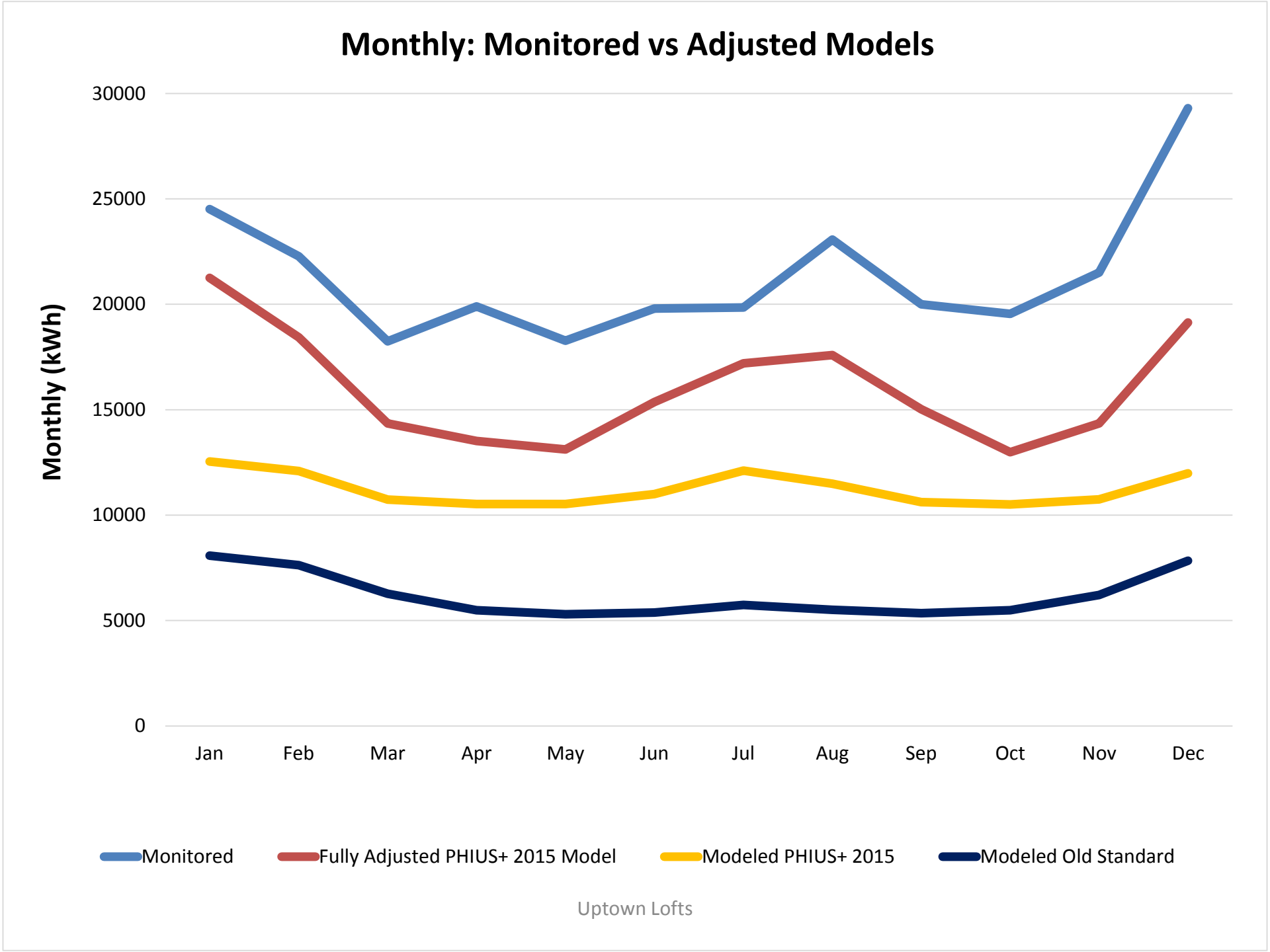
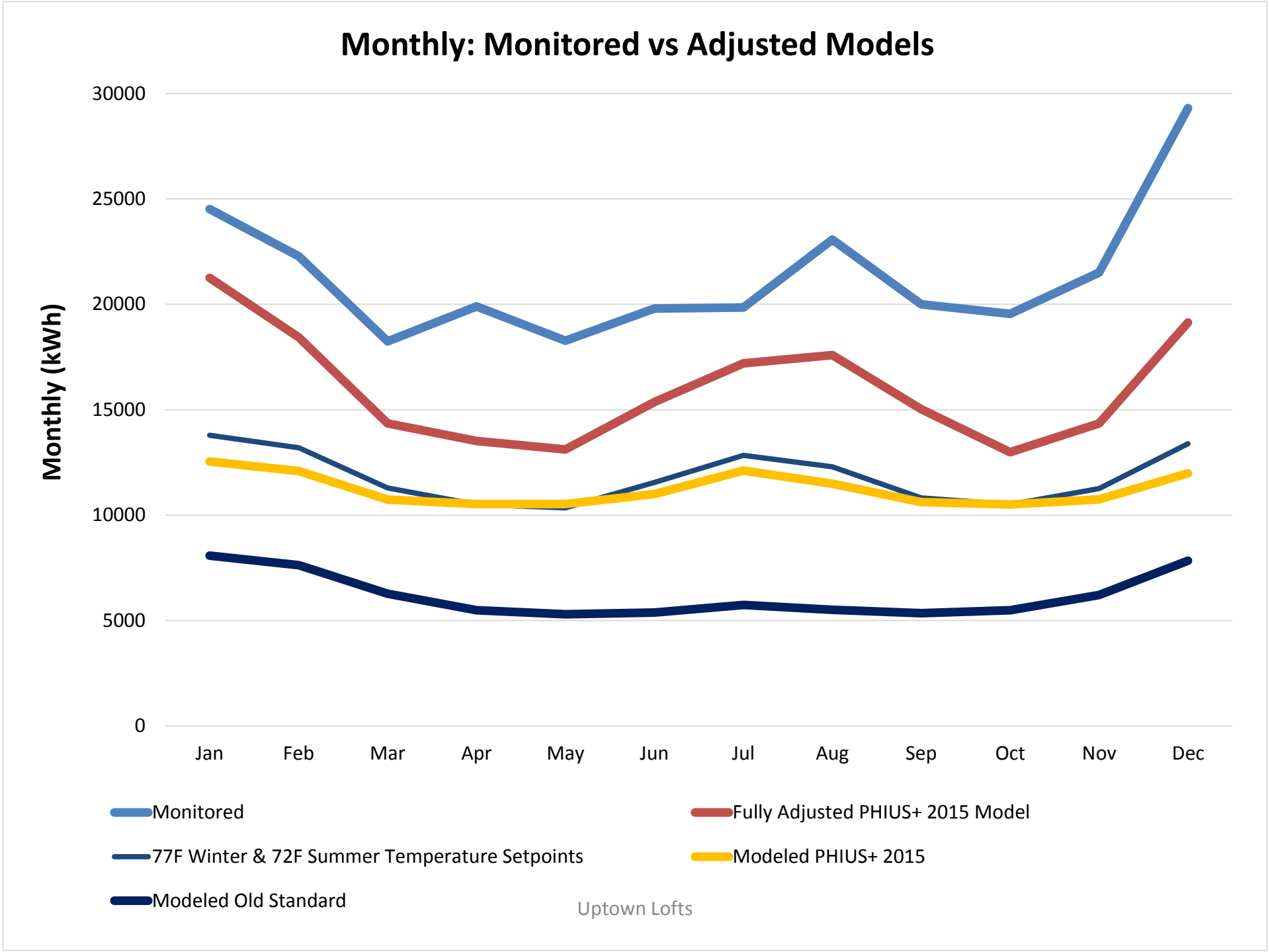
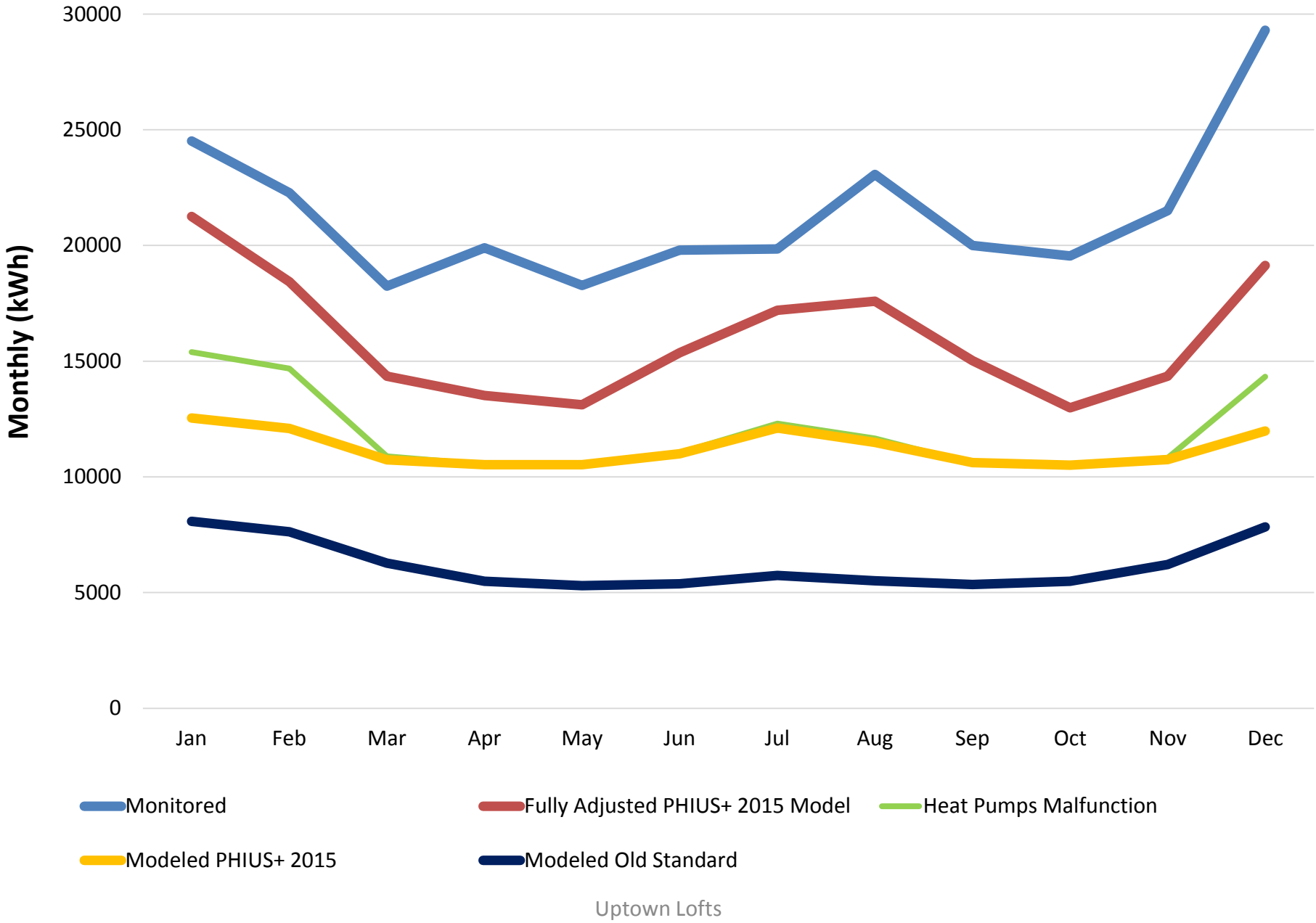
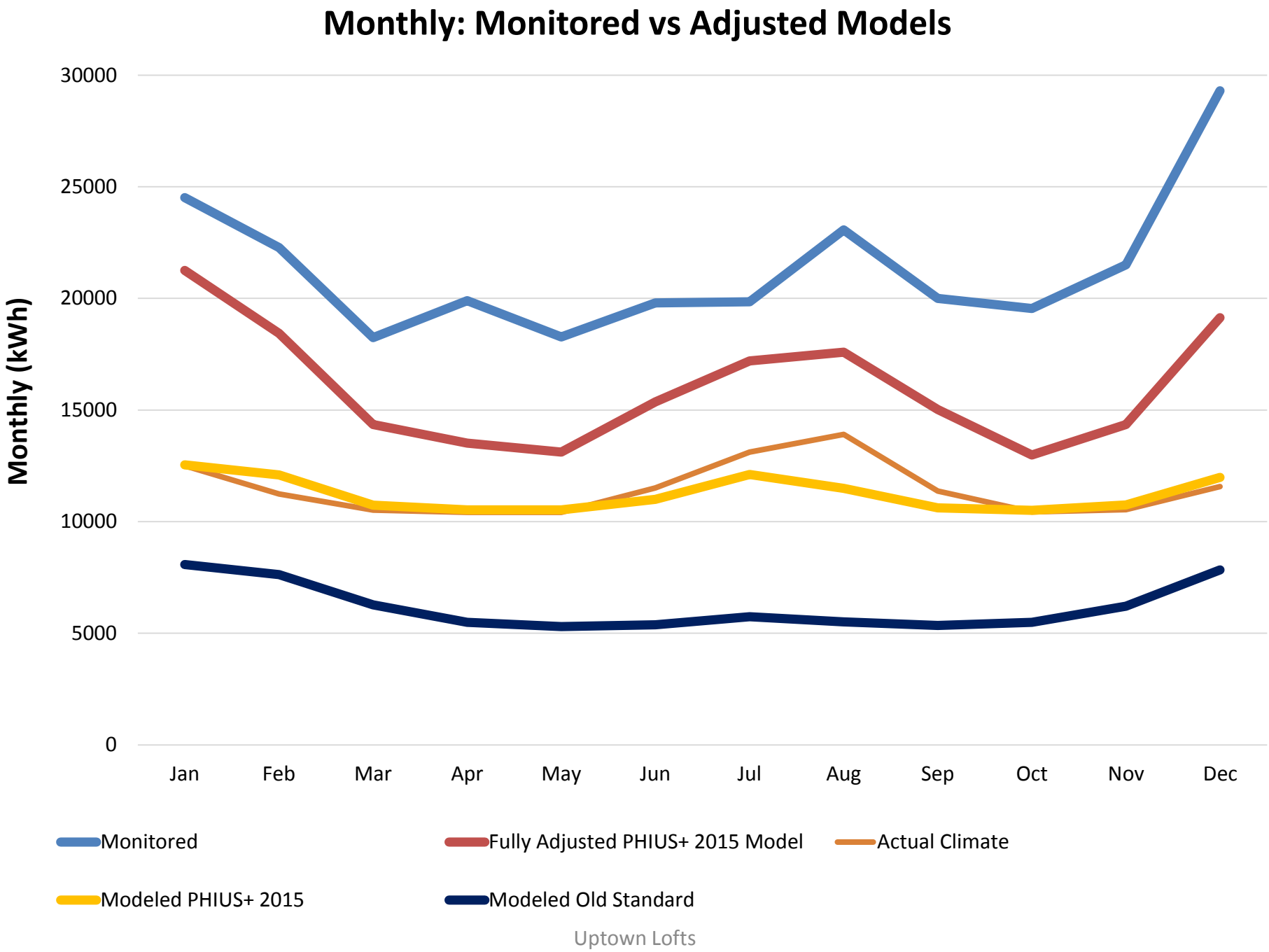

Monthly: Monitored vs Adjusted Models
Monthly (kWh)
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored
Fully Adjusted PHIUS+ 2015 Model
Modeled PHIUS+ 2015
Modeled Old Standard
Uptown Lofts

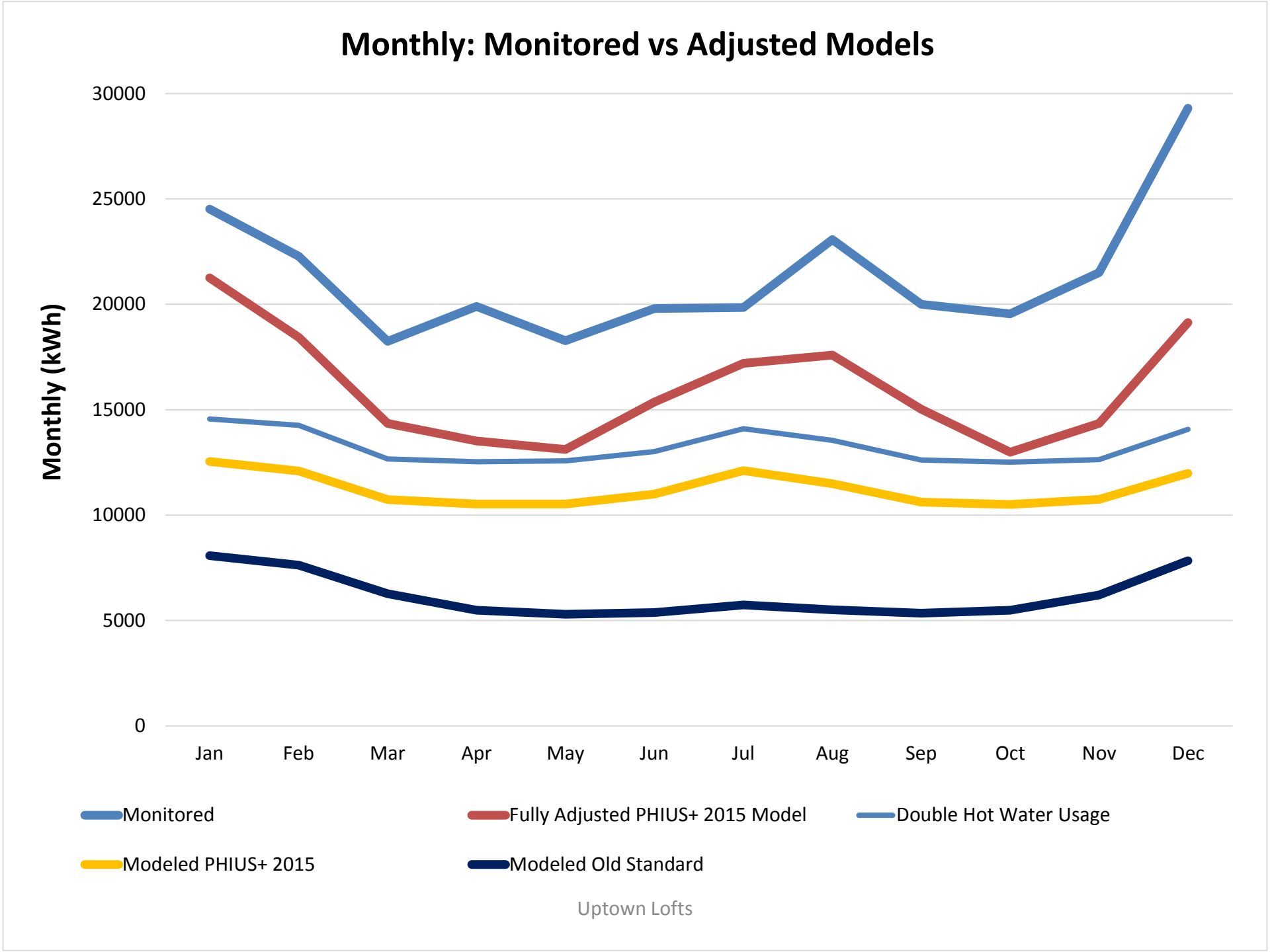

Monthly: Monitored vs Adjusted Models
Monthly (kWh)
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored
Fully Adjusted PHIUS+ 2015 Model
77F Winter & 72F Summer Temperature Setpoints
Modeled PHIUS+ 2015
Modeled Old Standard
Uptown Lofts

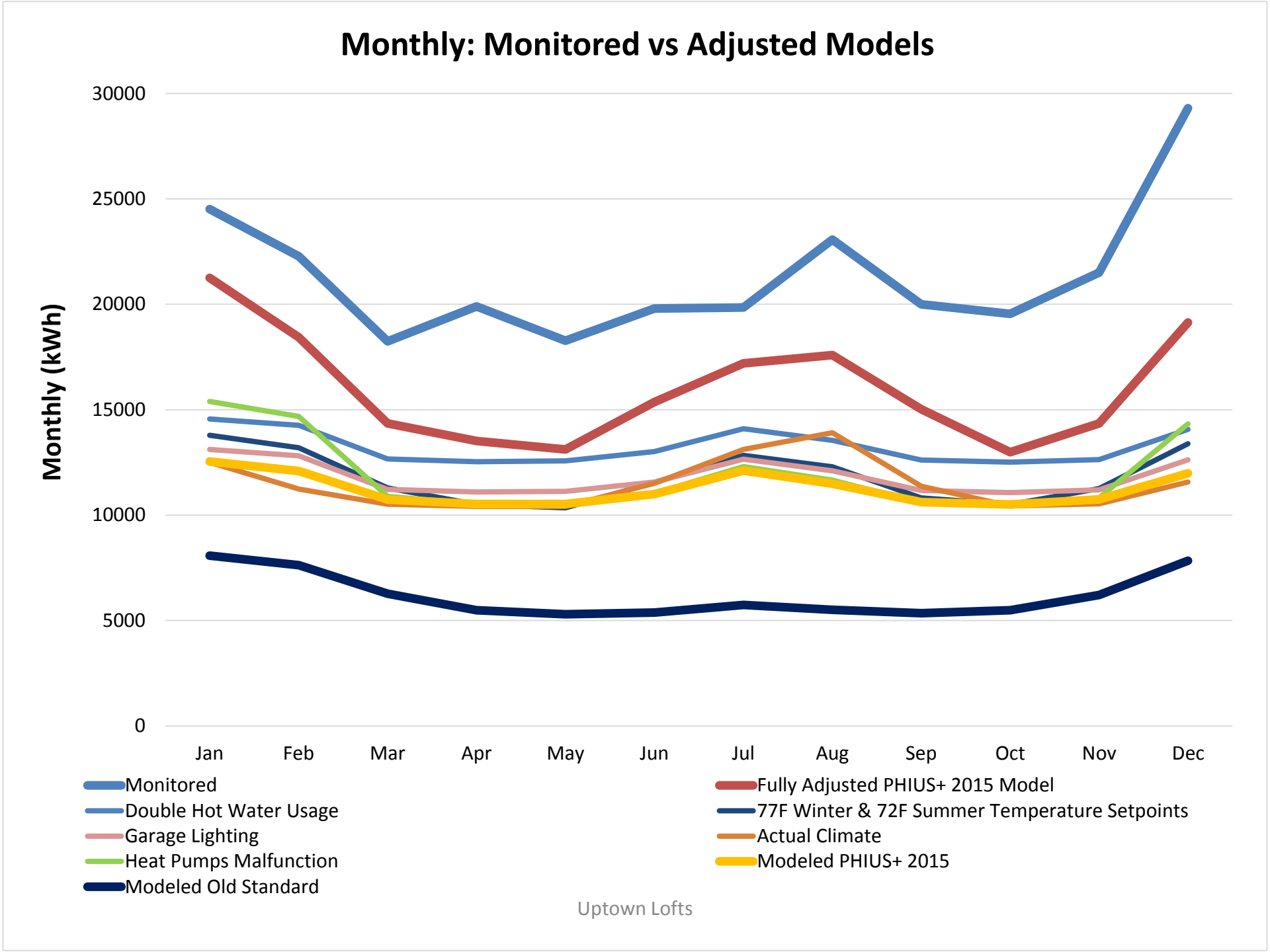
Monthly: Monitored vs Adjusted Models



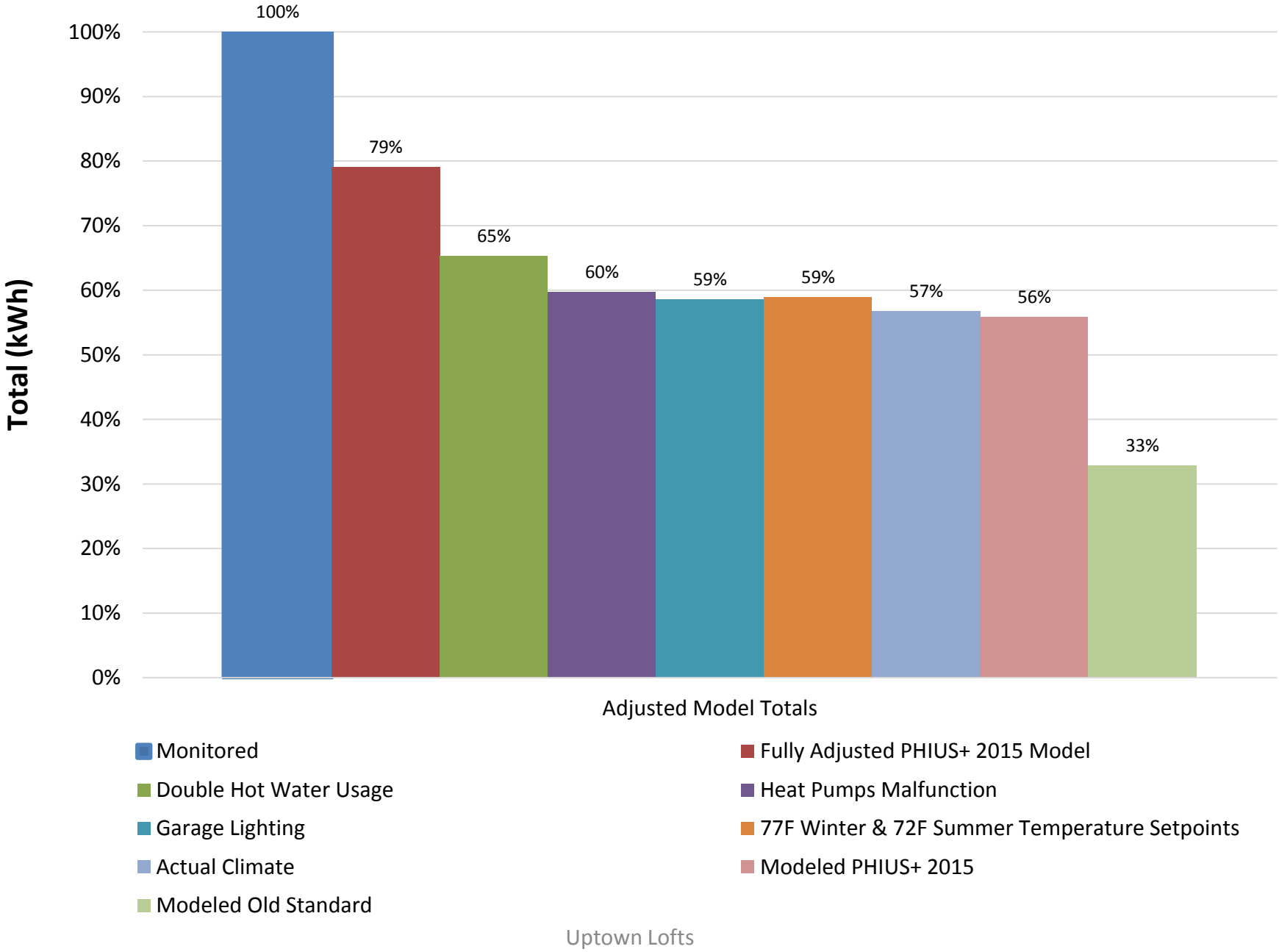
Uptown Lofts


Monthly: Monitored vs Adjusted Models
Monthly (kWh)
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored
Fully Adjusted PHIUS+ 2015 Model
Actual Climate
Modeled PHIUS+ 2015
Modeled Old Standard
Uptown Lofts


Monthly: Monitored vs Adjusted Models
Monthly (kWh)
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored
Fully Adjusted PHIUS+ 2015 Model
Double Hot Water Usage
Modeled PHIUS+ 2015
Modeled Old Standard
Uptown Lofts


Monthly: Monitored vs Adjusted Models
Monthly (kWh)
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored
Fully Adjusted PHIUS+ 2015 Model
Double Hot Water Usage
77F Winter & 72F Summer Temperature Setpoints
Garage Lighting
Actual Climate
Heat Pumps Malfunction
Modeled PHIUS+ 2015
Modeled Old Standard
Uptown Lofts

Total: Monitored vs Adjusted Models

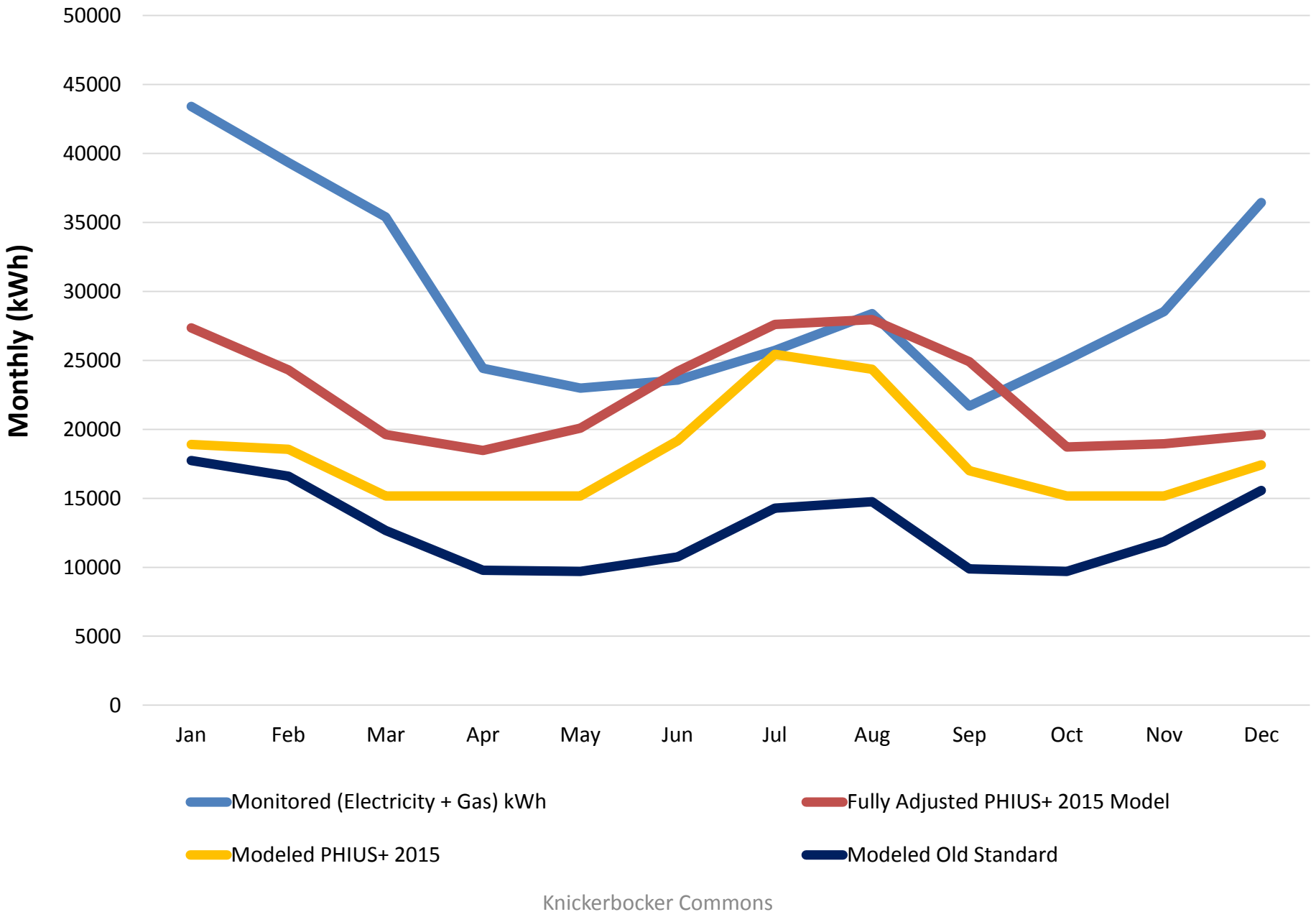


Knickerbocker Commons

Things to keep in mind

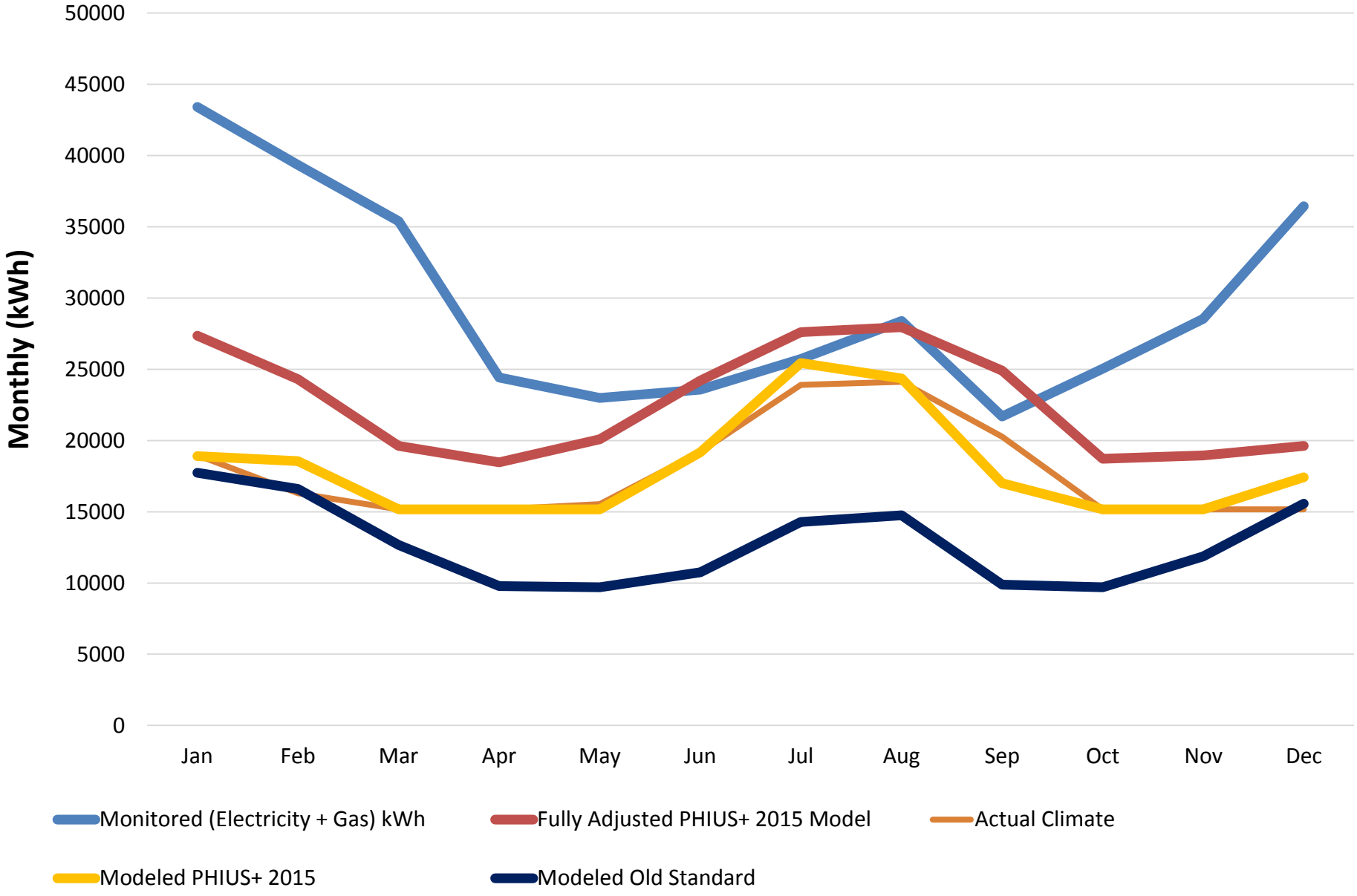
- Site Energy analyzed (converted to kWh)
- Electricity and gas monitored separately
  - Electric: cooling, lighting, MELs
  - Gas: heating, water heating, dryers
- Hydronic Heating/water heater system
- ERV
- Individual AC units for cooling

Monthly: Monitored vs Adjusted Models

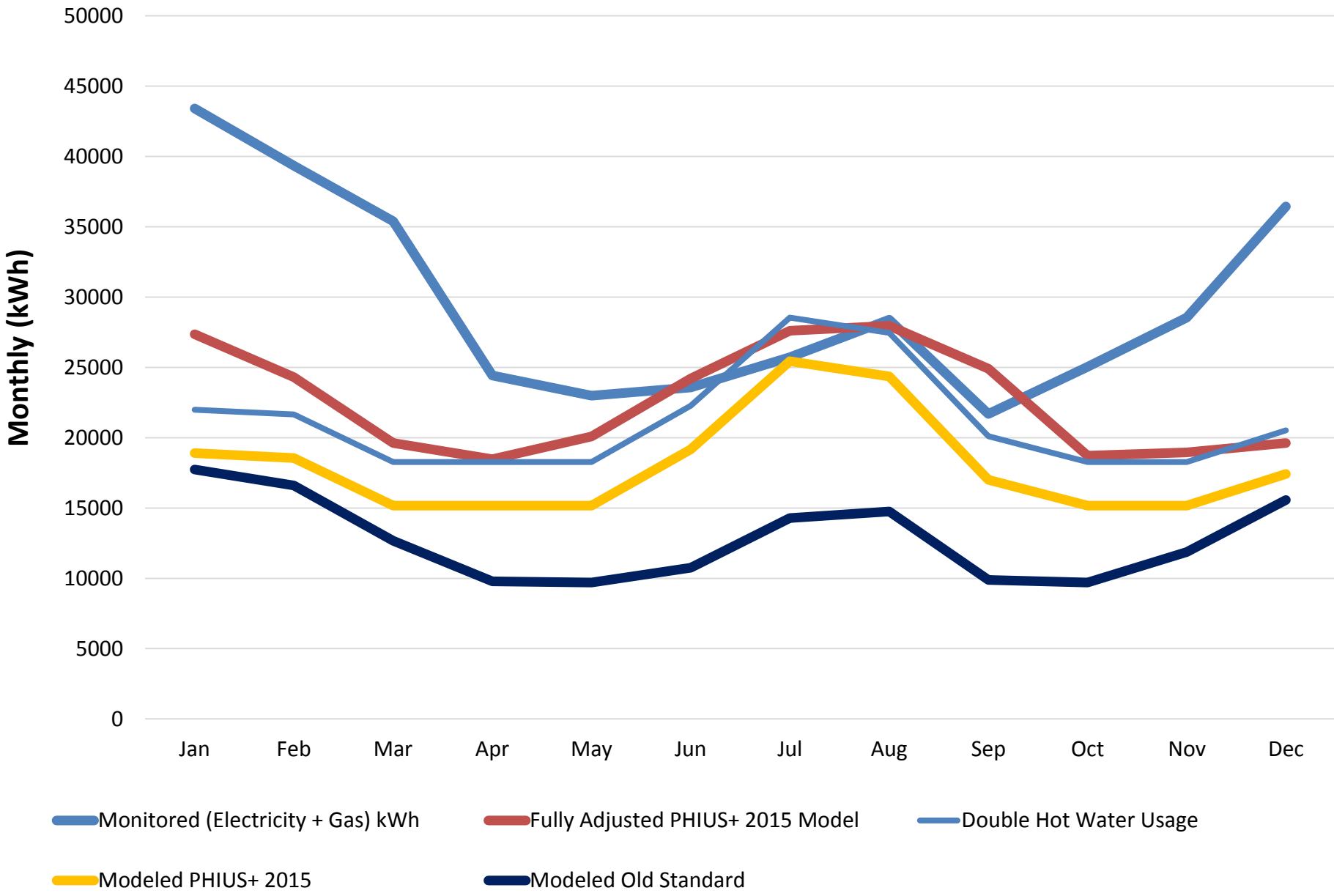


Knickerbocker Commons

Monthly: Monitored vs Adjusted Models

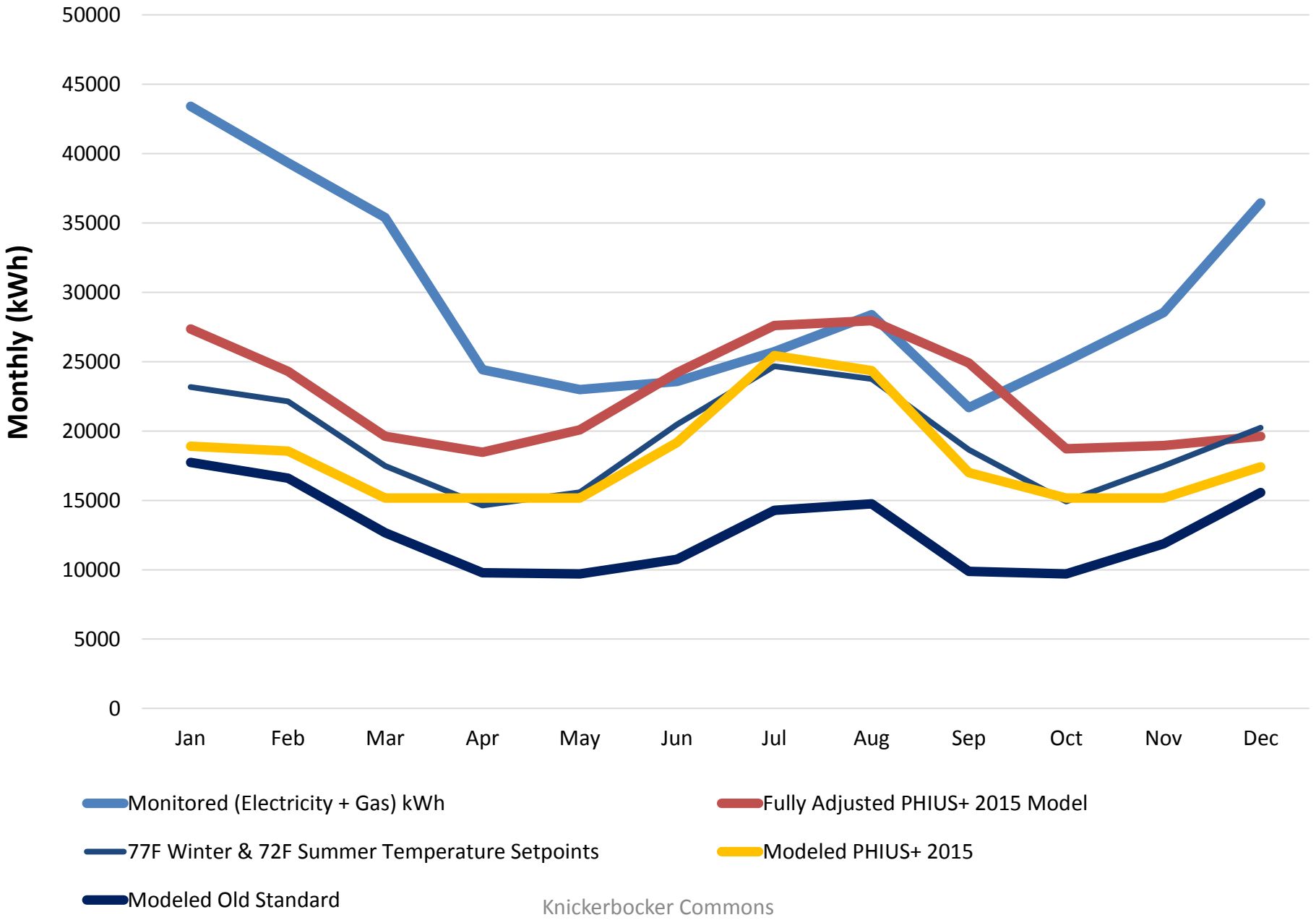


Monthly: Monitored vs Adjusted Models

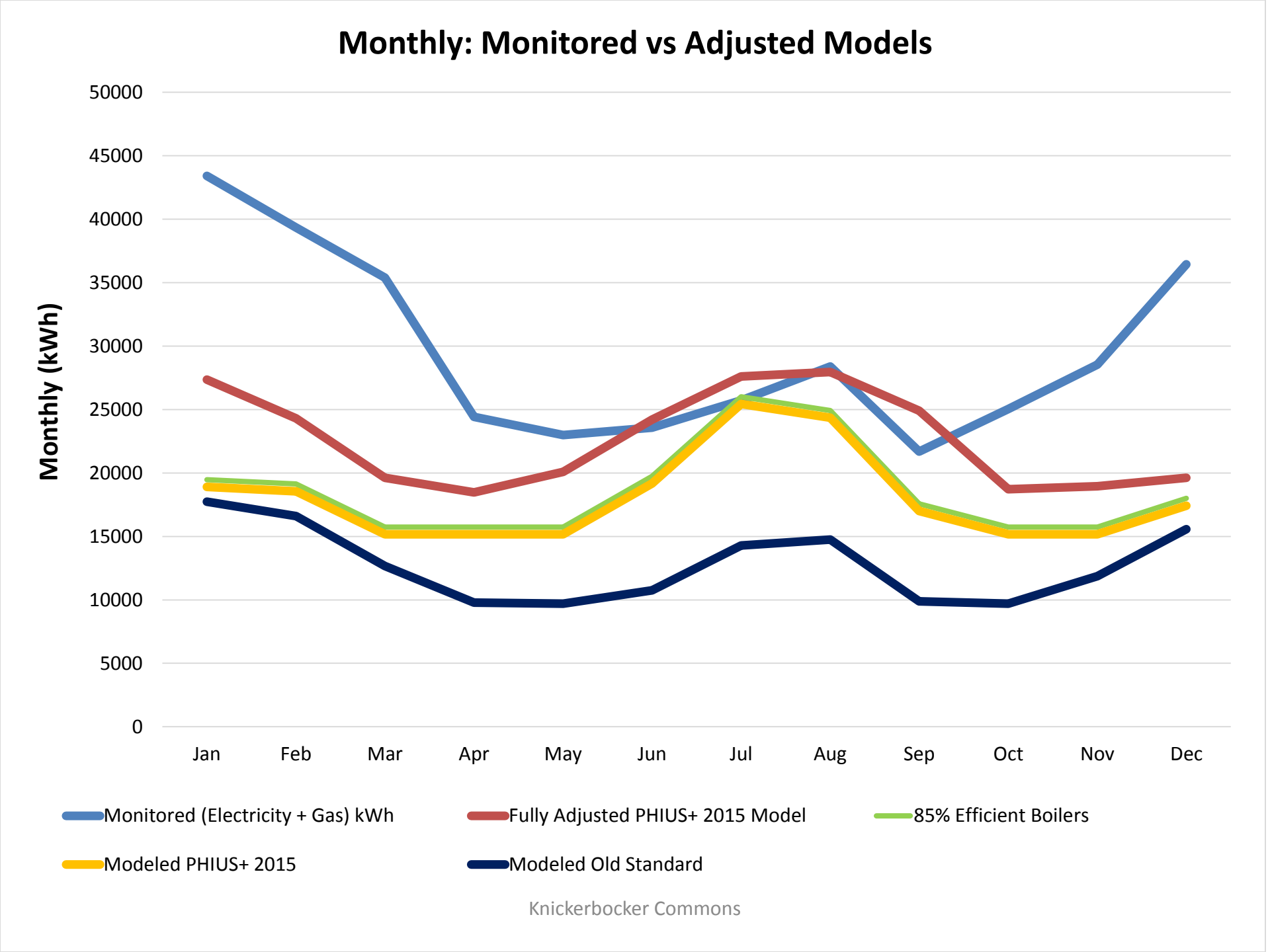


Knickerbocker Commons

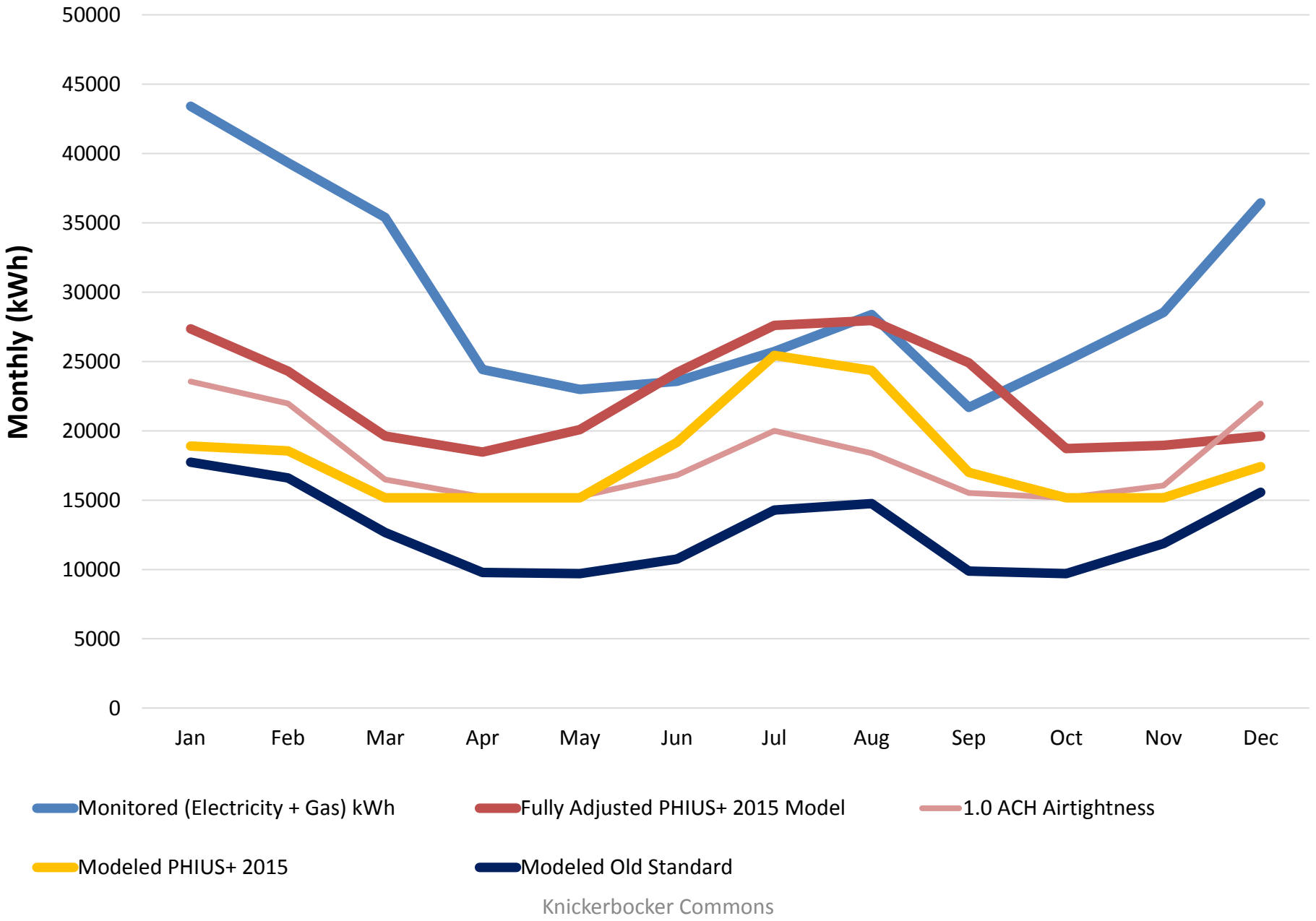
Monthly: Monitored vs Adjusted Models



Knickerbocker Commons

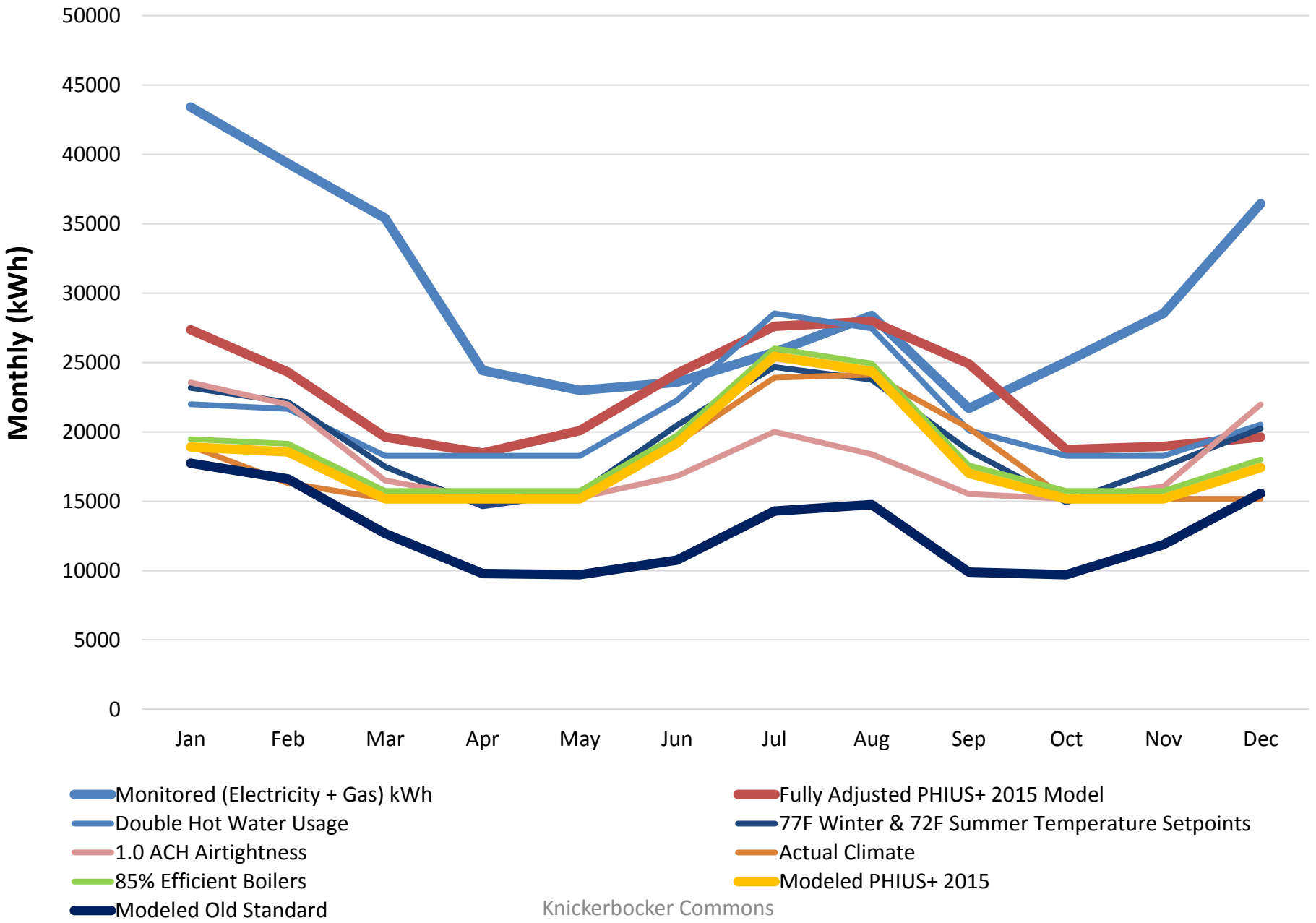

Monthly: Monitored vs Adjusted Models
Monthly (kWh)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored (Electricity + Gas) kWh
Fully Adjusted PHIUS+ 2015 Model
85% Efficient Boilers
Modeled PHIUS+ 2015
Modeled Old Standard
Knickerbocker Commons

Monthly: Monitored vs Adjusted Models

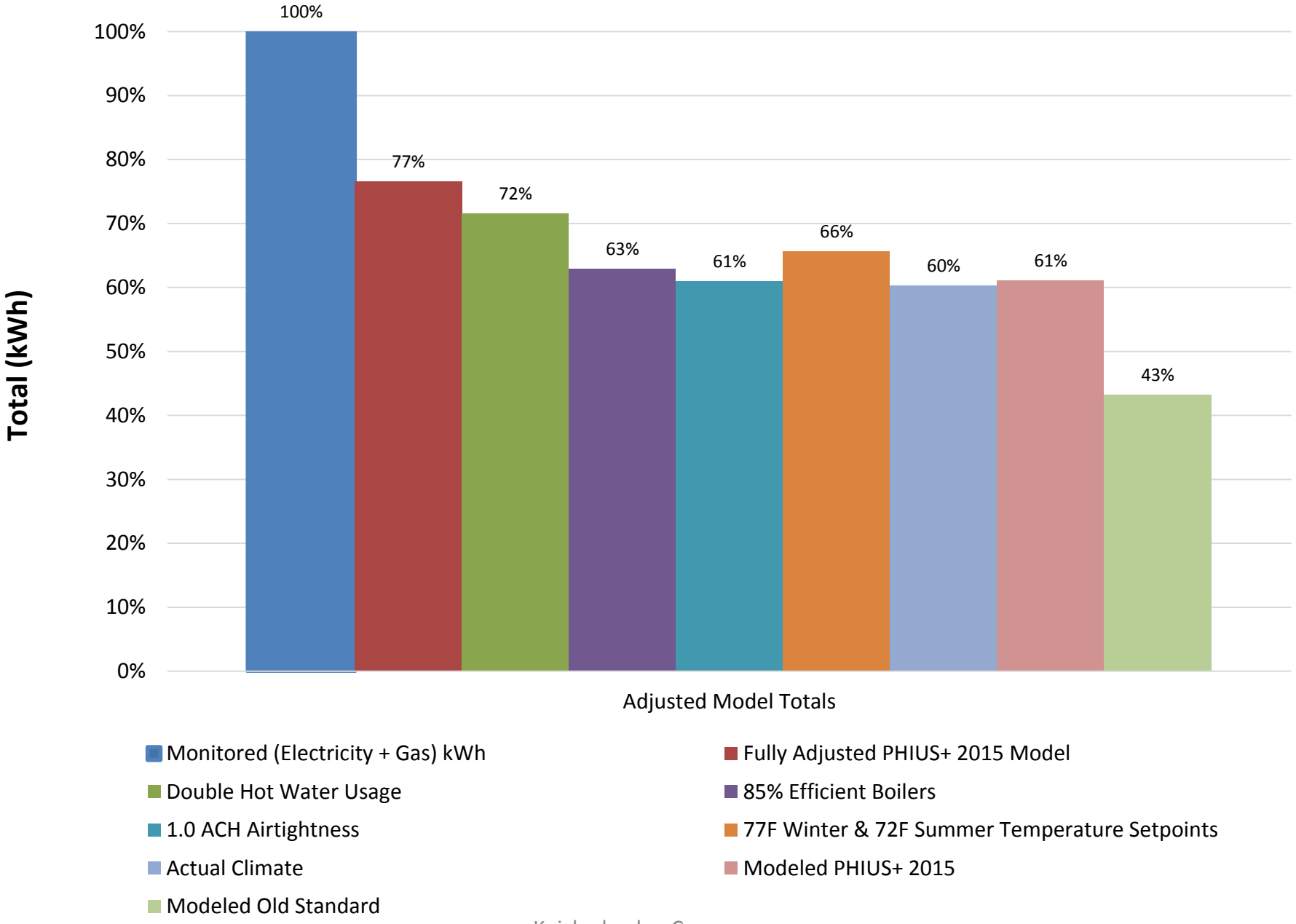


Knickerbocker Commons

Monthly: Monitored vs Adjusted Models



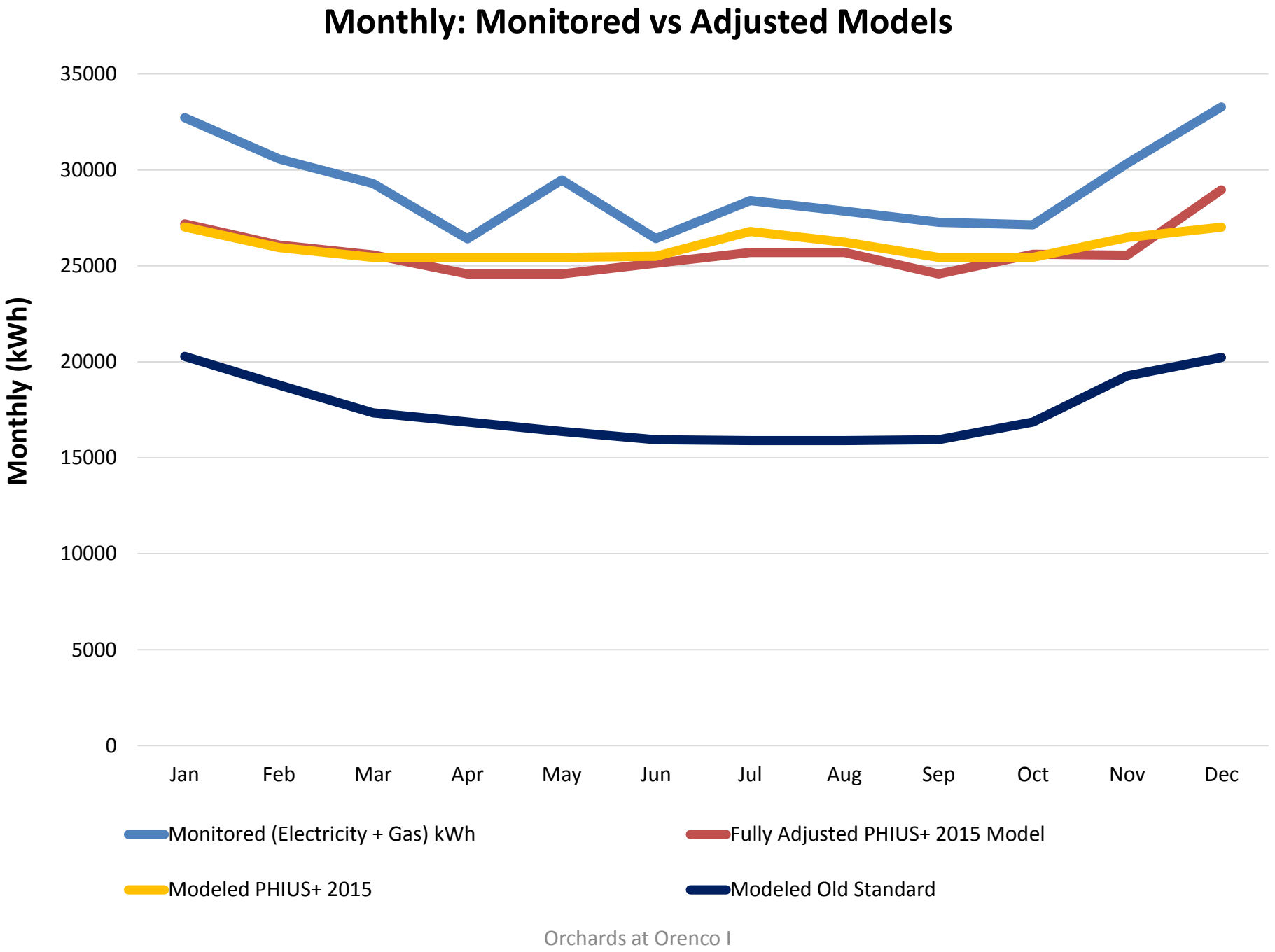
Total: Monitored vs Adjusted Models



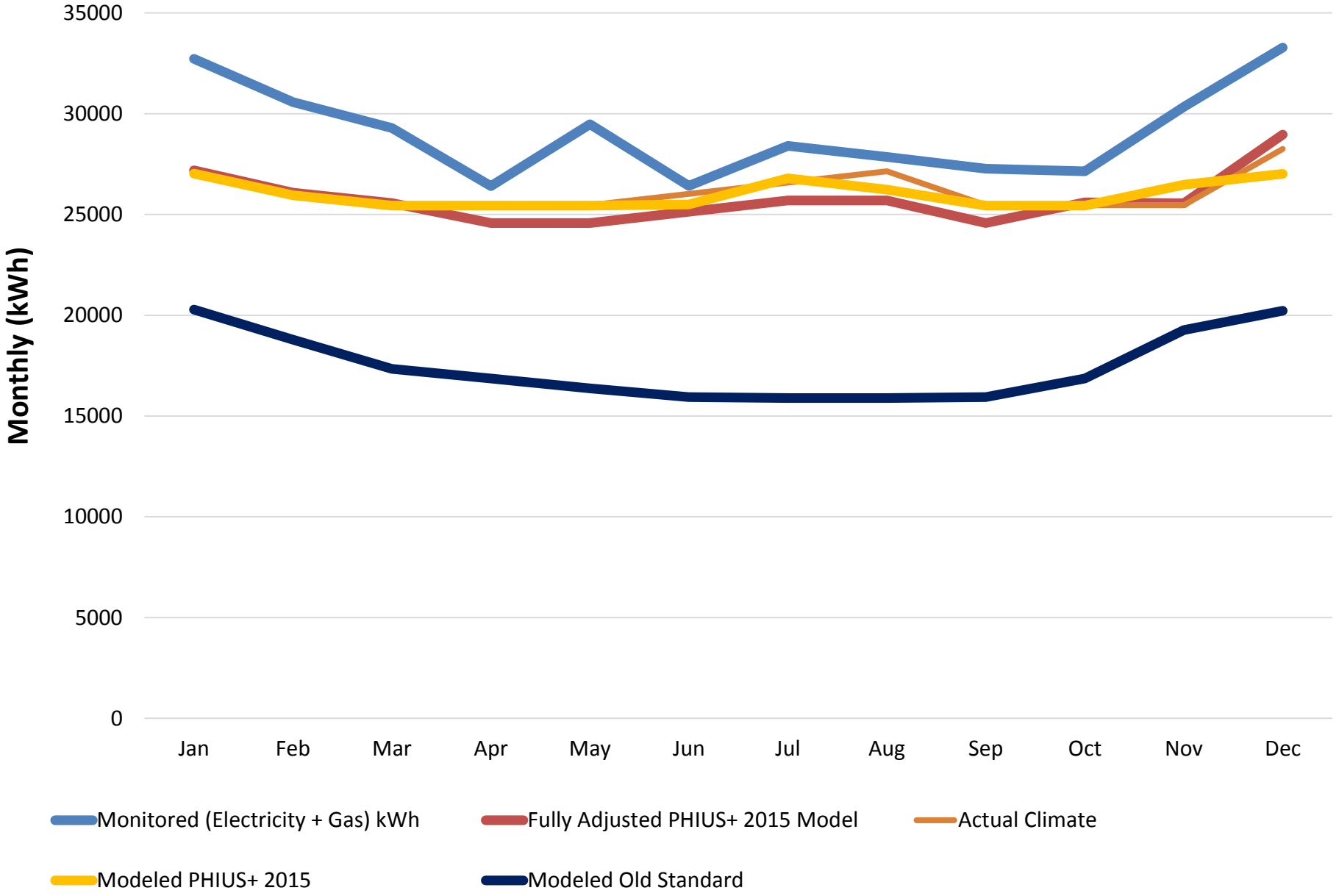
Orchards at Orenco I

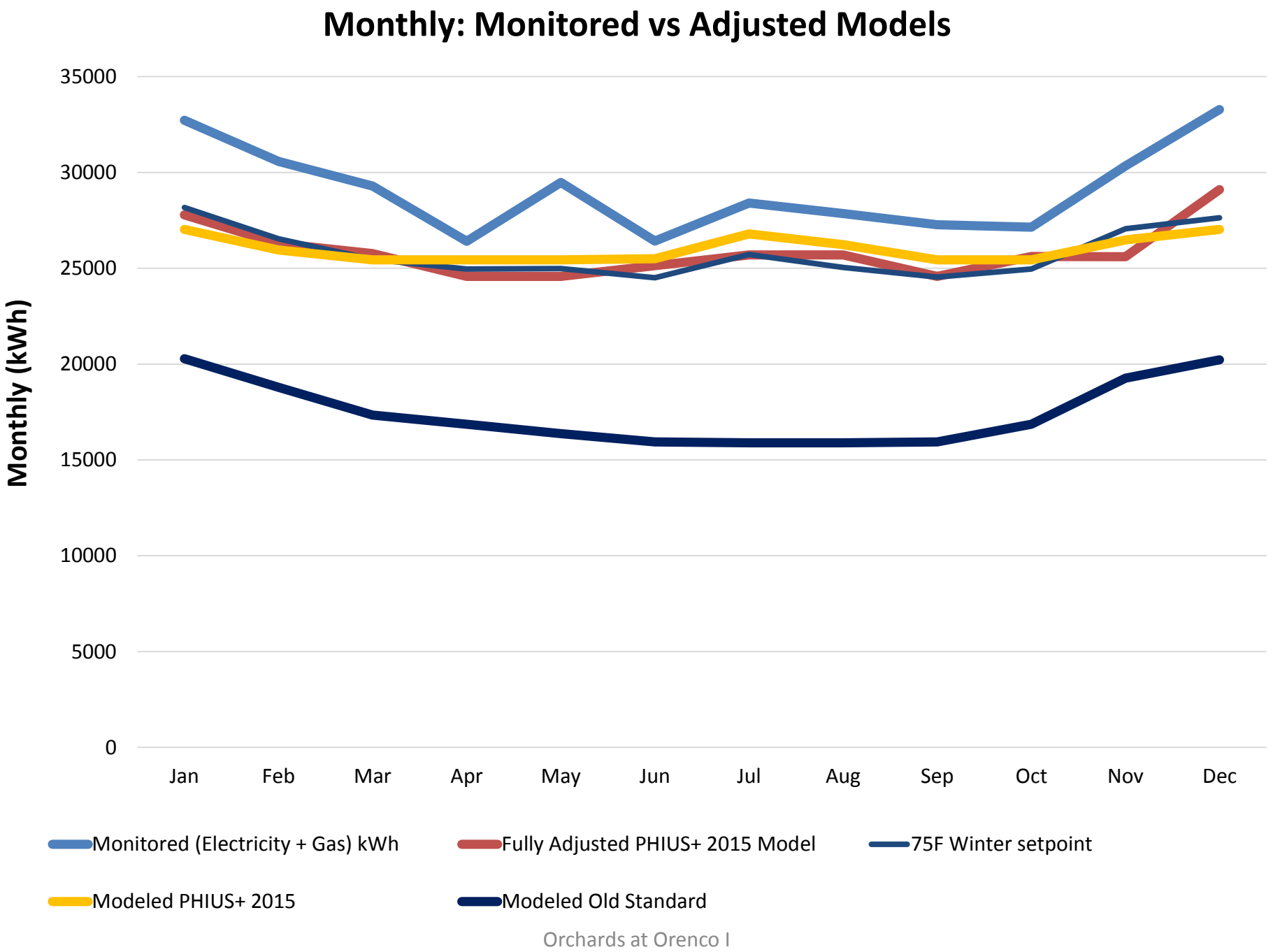
Things to keep in mind

- Site Energy analyzed (converted to kWh)
- Electricity monitored separately
- Heat pumps (heating/cooling) in apartments w/ direct electric backup
- HRV
- Natural Gas WH
- Natural Gas Clothes Dryers

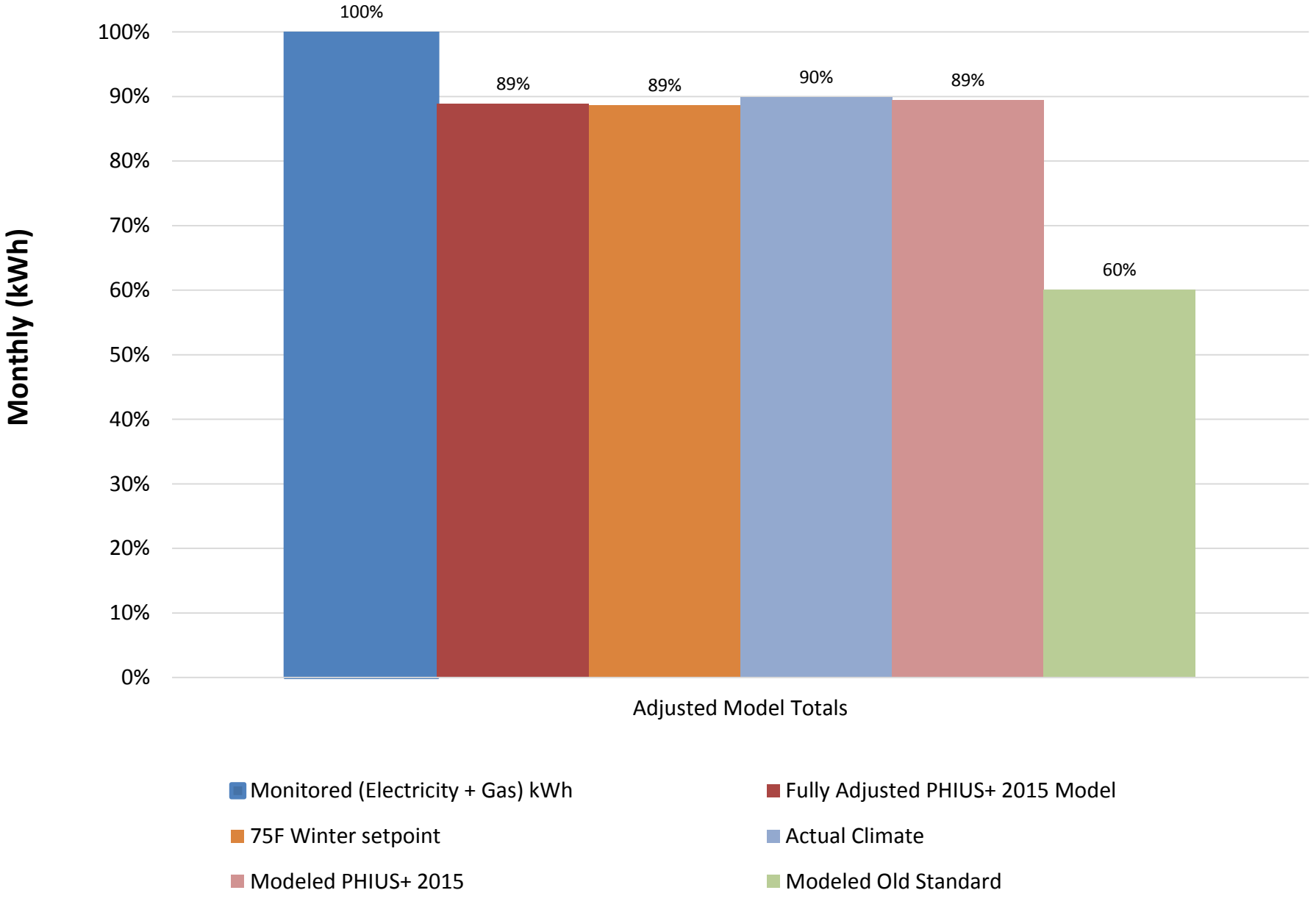

Monthly: Monitored vs Adjusted Models
Monthly (kWh)
35000
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored (Electricity + Gas) kWh
Fully Adjusted PHIUS+ 2015 Model
Modeled PHIUS+ 2015
Modeled Old Standard
Orchards at Orenco I

Monthly: Monitored vs Adjusted Models




Monthly: Monitored vs Adjusted Models
Monthly (kWh)
35000
30000
25000
20000
15000
10000
5000
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monitored (Electricity + Gas) kWh
Fully Adjusted PHIUS+ 2015 Model
75F Winter setpoint
Modeled PHIUS+ 2015
Modeled Old Standard
Orchards at Orenco I

Total: Monitored vs Adjusted Models



Thoughts so far

1. Onsite Verification is a must!
2. 1-year monitoring period = not normalized
3. Climate Specific Design Targets are *crucial*

PASSIVE BUILDING

PART OF THE SOLUTION

Katrin Klingenberg, Executive Director PHIUS
James Ortega, Certification Staff

www.PHIUS.org/www.PHAUS.org