Thermal Comfort in Informal Communities in Indian cities

Impact Report 2025

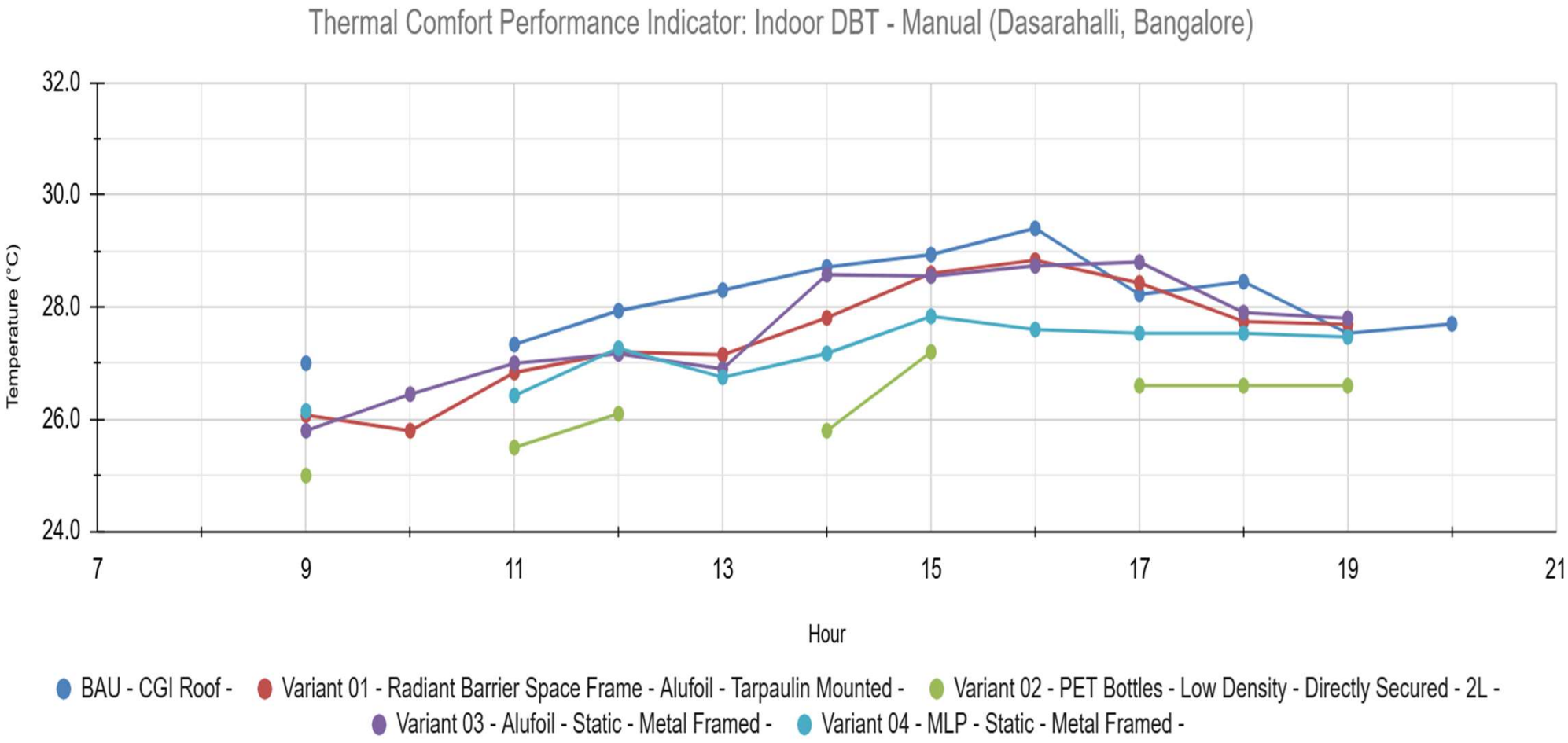
COOLING DOWN THE FAIR WAY

The (F)air conditioning campaign was created by a confluence of consumers and associations protecting the planet's climate. Our program aims at reducing bills and greenouse gas emissions from the indoor cooling sector.

fAIR CONDITIONING

CURRENT IMPACT - BANGALORE

Thermal Comfort Performance Indicator: Indoor DBT - Manual (Dasarahalli, Bangalore)



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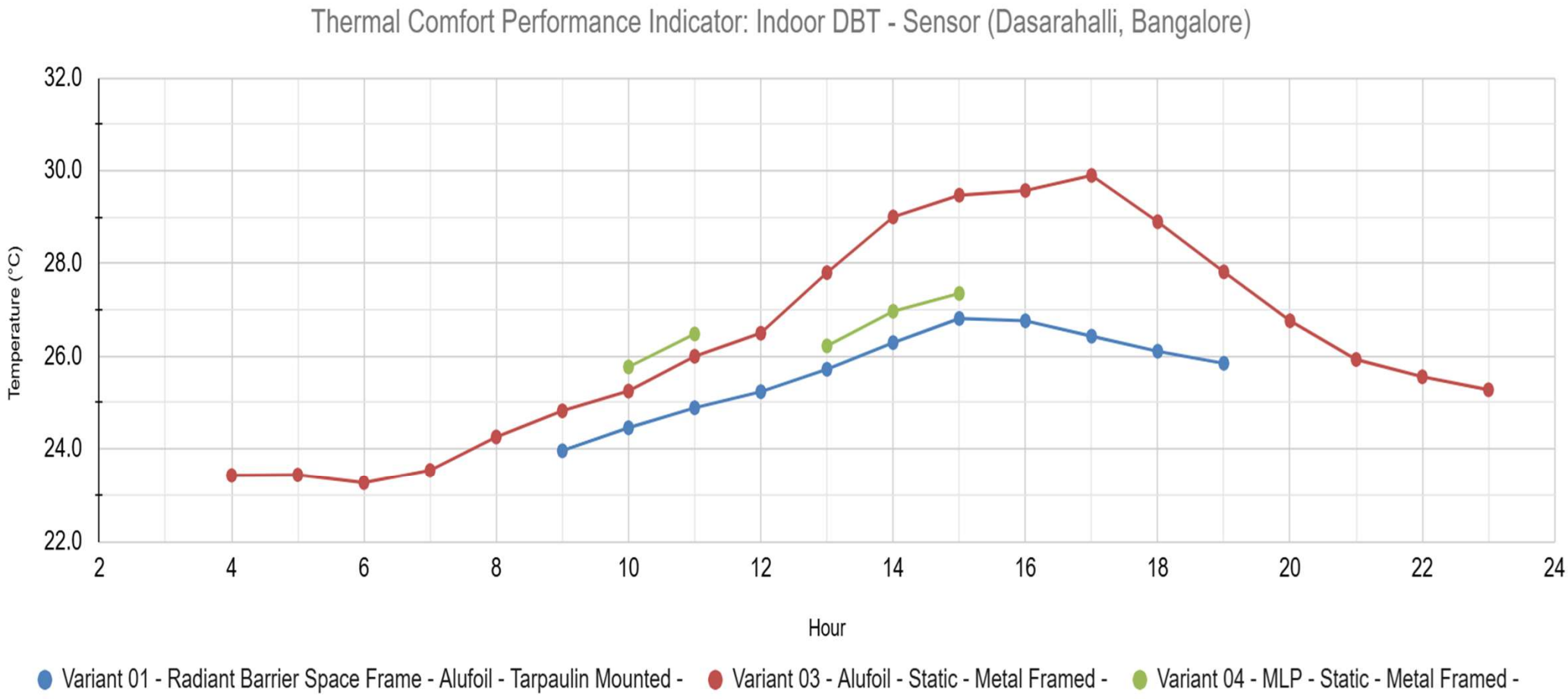
Thermal Comfort Performance Indicator: Indoor DBT - Sensor (Dasarahalli, Bangalore)



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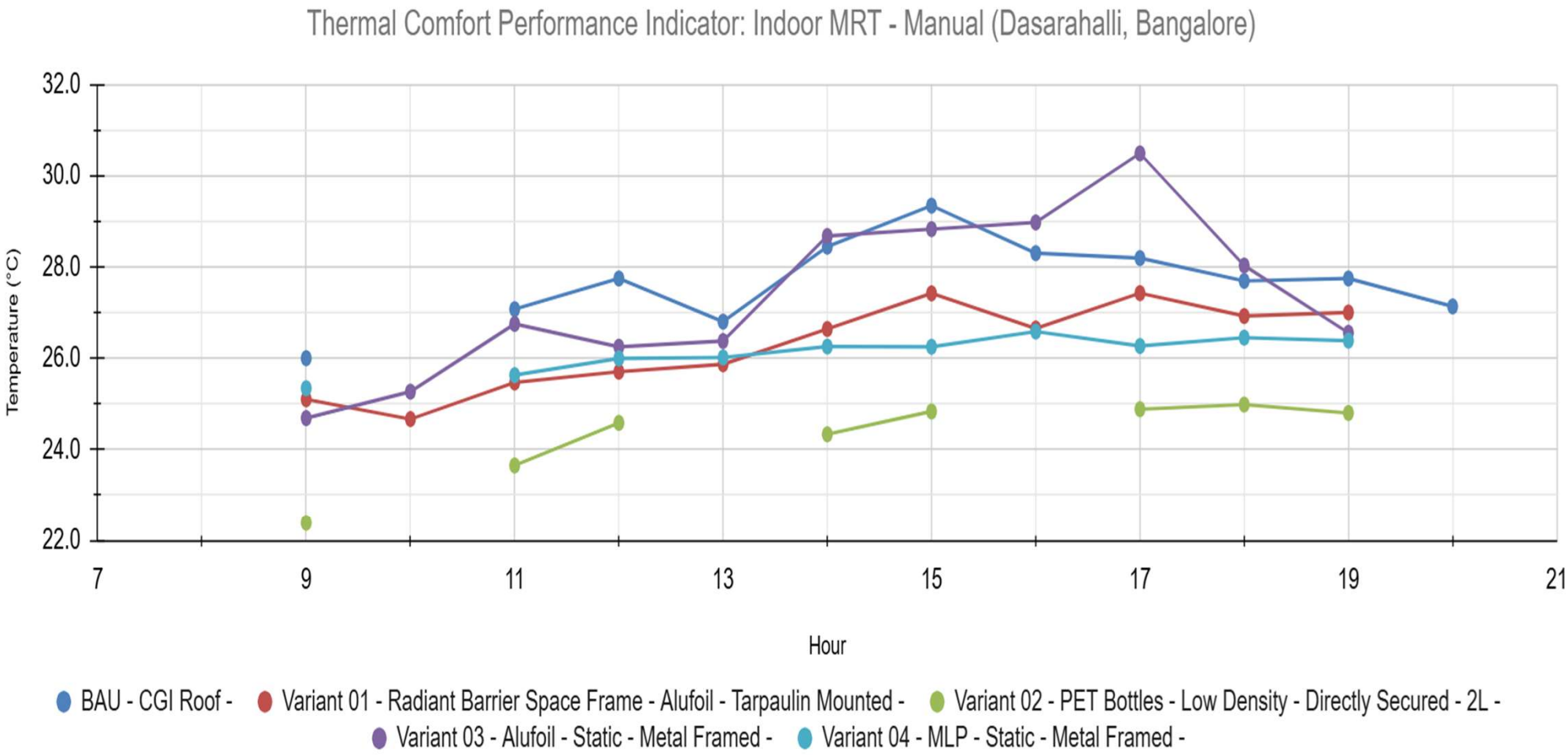
Thermal Comfort Performance Indicator: Indoor MRT - Manual (Dasarahalli, Bangalore)



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Thermal Comfort Performance Indicator: Roof (Underside) Temp. - Manual (Dasarahalli, Bangalore)

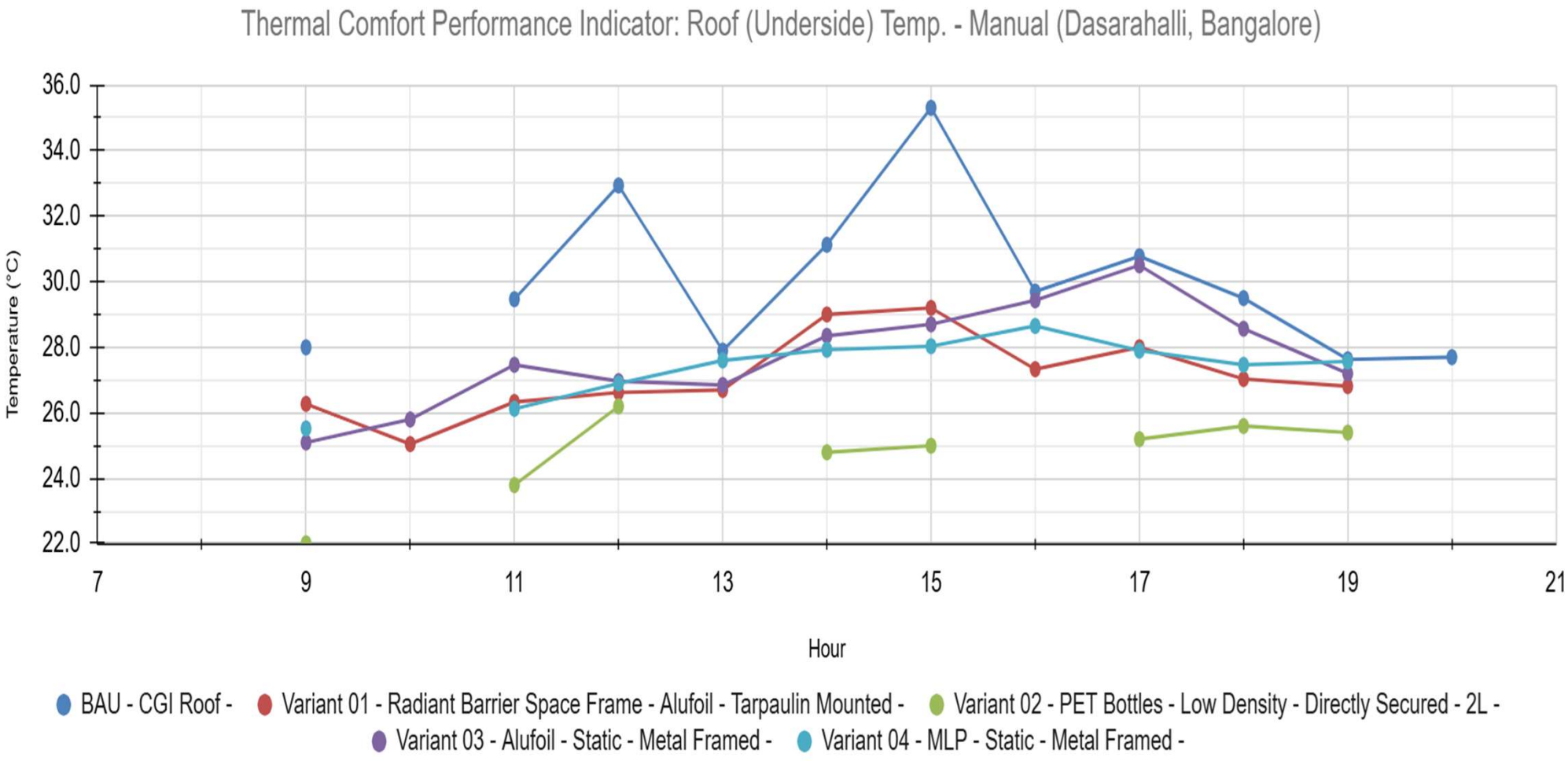

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Table: Thermal Comfort Performance Indicators (Manual) vs. BAU: Dasarahalli, Bangalore

Legend DBT = Dry Bulb Temperature MRT = Mean Radiant Temperature	DBT	DBT	DBT	DBT	MRT	MRT	MRT	MRT	Roof Temp.	Roof Temp.	Roof Temp.	Roof Temp.
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value
Variant 01 - Radiant Barrier Space Frame - Alufoil - Tarpaulin Mounted -	1.2	13.0	-0.2	0.5	2.0	12.0	0.7	1.3	6.3	12.0	0.8	2.9
Variant 02 - PET Bottles - Low Density - Directly Secured - 2L -	2.9	14.0	0.9	1.8	4.5	15.0	2.7	3.5	10.3	15.0	2.2	5.8
Variant 03 - Alufoil - Static - Metal Framed -	1.4	13.0	-0.6	0.5	1.5	12.0	-2.3	0.2	6.6	15.0	0.3	2.3
Variant 04 - MLP - Static - Metal Framed -	1.8	16.0	0.1	1.0	3.1	15.0	0.7	1.6	7.3	15.0	0.1	2.9

Performance Results

The thermal comfort indicator-based performance analysis presented in the Charts and Tables above, yield the following conclusions:

- In terms of all performance indicators - Dry-Bulb Temperature Reduction, Mean Radiant Temperature Reduction and Roof (Underside) Temperature Reduction - the PET Bottle Solution was demonstrably the most effective solution. It must be noted however, that the PET Bottle's Home benefits greatly from its unique location under the foliage of an adjacent tree which supplements the thermal benefit of the solution. The current data-gathering methodology is not designed to isolate the influence of surrounding structures/physical features and hence this is currently only an informed speculation. Further data collection and analysis is required to unequivocally validate the observation that the PET Bottle Solution is the most effective relative to the other Solutions that were part of the Pilot Study.
- Since all the solutions are designed to mitigate the influence of solar ingress/heat gain through the roof, it was anticipated that the primary beneficial impact of the Pilot Installations would be observed through measurements of Roof (Underside) Temperature. The measurement of performance indicators confirms this anticipated effect.
- Roof (Underside) Temperatures for all Solutions were significantly reduced relative to the BAU Home:

1. PET Bottles resulted in an average Roof (Underside) Temperature reduction of approximately 6 ^{0}C (with a range of 2.2 ^{0}C to 10.3 ^{0}C, with the peak difference observed at 3 pm)
2. The Under-Roof Static Radiant Barrier Solutions (Alufoil and MLP-panel based) resulted in an average Roof (Underside) Temperature reduction of approximately 2.5 ^{0}C (with a range of 0.1 ^{0}C to 7.3 ^{0}C, with the peak difference observed at 3 pm)
3. The Above-Roof Dynamic Radiant Barrier Solutions (i.e. Tarpaulin-Mounted Alufoil 'Space Frame') resulted in an average Roof (Underside) Temperature reduction of approximately 3 ^{0}C (with a range of 0.8 ^{0}C to 6.3 ^{0}C, with the peak difference observed at 12 noon).

Performance Results

- Indoor Air Temperatures (DBT) for all Solutions were much less impacted relative to the BAU Home. It must be noted however, that evaluation of indoor air temperature phenomenon requires extensive sensor-based data gathering at frequent intervals which was undermined during this Pilot Study due to the earlier mentioned causes. Extended sensor-based data collection from the BAU and Pilot Test Homes is required to make scientifically rigorous claims about the influence of these Solutions on Indoor Air Temperature. Notwithstanding the above mitigating circumstances, the analysis of the current data set yields the following conclusion.

1. PET Bottles resulted in an average DBT reduction of approximately 2 0C (with a range of 0.9 0C to 2.9 0C, with the peak difference observed at 2 pm)
2. The Under-Roof Static Radiant Barrier Solutions (Alufoil and MLP-panel based) resulted in an average DBT reduction of approximately 0.8 0C (with a range of -0.6 0C to 1.8 0C, with the peak difference observed at 1 pm and 4 pm)
3. The Above-Roof Dynamic Radiant Barrier Solutions (i.e. Tarpaulin-Mounted Alufoil 'Space Frame') resulted in an average Roof (Underside) Temperature reduction of approximately 0.5 0C (with a range of -0.2 0C to 1.2 0C, with the peak difference observed at 1 pm).

Performance Results

In terms of Peak DBT Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest DBT vs. BAU home):

Rank	Solution	Delta (^{0}C)
1	Variant 02 - PET Bottles - Low Density - Directly Secured - 2L -	2.9
2	Variant 04 - MLP - Static - Metal Framed -	1.8
3	Variant 03 - Alufoil - Static - Metal Framed -	1.4
4	Variant 01 - Radiant Barrier Space Frame - Alufoil - Tarpaulin Mounted -	1.2

Performance Results

In terms of Peak MRT Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest MRT vs. BAU home):

Rank	Solution	Delta (^{0}C)
1	Variant 02 - PET Bottles - Low Density - Directly Secured - 2L -	4.5
2	Variant 04 - MLP - Static - Metal Framed -	3.1
3	Variant 01 - Radiant Barrier Space Frame - Alufoil - Tarpaulin Mounted -	2.0
4	Variant 03 - Alufoil - Static - Metal Framed -	1.5

Performance Results

In terms of Peak Roof Radiant Temperature (Underside) Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest Roof Radiant Temperature vs. BAU home):

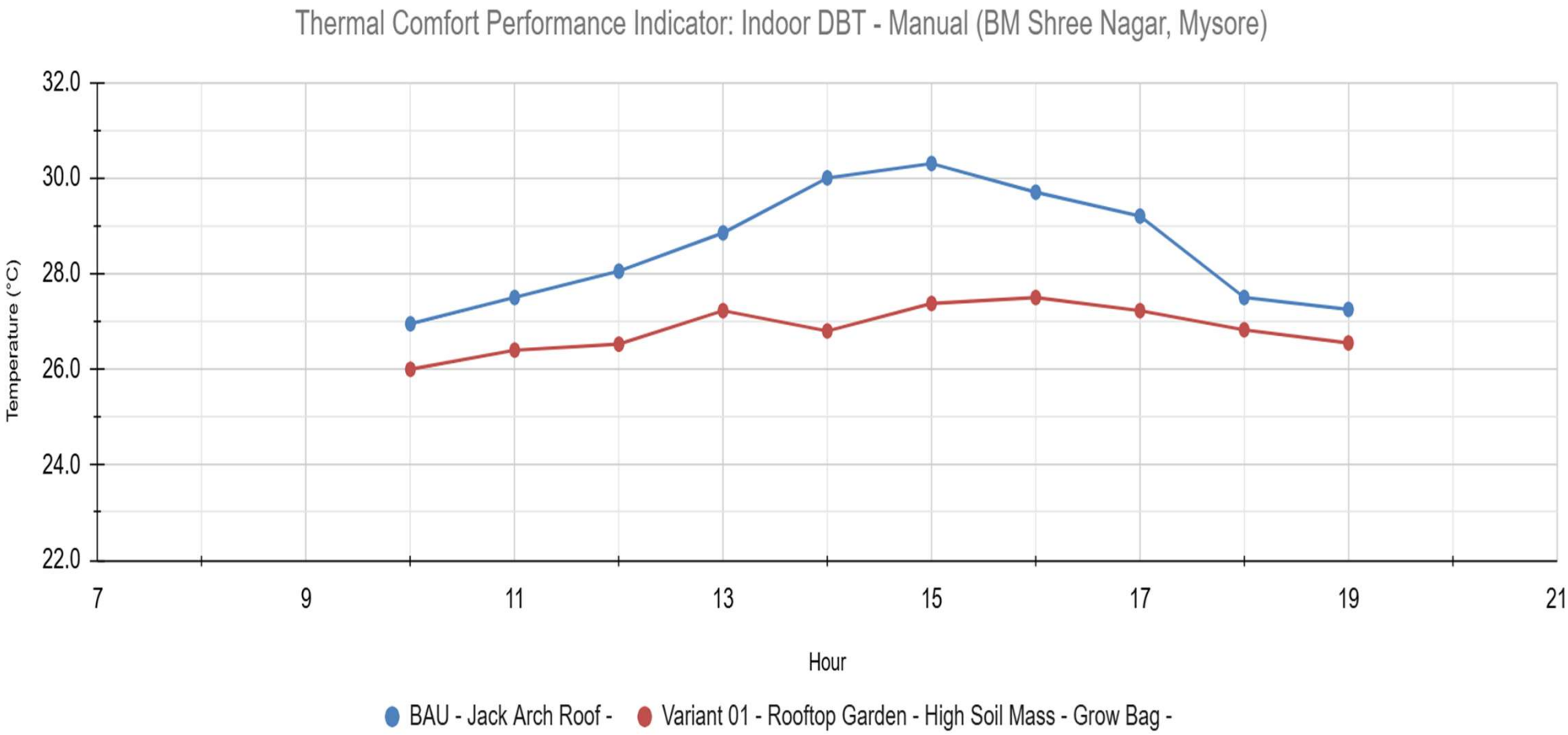
Rank	Solution	Delta (^{0}C)
1	Variant 02 - PET Bottles - Low Density - Directly Secured - 2L -	10.3
2	Variant 04 - MLP - Static - Metal Framed -	7.3
3	Variant 03 - Alufoil - Static - Metal Framed -	6.6
4	Variant 01 - Radiant Barrier Space Frame - Alufoil - Tarpaulin Mounted -	6.3

Performance Results

- The solutions that performed better than 'median' performance in terms of MRT were:
  1. Variant 02 - PET Bottles - Low Density - Directly Secured - 2L -
  2. Variant 04 - MLP - Static - Metal Framed -
- The solutions that performed better than 'median' performance in terms of Roof Radiant Temperature were:
  1. Variant 02 - PET Bottles - Low Density - Directly Secured - 2L -
  2. Variant 04 - MLP - Static - Metal Framed -

CURRENT IMPACT - MYSORE

Thermal Comfort Performance Indicator: Indoor DBT - Manual (BM Shree Nagar, Mysore)



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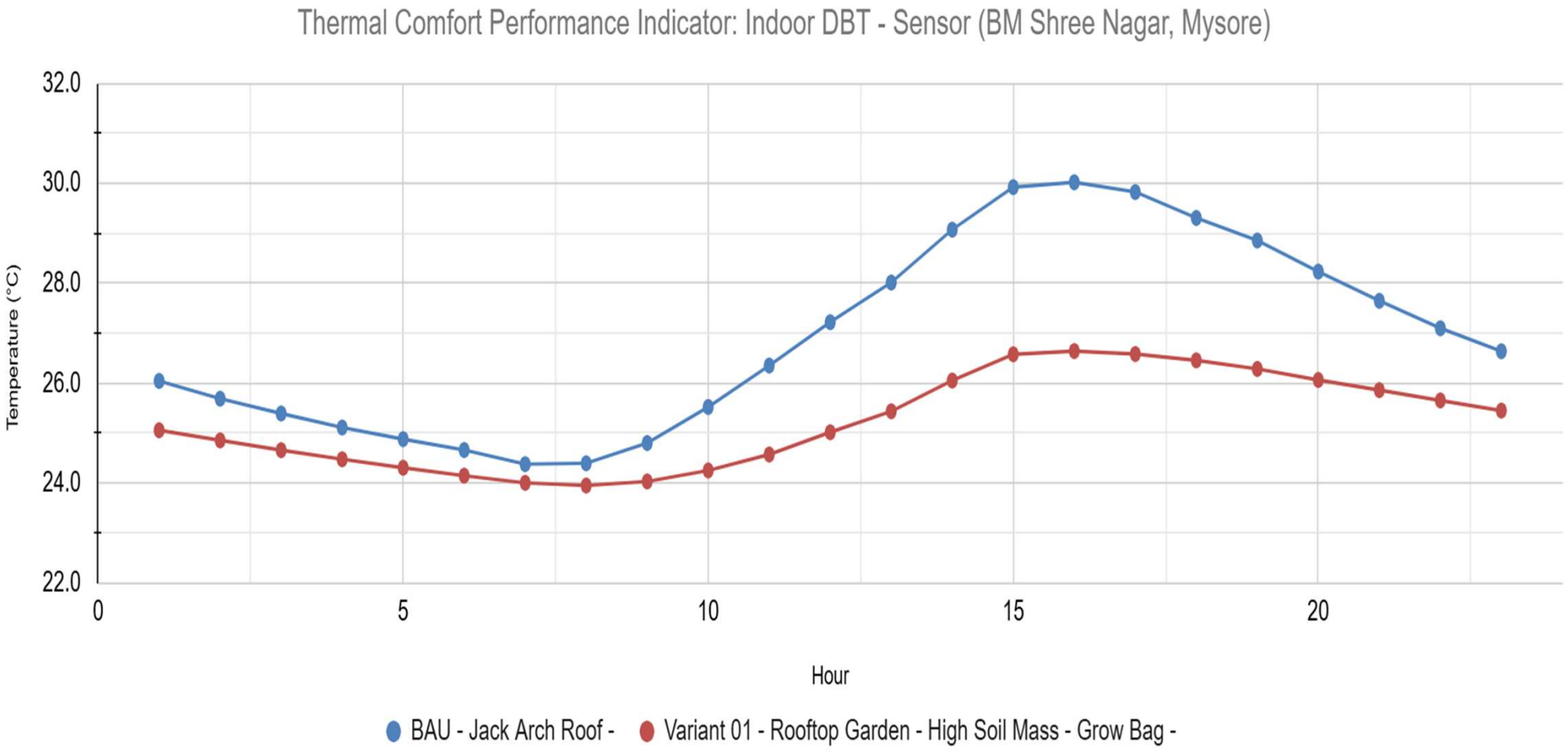
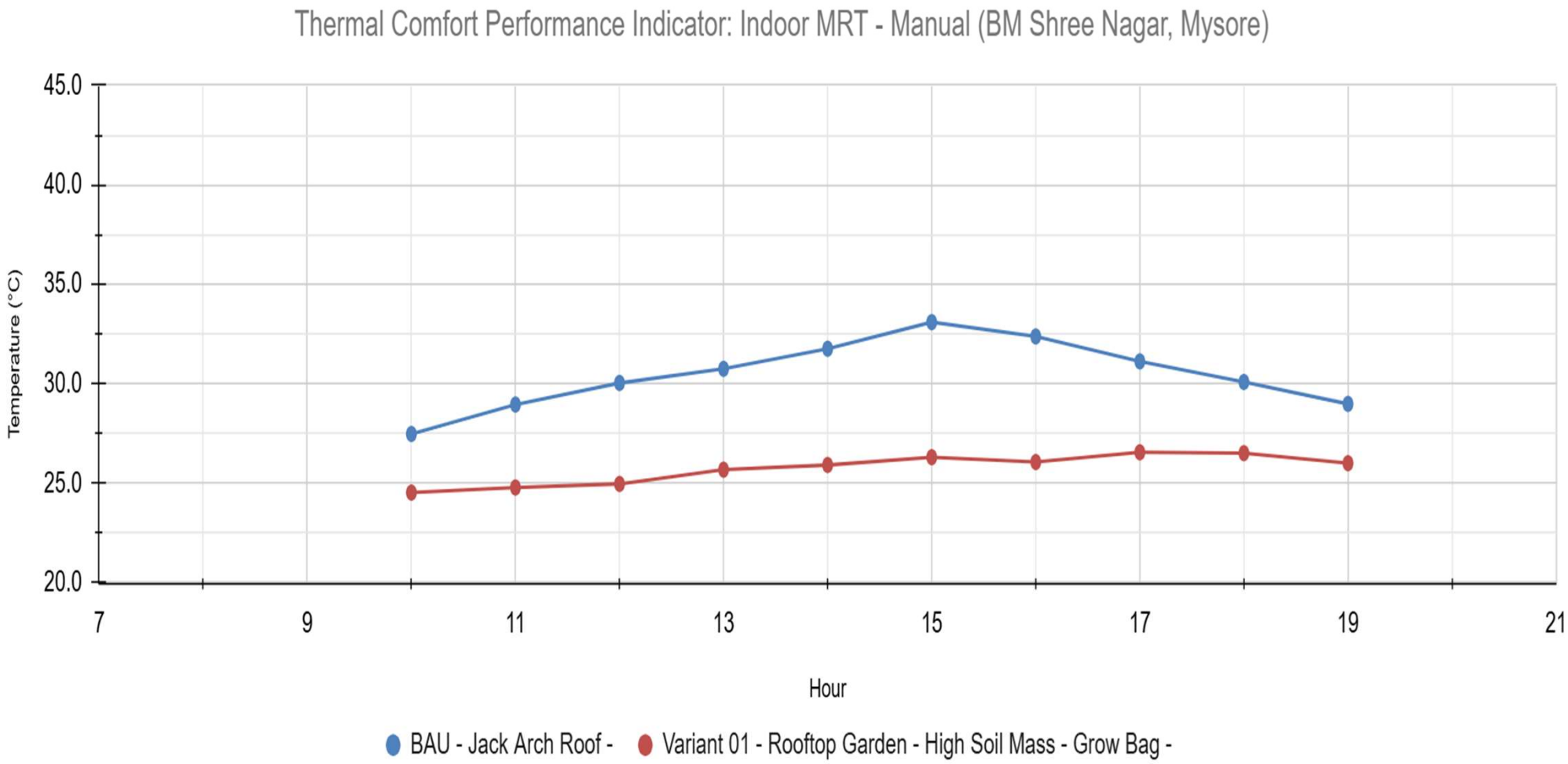
Thermal Comfort Performance Indicator: Indoor DBT - Sensor (BM Shree Nagar, Mysore)



fAIR CONDITIONING

Thermal Comfort Performance Indicator: Indoor MRT - Manual (BM Shree Nagar, Mysore)



fAIR CONDITIONING

Thermal Comfort Performance Indicator: Roof (Underside) Temp. - Manual (BM Shree Nagar, Mysore)

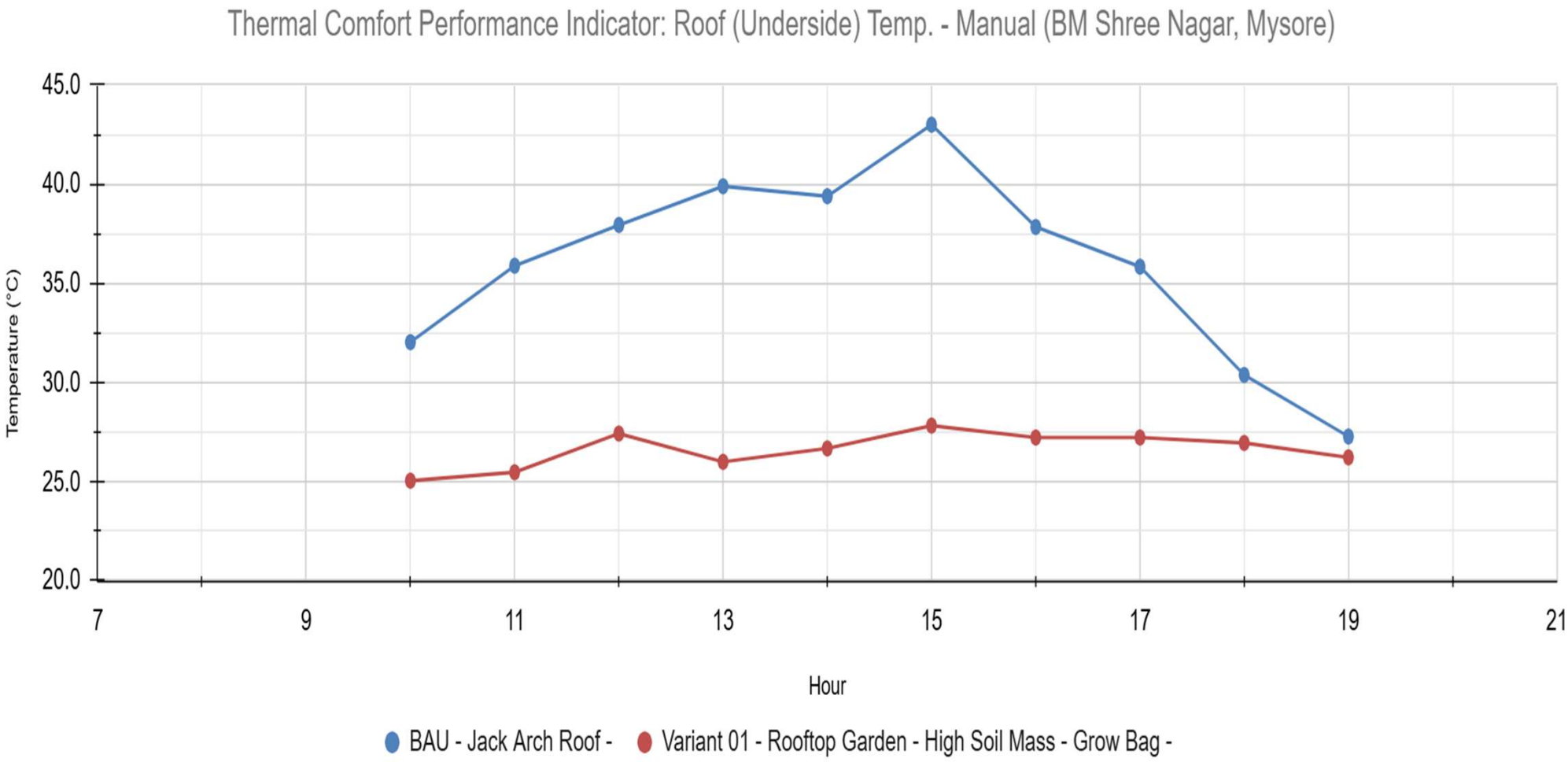


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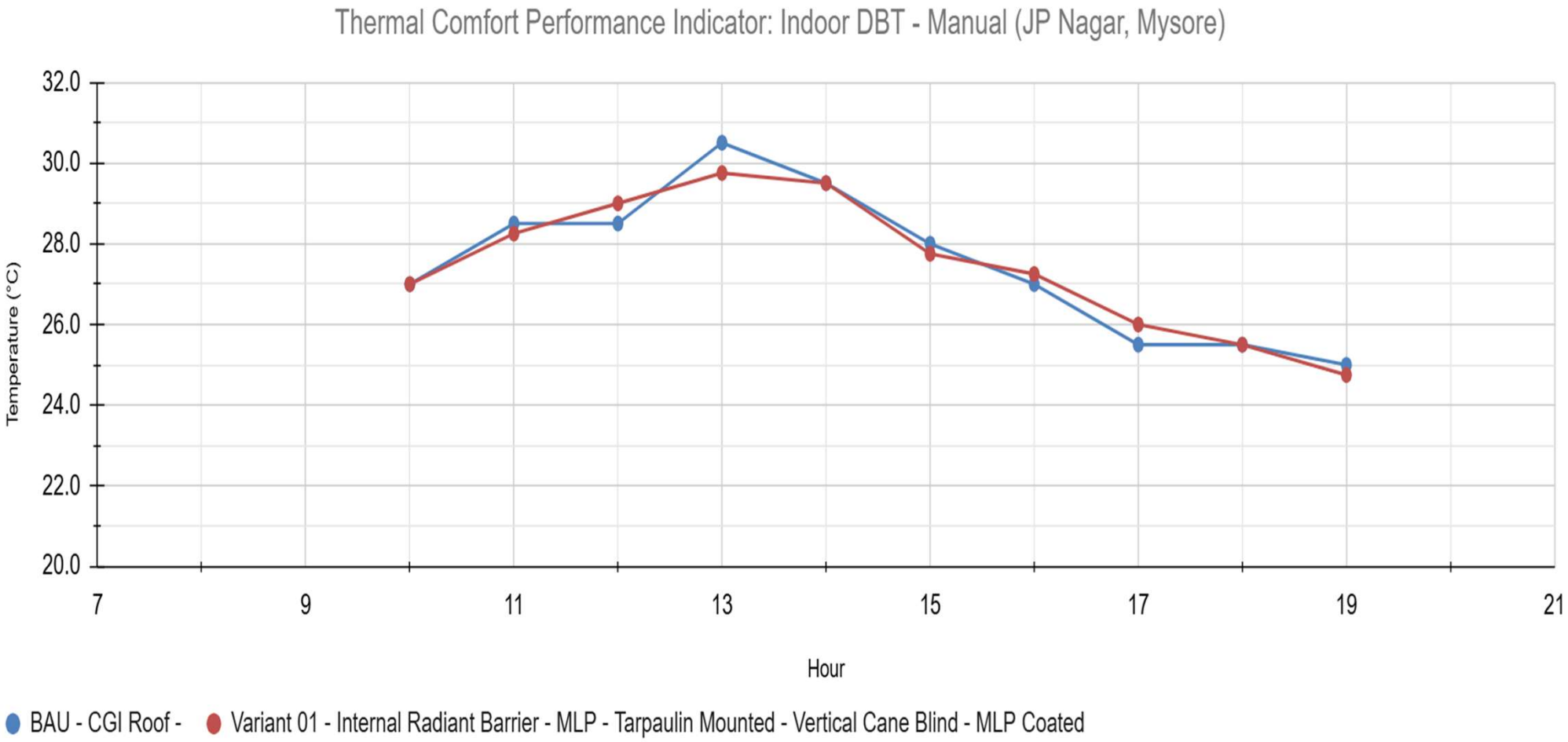
Table: Thermal Comfort Performance Indicators (Manual) vs. BAU: BM Shree Nagar, Mysore

Legend DBT = Dry Bulb Temperature MRT = Mean Radiant Temperature	DBT	DBT	DBT	DBT	MRT	MRT	MRT	MRT	Roof Temp.	Roof Temp.	Roof Temp.	Roof Temp.
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value
Rooftop Garden - High Soil Mass - Grow Bag -	3.2	14.0	0.7	1.7	6.8	15.0	2.9	4.7	15.2	15.0	1.1	9.3

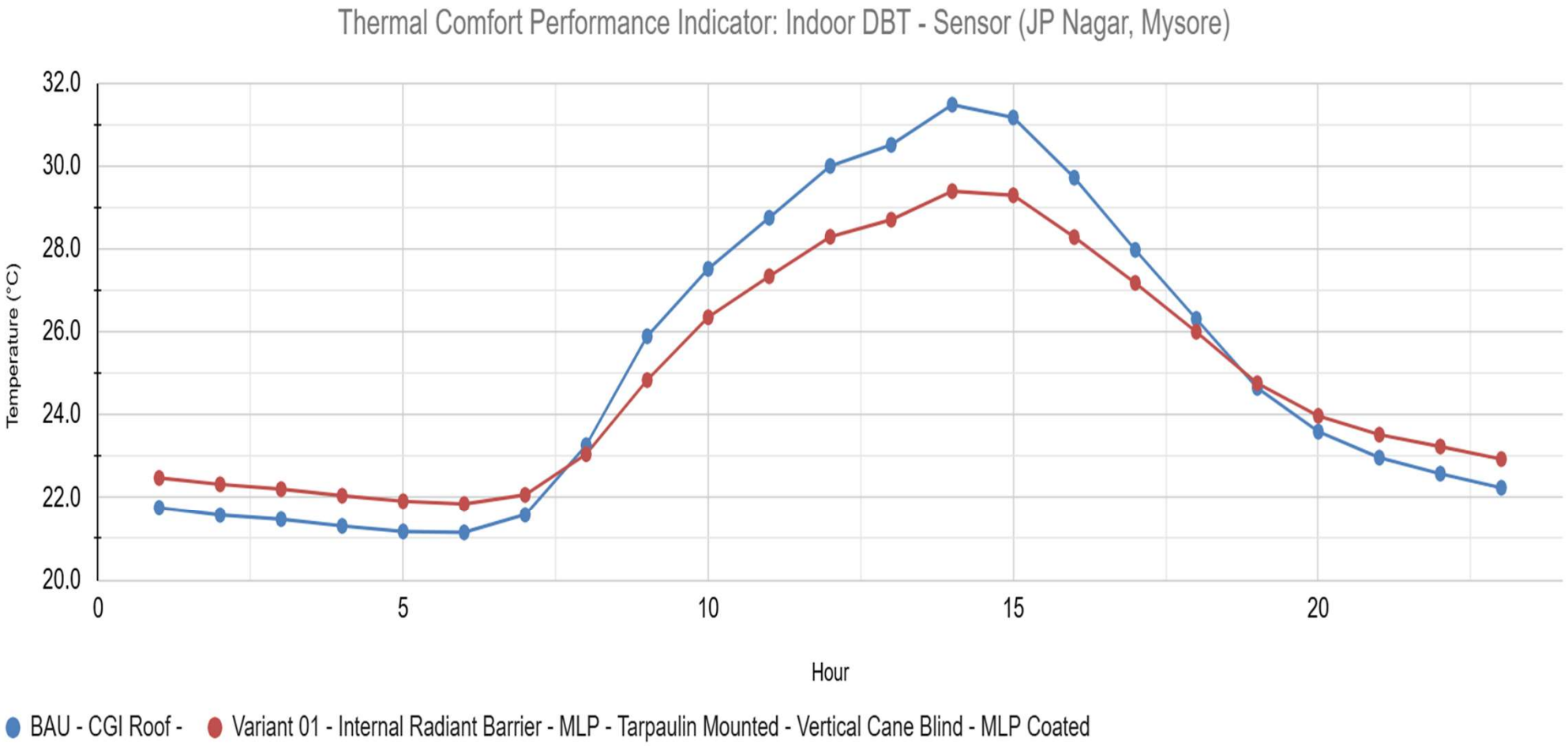
Table: Thermal Comfort Performance Indicators (Sensor) vs. BAU: BM Shree Nagar, Mysore

Legend DBT = Dry Bulb Temperature	DBT	DBT	DBT	DBT
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value
Rooftop Garden - High Soil Mass - Grow Bag -	3.4	16.0	0.4	1.7

Thermal Comfort Performance Indicator: Indoor DBT - Manual (JP Nagar, Mysore)



Thermal Comfort Performance Indicator: Indoor DBT - Sensor (JP Nagar, Mysore)



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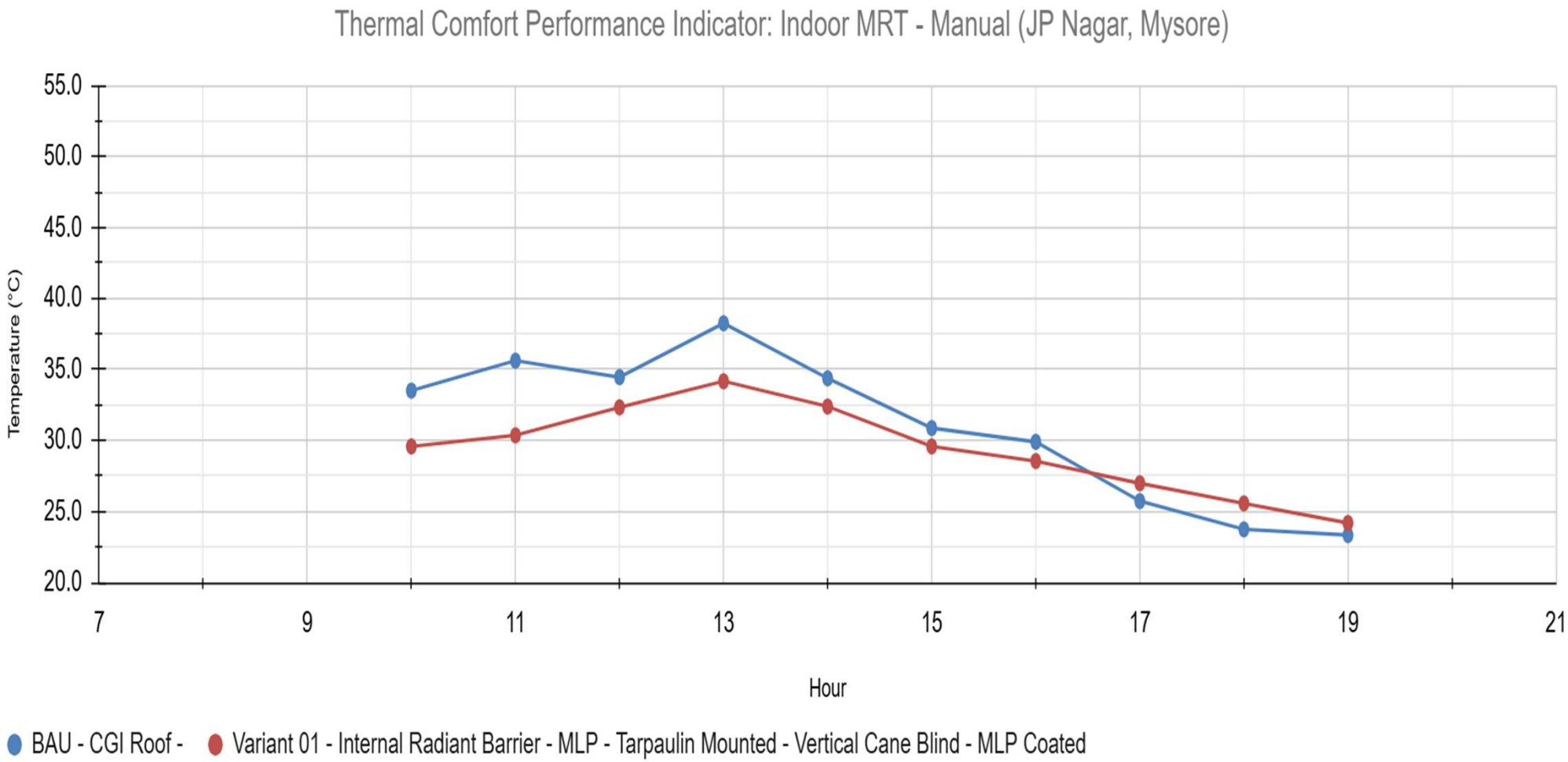
Thermal Comfort Performance Indicator: Indoor MRT - Manual (JP Nagar, Mysore)



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Thermal Comfort Performance Indicator: Roof (Underside) Temp. - Manual (JP Nagar, Mysore)

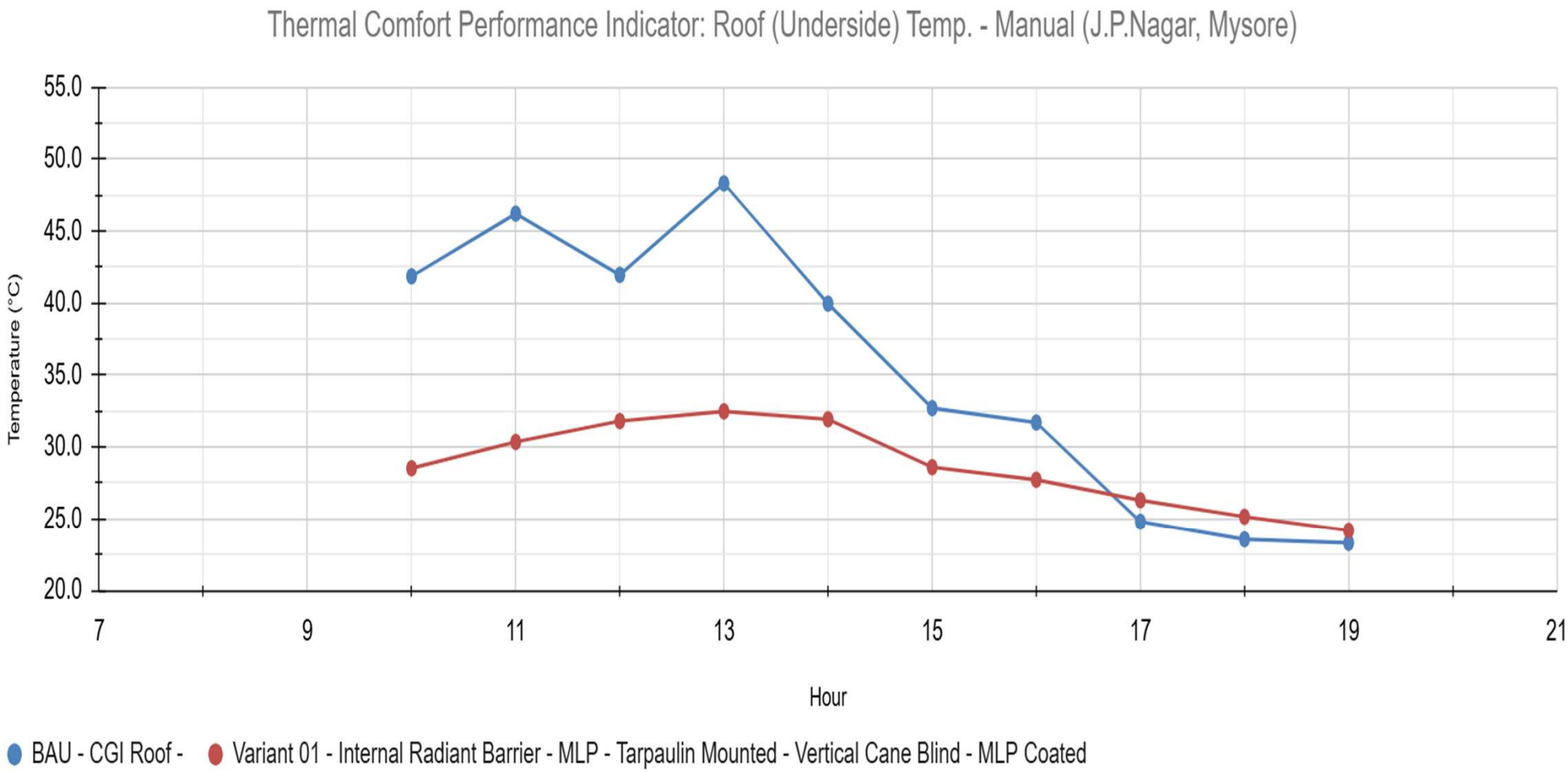

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Table: Thermal Comfort Performance Indicators (Manual) vs. BAU: JP Nagar, Mysore

Legend DBT = Dry Bulb Temperature MRT = Mean Radiant Temperature	DBT	DBT	DBT	DBT	MRT	MRT	MRT	MRT	Roof Temp.	Roof Temp.	Roof Temp.	Roof Temp.
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value
Internal Radiant Barrier - MLP - Tarpaulin Mounted - Vertical Cane Blind - MLP Coated	0.8	13.0	-0.5	0.0	7.4	11.0	-1.8	1.8	23.9	11.0	-1.6	7.5

Table: Thermal Comfort Performance Indicators (Sensor) vs. BAU: JP Nagar, Mysore

Legend DBT = Dry Bulb Temperature	DBT	DBT	DBT	DBT
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value
Internal Radiant Barrier - MLP - Tarpaulin Mounted - Vertical Cane Blind - MLP Coated	2.1	14.0	-0.8	0.3

Performance Results

The thermal comfort indicator-based performance analysis presented in the Charts and Tables above, yield the following conclusions:

- In terms of all performance indicators - Dry-Bulb Temperature Reduction, Mean Radiant Temperature Reduction and Roof (Underside) Temperature Reduction - the Internal Dynamic Barrier + Vertical Bamboo Blind Solution was demonstrably the most effective solution.
- Since all the solutions are designed to mitigate the influence of solar ingress/heat gain through the roof, it was anticipated that the primary beneficial impact of the Pilot Installations would be observed through measurements of Roof (Underside) Temperature. The measurement of performance indicators confirms this anticipated effect.
- Roof (Underside) Temperatures for all Solutions were significantly reduced relative to the BAU Home:
  1. Internal Dynamic Barrier + Vertical Bamboo Blind resulted in an average Roof (Underside) Temperature reduction of approximately 7.5 0C (with a range of -1.6 0C to 23.9 0C, with the peak difference observed at 11 am)
  2. Rooftop Garden resulted in an average Roof (Underside) Temperature reduction of approximately 9.3 0C (with a range of 1.1 0C to 15.2 0C, with the peak difference observed at 3 pm)

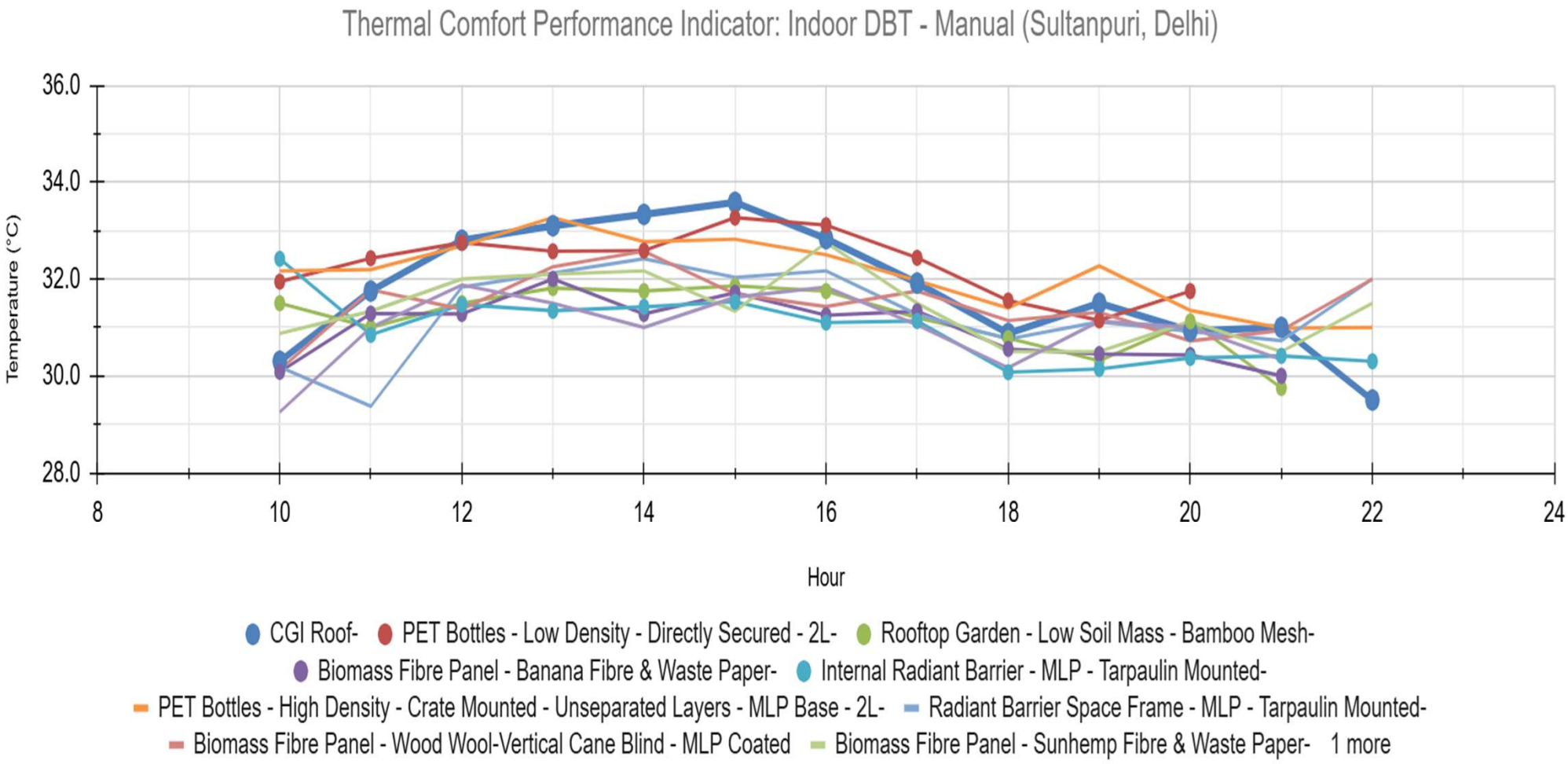
Performance Results

- Indoor Air Temperatures (DBT) for all Solutions were much less impacted relative to the BAU Home. It must be noted however, that evaluation of indoor air temperature phenomenon requires extensive sensor-based data gathering at frequent intervals which was undermined during this Pilot Study due to the earlier mentioned causes. Extended sensor-based data collection from the BAU and Pilot Test Homes is required to make scientifically rigorous claims about the influence of these Solutions on Indoor Air Temperature. Notwithstanding the above mitigating circumstances, the analysis of the current data set yields the following conclusion.

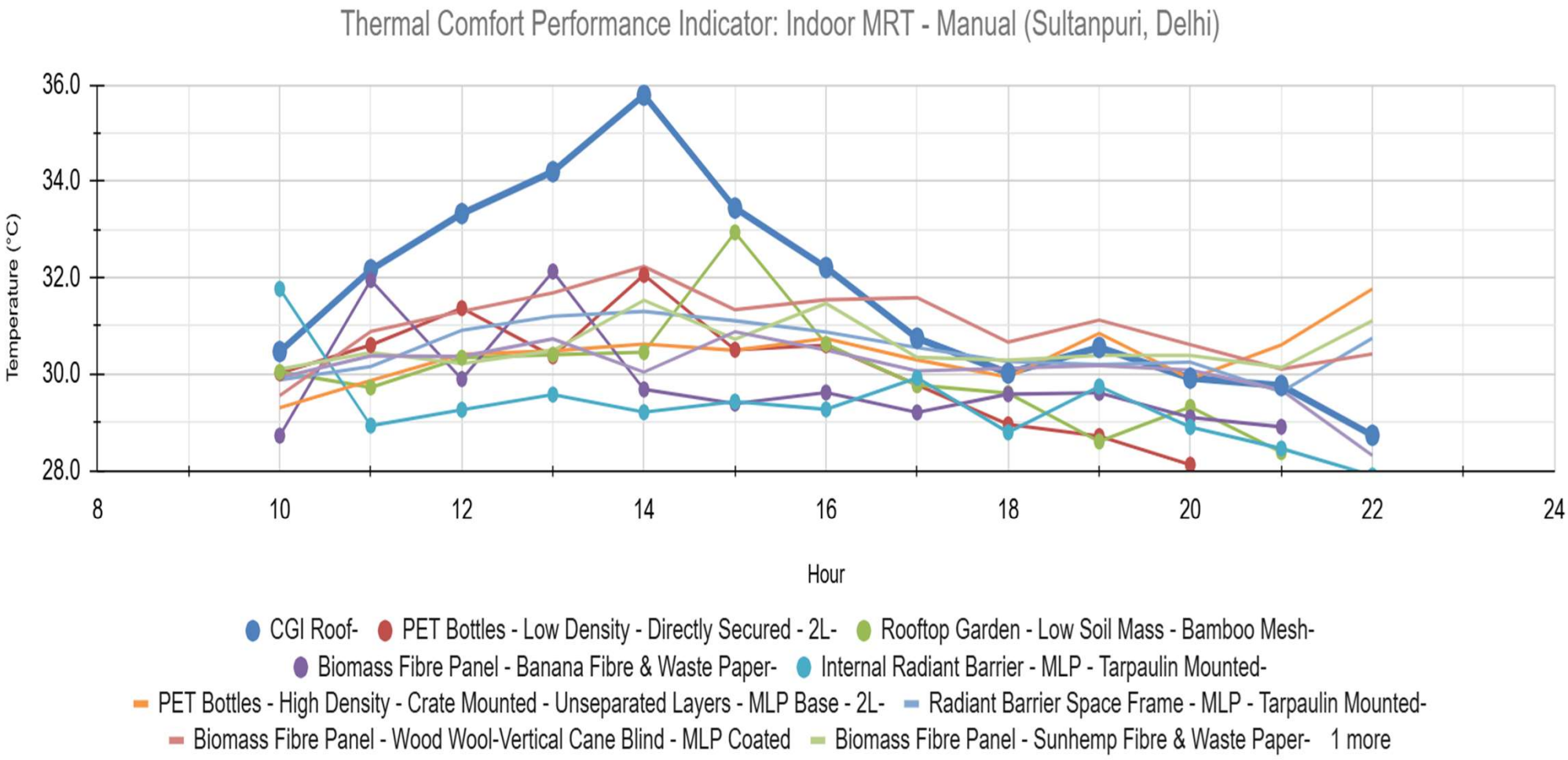
1. Internal Dynamic Barrier + Vertical Bamboo Blind Solutions resulted in an average DBT reduction of approximately 0.3 0C (with a range of -0.8 0C to 2.1 0C, with the peak difference observed at 2 pm)
2. Rooftop Garden Solutions resulted in an average DBT reduction of approximately 1.7 0C (with a range of 0.7 0C to 3.2 0C, with the peak difference observed at 2 pm)

CURRENT IMPACT - DELHI

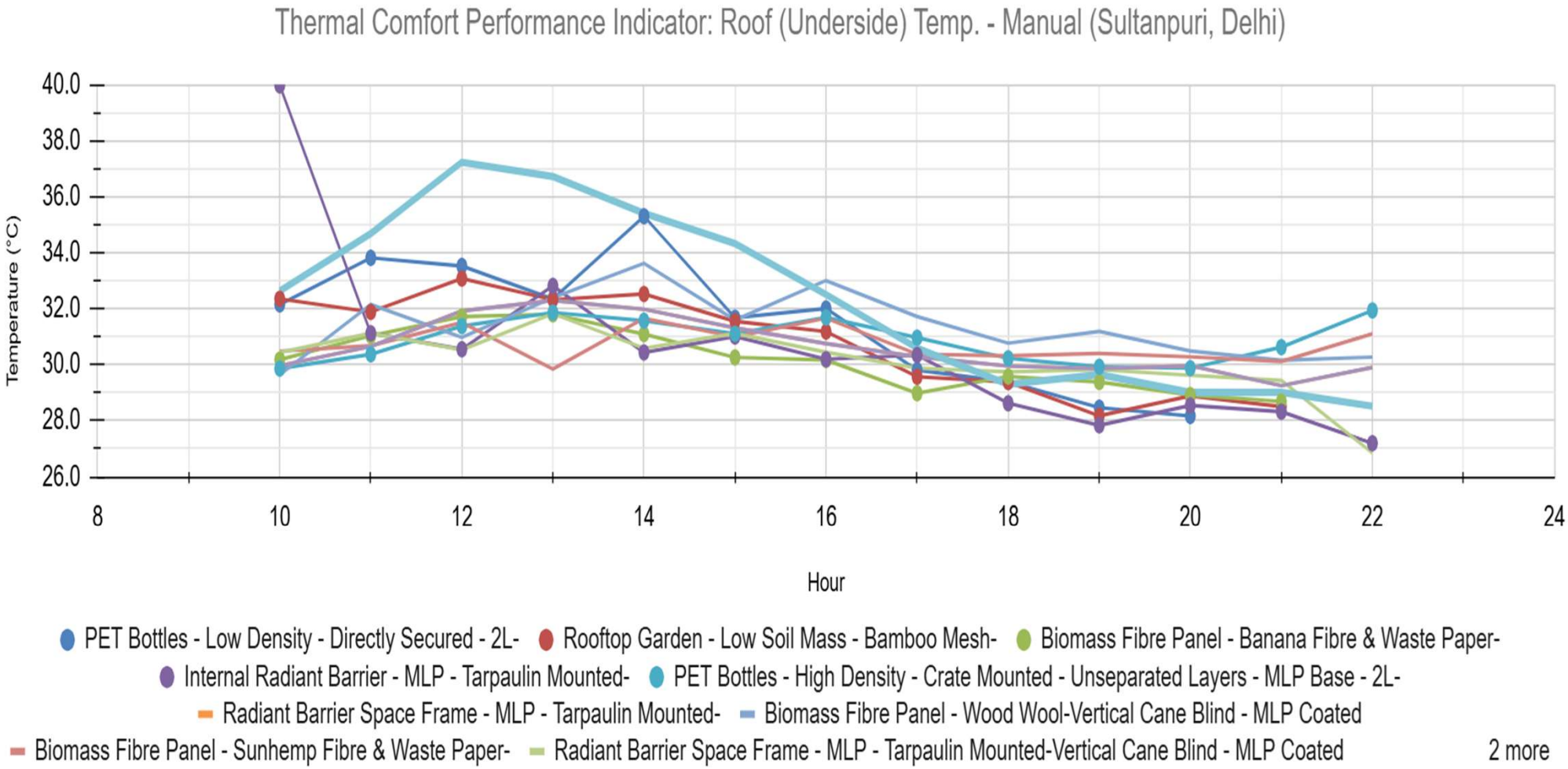
Thermal Comfort Performance Indicator: Indoor DBT - Manual (Sultanpuri, Delhi)



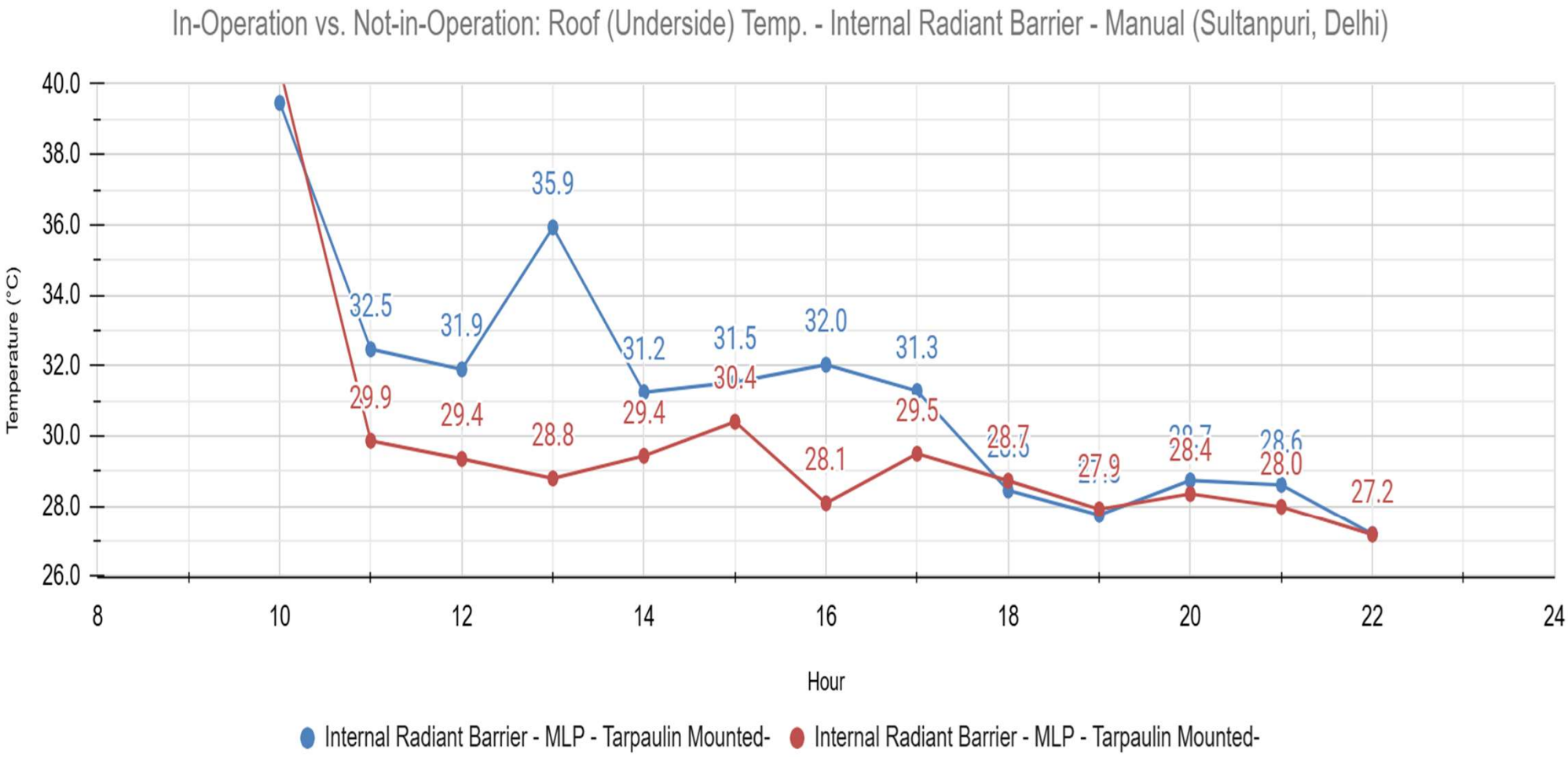
Thermal Comfort Performance Indicator: Indoor MRT - Manual (Sultanpuri, Delhi)



Thermal Comfort Performance Indicator: Roof (Underside) Temp. - Manual (Sultanpuri, Delhi)



In-Operation vs. Not-in-Operation: Roof (Underside) Temp. - Internal Radiant Barrier (Sultanpuri, Delhi)



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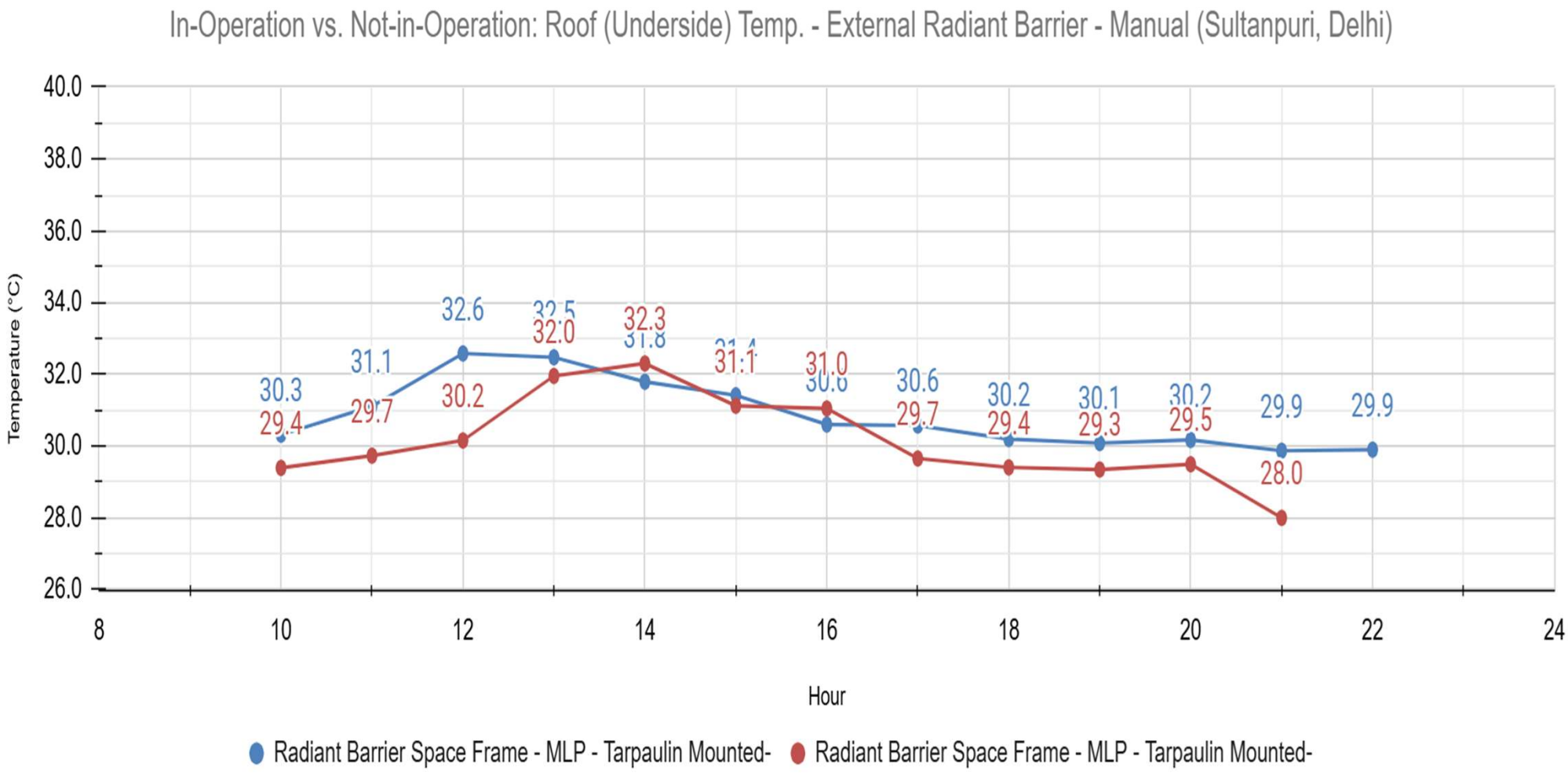
In-Operation vs. Not-in-Operation: Roof (Underside) Temp. - External Radiant Barrier (Sultanpuri, Delhi)



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In-Operation vs. Not-in-Operation: Roof (Underside) Temp. - External Radiant Barrier + Vertical Cane Blind (Sultanpuri, Delhi)

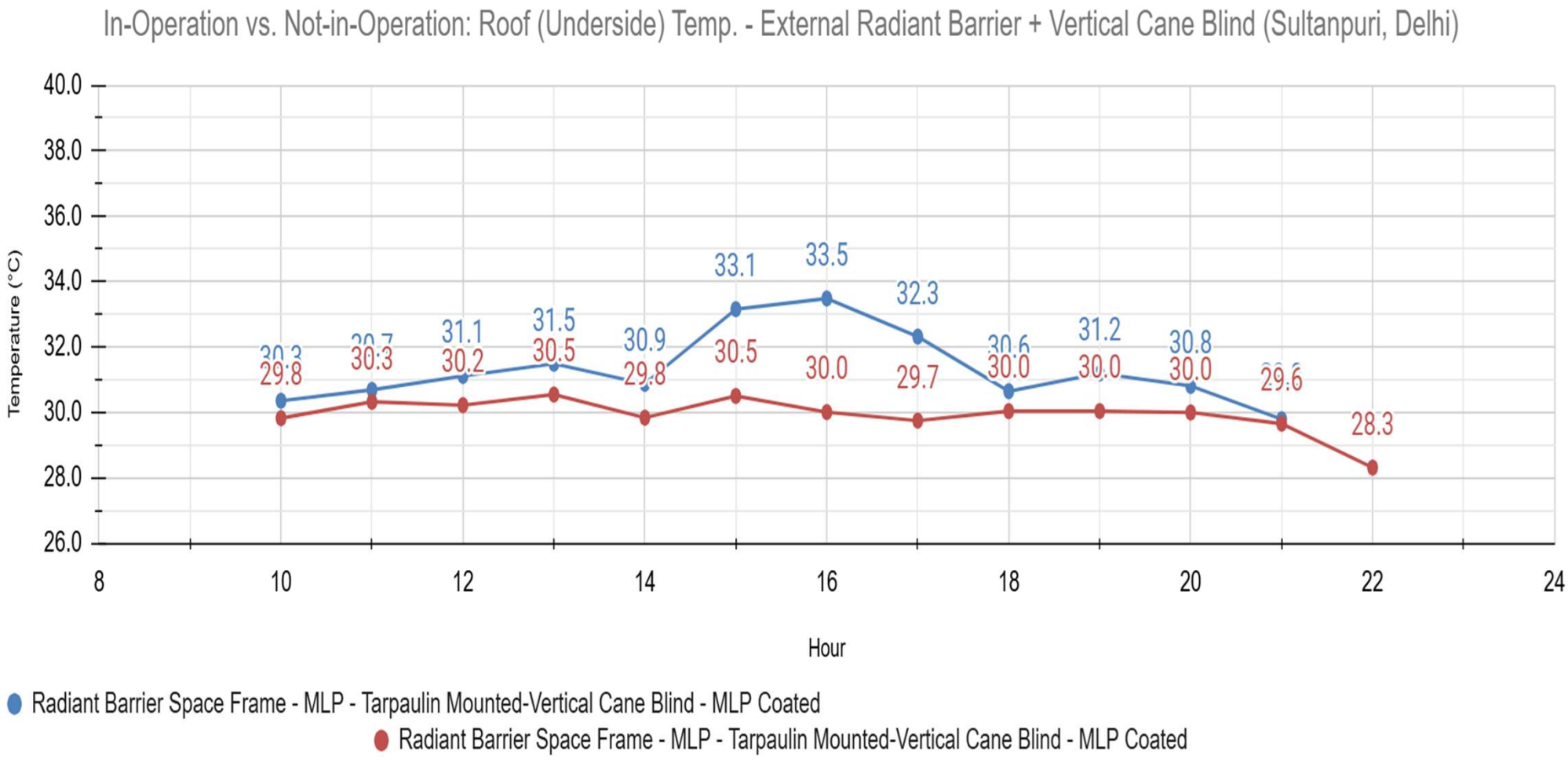

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Table: Thermal Comfort Performance Indicators (Manual) vs. BAU: Sultanpuri, Delhi

Legend DBT = Dry Bulb Temperature MRT = Mean Radiant Temperature	DBT	DBT	DBT	DBT	MRT	MRT	MRT	MRT	Roof Temp.	Roof Temp.	Roof Temp.	Roof Temp.
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min. Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min. Delta Value	Avg. Delta Value
Biomass Panel - Banana Fibre & Waste Paper	1.7	15.0	-1.2	0.8	5.3	14.0	0.4	1.9	4.4	13.0	-0.1	1.8
Biomass Panel - Sunhemp Fibre & Waste Paper	2.1	14.0	0.2	1.0	6.1	14.0	0.2	2.1	5.5	12.0	-0.3	2.4
Wood Wool-Vertical Cane Blind	2.1	15.0	-2.1	0.8	6.6	14.0	-1.3	2.3	6.7	12.0	-7.3	1.7
Internal Radiant Barrier	0.7	14.0	-1.6	-0.2	3.8	13.0	0.4	2.0	4.4	13.0	-0.1	1.4
PET Bottles - Crate Mounted	0.8	15.0	-1.9	-0.3	5.2	14.0	-3.0	1.2	5.8	12.0	-3.4	1.4
PET Bottles - Directly Secured	2.4	11.0	-2.5	0.5	4.5	14.0	-2.0	1.1	5.3	12.0	-1.4	1.7
External Radiant Barrier	1.9	15.0	-2.5	0.3	3.6	14.0	-1.7	0.6	6.2	12.0	-1.8	0.9
External Radiant Barrier + Vertical Cane Blind	2.3	15.0	-2.0	0.4	4.3	14.0	-2.4	1.1	6.9	13.0	-2.6	1.6
Rooftop Garden	2.3	14.0	-0.1	1.0	5.7	14.0	-0.2	1.5	6.7	12.0	-0.6	2.2

Table: Thermal Comfort Performance Indicators - In-Operation vs. Not-in-Operation: Sultanpuri, Delhi

Legend DBT = Dry Bulb Temperature MRT = Mean Radiant Temperature	DBT	DBT	DBT	DBT	MRT	MRT	MRT	MRT	Roof Temp.	Roof Temp.	Roof Temp.	Roof Temp.
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min. Delta Value	Avg. Delta Value	Peak Delta	Peak Delta Time	Min. Delta	Avg. Delta
Internal Radiant Barrier	2.1	16.0	-0.3	0.8	2.4	19.0	0.0	1.1	7.1	13.0	-1.0	1.6
External Radiant Barrier + Vertical Cane Blind	1.5	12.0	-1.3	0.4	3.5	16.0	0.1	1.3	6.4	16.0	-1.1	1.3

Performance Results

The thermal comfort indicator-based performance analysis presented in the Charts and Tables above, yield the following conclusions:

- As indicated in previous Indoor DBT chart, between 12 noon and 4 pm, the BAU home witnessed the highest Dry-Bulb Temperature (DBT) relative to all 'Intervention' homes.
- As indicated in previous Indoor MRT chart, between 10 am and 4 pm, the BAU home witnessed the highest Mear Radiant Temperature (MRT) relative to all 'Intervention' homes.
- As indicated in previous Roof(Underside) chart, between 10 am and 4 pm, the BAU home witnessed the highest Roof (Underside) Radiant Temperature (MRT) relative to all 'Intervention' homes.
- The Peak Diurnal Delta for DBT (i.e. maximum difference witnessed during the day) between Intervention homes vs. BAU homes ranged from 0.7 (for Internal Radiant Barrier) to 2.4 0C (for PET Bottles - Single Layer Directly Secured to the Roof) with most solutions (median value) yielding an approximately 2.1 0C DBT reduction.
- Indoor Air Temperatures (DBT) for all Solutions were much less impacted relative to the BAU Home. It must be noted however, that evaluation of indoor air temperature phenomenon requires extensive sensor-based data gathering at frequent intervals which was undermined during this Pilot Study due to time constraints. Extended sensor-based data collection from the BAU and Pilot Test Homes is required to make scientifically rigorous claims about the influence of these Solutions on Indoor Air Temperature.
- Since all the solutions are designed to mitigate the influence of solar ingress/heat gain through the roof, it was anticipated that the primary beneficial impact of the Pilot Installations would be observed through measurements of Roof (Underside) Temperature. The measurement of performance indicators confirms this anticipated effect.
- Mean Radiant and Roof (Underside) Temperatures for all Solutions were significantly reduced relative to the BAU Home.

Performance Results

- The Peak Delta for MRT between Intervention homes vs. BAU homes ranged from 3.6 (for External Radiant Barrier) to 6.6 0C (for MLP-wrapped Wood Wool Panel with MLP-coated Vertical Cane Blinds) with most solutions (median value) yielding an approximately 5.2 0C MRT reduction.
- The Peak Delta for Roof Radiant Temperature between Intervention homes vs. BAU homes ranged from 4.4 (for Internal Radiant Barrier, and MLP-wrapped Banana-Fibre Biomass Panel) to 6.9 0C (for External Radiant Barrier + MLP-coated Vertical Cane Blind) with most solutions (median value) yielding an approximately 5.8 0C Roof Radiant Temperature reduction.

Performance Results

In terms of Peak DBT Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest DBT vs. BAU home):

Rank	Solution	Delta (^{0}C)
1	PET Bottles - Low Density - Directly Secured - 2L-	2.4
2	Rooftop Garden - Low Soil Mass - Bamboo Mesh-	2.3
3	Radiant Barrier Space Frame - MLP - Tarpaulin Mounted-Vertical Cane Blind - MLP Coated	2.3
4	Biomass Fibre Panel - Sunhemp Fibre & Waste Paper-	2.1
5	Biomass Fibre Panel - Wood Wool-Vertical Cane Blind - MLP Coated	2.1
6	Radiant Barrier Space Frame - MLP - Tarpaulin Mounted-	1.9
7	Biomass Fibre Panel - Banana Fibre & Waste Paper-	1.7
8	PET Bottles - High Density - Crate Mounted - Unseparated Layers - MLP Base - 2L-	0.8
9	Internal Radiant Barrier - MLP - Tarpaulin Mounted-	0.7

Performance Results

In terms of Peak MRT Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest MRT vs. BAU home):

Rank	Solution	Delta (^{0}C)
1	Biomass Fibre Panel - Wood Wool-Vertical Cane Blind - MLP Coated	6.6
2	Biomass Fibre Panel - Sunhemp Fibre & Waste Paper-	6.1
3	Rooftop Garden - Low Soil Mass - Bamboo Mesh-	5.7
4	Biomass Fibre Panel - Banana Fibre & Waste Paper-	5.3
5	PET Bottles - High Density - Crate Mounted - Unseparated Layers - MLP Base - 2L-	5.2
6	PET Bottles - Low Density - Directly Secured - 2L-	4.5
7	Radiant Barrier Space Frame - MLP - Tarpaulin Mounted-Vertical Cane Blind - MLP Coated	4.3
8	Internal Radiant Barrier - MLP - Tarpaulin Mounted-	3.8
9	Radiant Barrier Space Frame - MLP - Tarpaulin Mounted-	3.6

Performance Results

In terms of Peak Roof Radiant Temperature (Underside) Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest Roof Radiant Temperature vs. BAU home):

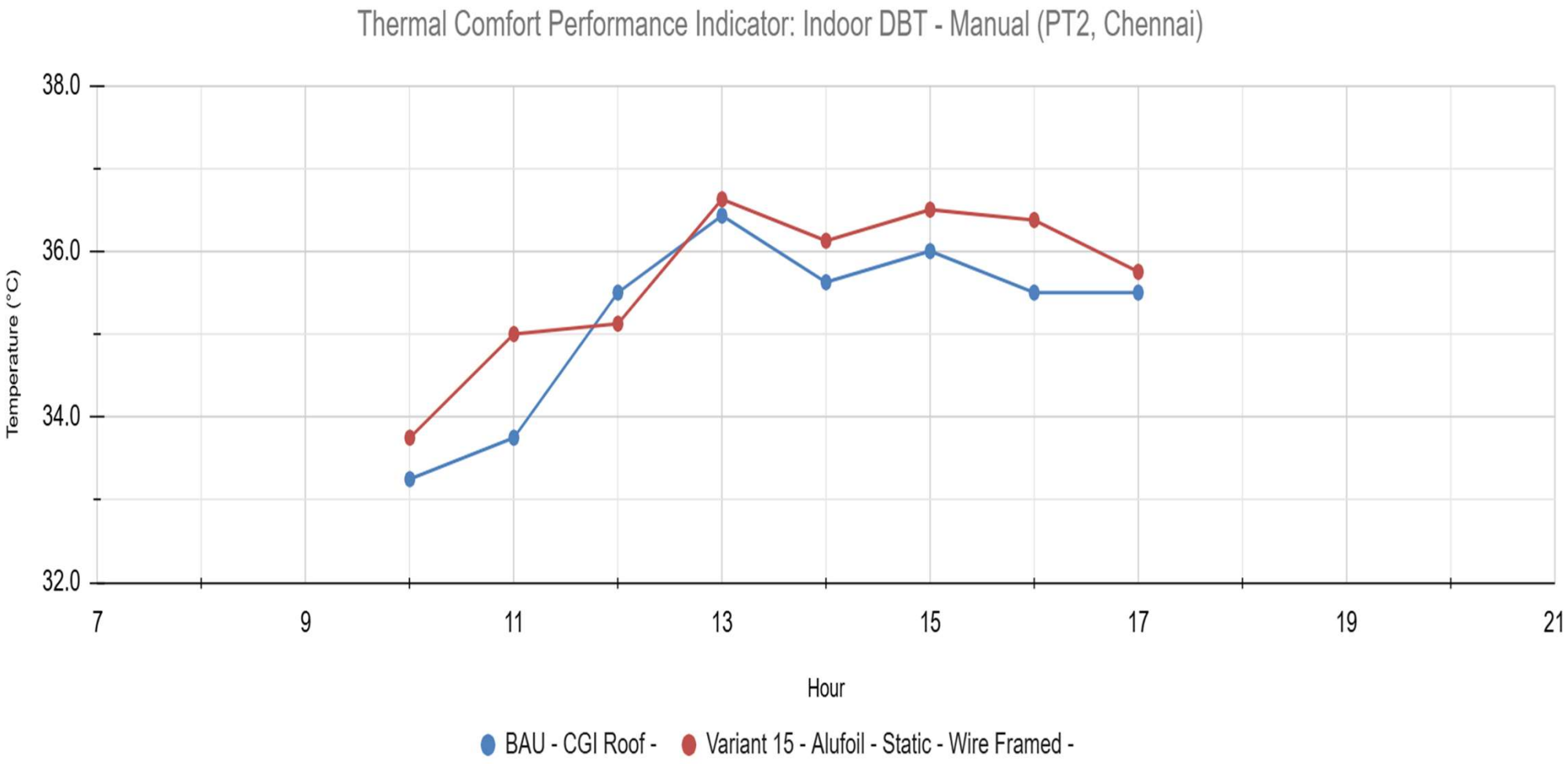
Rank	Solution	Delta (^{0}C)
1	Radiant Barrier Space Frame - MLP - Tarpaulin Mounted-Vertical Cane Blind - MLP Coated	6.9
2	Rooftop Garden - Low Soil Mass - Bamboo Mesh-	6.7
3	Biomass Fibre Panel - Wood Wool-Vertical Cane Blind - MLP Coated	6.7
4	Radiant Barrier Space Frame - MLP - Tarpaulin Mounted-	6.2
5	PET Bottles - High Density - Crate Mounted - Unseparated Layers - MLP Base - 2L-	5.8
6	Biomass Fibre Panel - Sunhemp Fibre & Waste Paper-	5.5
7	PET Bottles - Low Density - Directly Secured - 2L-	5.3
8	Biomass Fibre Panel - Banana Fibre & Waste Paper-	4.4
9	Internal Radiant Barrier - MLP - Tarpaulin Mounted-	4.4

Performance Results

- The solutions that performed better than 'median' performance in terms of MRT were:
  1. Biomass Fibre Panel - Wood Wool-Vertical Cane Blind - MLP Coated
  2. Biomass Fibre Panel - Sunhemp Fibre & Waste Paper
  3. Rooftop Garden - Low Soil Mass - Bamboo Mesh.
- The solutions that performed better than 'median' performance in terms of Roof Radiant Temperature were:
  1. Radiant Barrier Space Frame - MLP - Tarpaulin Mounted-Vertical Cane Blind - MLP Coated
  2. Rooftop Garden - Low Soil Mass - Bamboo Mesh
  3. Biomass Fibre Panel - Wood Wool-Vertical Cane Blind - MLP Coated
  4. Radiant Barrier Space Frame - MLP - Tarpaulin Mounted
- It must be noted however, that it is likely that some of the performance evaluations are influenced in materially significant ways (eg. shade from adjacent trees or structures which may supplement the thermal benefit of the installed solution). The current data-gathering methodology is not designed to isolate the influence of surrounding structures/physical features. Further data collection and analysis is required to unequivocally validate the observation related to relative effectiveness of solutions in comparison with each other and the BAU context.

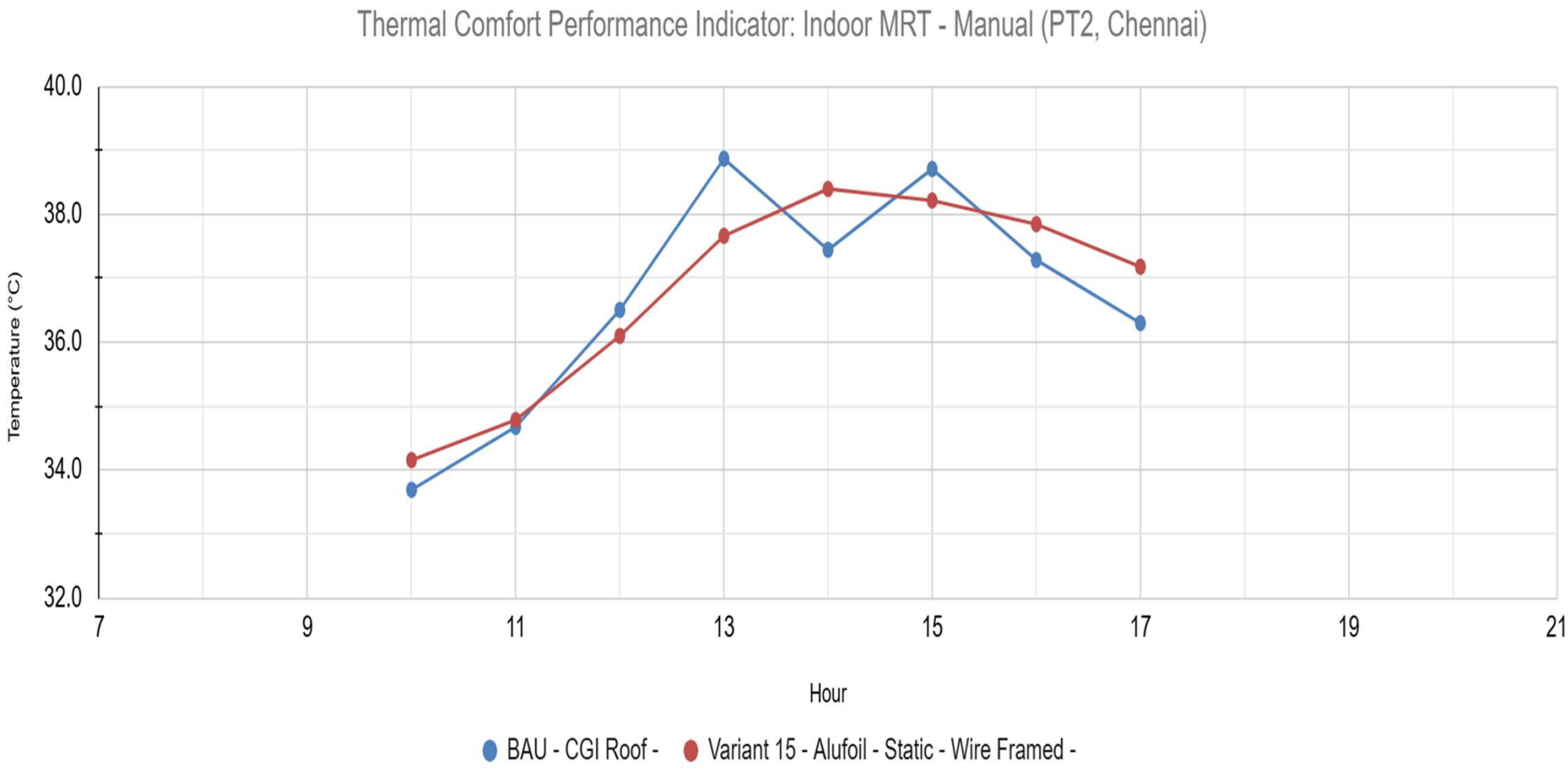
CURRENT IMPACT - CHENNAI

Thermal Comfort Performance Indicator: Indoor DBT - Manual (Pulianthope2, Chennai)



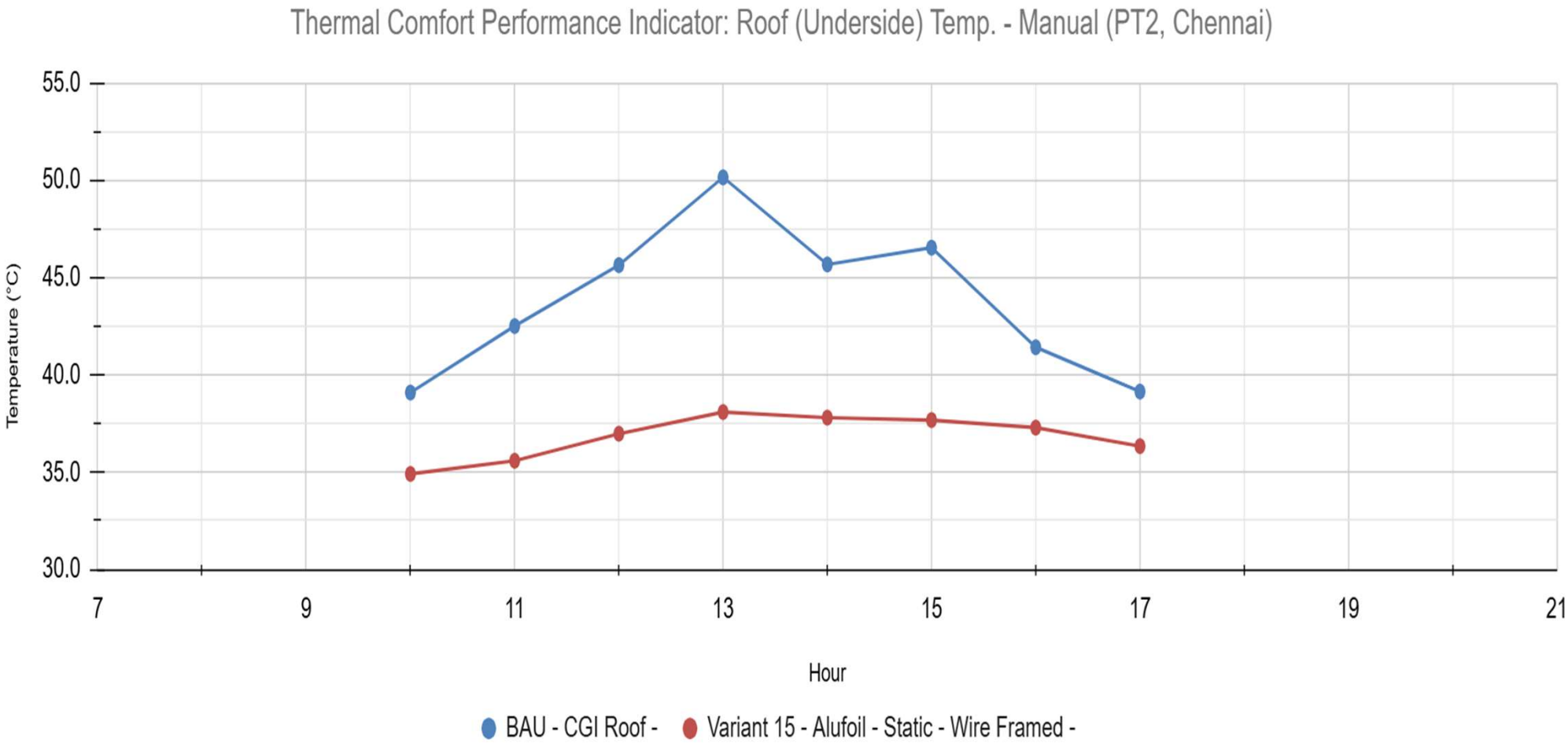
fAIR CONDITIONING

Thermal Comfort Performance Indicator: Indoor MRT - Manual (Pulianthope2, Chennai)



fAIR CONDITIONING

Thermal Comfort Performance Indicator: Roof (Underside) Temp. - Manual (Pulianthope2, Chennai)

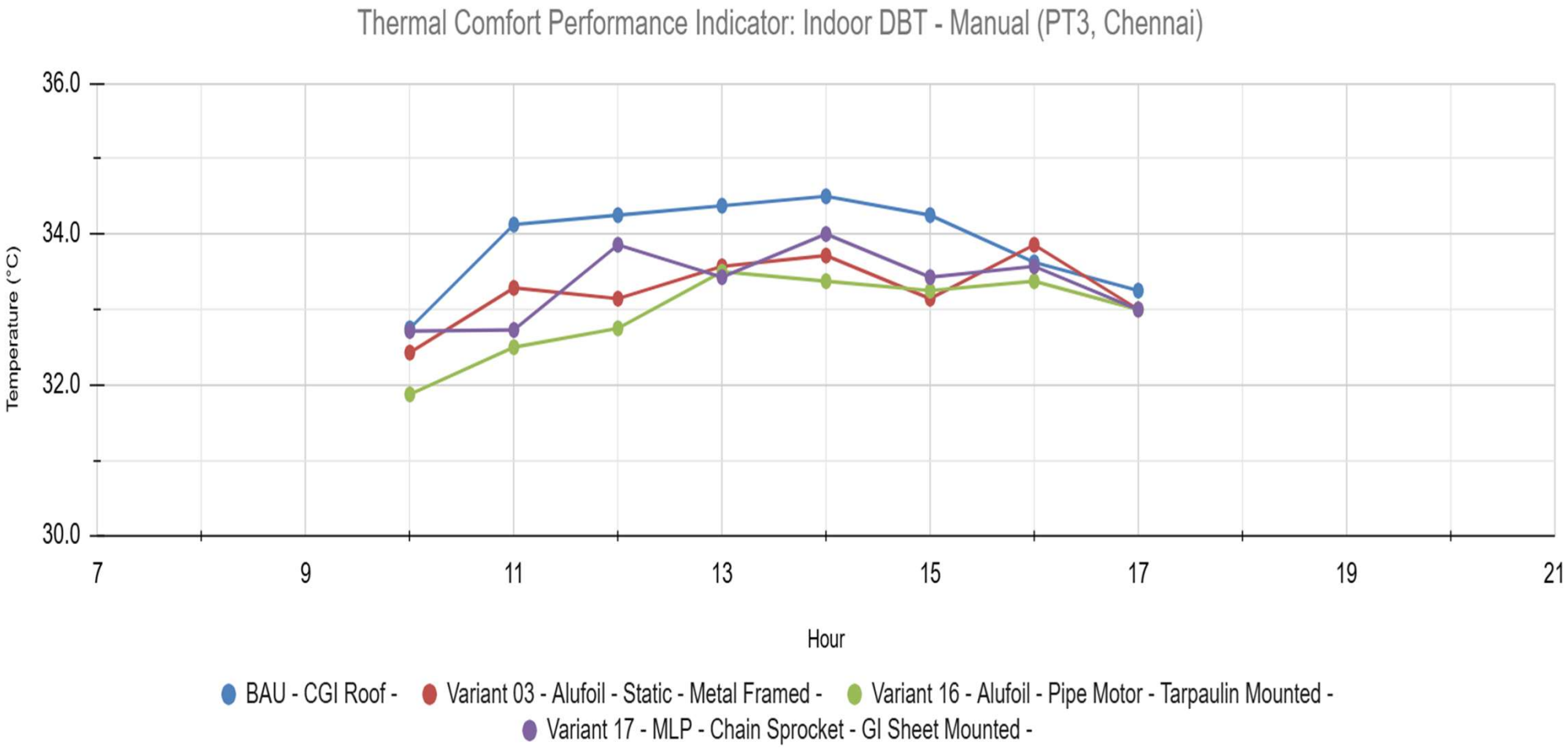


fAIR CONDITIONING

Table: Thermal Comfort Performance Indicators (Manual) vs. BAU: Pulianthope2, Chennai

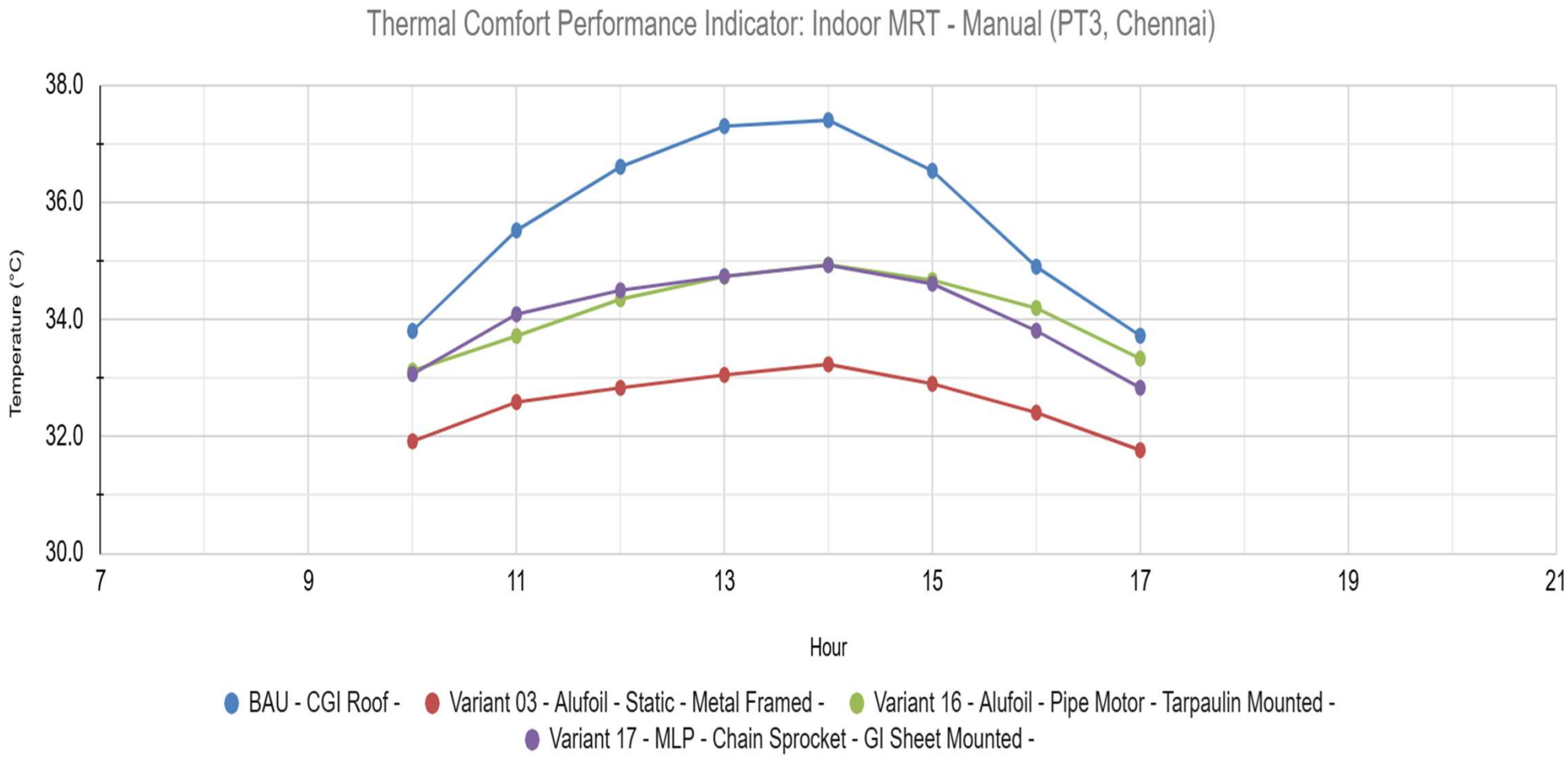
Legend DBT = Dry Bulb Temperature MRT = Mean Radiant Temperature	DBT	DBT	DBT	DBT	MRT	MRT	MRT	MRT	Roof Temp.	Roof Temp.	Roof Temp.	Roof Temp.
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value
Variant 15 - Alufoil - Static - Wire Framed -	0.4	12.0	-1.3	-0.5	1.2	13.0	-1.0	-0.1	12.0	13.0	2.8	6.9

Thermal Comfort Performance Indicator: Indoor DBT - Manual (Pulianthope3, Chennai)



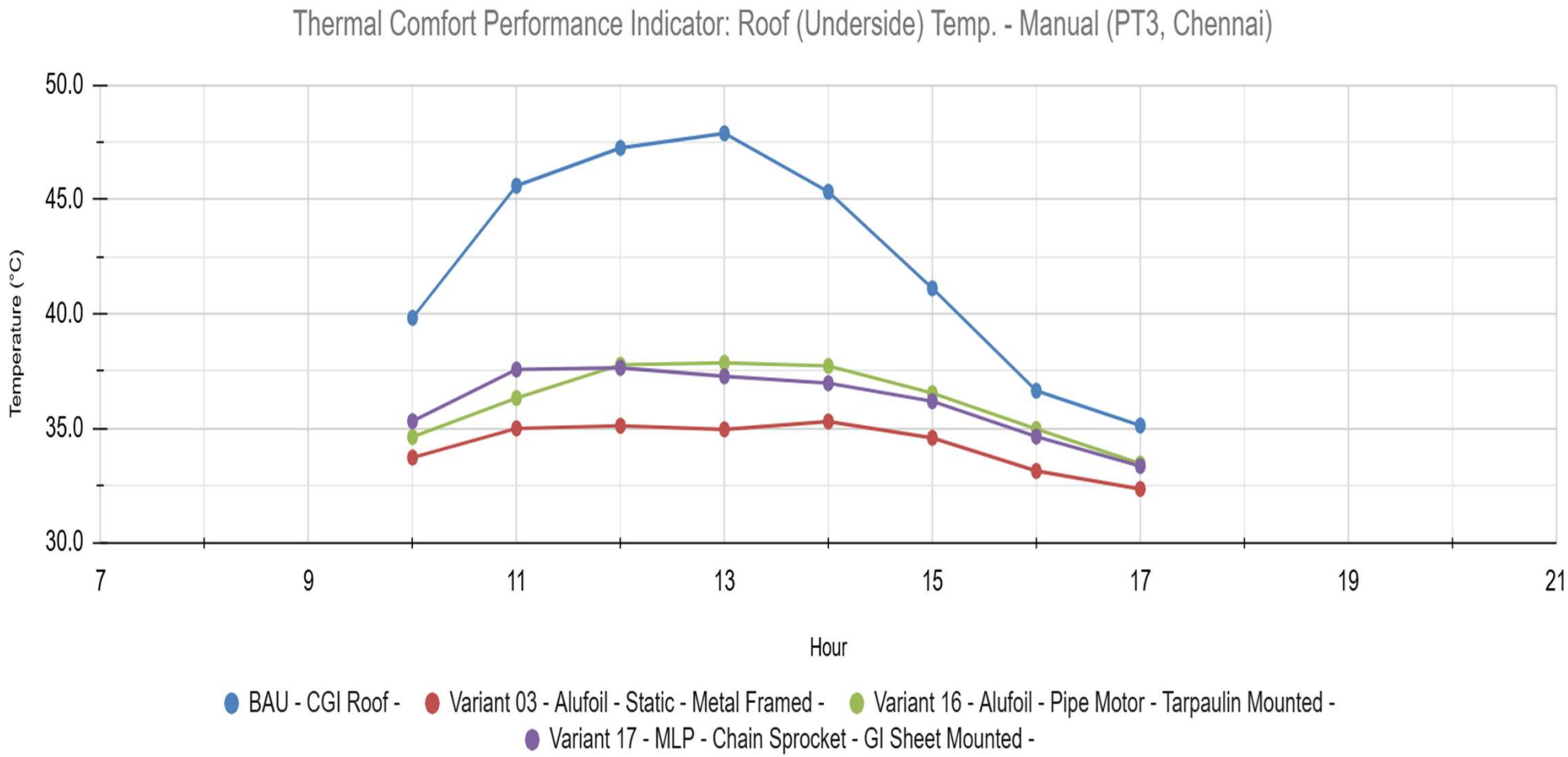
fAIR CONDITIONING

Thermal Comfort Performance Indicator: Indoor MRT - Manual (Pulianthope3, Chennai)



fAIR CONDITIONING

Thermal Comfort Performance Indicator: Roof (Underside) Temp. - Manual (Pulianthope3, Chennai)



fAIR CONDITIONING

Table: Thermal Comfort Performance Indicators (Manual) vs. BAU: Pulianthope3, Chennai

Legend DBT = Dry Bulb Temperature MRT = Mean Radiant Temperature	DBT	DBT	DBT	DBT	MRT	MRT	MRT	MRT	Roof Temp.	Roof Temp.	Roof Temp.	Roof Temp.
Solution Name	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value	Peak Delta Value	Peak Delta Time	Min Delta Value	Avg. Delta Value
Variant 03 - Alufoil - Static - Metal Framed -	1.1	12.0	-0.2	0.6	4.2	13.0	1.9	3.1	12.9	13.0	2.8	8.1
Variant 16 - Alufoil - Pipe Motor - Tarpaulin Mounted -	1.6	11.0	0.3	0.9	2.6	13.0	0.4	1.6	10.0	13.0	1.7	6.2
Variant 17 - MLP - Chain Sprocket - GI Sheet Mounted -	1.4	11.0	0.0	0.5	2.6	13.0	0.7	1.7	10.6	13.0	1.8	6.2

Performance Results

The thermal comfort indicator-based performance analysis presented in the Charts and Tables above, yield the following conclusions:

- As indicated in Indoor DBT for PT3 Chart, between 11 am and 3 pm, the BAU home witnessed the highest Dry-Bulb Temperature (DBT) relative to all 'Intervention' homes.
- As indicated in Indoor MRT for PT3, between 11 am and 3 pm, the BAU home witnessed the highest Mean Radiant Temperature (MRT) relative to all 'Intervention' homes.
- As indicated in previous Roof(Underside) chart for PT2 & PT3, between 10 am and 3 pm, the BAU home witnessed the highest Roof (Underside) Radiant Temperature (MRT) relative to all 'Intervention' homes.
- Since all the solutions are designed to mitigate the influence of solar ingress/heat gain through the roof, it was anticipated that the primary beneficial impact of the Pilot Installations would be observed through measurements of Roof (Underside) Temperature. The measurement of performance indicators confirms this anticipated effect.
- Mean Radiant and Roof (Underside) Temperatures for all Solutions were significantly reduced relative to the BAU Home.
- The Peak Delta for MRT between Intervention homes vs. BAU homes ranged from 2.6 (for Alufoil - Pipe Motor & MLP - Chain Sprocket) to 4.2 0C (for Alufoil - Static - Metal Framed).
- The Peak Delta for Roof Radiant Temperature between Intervention homes vs. BAU homes ranged from 10.0 (for Alufoil - Pipe Motor) to 12.9 0C (for Alufoil - Static - Metal Framed).

Performance Results

In terms of Peak DBT Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest DBT vs. BAU home):

Rank	Solution	Delta (^{0}C)
1	Variant 16 - Alufoil - Pipe Motor - Tarpaulin Mounted -	1.6
2	Variant 17 - MLP - Chain Sprocket - GI Sheet Mounted -	1.4
3	Variant 03 - Alufoil - Static - Metal Framed -	1.1

Performance Results

In terms of Peak MRT Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest MRT vs. BAU home):

Rank	Solution	Delta (^{0}C)
1	Variant 03 - Alufoil - Static - Metal Framed -	4.2
2	Variant 16 - Alufoil - Pipe Motor - Tarpaulin Mounted -	2.6
3	Variant 17 - MLP - Chain Sprocket - GI Sheet Mounted -	2.6

Performance Results

In terms of Peak Roof Radiant Temperature (Underside) Delta, the 'Ranking' of Solutions is as follows (highest rank = lowest Roof Radiant Temperature vs. BAU home):

Rank	Solution	Delta (^{0}C)
1	Variant 03 - Alufoil - Static - Metal Framed -	12.9
2	Variant 17 - MLP - Chain Sprocket - GI Sheet Mounted -	10.6
3	Variant 16 - Alufoil - Pipe Motor - Tarpaulin Mounted -	10.0

Performance Results

- The solutions that performed better than 'median' performance in terms of MRT were:
    1. Variant 03 - Alufoil - Static - Metal Framed -
- The solutions that performed better than 'median' performance in terms of Roof Radiant Temperature were:
    1. Variant 03 - Alufoil - Static - Metal Framed -
    2. Variant 17 - MLP - Chain Sprocket - GI Sheet Mounted -

CURRENT IMPACT

Pilot Installations

- Diverse roof-retrofit solutions field tested in 200 informal settlement homes and 7 community buildings in resettlement communities across 7 Indian cities (Mumbai, Pune, Bangalore, Mysore Delhi, Chennai and Coimbatore) over 4 years; in another 100 (including Bhubaneswar, Indonesia) by mid-2026
- 3^0C to 25 ^{0}C reduction in roof temperature

Academic Curricula Change

- July 2022: VTU Board of Studies (~ 49 architecture colleges in Karnataka) accepted all recommendations to integrate informal settlement thermal stress related pedagogy, across 5 years of the Bachelors of Architecture Curriculum; 0 mentions in previous curricula, now 'Informal Settlements' finds 67 mentions in new curriculum: VTU B. Arch Curricula
- Sept 2023: signing of an MoU with the University to establish a pedagogy training centre for 50% teachers (approx. 500 teachers across the State) to be trained in teaching the revised curriculum

Policy Change

- Co-Authored Heat Actions Plan for Pimpri-Chinchwad Municipal Corp. to integrate roof-retrofits for heat mitigation in Informal Settlements: PCMC Heat Action Plan
- Upgraded the Cool Roof Policy for the State of Telangana
- Technical Advisor related to Heat Stress Mitigation for Oxfam's Global Humanitarian-Assistance Shelter Design Guidelines; Draft Guidelines published in February 2025, Final Guidelines expected in mid-2025.