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crookes walker consulting

Old Mill Street

Ancoats, Manchester

CIBSE TM54 Operational Energy Assessment

Date: 09/10/2026

Ref: 3603-CWC-XX-XX-RP-N-7007



Revision Record

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Date	Reference	Revision	Prepared	Checked	Authorised
09/10/2026	3603-CWC-XX-XX-RP-N-7007	P01	Mohammad Elsarraj	John Barnett	John Barnett

Executive Summary

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This report presents the predicted operational energy use of Old Mill Street, Ancoats, Manchester: a six-storey residential block of 41 dwellings (19 one-bed flats, 19 two-bed flats and three duplexes) with associated landlord areas.

An IES:VE dynamic simulation model has been developed following CIBSE TM54:2022. Unlike a Part L calculation, it uses realistic occupancy, heating patterns, appliance use, hot water demand and landlord loads to predict how the building is likely to perform in use.

The design uses direct electric panel heating, an air source hot water cylinder in every dwelling, MVHR throughout, LED lighting and roof-mounted PV, within an enhanced fabric specification.

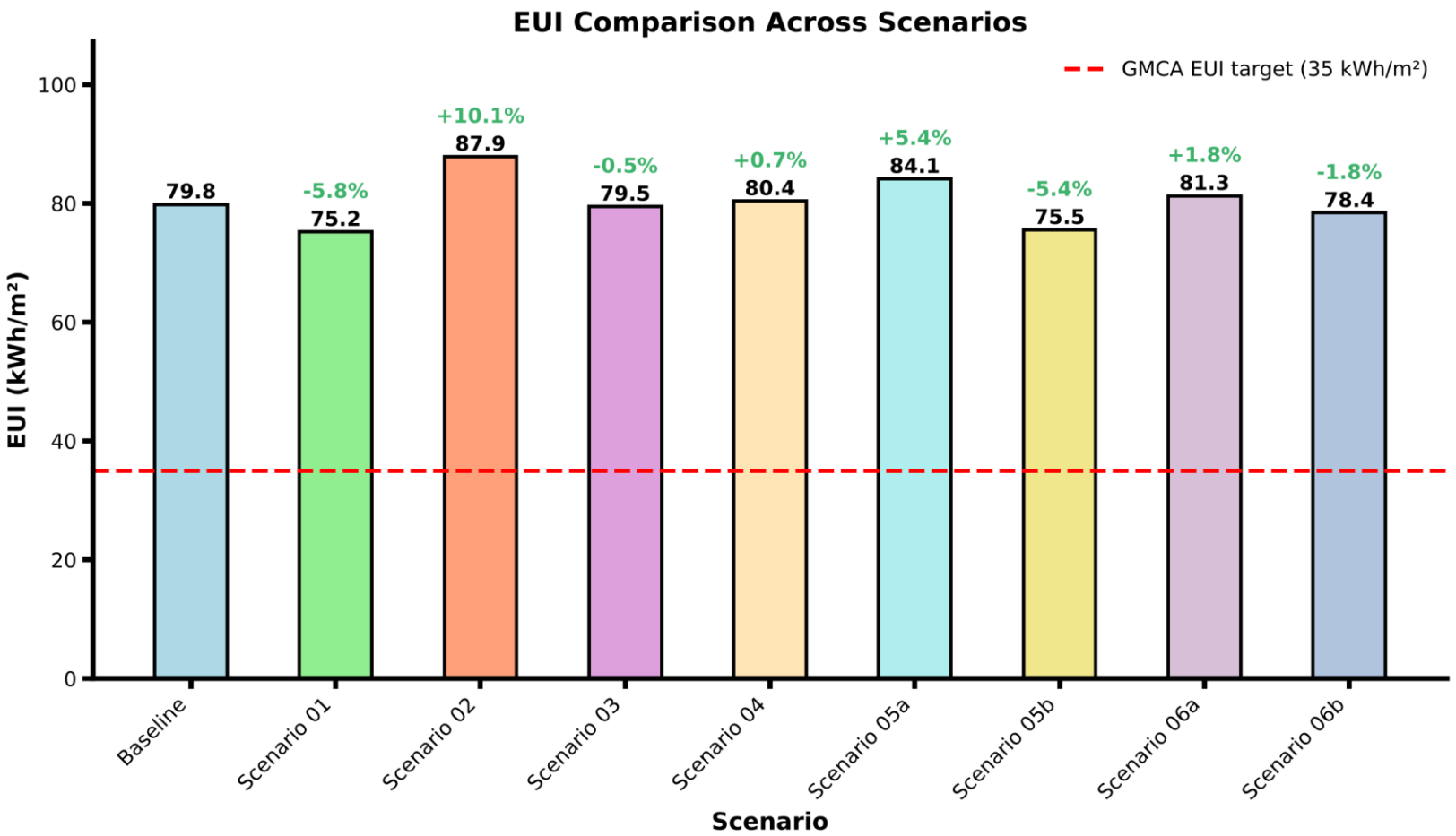
Results are compared with the GMCA Places for Everyone guidance values for residential schemes: an energy use intensity (EUI) of 35 kWh/m²·yr and a space heating demand of 15 kWh/m²·yr.

79.8 Baseline EUI, kWh/m²·yr (before PV)	**75.3** Baseline EUI net of PV, kWh/m²·yr
30.8 Space heating, kWh/m²·yr	**75 to 88** EUI range across scenarios, kWh/m²·yr
≈ 51 EUI with recommended measures, kWh/m²·yr	**≈ 46** With measures, net of PV, kWh/m²·yr

Intensities use the GIA of 3,226 m². Electricity is the only fuel. Pathway values are indicative.

Executive Summary: Scenario Results

Predicted EUI before PV for each scenario against the GMCA value of 35 kWh/m²·yr; percentages show the change from the baseline.



Scenario	Description	EUI (kWh/m²·yr)
Baseline	Typical weather (CIBSE TRY), design as specified, realistic occupancy	79.8
01	Future weather (DSY1 2050, High, 50th percentile)	75.2
02	Air permeability 5.0 m³/(h·m²) (base 3.0)	87.9
03	Ancillary stores heated to 16 °C (base 5 °C)	79.5
04	All households home working	80.4
05a	Dwelling appliance use +25%	84.1
05b	Dwelling appliance use −25%	75.5
06a	Cooking energy +33%	81.3
06b	Cooking energy −33%	78.4

Executive Summary: Key Findings

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Predicted performance

- The baseline is predicted to use 258 MWh of electricity a year: an EUI of 79.8 kWh/m^2·yr before PV and 75.3 kWh/m^2·yr after the 14.5 MWh generated by the PV.
- Space heating is the largest end use (39% of the total, 30.8 kWh/m^2·yr). With direct electric panel heaters, each kWh of heat needed is a kWh of electricity.
- Dwelling appliances and cooking are the second largest end use (21.6 kWh/m^2·yr), followed by hot water (11.0) and the lift (4.7 kWh/m^2·yr).

Comparison with the GMCA guidance values

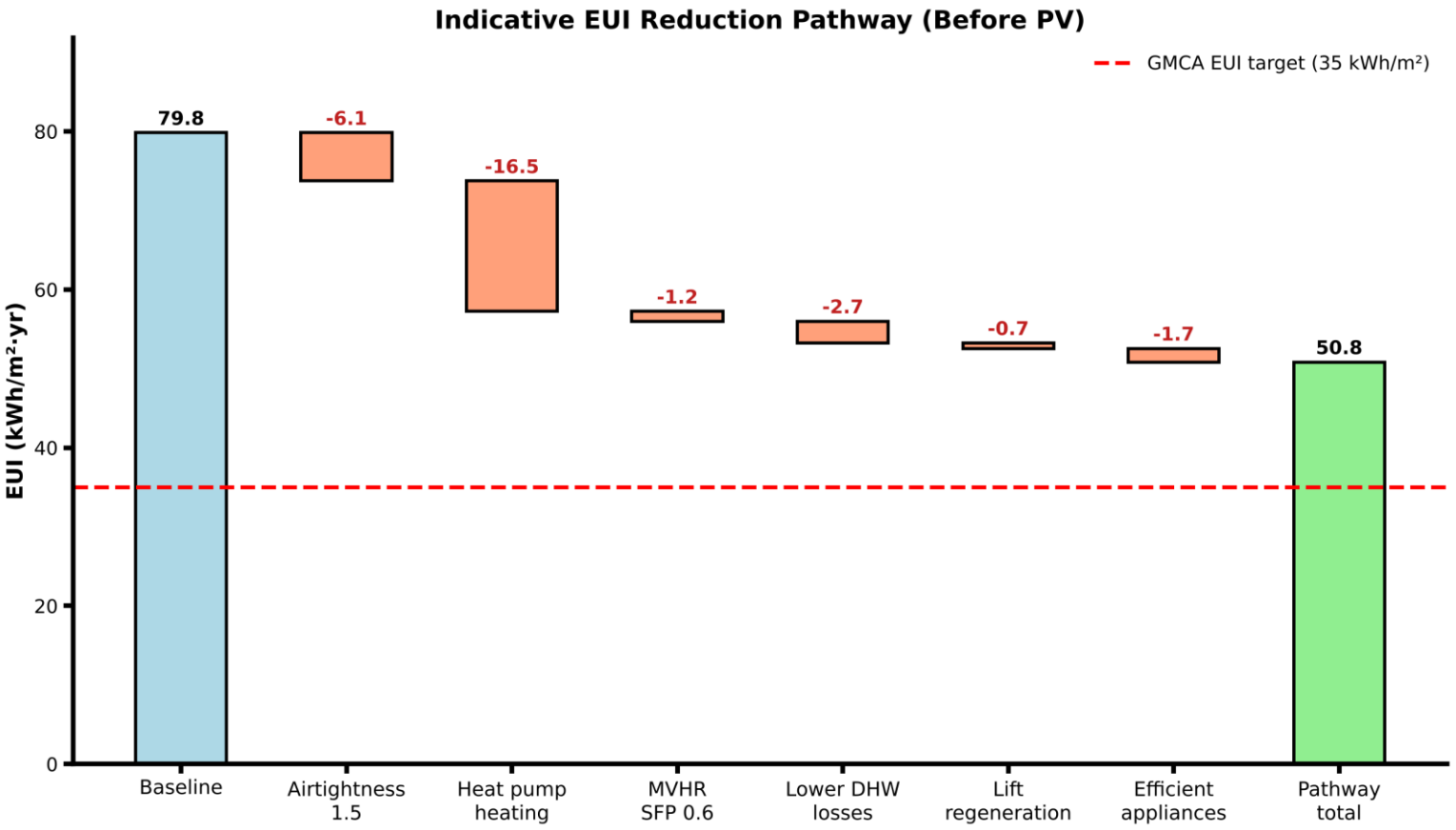
- The predicted EUI is about 2.3 times the GMCA value of 35 kWh/m^2·yr and the space heating about 2.1 times the value of 15 kWh/m^2·yr. Appliance and cooking use alone is 21.6 kWh/m^2·yr, leaving little headroom for everything else.

Sensitivity

- Airtightness is the most influential variable tested: at 5.0 m^3/(h·m^2) the EUI rises to 87.9 kWh/m^2·yr (+10.1%). Each 1 m^3/(h·m^2) changes space heating by about 4.1 kWh/m^2·yr.
- Appliance use of ±25% moves the EUI by about ±4.3 kWh/m^2·yr and cooking ±33% by about ±1.4. The future 2050 weather file reduces the EUI to 75.2 kWh/m^2·yr through lower heating demand.

Executive Summary: Recommendations

Measures derived from the results and scenarios, combined as an indicative pathway to be confirmed by modelling (section 4).



- Heat pump space heating: -16.5 kWh/m²·yr, the largest single saving.
- Airtightness 1.5 m³/(h·m²): -6.1 kWh/m²·yr.
- Lower DHW losses: -2.7; MVHR SFP: -1.2; efficient appliances: -1.7; lift regeneration: -0.7.
- Combined: about 51 kWh/m²·yr before PV and 46 net of PV, against 35.
- Not yet included: setting the heaters to follow occupancy (on about an hour before and after occupied periods, off otherwise) instead of the modelled 16 °C set-back, pre-set in the app at handover with resident guidance, would reduce space heating further.

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1 Introduction

Operational Energy and CIBSE TM54

There is a well documented gap between the energy use predicted by compliance calculations and the energy buildings use in operation. Part L calculations use standardised occupancy and exclude unregulated loads such as appliances, cooking and lifts.

CIBSE TM54:2022 sets out a method for evaluating operational energy at the design stage, using a dynamic simulation model with realistic inputs and testing the result against a range of scenarios. This assessment follows the TM54 steps:

- Steps 1 to 3: building information, occupancy and operation (sections 2.5 and 2.8).
- Steps 4 to 9: lifts, equipment, lighting, heating, ventilation and hot water (sections 2.2 to 2.7).
- Steps 10 to 14: gains in the model, energy totals and scenario testing (sections 2.10 and 3).



Lampwick Lane view (Buttress CGI, OLDMS-BUT-01-ZZ-DR-A-97002).

Policy Context: Places for Everyone and GMCA

Places for Everyone policy JP-S2 and the GMCA net zero guidance (March 2025) expect major residential schemes to predict operational energy with PHPP or CIBSE TM54 and to report the results against the values below, which are used in this report as benchmarks.

Metric	GMCA guidance value	How it is reported in this assessment
Energy use intensity (EUI)	35 kWh/m² GIA per year	All regulated and unregulated electricity for dwellings and landlord areas, before PV generation
Space heating demand	15 kWh/m² GIA per year	IES space heating (direct electric, so energy equals heat delivered); plant sensible load also reported
On-site renewables	PV equivalent to 40% of the ground floor footprint	About 85 m² of unshaded roof available (estimate, M&E engineer to confirm); generation reported separately
Fossil fuels	No fossil fuel use on site	All-electric design
Overheating	Part O without mechanical cooling	No cooling in the model; Part O window opening and MVHR boost included

Source: GMCA, Places for Everyone policy JP-S2 and Net Zero Buildings guidance (March 2025). The values are used as benchmarks only; this report does not assess policy compliance.

The Development

Dwelling type	No.	Bedspaces	Household types modelled (section 2.5)
1B1P flat	19	1	10 commuter, 5 hybrid, 4 home-based (1 person each)
2B4P flat	19	4	9 commuter couples, 6 hybrid couples, 4 young families
2B4P duplex	1	4	Family of 3, one school-age child
3B6P duplex	1	6	Family of 4, two school-age children
4B7P duplex	1	7	Family of 5, three school-age children
Total	41		73 residents (realistic occupancy, not bedspaces)



Old Mill Street view (Buttress CGI, OLDMS-BUT-01-ZZ-DR-A-97000).

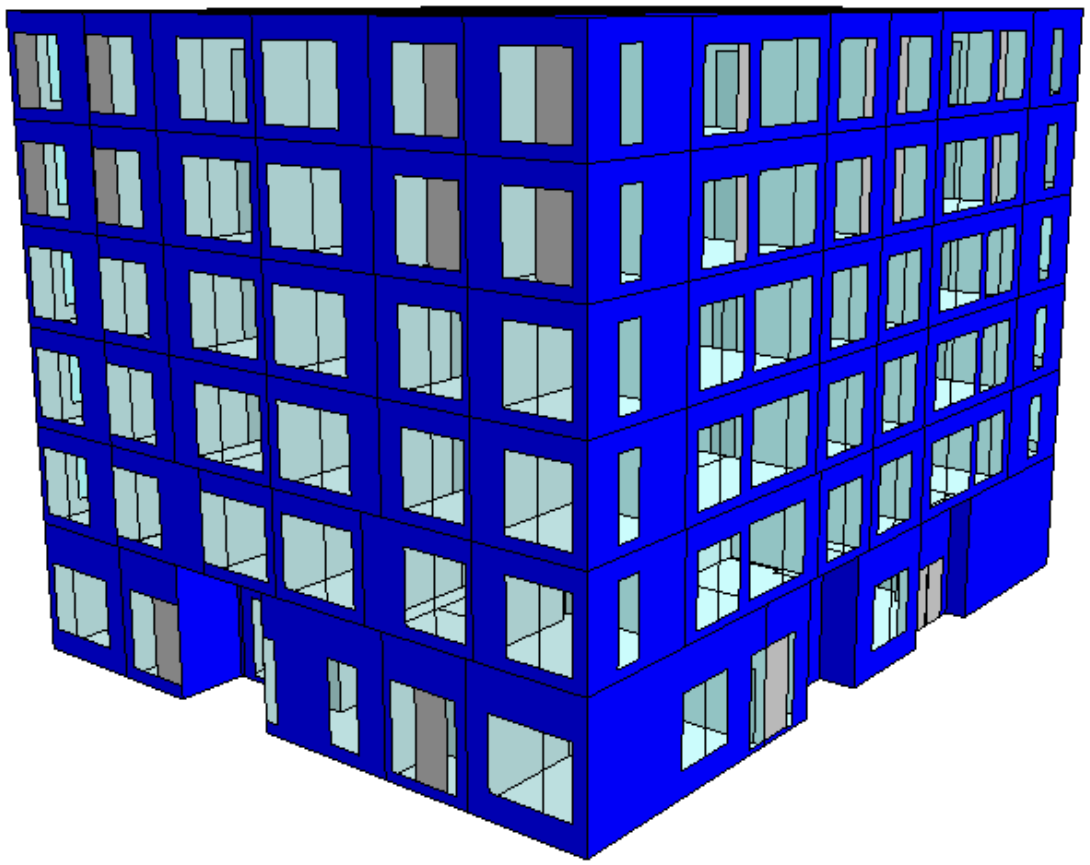
Landlord areas

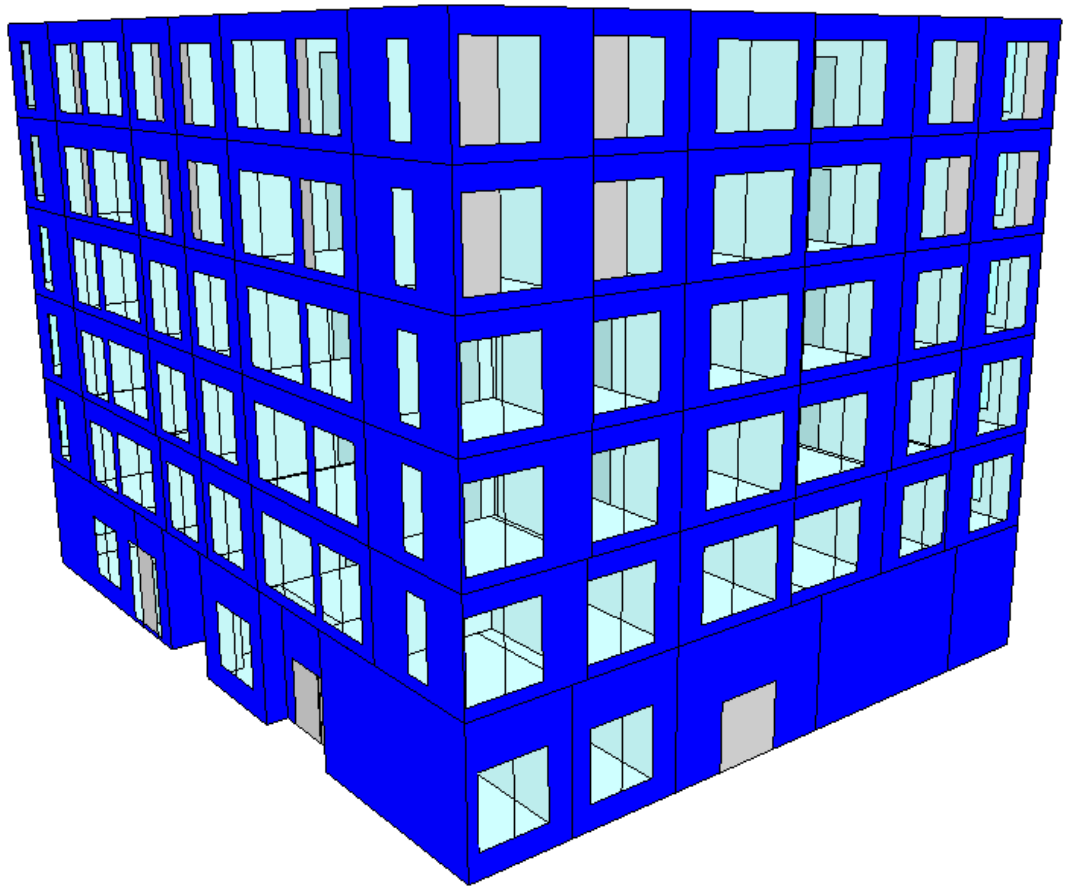
- Ground floor entrance and lift lobby, corridors, plant room, meter room, bin store and bike store.
- Stair and one 17-person evacuation lift serving ground to fifth floor.

Thermal Model

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The IES:VE model represents each dwelling room by room, built from the architect's GA plans and elevations. It contains 281 spaces, including landlord areas, risers and lift shafts, with adjacent buildings as shading.





Scenarios Assessed

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The baseline represents the design operated as expected. Scenarios 01 to 04 are separate IES simulations. Scenarios 05 and 06 scale the relevant end use from the baseline results, as these loads scale almost linearly.

Scenario	Theme (TM54 step)	Description	Method
Baseline	Base case	Base case: CIBSE TRY Manchester; realistic occupancy (41 dwellings, 73 residents); heating profiles H01 to H15; hot water per section 2.4; systems per section 2.2.	IES run
01	Weather (13)	Future hot summer: Manchester DSY1 2050 High emissions 50th percentile weather file.	IES run
02	Fabric (13)	Air permeability 5.0 $m^3/(h \cdot m^2)$ at 50 Pa (base 3.0).	IES run
03	Landlord operation (14)	Landlord ancillary spaces (plant room, meter room, bin store, bike store) heated to 16 °C constant instead of 5 °C frost protection.	IES run
04	Occupant behaviour (14)	All home working: all living room templates on profile H03; study bedrooms on H06 Monday to Friday; other profiles and gains as base.	IES run
05a	Occupant behaviour (14)	Appliances +25%: dwelling appliance electricity (IES 'Other Process') × 1.25, post-processed from the base run.	Post-processed
05b	Occupant behaviour (14)	Appliances −25%: dwelling appliance electricity × 0.75, post-processed from the base run.	Post-processed
06a	Occupant behaviour (14)	Cooking +33%: cooking electricity × 1.33 (upper end of the Powering the Nation 2 range), post-processed from the base run.	Post-processed
06b	Occupant behaviour (14)	Cooking −33%: cooking electricity × 0.67, post-processed from the base run.	Post-processed

Weather Data

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The baseline uses a typical year so that the prediction can be compared with metered energy in a normal year. Scenario 01 tests a future hot summer year, representing the warmer climate expected over the life of the building. The site is in Ancoats, Manchester city centre (53.48° N, 2.24° W), with adjacent buildings modelled as shading.

Weather file	Used for	Represents
CIBSE Test Reference Year (TRY), Manchester	Baseline and scenarios 02 to 06	A typical year built from long-term records of temperature, solar radiation, humidity and wind
CIBSE Design Summer Year DSY1, Manchester, 2050s, High emissions, 50th percentile	Scenario 01	A future year with a moderately warm summer under the high emissions climate projection

Modelling Disclaimer

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The building has been modelled with accredited software package IES:VE version 2025.2.0.0, which is an approved dynamic simulation software, compliant with CIBSE AM11.

This is a dynamic simulation package accredited for Building Regulations energy calculations, by an energy specialist with recognised expertise in building performance modelling who is not connected to a single technology or manufacturer.

The results are computer predictions and the best available estimate of performance at this stage. Actual energy use depends on construction quality, commissioning, the way residents and the building manager operate the building, and the weather. Certainty can only be obtained by measuring the performance of the completed building over a period of use.

Whilst the calculations have been undertaken in good faith using reasonable skill and care, Crookes Walker Consulting Limited can take no responsibility for differences between the predictions and the actual performance of the completed building.

Assumptions have been made where information was not yet available. These are identified in this report, and the calculations should be revisited as the design develops.

Abbreviations

Abbreviation	Full form	Abbreviation	Full form
AD F / G / L / O	Approved Document F / G / L / O	LKD	Living / kitchen / diner
AOV	Automatic opening vent	MVHR	Mechanical ventilation with heat recovery
BCWS	Boosted cold water service	NIA / GIA	Net / gross internal area
COP / SCOP	(Seasonal) coefficient of performance	PCDB	SAP Product Characteristics Database
DHW	Domestic hot water	PfE	Places for Everyone
DSY / TRY	Design summer year / test reference year	PV	Photovoltaic
EUI	Energy use intensity, kWh/m^2·yr	SFP	Specific fan power, W/(l/s)
GMCA	Greater Manchester Combined Authority	SHD	Space heating demand, kWh/m^2·yr
HES	Household Electricity Survey	TM54 / TM59	CIBSE Technical Memoranda 54 / 59
WWHRS	Waste water heat recovery system	VVVF	Variable voltage, variable frequency (lift drive)

Drawings Used

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The thermal model geometry is based on the following Buttress planning drawings (revised scheme, September 2026).

Drawing number	Title
OLDMS-BUT-01-00-DR-A-94000	Ground Floor GA Plan
OLDMS-BUT-01-01-DR-A-94001	First Floor GA Plan
OLDMS-BUT-01-ZZ-DR-A-94002	Typical Floor GA Plan
OLDMS-BUT-01-05-DR-A-94005	Fifth Floor GA Plan
OLDMS-BUT-01-R5-DR-A-94006	Roof GA Plan
OLDMS-BUT-01-ZZ-DR-A-95001	Planning GA Elevations: South
OLDMS-BUT-01-ZZ-DR-A-95002	Planning GA Elevations: North

2 Model Inputs

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2.1 Fabric

Model Inputs: Fabric

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Fabric performance follows the enhanced specification for the scheme.

Element	Modelled
External wall U-value (W/m^2K)	0.14
Roof U-value (W/m^2K)	0.11
Ground floor U-value (W/m^2K)	0.16
Windows, whole unit (W/m^2K)	1.20
Glass g-value	0.40 (south, east, west); 0.50 (north)
Personnel doors (W/m^2K)	1.60
Air permeability ($m^3/(h \cdot m^2)$ at 50 Pa)	3.0 (scenario 02: 5.0)

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2.2 HVAC Systems

Model Inputs: HVAC Systems, Dwellings

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The table below confirms the dwelling heating, ventilation and hot water systems modelled, from the M&E design.

System	Spaces	Heating / hot water	Efficiency	Ventilation	SFP (W/(l/s))	Heat recovery
MVHR and electric panel heaters	Living/kitchen/diners and bedrooms	Adax Neo panel heaters, Wi-Fi app control	1.0 (direct electric)	Living/kitchen/diners - Supply + Extract Bedrooms – Supply	1.0 (0.5 supply + 0.5 extract)	93%
Bathrooms	Bathrooms, en-suites, WCs	Adax Bray electric towel rails	1.0	MVHR extract	0.5	-
Duplex halls	Stairs and landings	Electric panel heaters	1.0	None (transfer)	-	-
Utility cupboards	Cylinder cupboards	Unheated (cylinder losses as a gain)	-	None	-	-
DHW 1 to 3	One per dwelling	Kers Weatherby air source hot water cylinder, 3 kW immersion back-up	SCOP 3.5; delivery 0.95	Ducted to facade	-	-

Model Inputs: HVAC Systems, Landlord Areas

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The table below confirms the landlord area systems. All heating is direct electric.

System	Spaces	Heating	Efficiency	Ventilation	SFP (W/(l/s))
Entrance heating	Entrance and lift lobby	Feature radiators and panel heaters	1.0	Natural (doors)	-
Landlord panel heaters	GF corridor, L05 stair	Electric panel heaters	1.0	Natural	-
Radiant ceiling panels	Corridors and lobbies L01 to L05	Electric radiant ceiling panels	1.0	Natural; smoke shafts on standby	-
Stores	Bin store, bike store	Tubular heaters (frost protection)	1.0	MVHR, supply and extract	1.1
Plant room	Plant (tank) room	Tubular heaters (frost protection)	1.0	Natural	-
Meter room	Meter room	Tubular heater (frost protection)	1.0	None	-

2.3 Ventilation

Model Inputs: Ventilation

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The MVHR runs continuously at the Approved Document F whole dwelling rates. Window opening and boosted MVHR flow rates from the Part O assessment have been incorporated for the summer months, so the TM54 model includes the same summer ventilation strategy as the overheating assessment.

Dwelling type	Part F continuous supply LKD / bedroom / total (l/s)	Part F continuous extract LKD / bathroom / total (l/s)	Part O boost supply LKD / bedroom / total (l/s)	Part O boost extract LKD / bathroom / total (l/s)
1B flat	13 / 8 / 21	13 / 8 / 21	30.3 / 18.7 / 49	30.3 / 18.7 / 49
2B flat	13 / 8 / 29	13 / 8 / 29	18.4 / 11.3 / 41	18.4 / 11.3 / 41
2B duplex	13 / 12 / 37	13 / 8 / 37	11.6 / 10.7 / 33	11.6 / 7.14 / 33
3B duplex	13 / 8 / 37	13 / 8 / 37	11.6 / 7.1 / 33	11.6 / 7.1 / 33
4B duplex	13 / 6 / 37	13 / 8 / 37	15.8 / 7.3 / 45	15.8 / 9.73 / 45

- Boost operates when the room air temperature exceeds 21 °C; heat recovery has an automatic summer bypass.

2.4 Domestic Hot Water

Model Inputs: Domestic Hot Water

Hot water demand follows TM54 Step 9. Each dwelling's daily volume is the SAP 2012 Appendix J volume, based on Energy Saving Trust measurements in about 120 homes:

$$Vd = 25N + 36 \text{ litres/day}$$

Volumes are converted to hot water at 60 °C (× 0.739) and drawn 70% in bathrooms and 30% at the kitchen sink, linked to occupancy. The block uses about 2,440 litres/day (33 litres per person).

Input	DHW 1 1 bed	DHW 2 2 bed	DHW 3 3/4 bed
System	Kers Weatherby	Kers Weatherby	Kers Weatherby
Storage volume (l)	210	260	300
Seasonal COP	3.5	3.5	3.5
Cold feed / supply (°C)	10 / 60	10 / 60	10 / 60

Model Inputs: DHW Rates per Template

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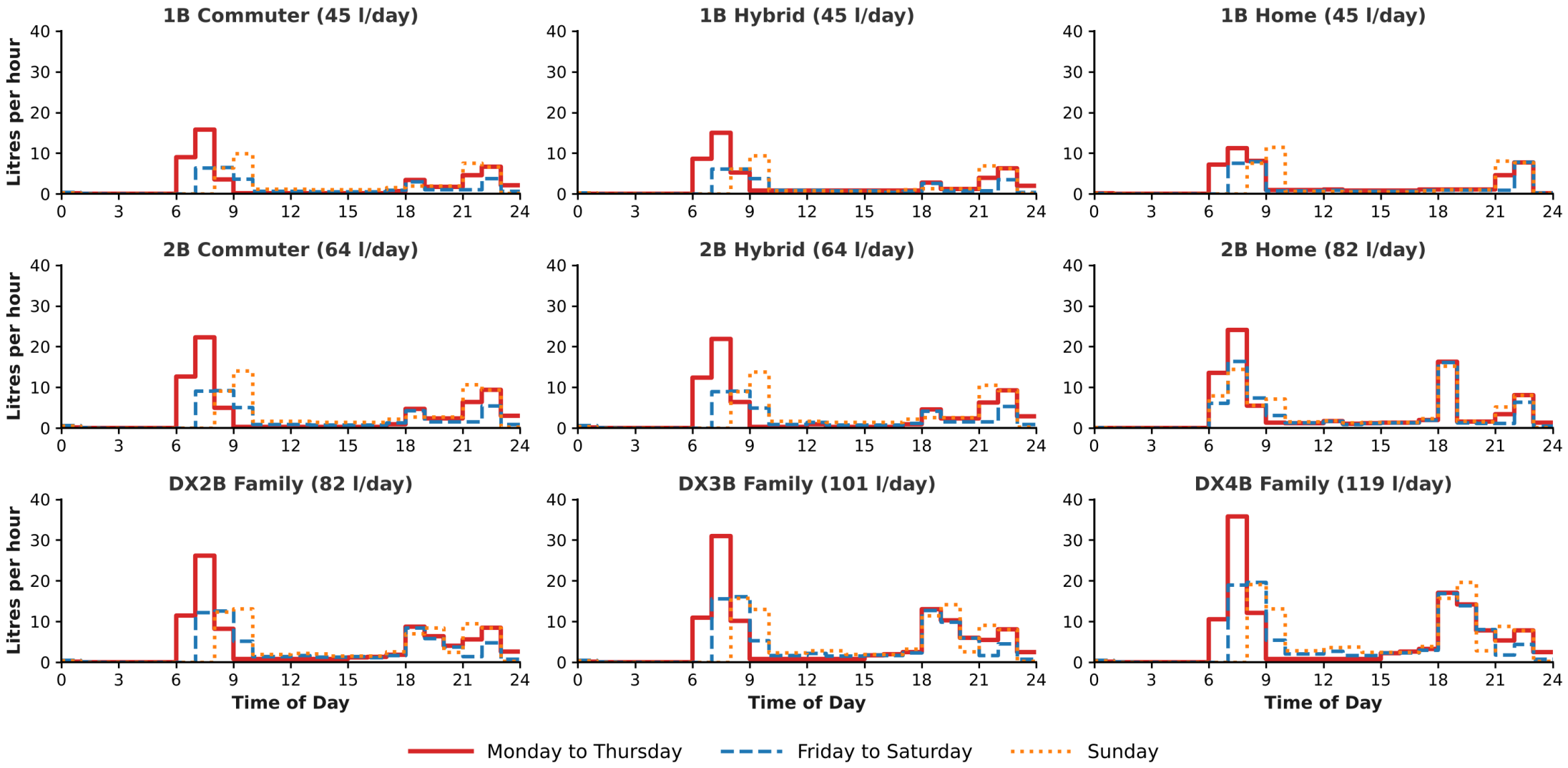
IES applies the rate in l/(h·person) to the people present, so the daily volume is achieved when the room is used as profiled.

IES template	Spaces	N	l/day per dwelling	Rate l/(h·pers)
1B Commuter: LKD	10	1	45	2.27
1B Commuter: Bathrooms	10	1	45	58.92
1B Hybrid: LKD	5	1	45	1.57
1B Hybrid: Bathrooms	5	1	45	57.09
1B Home: LKD	4	1	45	1.20
1B Home: Bathrooms	4	1	45	72.44
2B Commuter: LKD	9	2	64	1.60
2B Commuter: Bathrooms	18	2	64	41.53
2B Hybrid: LKD	6	2	64	1.55

IES template	Spaces	N	l/day per dwelling	Rate l/(h·pers)
2B Hybrid: Bathrooms	12	2	64	40.88
2B Home: LKD	4	3	82	0.96
2B Home: Bathrooms	8	3	82	37.05
DX2B Family: LKD	1	3	82	1.27
DX2B Family: Bathrooms	3	3	82	25.12
DX3B Family: LKD	1	4	101	1.25
DX3B Family: Bathrooms	3	4	101	35.90
DX4B Family: LKD	1	5	119	1.24
DX4B Family: Bathrooms	3	5	119	34.77

Model Inputs: Domestic Hot Water Profiles

Hourly hot water draw per dwelling, following bathroom and kitchen occupancy. Hourly values are tabulated in Appendix B.



2.5 Occupancy and People Gains

Model Inputs: Occupancy, Household Types

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TM54 requires realistic occupancy rather than design bedspaces. Each dwelling is assigned a household type. One and two-bed flats are split 50% commuter, 30% hybrid and 20% home-based; the duplexes are family households.

Household type	Dwellings	People	Members	Description
1B Commuter	10	1	Commuter	Single adult, office-based
1B Hybrid	5	1	Hybrid (desk in LKD)	Single adult, two days a week at home
1B Home	4	1	Home-based	Single adult at home most of the day
2B Commuter	9	2	2 × commuter	Couple, both office-based; spare second bedroom
2B Hybrid	6	2	Hybrid (study) + commuter	Couple; second bedroom used as a study
2B Home	4	3	Parent at home + commuter + pre-school child	Young family
DX2B Family	1	3	Commuter + hybrid + school-age child	Family of 3
DX3B Family	1	4	Commuter + hybrid + 2 school-age	Family of 4
DX4B Family	1	5	Commuter + hybrid + 3 school-age	Family of 5
Total	41	73		

Model Inputs: Occupancy, Person Types

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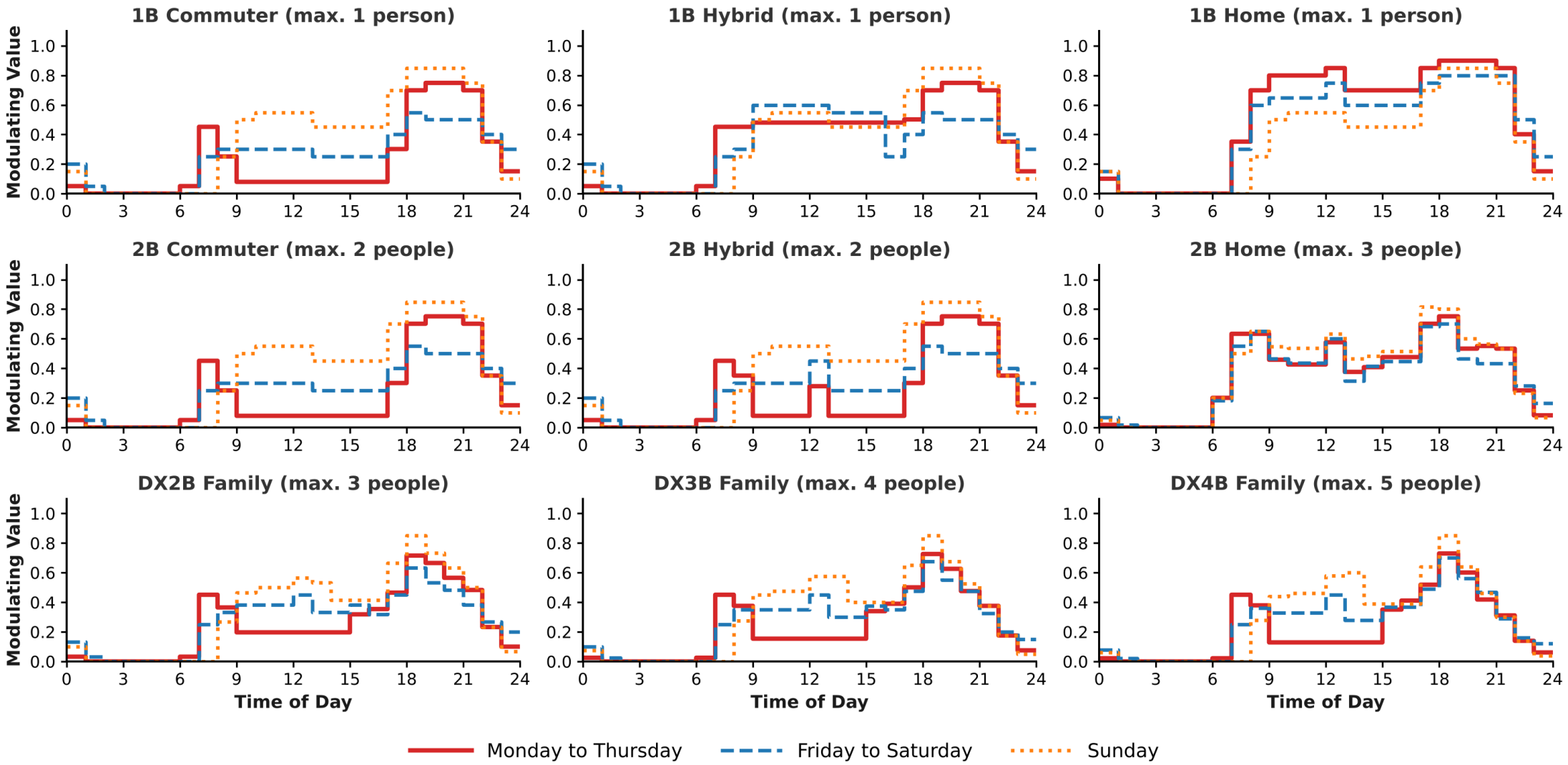
Each person type has an hourly probability of being in each room or out, for three day types. The room profiles on the following slides are built by adding the members of each household.

Person type	Hours at home Mon to Thu	Hours at home Fri to Sat	Hours at home Sun	Hours in LKD Mon to Thu	Hours asleep Mon to Thu	Hours in study Mon to Thu
Adult: office-based commuter	14.3	14.8	19.7	5.1	7.8	-
Adult: hybrid worker, desk in LKD	18.0	16.9	19.7	8.7	7.8	-
Adult: hybrid worker, study in bedroom 2	18.0	16.9	19.7	5.7	7.8	3.0
Adult: home-based (remote, shift, retired)	21.3	19.9	19.7	12.2	8.4	-
Adult: parent at home with pre-school child	20.9	19.0	19.6	11.9	7.9	-
Child: pre-school	21.4	21.0	21.0	8.5	12.4	-
Child: school age	16.5	19.0	20.3	4.0	10.2	-

People gains: 75 W sensible and 55 W latent per person (CIBSE TM59), reduced to 70% while asleep. The modulating value is the fraction of the room's maximum occupancy present in each hour.

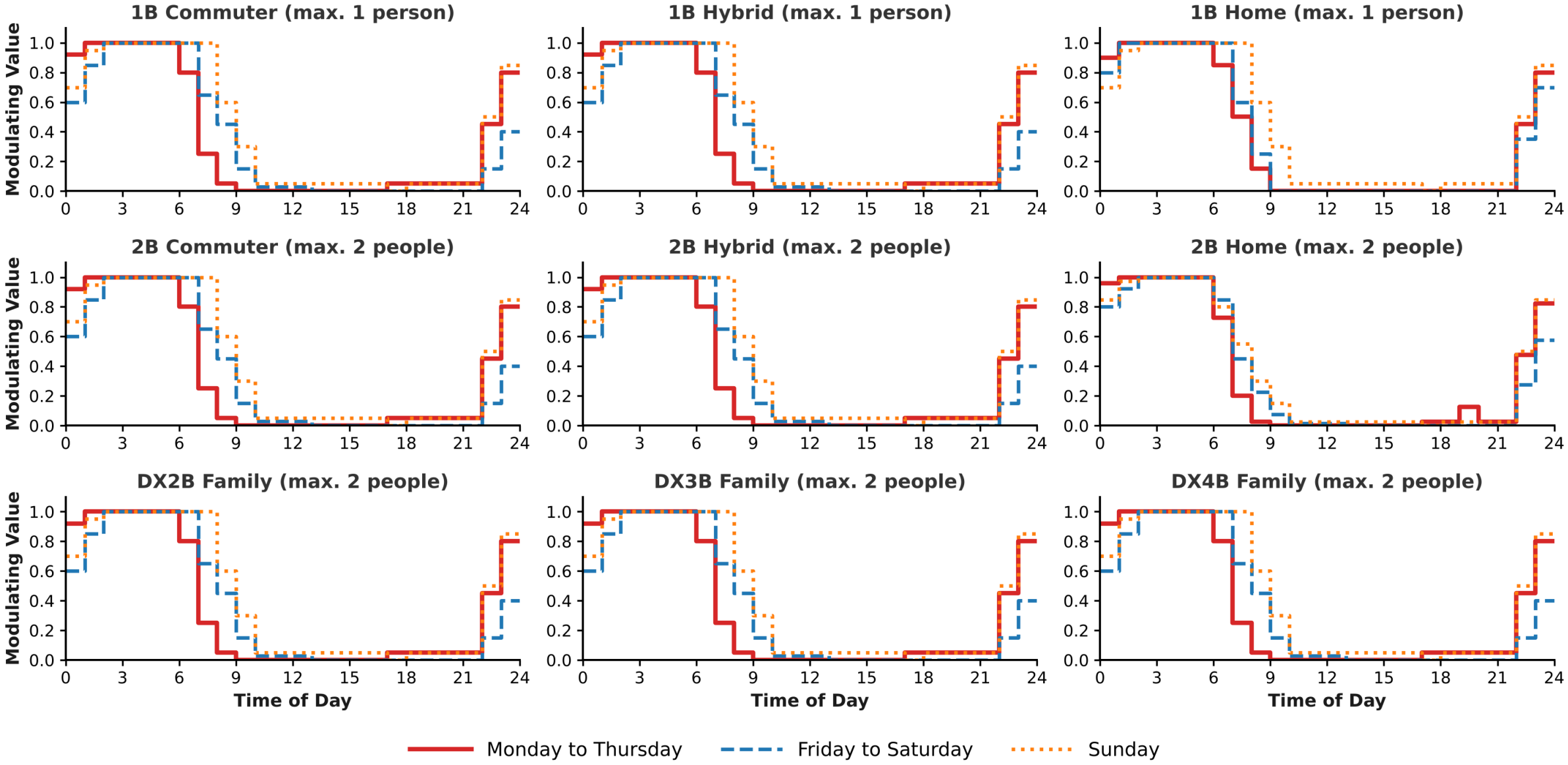
Model Inputs: People Profiles, LKD

Modulating value of the room's maximum occupancy. Hourly values for every profile are tabulated in Appendix B.

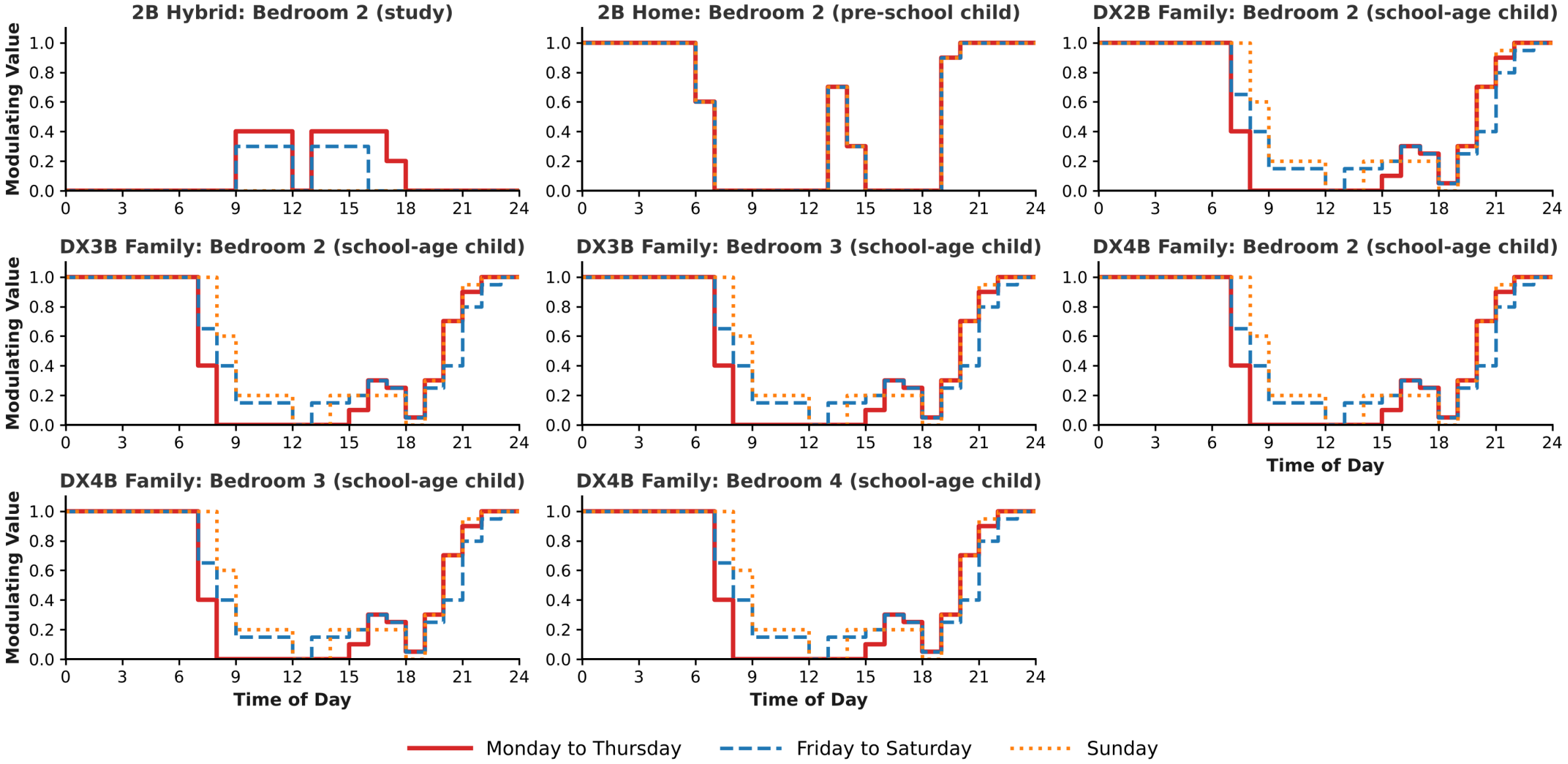


Model Inputs: People Profiles, Main Bedroom

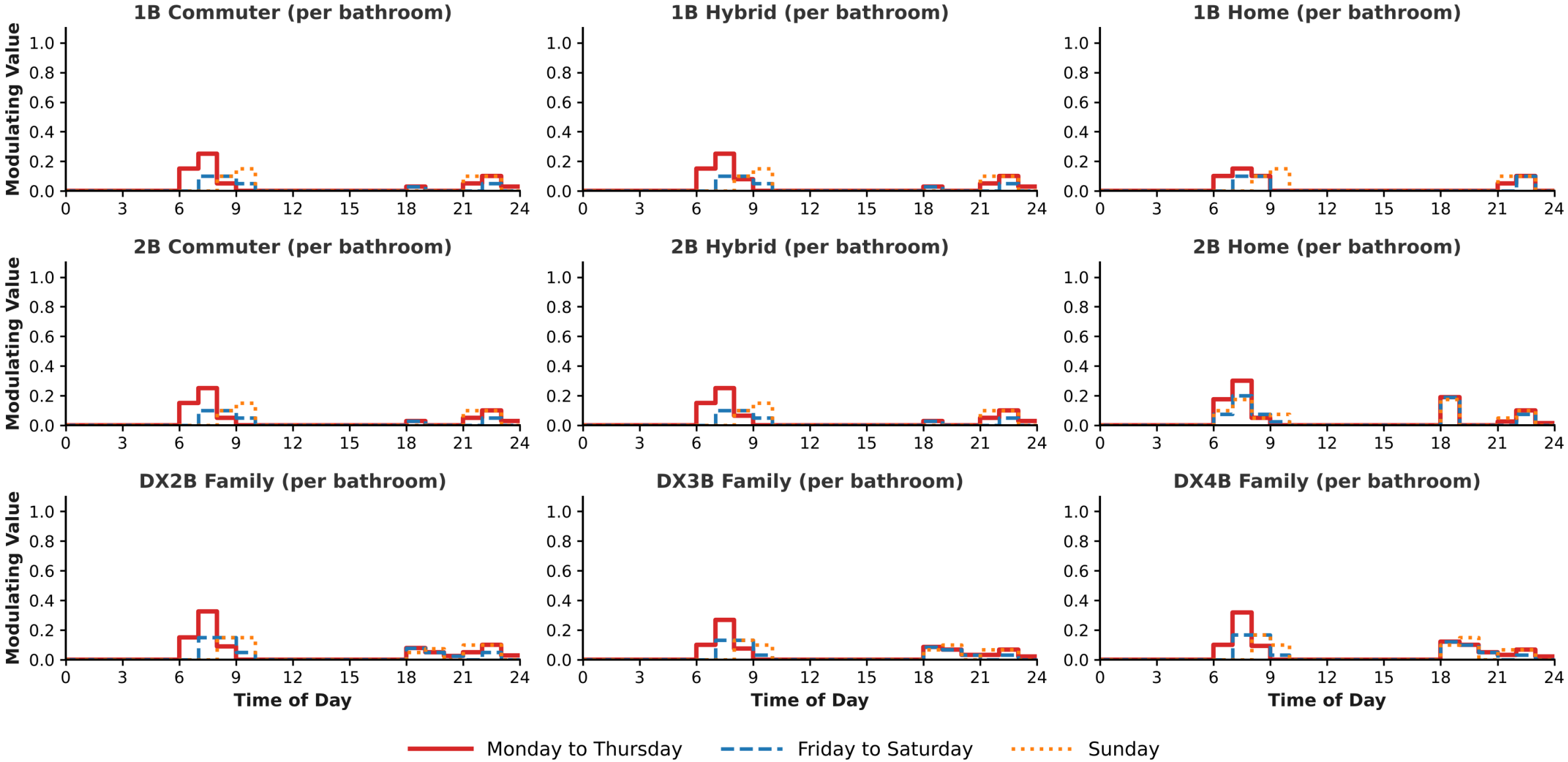
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Model Inputs: People Profiles, Other Bedrooms



Model Inputs: People Profiles, Bathrooms



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2.6 Lighting

Model Inputs: Lighting

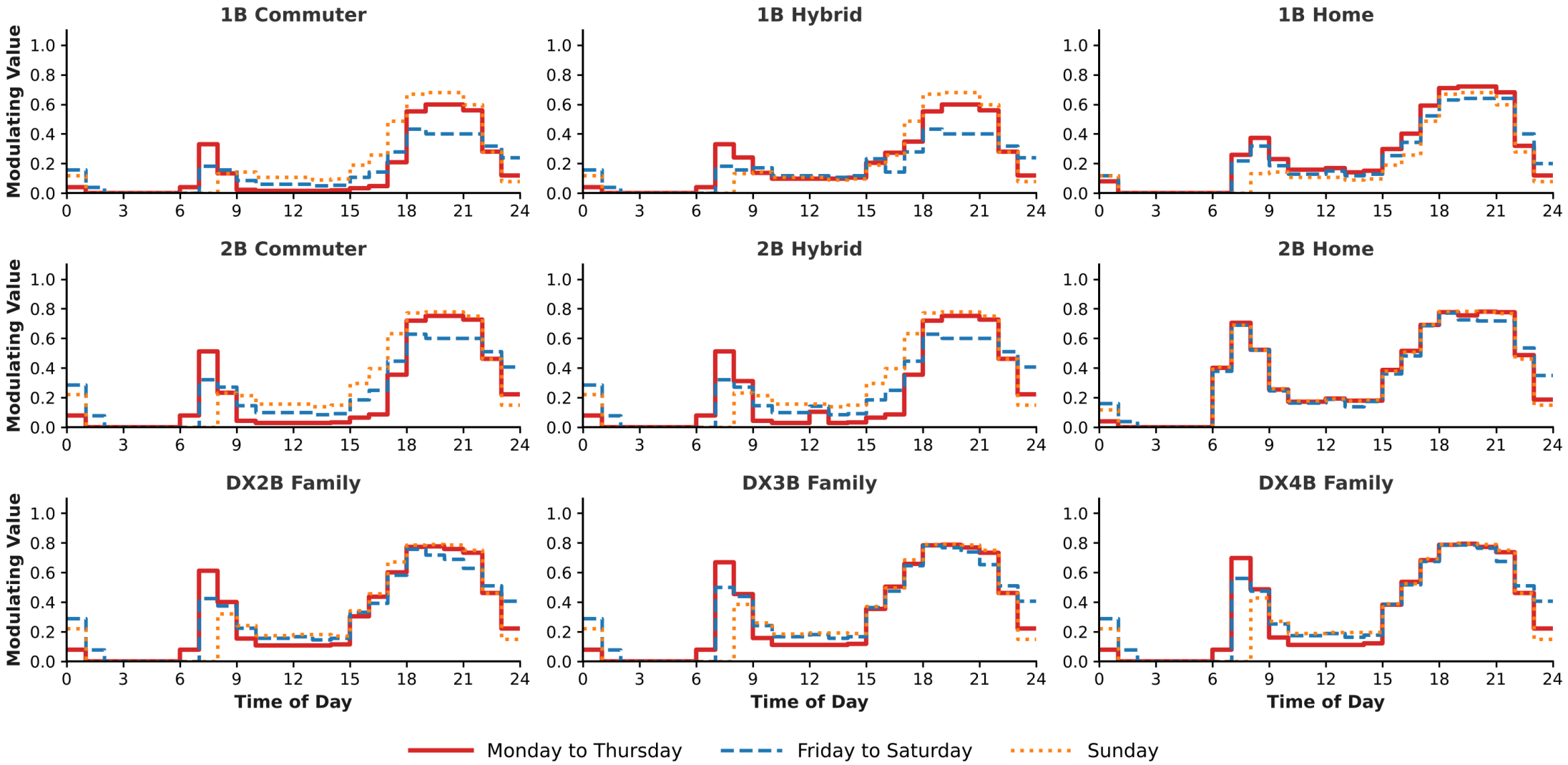
LED lighting throughout, with profiles linked to occupancy and the hours of darkness in Manchester.

Space	W/m²	Basis	Profile
Living / kitchen / diner	3.5	LED ≥ 81 lm/W; 100 lux general, 200 lux kitchen	Presence and daylight, winter and summer sets
Bedrooms	2.5	100 lux	Presence and daylight, winter and summer sets
Bathrooms and en-suites	4.0	150 lux plus mirror light	Use (internal rooms)
Duplex halls, utility cupboards	2.5	100 lux	Use
Entrance and lift lobby	3.0	200 lux at 120 lm/W, presence detection	Entrance traffic
Corridors (ground and upper)	1.5	100 lux at 120 lm/W, microwave detection	Corridor traffic
Stair	2.3	150 lux at 120 lm/W, presence detection	Stair use
Plant, meter, bin and bike stores	1.5 to 3.0	100 to 200 lux, presence or manual	Visits

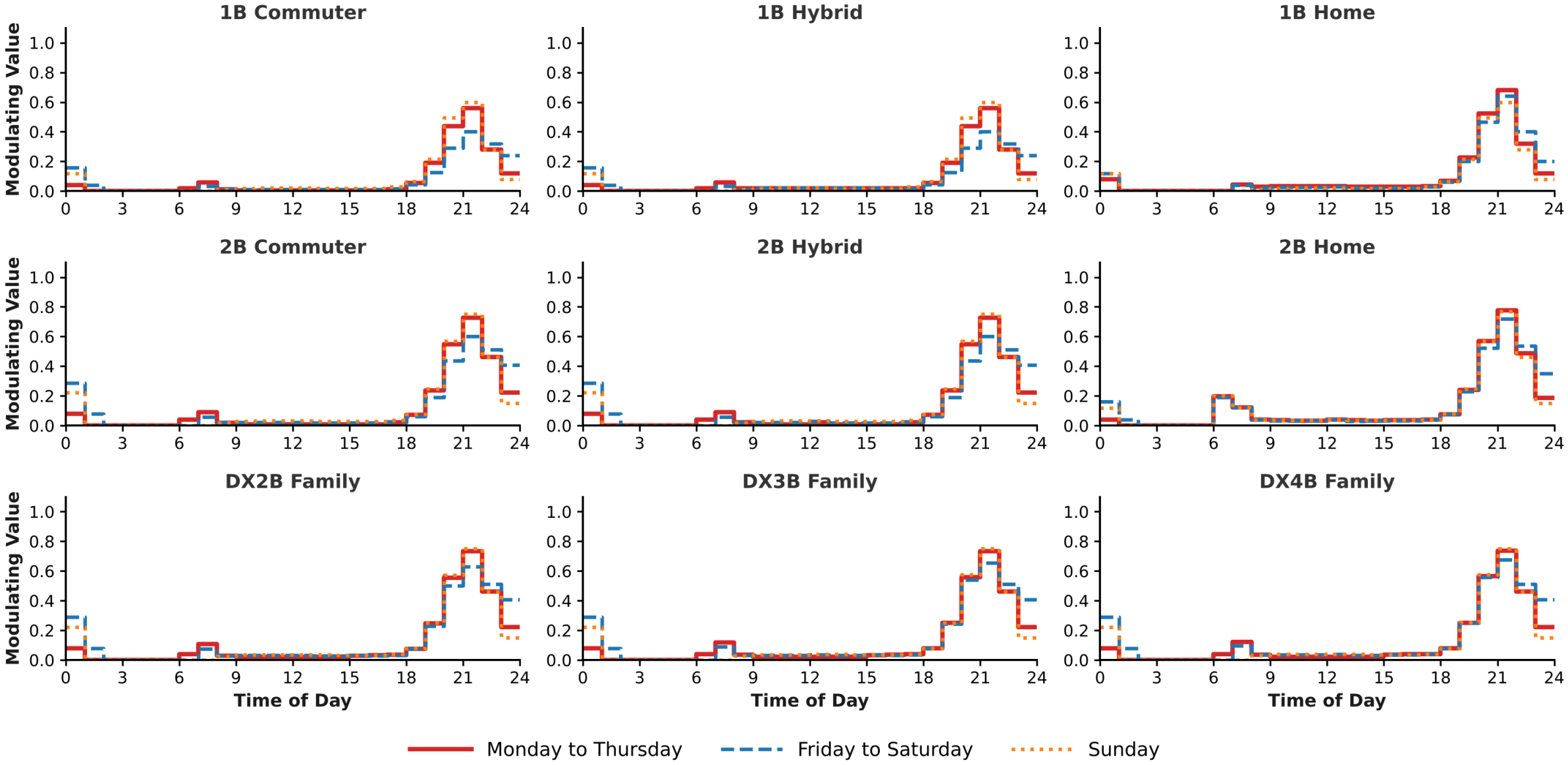
Winter profiles apply October to March and summer profiles April to September. Hourly values for every profile are tabulated in Appendix B.

Model Inputs: Living Room Lighting (Winter)

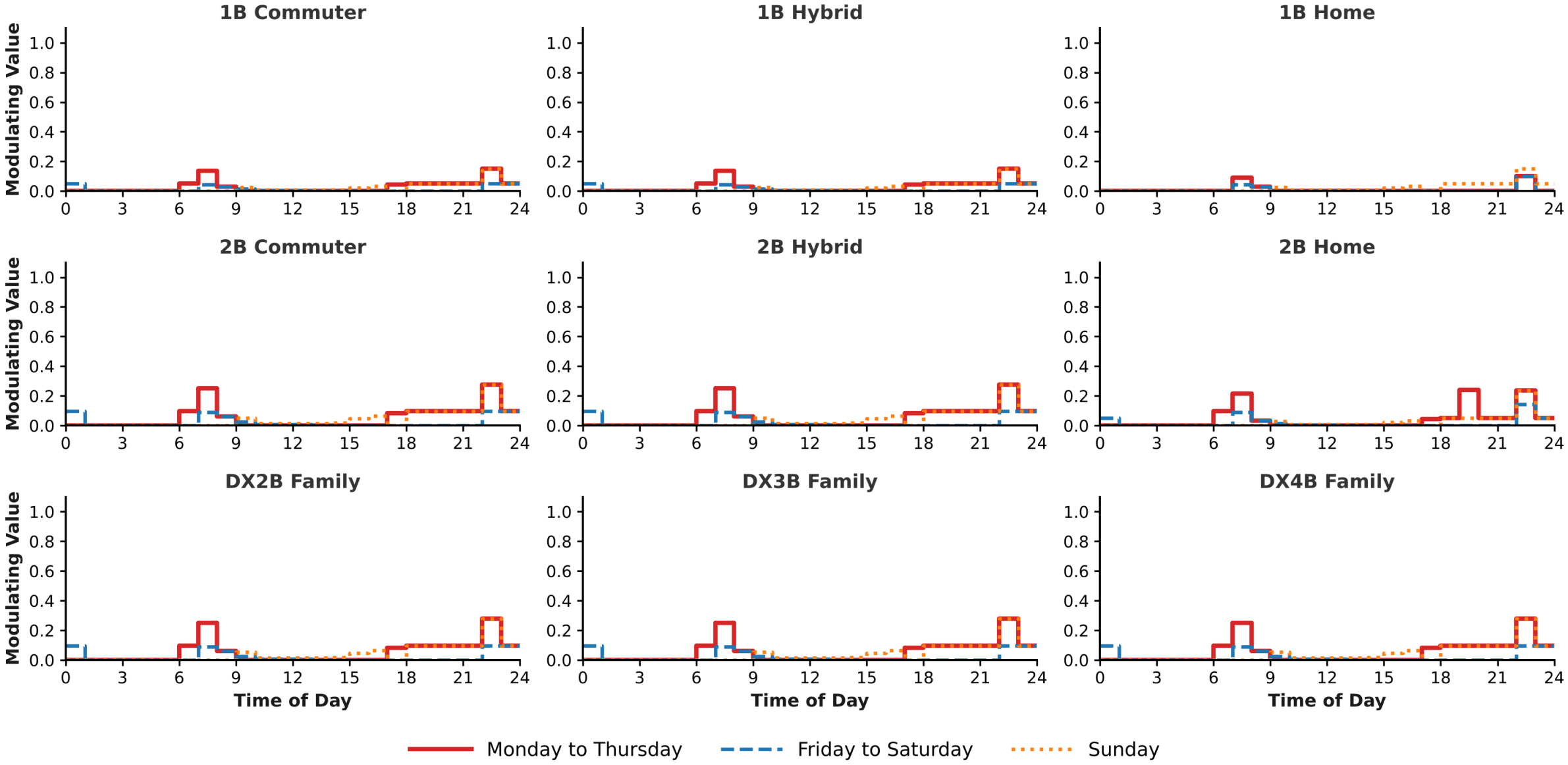
Modulating value of the installed lighting load.



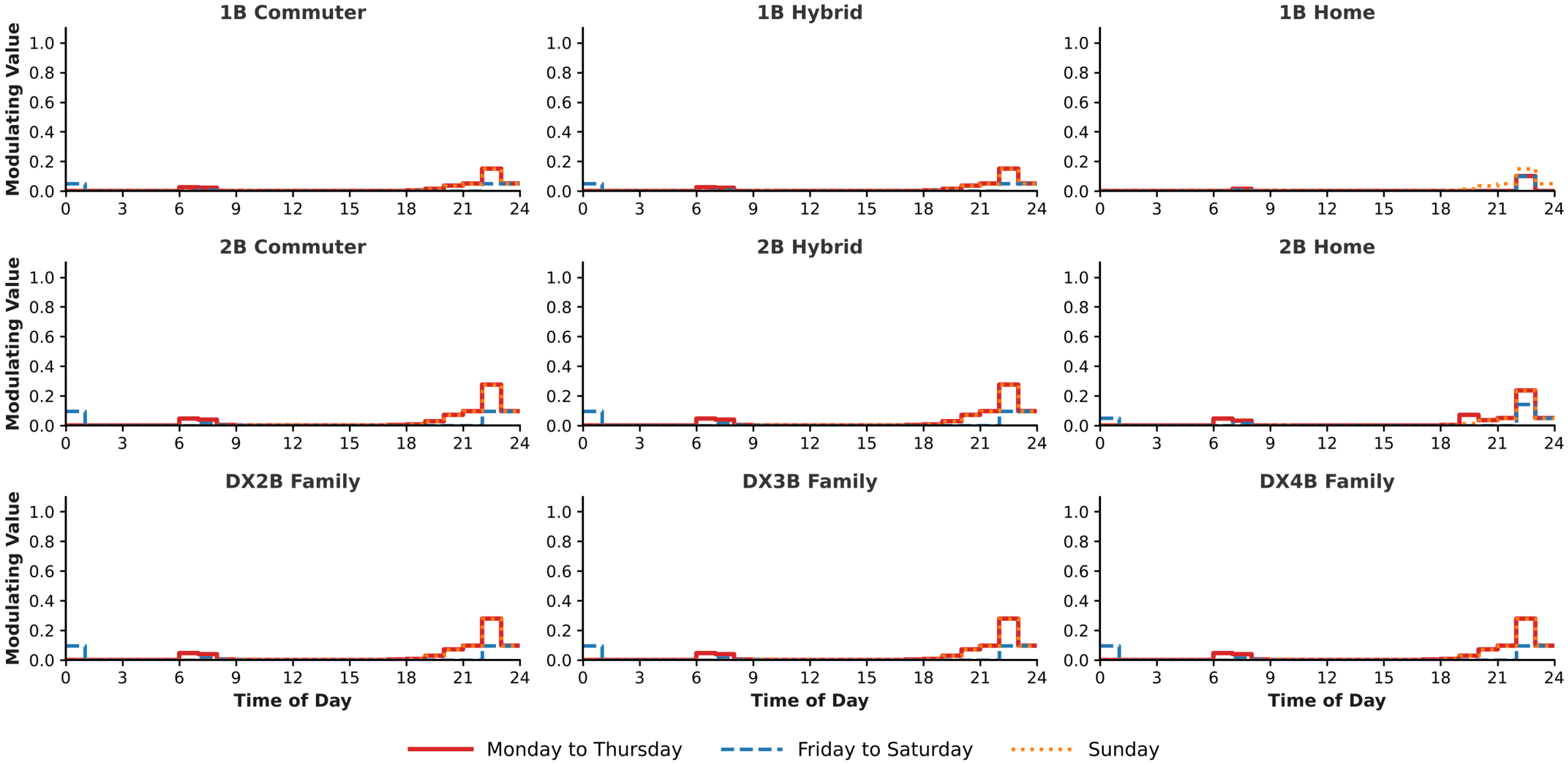
Model Inputs: Living Room Lighting (Summer)



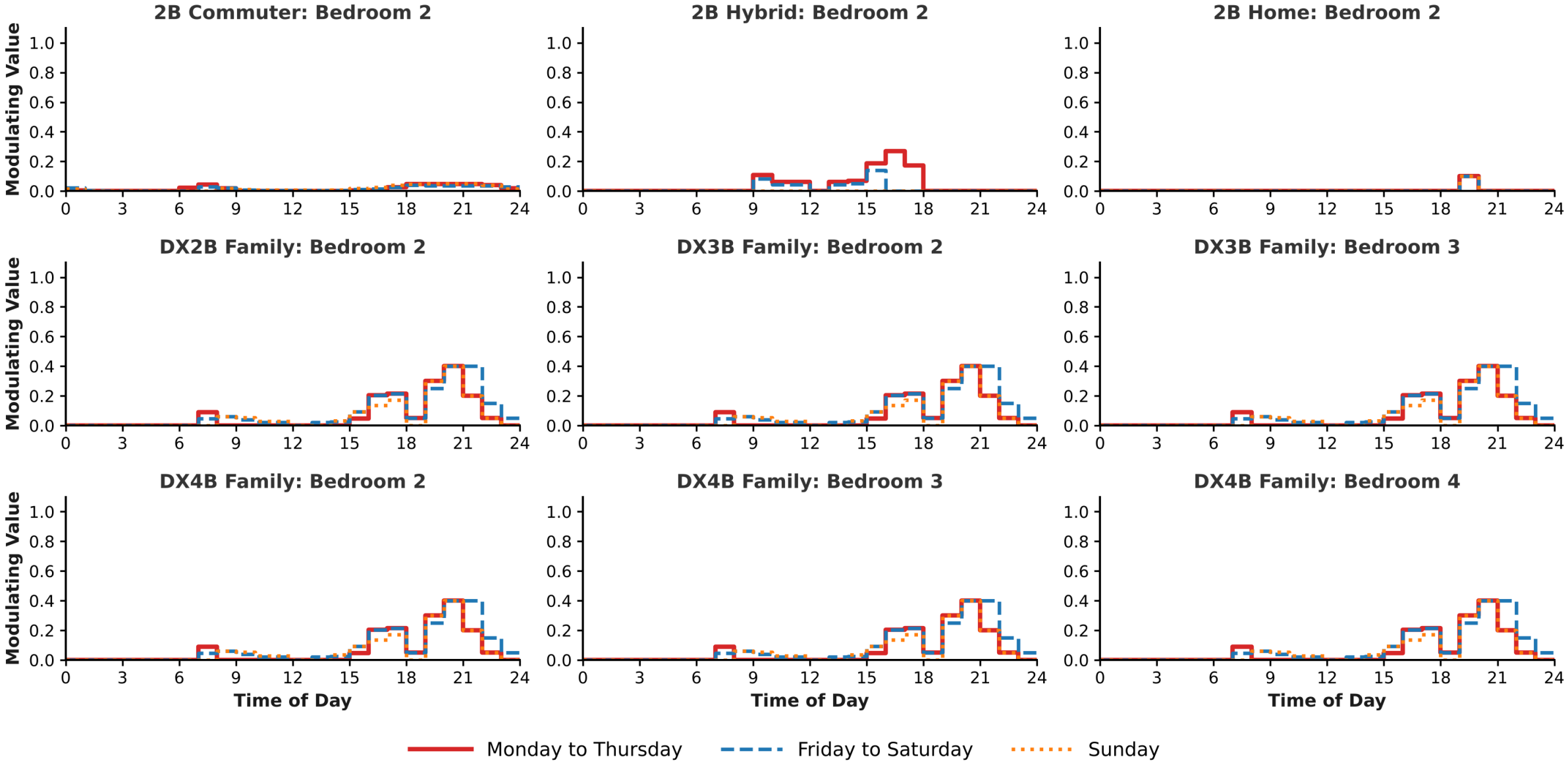
Model Inputs: Main Bedroom Lighting (Winter)



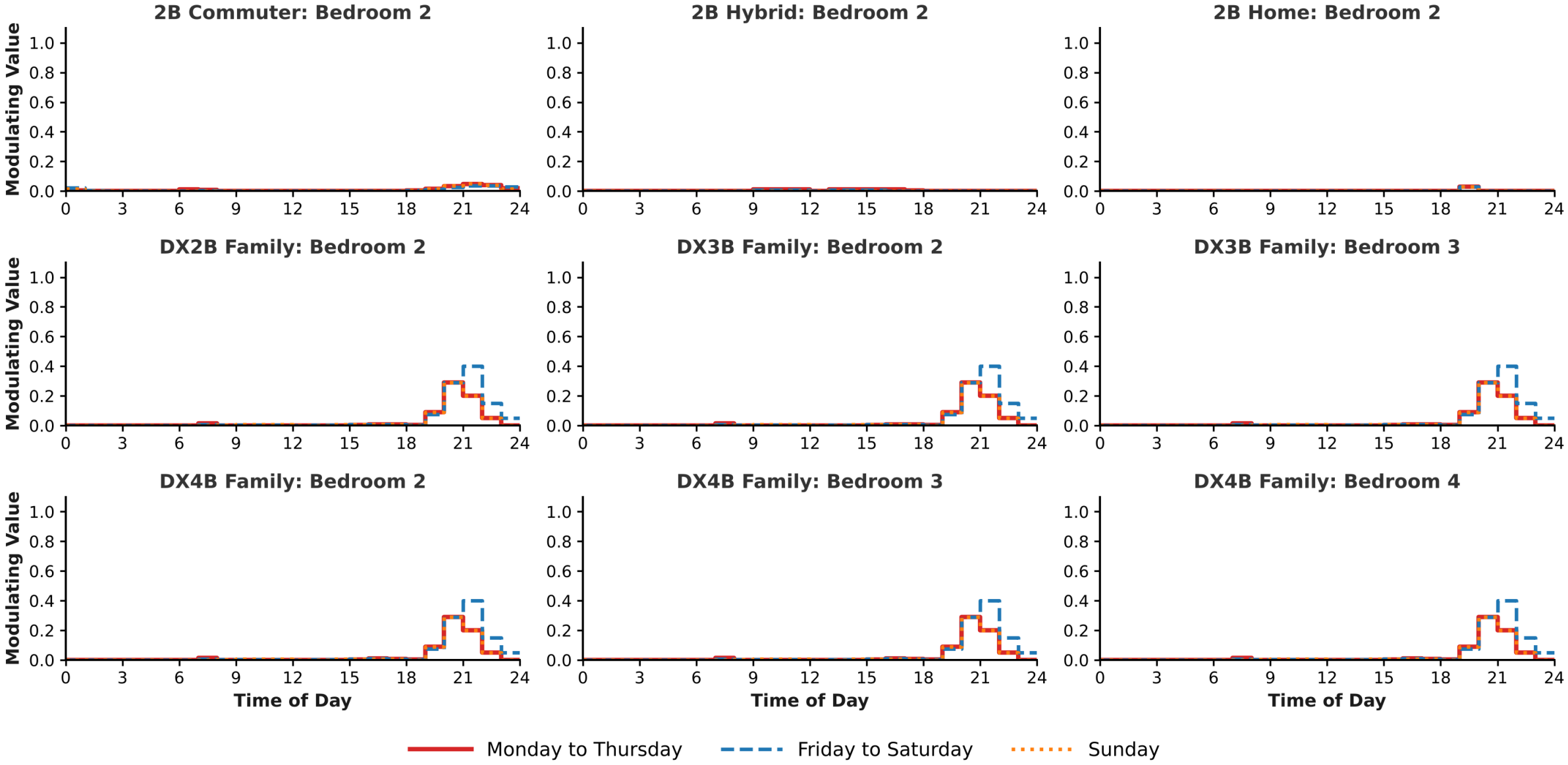
Model Inputs: Main Bedroom Lighting (Summer)



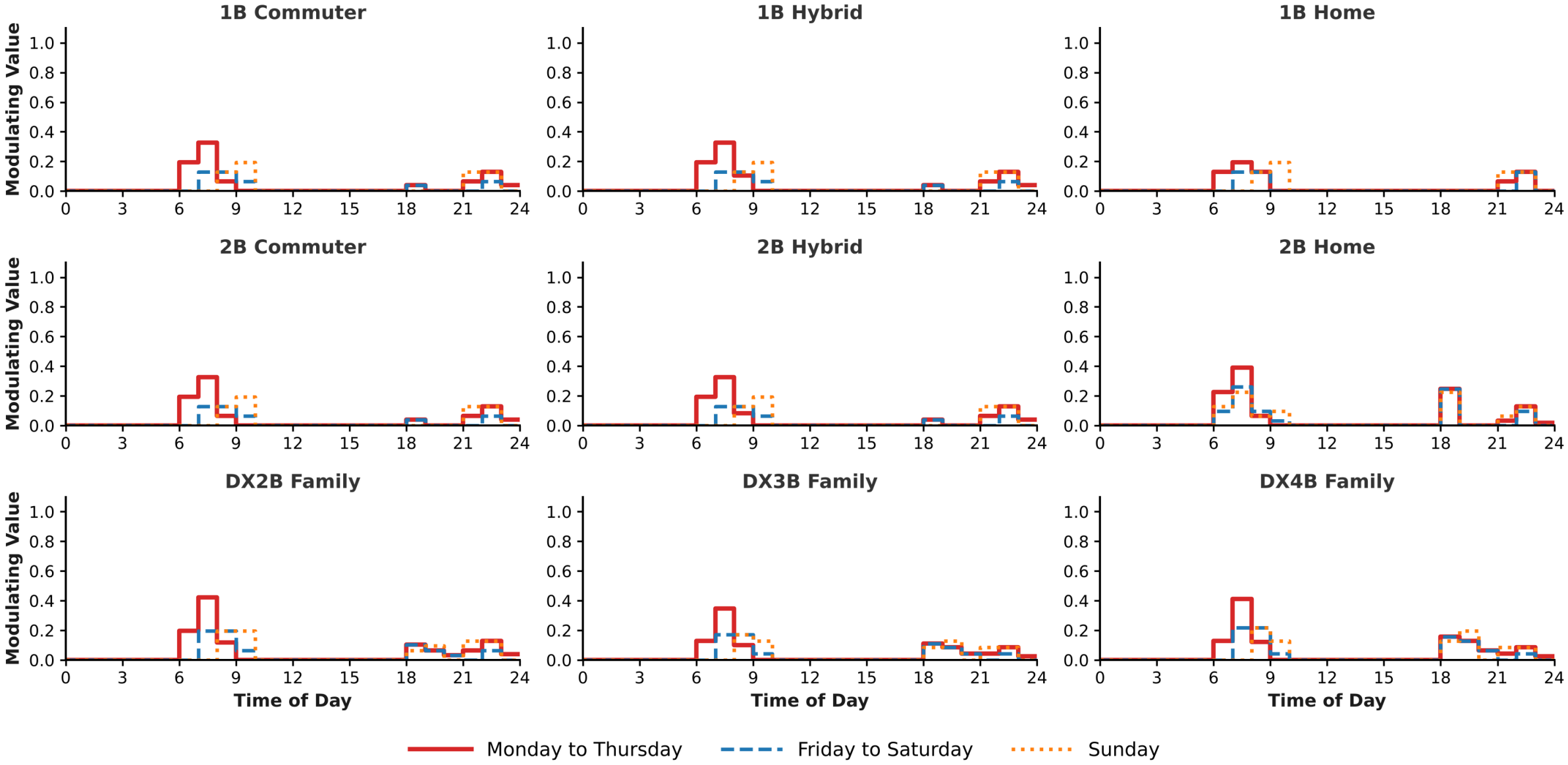
Model Inputs: Other Bedroom Lighting (Winter)



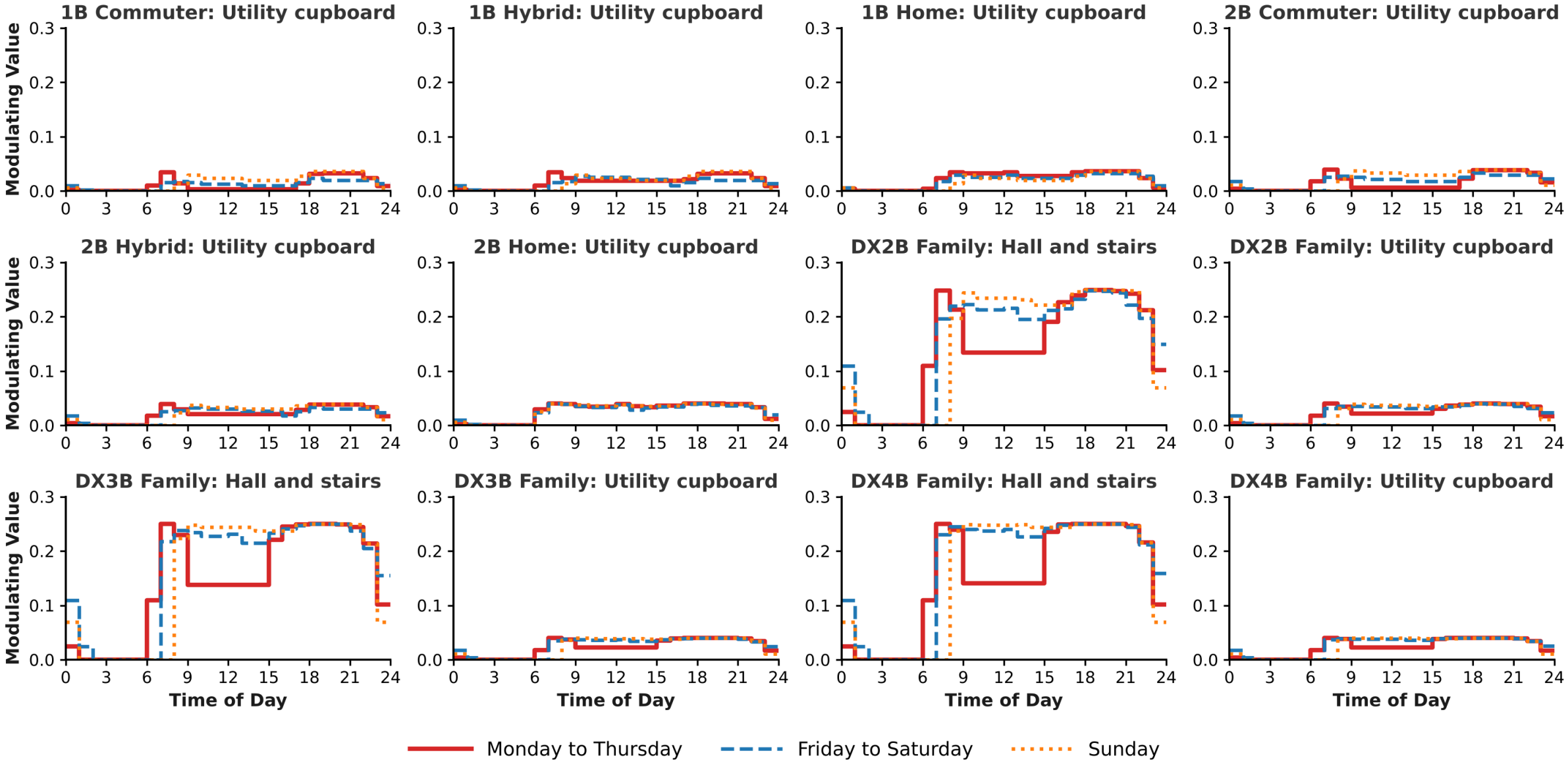
Model Inputs: Other Bedroom Lighting (Summer)



Model Inputs: Bathroom Lighting

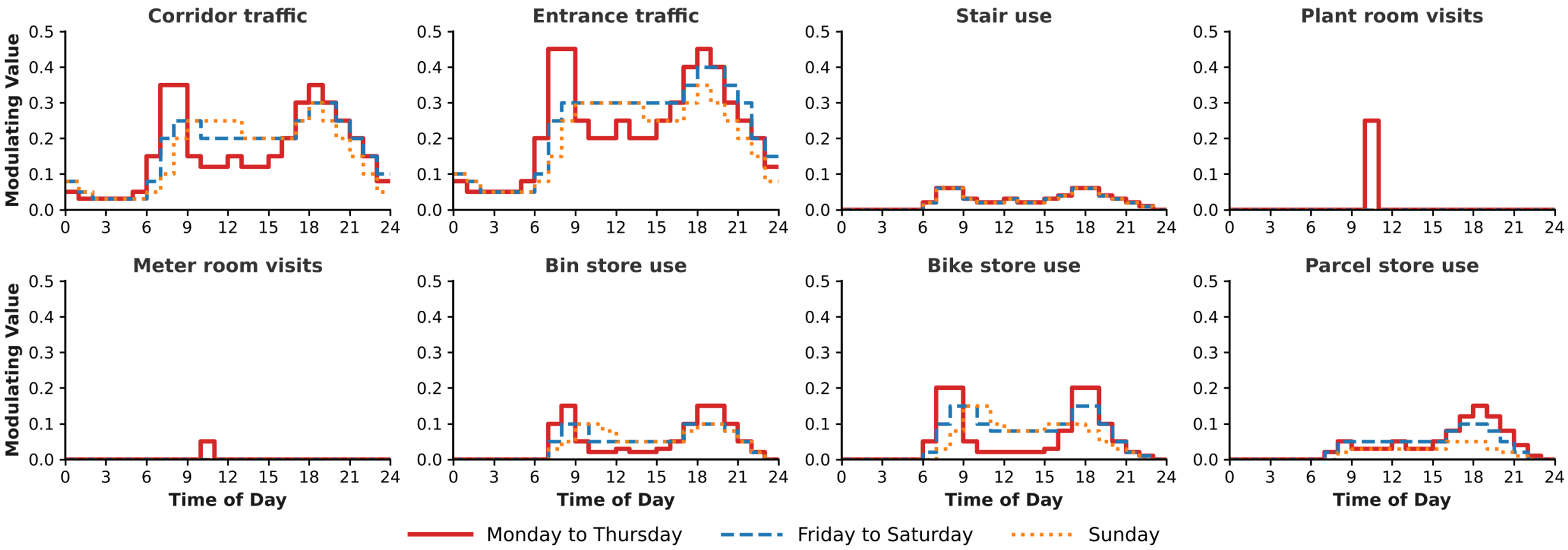


Model Inputs: Hall and Cupboard Lighting



Model Inputs: Landlord Lighting Profiles

Fraction of installed lighting on, reflecting traffic through each space with presence detection.



CWC

2.7 Equipment

Model Inputs: Equipment, Method

Every appliance is a separate gain in IES with its own timing profile, rather than a single W/m² allowance. Energy per appliance comes from product data for efficient, mid-price models and measured UK use.

- Products: energy labels and product fiches for typical kitchen and laundry appliances for this type of development.
- Use: Household Electricity Survey (Powering the Nation 2), Which?, ENERGY STAR and Ofcom data.
- Heat gains: CIBSE Guide A (2015) chapter 6, including the cooking 66% sensible / 34% latent split.
- IES maximum power = annual energy / full-load hours of the profile, so the modelled energy matches the evidence.
- Cooking and kitchen appliance timing follows the household's occupancy pattern (commuter, hybrid, home-based or family); laundry and dishwashing follow typical use events; fridge freezers, routers and standby run continuously.

Model Inputs: Appliance Energy per Dwelling

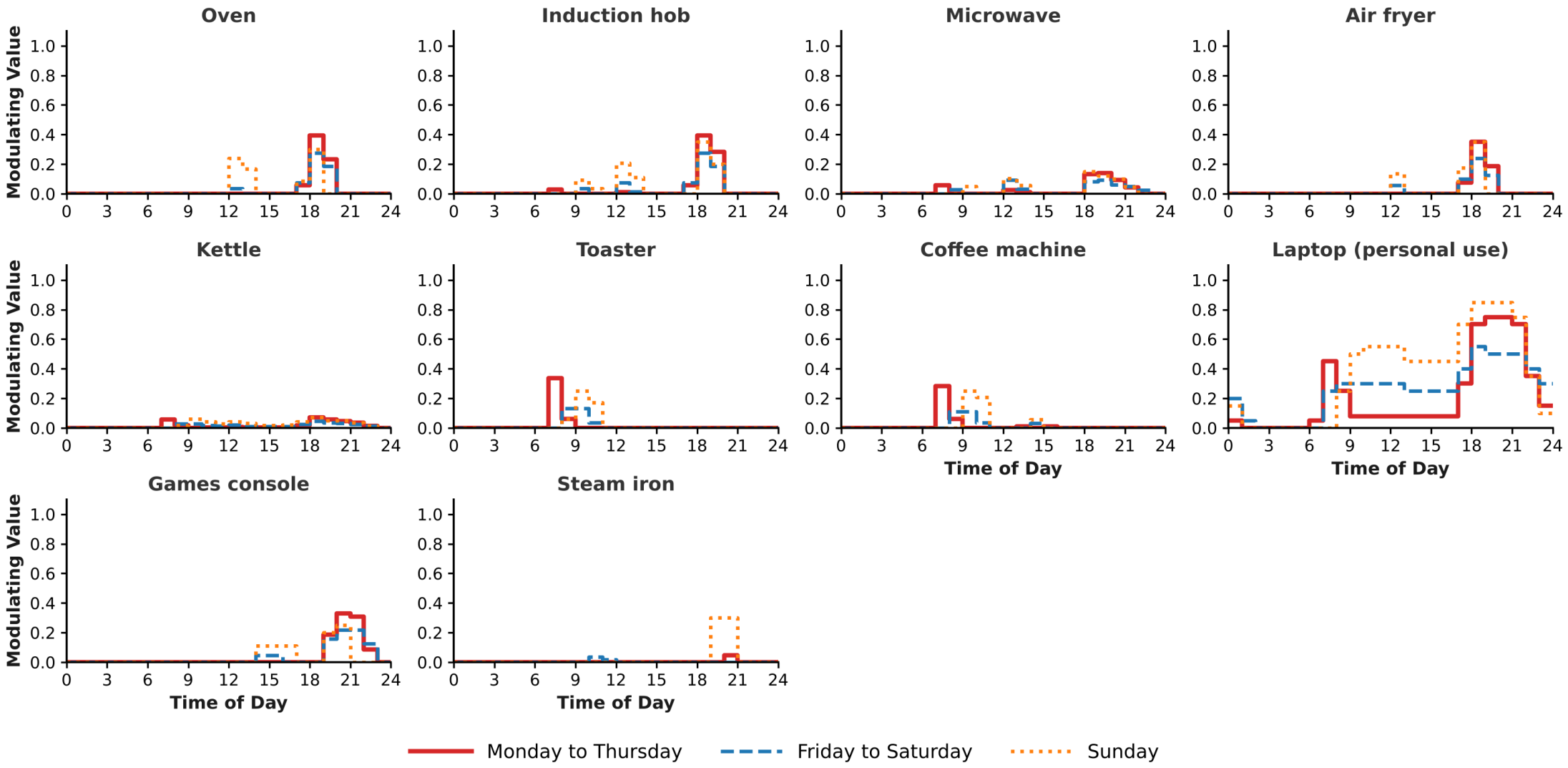
CWC

Annual appliance and cooking electricity per dwelling (kWh/yr), including all bathrooms.

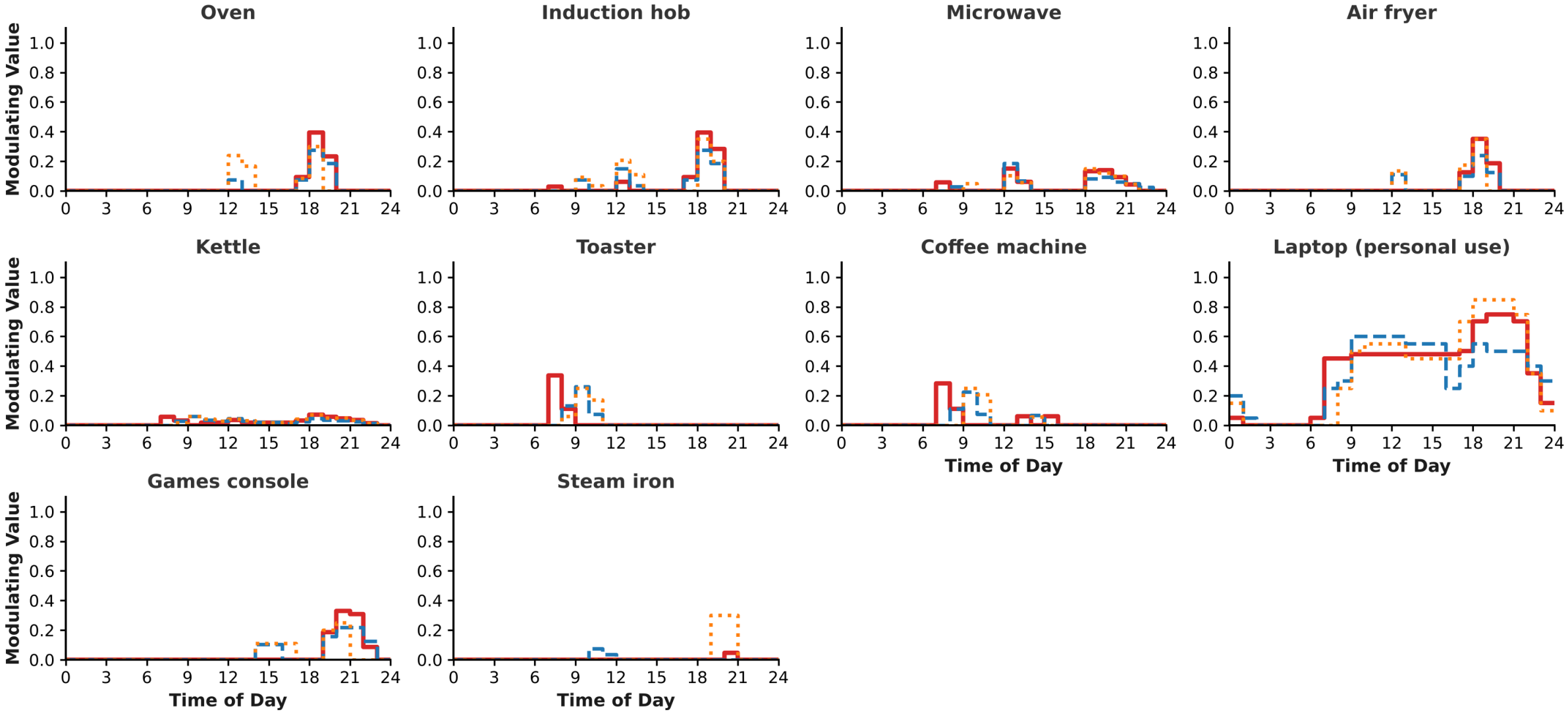
Household	Cooking	Fridge freezer	Dishwasher, washer dryer	Kettle, toaster, coffee	TV and standby	IT, home working, chargers	Iron, vacuum	Bathroom	Router	Total
1B Commuter	240	184	335	110	141	31	25	26	123	1,215
1B Hybrid	264	184	335	145	159	55	32	26	123	1,323
1B Home	326	184	335	179	183	58	37	26	123	1,451
2B Commuter	357	184	483	182	203	61	48	52	123	1,693
2B Hybrid	393	184	483	240	206	93	61	52	123	1,835
2B Home	475	184	593	263	255	54	76	67	123	2,090
DX2B Family	495	186	593	307	252	108	85	67	123	2,216
DX3B Family	522	186	703	316	260	133	102	81	123	2,426
DX4B Family	586	186	813	361	266	162	112	95	123	2,704

Model Inputs: Commuter Appliance Profiles

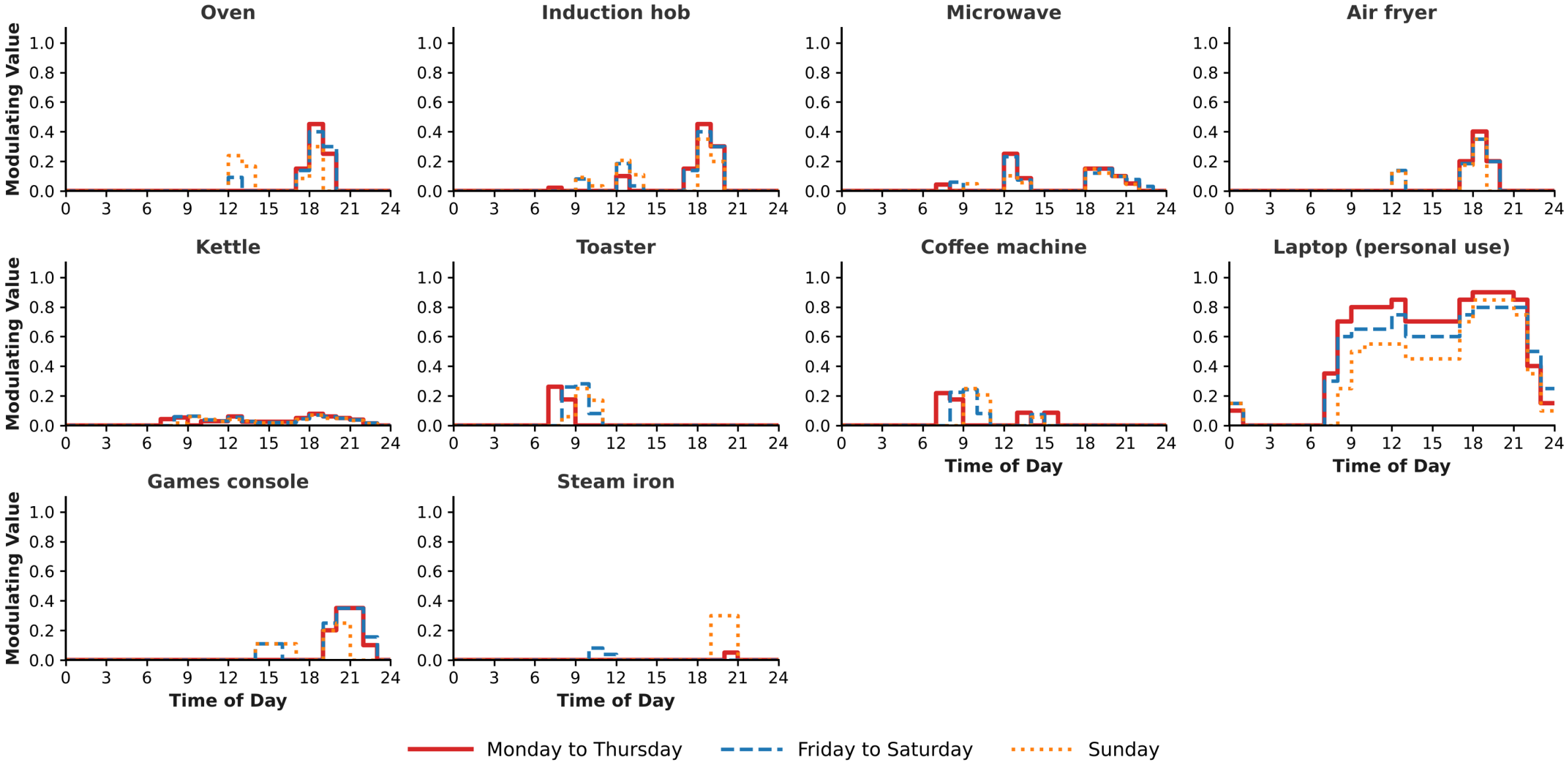
Modulating value of each appliance's maximum power. Hourly values for every profile are tabulated in Appendix B.



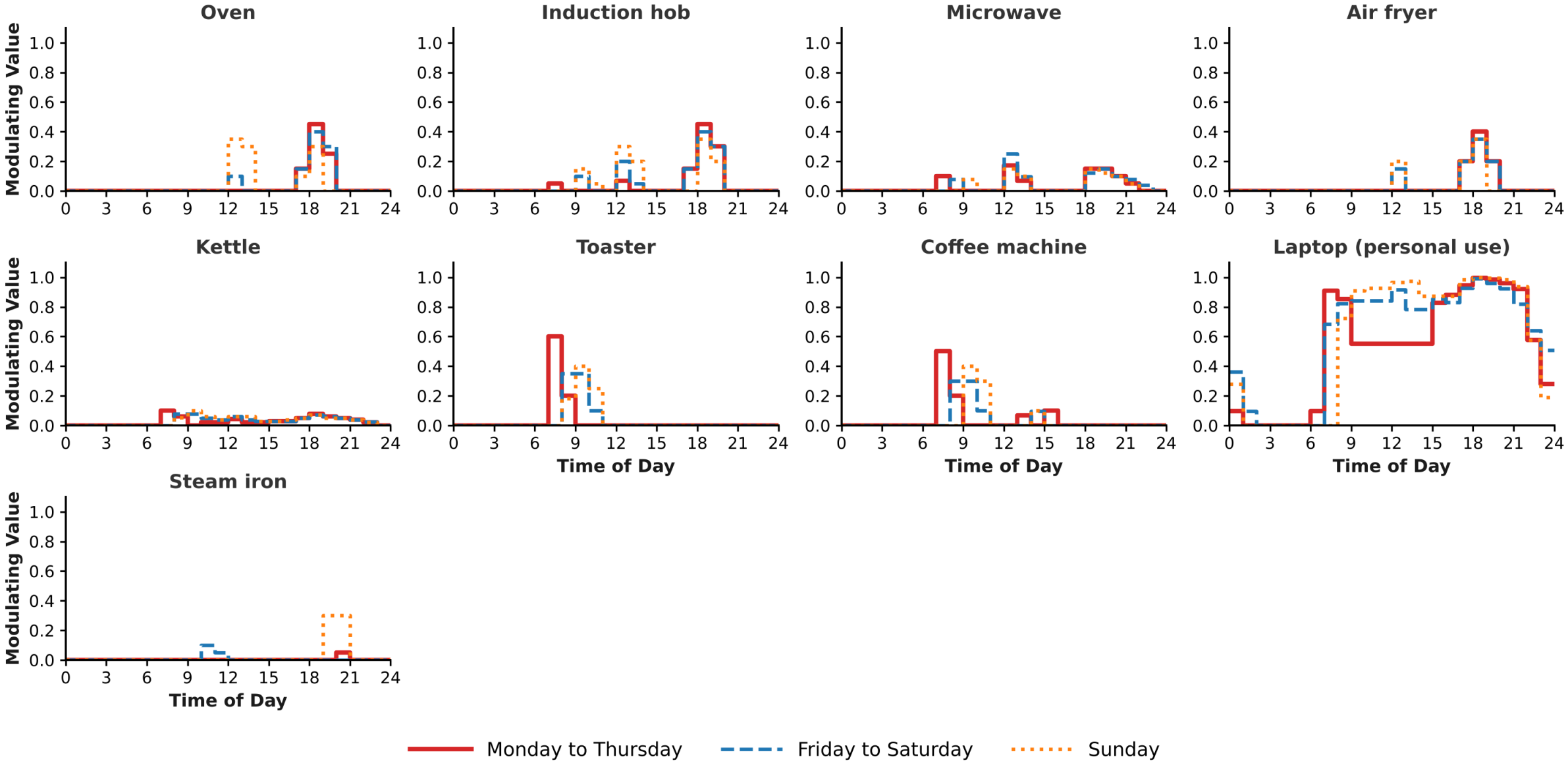
Model Inputs: Hybrid Appliance Profiles



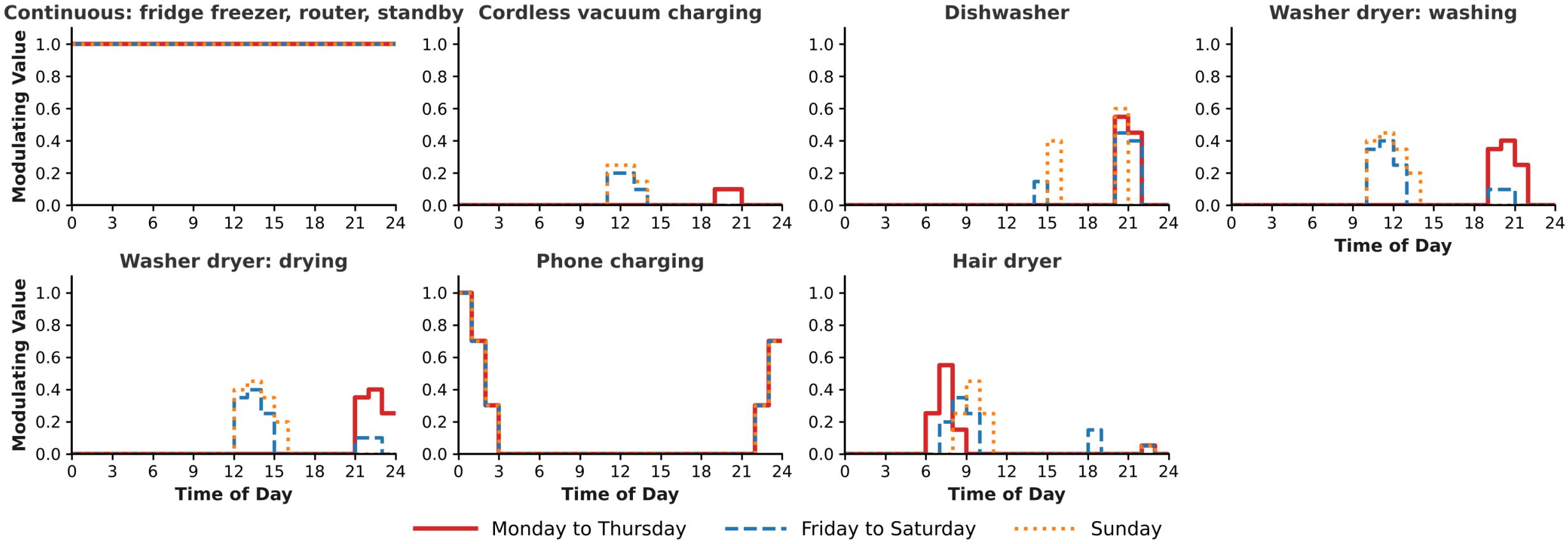
Model Inputs: Home-based Appliance Profiles



Model Inputs: Family Appliance Profiles

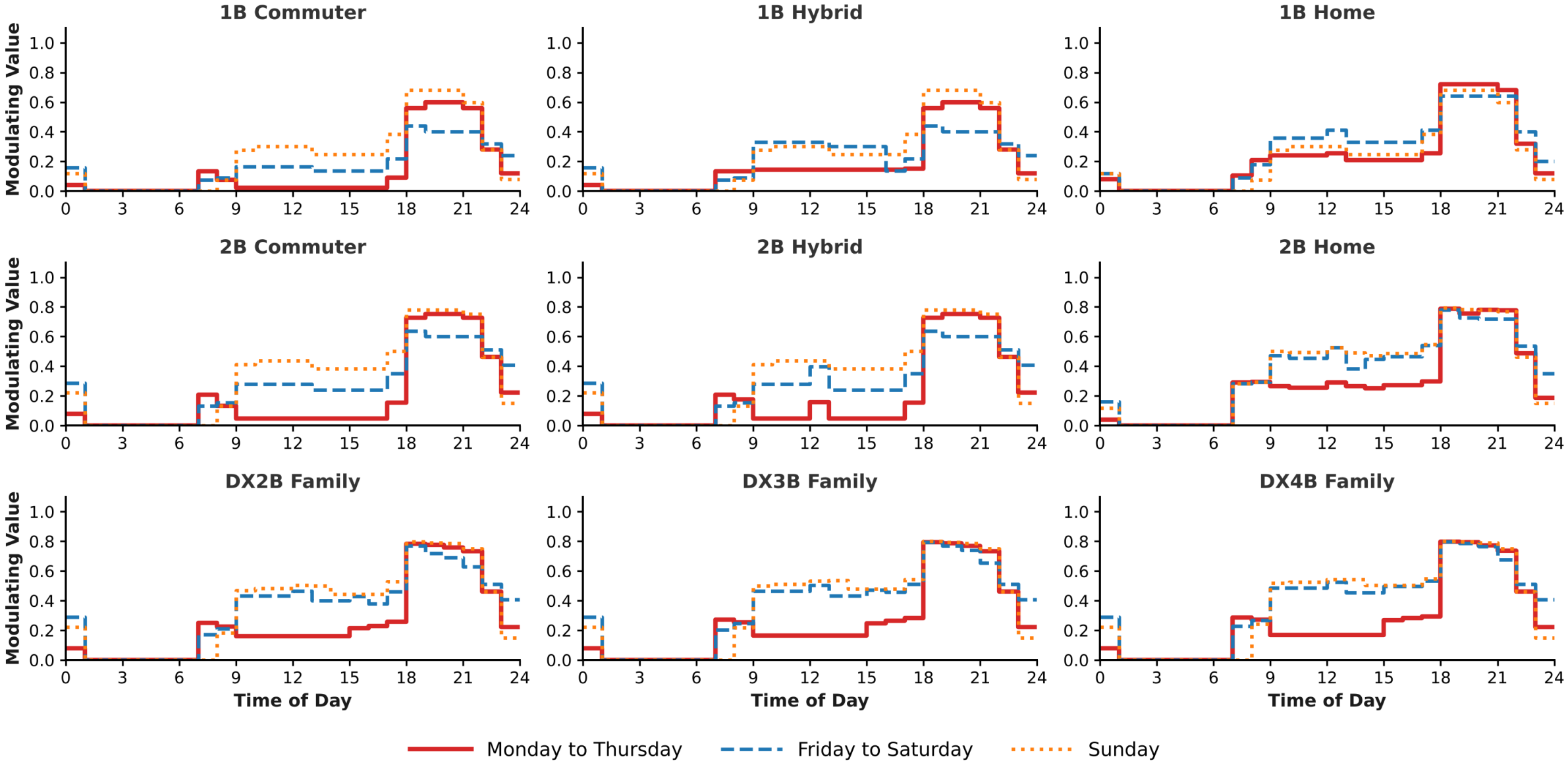


Model Inputs: Common Appliance Profiles

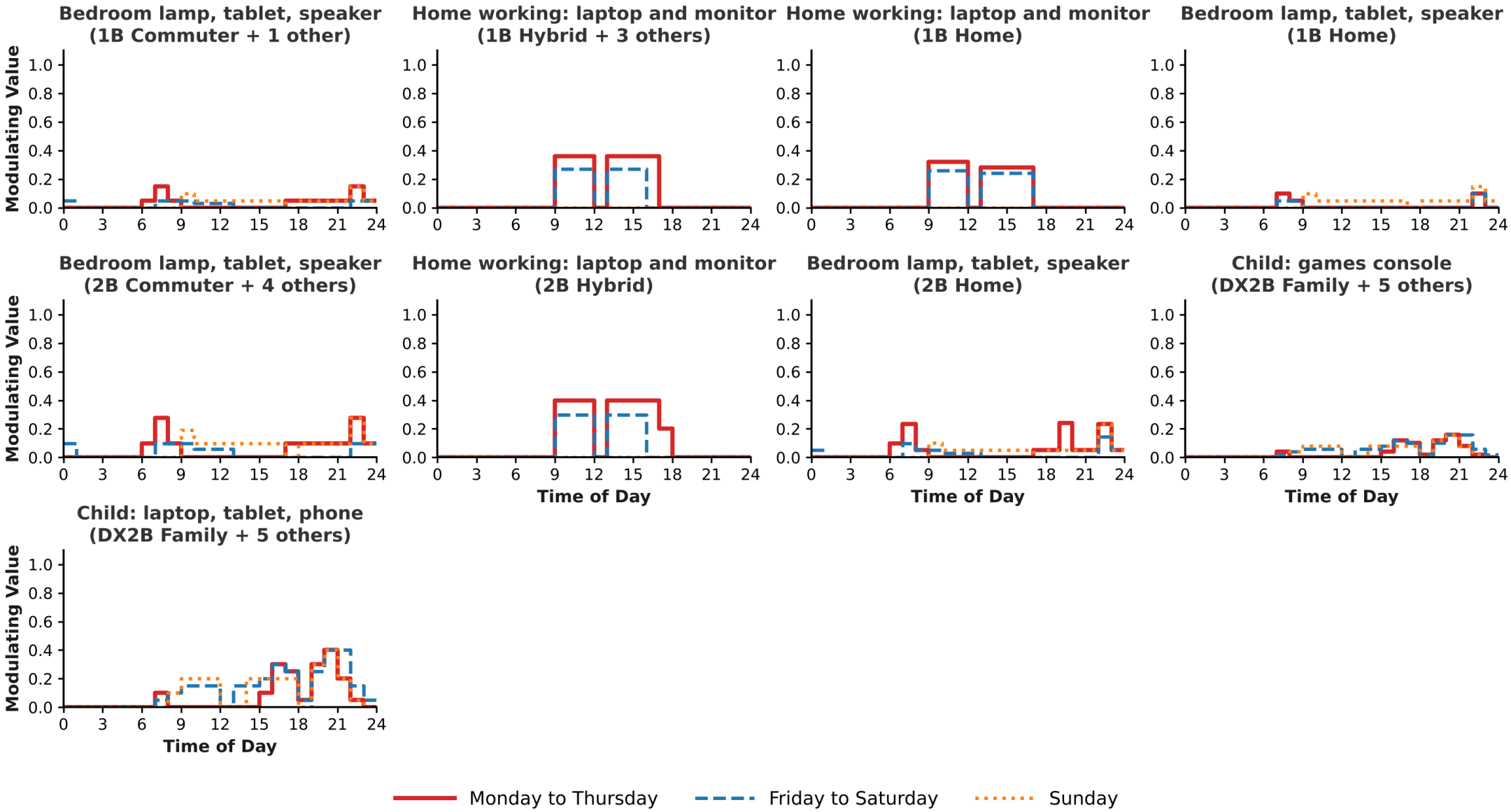


Model Inputs: TV and Streaming Profiles

CWC



Model Inputs: Study and Bedroom Devices



Model Inputs: Other Equipment

Landlord and dwelling loads not in the thermal model are added to the results as 'Other Equipment'.

Item	Power (kW)	Hours/day	kWh/yr
Mains smoke and heat alarms, 41 flats (6 × 0.5 W)	0.123	24	1,077
Wi-Fi heater standby, 41 flats (4 × 1 W)	0.164	24	1,437
Fire alarm, voice comms, access control, CCTV, data, TV	0.300	24	2,628
Smoke control panel and AOVs (standby)	0.030	24	263
Combined BCWS / sprinkler pump set: domestic duty	1.100	2.79	1,120
Combined pump set: controls and drives standby	0.020	24	175
Combined pump set: weekly automatic sprinkler test	5.500	0.036	72
CAT 5 booster: pump running	0.550	0.2	40
CAT 5 booster: controller standby	0.003	24	26
Total			6,839

Booster pump calculation

- 73 residents × 120 l/day = 8.76 m^3/day (Approved Document G).
- Head about 45 m; hydraulic energy 0.123 kWh/m^3; wire-to-water efficiency 35% gives 0.35 kWh/m^3, or 3.07 kWh/day.
- Sprinkler and domestic pumps are one combined set.

Power and run hours are assessor values pending the contractor's selections.

Model Inputs: Passenger Lift

Lift energy is calculated with the NABERS UK Design for Performance method (Appendix A.4), shown opposite, for one 17-person (1,275 kg) machine-room-less VVVF lift at 1.0 m/s serving ground to fifth floor.

The result, 15,083 kWh/yr, is added outside the thermal model. No regenerative drive is credited.

A.4 Vertical transportation

Lift energy should be calculated using ISO 25745-2 (2015). Otherwise, the following equation may be used for modern lift installations:

$$E_{lifts}(kWh) = (528F + 5.5A)(1 - \alpha)$$

Where A is the net internal area of the building, α is 0.26 for lifts without regeneration and 0.37 for lifts with regeneration and

$$F = \sum_{all\ floors} n$$

Where n is the number of lifts serving or express bypassing the floor.

Input	Value
Lifts × floors served (F)	1 × 6 = 6
Net internal area (A)	3,130 m²
α (no regenerative drive credited)	0.26
E = (528F + 5.5A)(1 − α)	15,083 kWh/yr

Model Inputs: External Lighting

CWC

Fitting	No.	Control
IP65 wall LED with photocell, entrance	2	Dusk to dawn, astronomical clock
IP65 bulkhead, bin store and stair exits	2	Photocell and presence, 5 min run-on
Connected load (with emergency charging)	0.05 kW	4,254 h/yr of darkness

- Energy = connected load × hours of darkness, split by month.
- Fittings for the car port shown on earlier layouts are excluded, as there is no car port in the current scheme.

Month	Hours of darkness	kWh
Jan	483	24.2
Feb	390	19.5
Mar	376	18.8
Apr	302	15.1
May	258	12.9
Jun	220	11.0
Jul	240	12.0
Aug	288	14.4
Sep	338	16.9
Oct	409	20.5
Nov	452	22.6
Dec	498	24.9
Year	**4,254**	**212.7**

CWC

2.8 HVAC Operation and Internal Conditions

Model Inputs: Heating Set-points, Dwellings

Profile	Set-point / set-back	Weekday hours	Weekend hours	Room groups
H01 Living room, commuter	21 / 16 °C	06:30 to 08:30, 17:30 to 23:00	08:00 to 23:00	1B and 2B Commuter LKD; 2B Hybrid LKD
H02 Living room, hybrid	21 / 16 °C	Mon, Fri 07:00 to 23:00; Tue to Thu as H01	08:00 to 23:00	1B Hybrid LKD
H03 Living room, home-based	21 / 16 °C	07:00 to 23:00	07:00 to 23:00	1B Home and 2B Home LKD
H04 Living room, family	21 / 16 °C	Mon, Fri 06:30 to 22:30; Tue to Thu 06:30 to 08:30, 15:30 to 22:30	07:30 to 22:30	Duplex LKDs
H05 Main bedroom	18 / 16 °C	06:30 to 08:00, 21:30 to 23:30	07:30 to 09:30, 22:00 to 00:00	All main bedrooms
H06 Study bedroom	20 / 16 °C	Mon, Fri 09:00 to 17:00	Set-back	2B Hybrid bedroom 2
H07 Pre-school child	18 / 16 °C	19:00 to 07:30, 13:00 to 15:00	As weekday	2B Home bedroom 2
H08 School-age child	18 / 16 °C	19:00 to 07:30	19:00 to 07:30	Duplex bedrooms 2 to 4
H09 Spare bedroom	16 °C constant	-	-	2B Commuter bedroom 2
H10 Bathrooms	18 / 16 °C	06:00 to 09:00, 18:00 to 22:00	07:00 to 10:00, 18:00 to 22:00	All bathrooms and en-suites
H11 Duplex hall, stairs	18 / 16 °C	As H04	As H04	Duplex halls

Set-points for realistic operation (CIBSE Guide A Table 1.5 ranges and English Housing Survey data); set-back 16 °C. Utility cupboards are unheated.

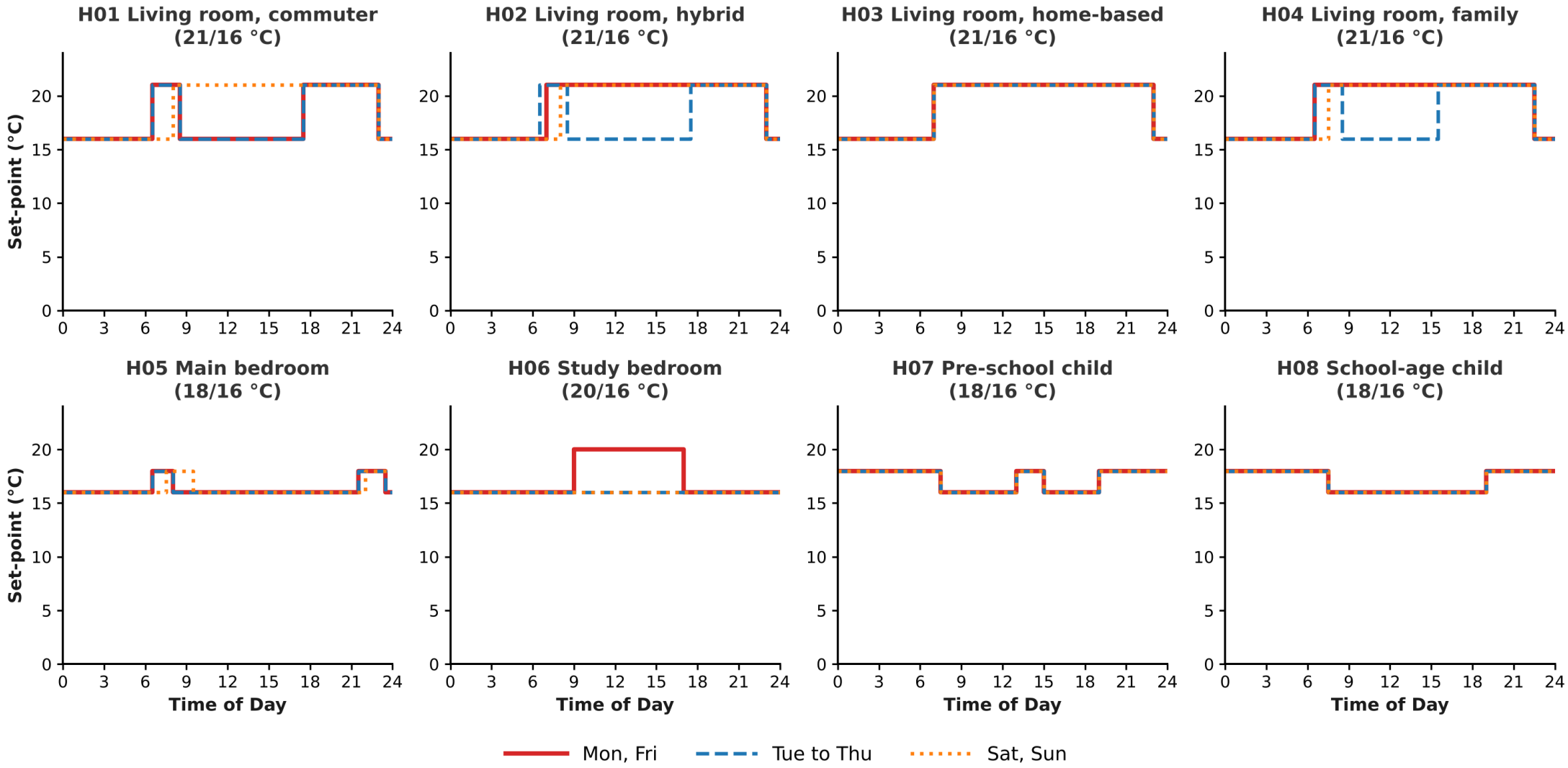
Model Inputs: Heating Set-points, Landlord

Profile	Set-point / set-back	Hours	Room groups
H12 Entrance lobby	19 / 5 °C	07:00 to 23:00 every day	Entrance and lift lobby
H13 Corridors	18 °C constant	24/7	Ground floor and upper corridors
H14 Stair	16 / 5 °C	07:00 to 23:00	Stair (heater at L05 only)
H15 Frost protection	5 °C constant	24/7	Plant room, meter room, bin store, bike store

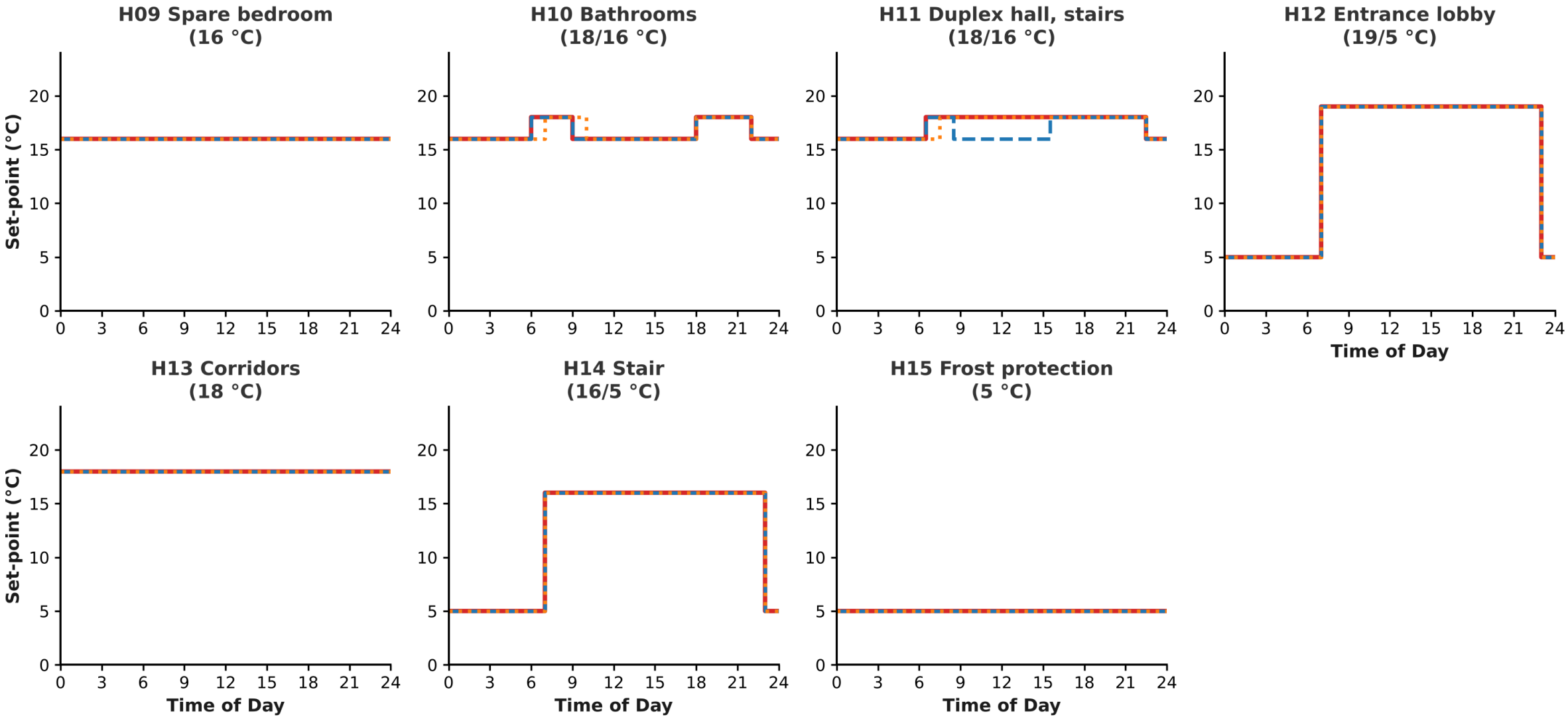
- 15 set-point profiles cover the 47 heated room groups (39 dwelling and 8 landlord). The 8 utility cupboard groups, voids and lift shafts are unheated.
- No space cooling is provided in any space.

Model Inputs: Heating Profiles, H01 to H08

Set-point in each period for the three heating day types.



Model Inputs: Heating Profiles, H09 to H15



CWC

2.9 Renewables

Model Inputs: Renewables

Approximately 85 m^2 of PV can be accommodated on the roof in areas that are not significantly shaded by parapets, plant and adjacent buildings. This is all of the unshaded roof space available. It is an estimate, to be confirmed by the M&E engineer.

Places for Everyone expects PV equivalent to 40% of the ground floor footprint. The available unshaded area is below this because the remaining roof is significantly shaded.

PV generation is reported separately in section 3 and is not deducted from the EUI used for the GMCA comparison.

≈ 85 m^2

Unshaded roof area available for PV
(estimate, M&E engineer to confirm)

40%

PfE expectation: PV equivalent to 40%
of the ground floor footprint

CWC

2.10 Sensitivity Scenarios

Model Inputs: Sensitivity Scenarios

CWC

Scenario	Change from the baseline	Method
Baseline	Base case: CIBSE TRY Manchester; realistic occupancy (41 dwellings, 73 residents); heating profiles H01 to H15; hot water per section 2.4; systems per section 2.2.	IES run
01	Future hot summer: Manchester DSY1 2050 High emissions 50th percentile weather file.	IES run
02	Air permeability 5.0 $m^3/(h \cdot m^2)$ at 50 Pa (base 3.0).	IES run
03	Landlord ancillary spaces (plant room, meter room, bin store, bike store) heated to 16 °C constant instead of 5 °C frost protection.	IES run
04	All home working: all living room templates on profile H03; study bedrooms on H06 Monday to Friday; other profiles and gains as base.	IES run
05a	Appliances +25%: dwelling appliance electricity (IES 'Other Process') × 1.25, post-processed from the base run.	Post-processed
05b	Appliances −25%: dwelling appliance electricity × 0.75, post-processed from the base run.	Post-processed
06a	Cooking +33%: cooking electricity × 1.33 (upper end of the Powering the Nation 2 range), post-processed from the base run.	Post-processed
06b	Cooking −33%: cooking electricity × 0.67, post-processed from the base run.	Post-processed

Post-processed scenarios scale the relevant end use from the base run: dwelling appliances and cooking. Their small knock-on effect on space heating (internal gains) is not modelled.

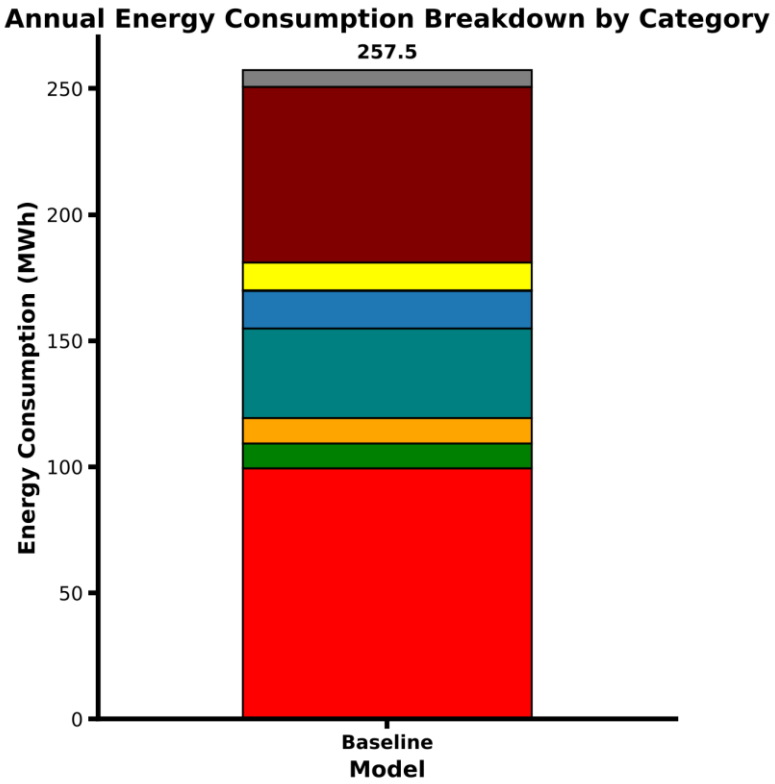
CWC

3 Results

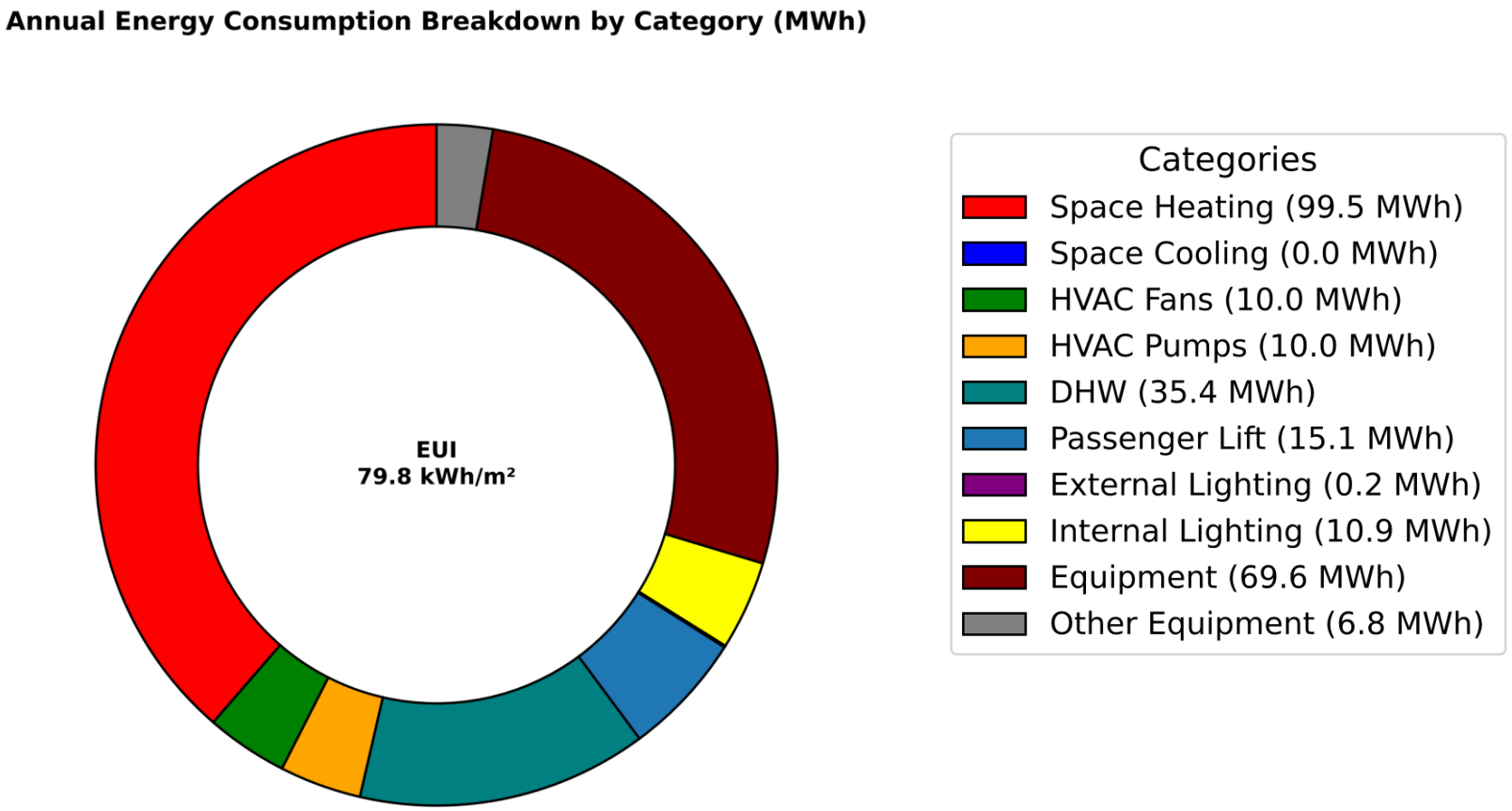
Results: Baseline

The baseline uses 257.5 MWh of electricity a year (EUI 79.8 kWh/m^2·yr before PV); space heating and equipment dominate.

Baseline: Total Yearly Consumption

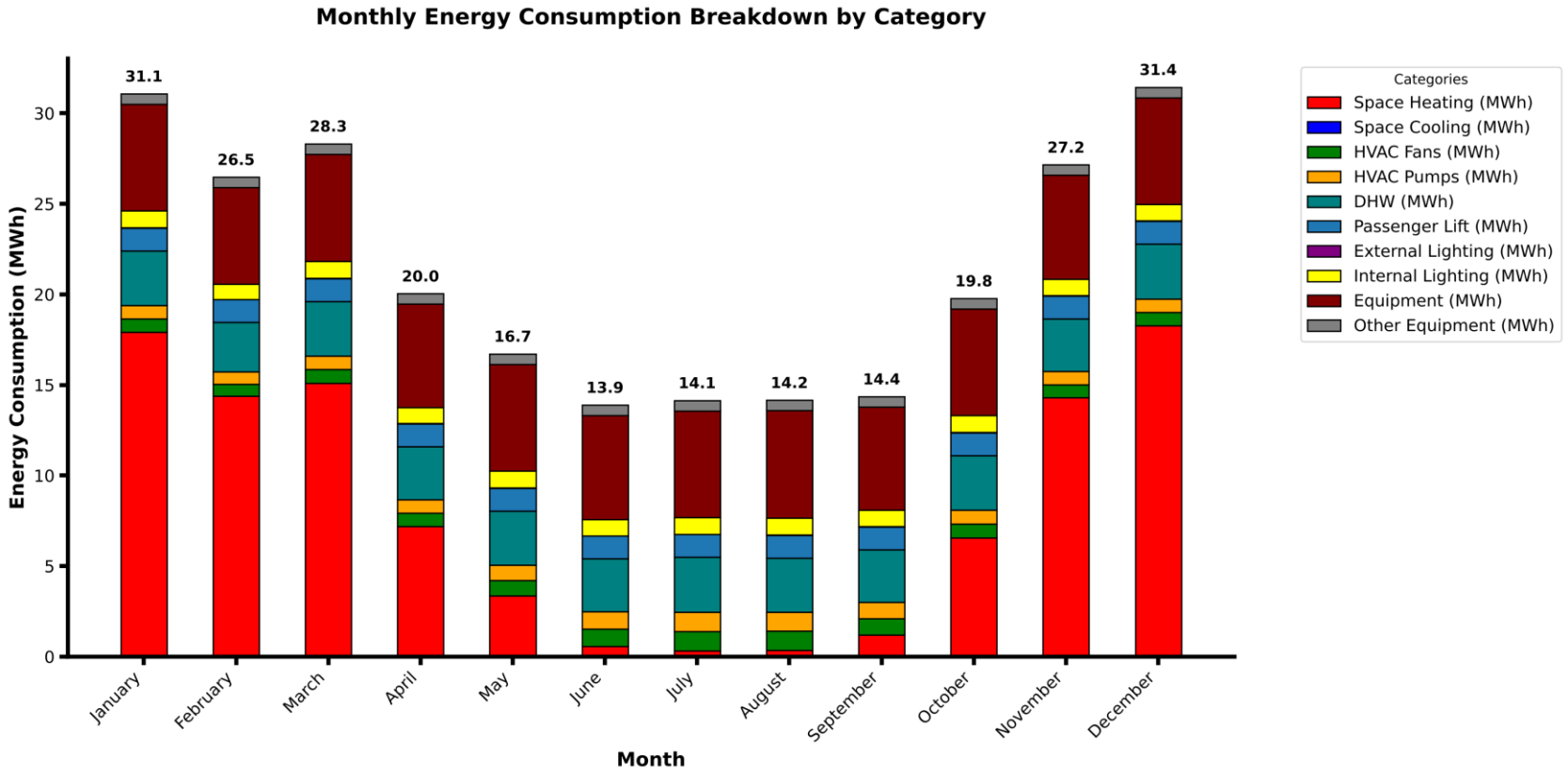


Baseline: End-Use Share



Results: Baseline Monthly Consumption

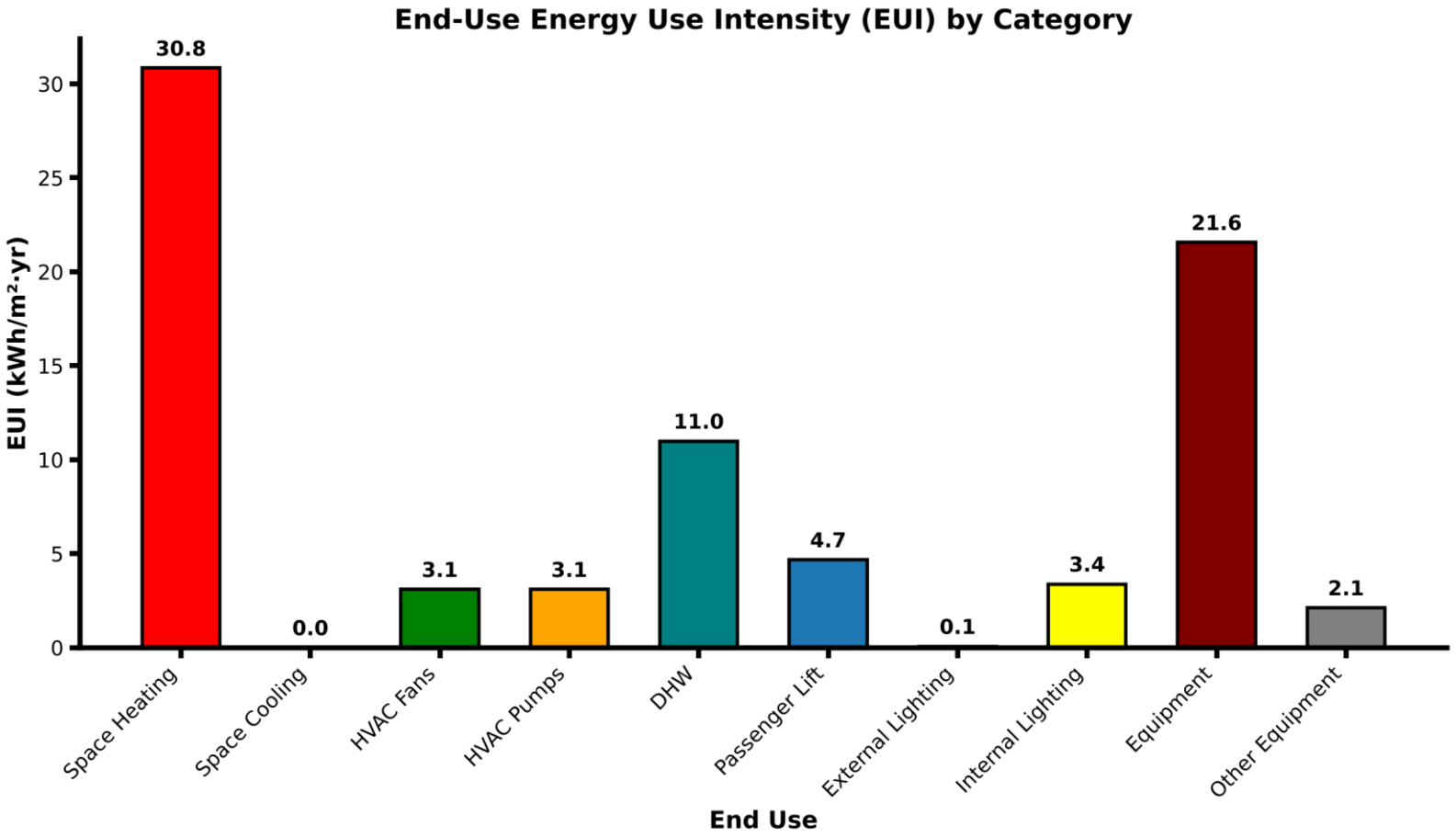
Consumption peaks in winter with space heating; hot water, appliances, cooking and landlord loads are steady through the year.



Month	Total (MWh)	Space heating (MWh)	Share
Jan	31.1	17.9	58%
Feb	26.5	14.4	54%
Mar	28.3	15.1	53%
Apr	20.0	7.2	36%
May	16.7	3.3	20%
Jun	13.9	0.6	4%
Jul	14.1	0.3	2%
Aug	14.2	0.4	3%
Sep	14.4	1.2	8%
Oct	19.8	6.6	33%
Nov	27.2	14.3	53%
Dec	31.4	18.3	58%
Year	**257.5**	**99.5**	**39%**

Results: Baseline End-Use Breakdown

The figure shows the contribution of each end use to the total EUI. The table lists the annual energy and intensity of each end use.

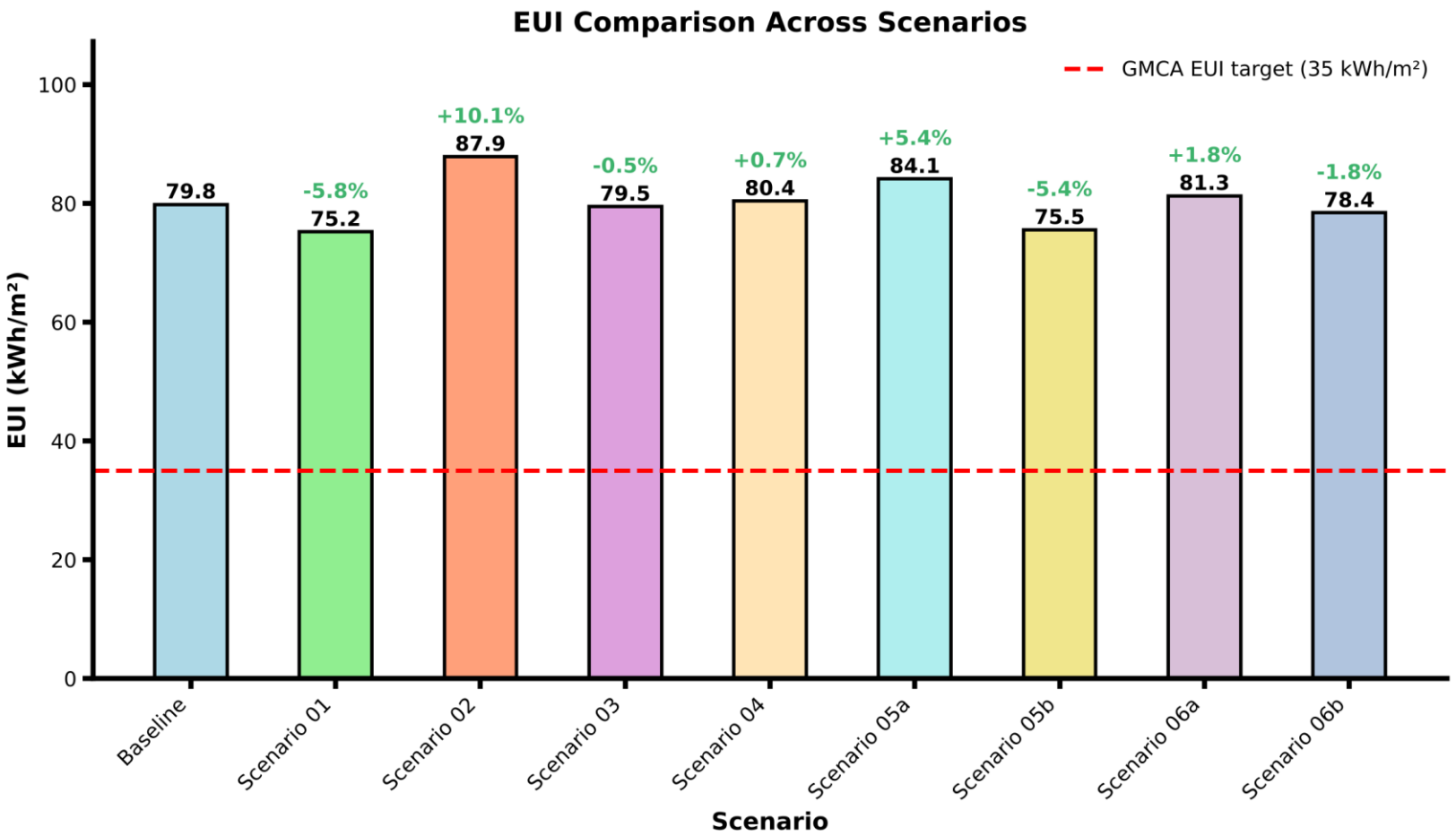


End use	MWh/yr	kWh/m²·yr	Share
Space Heating	99.5	30.8	38.6%
Space Cooling	0.0	0.0	0.0%
HVAC Fans	10.0	3.1	3.9%
HVAC Pumps	10.0	3.1	3.9%
DHW	35.4	11.0	13.8%
Passenger Lift	15.1	4.7	5.9%
External Lighting	0.2	0.1	0.1%
Internal Lighting	10.9	3.4	4.2%
Equipment	69.6	21.6	27.0%
Other Equipment	6.8	2.1	2.7%
Total before PV	257.5	79.8	100%
PV generation	-14.5	-4.5	
Total net of PV	243.0	75.3	

HVAC fans and pumps are as reported by IES.

Results: All Scenarios

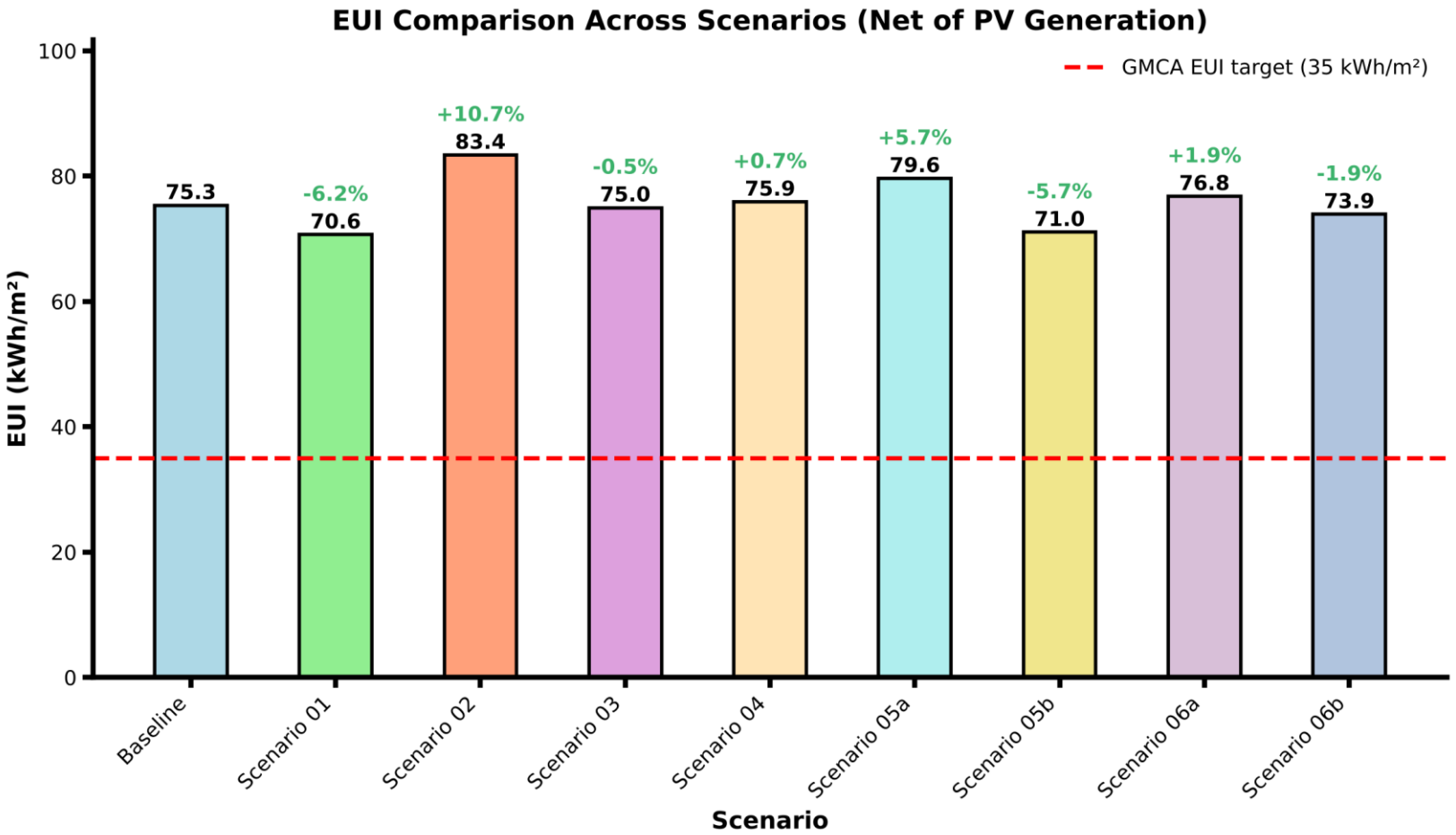
Predicted EUI before PV (the basis of the GMCA comparison) for each scenario; percentages show the change from the baseline.



Scenario	Description	EUI (kWh/m²·yr)
Baseline	Typical weather (CIBSE TRY), design as specified, realistic occupancy	79.8
01	Future weather (DSY1 2050, High, 50th percentile)	75.2
02	Air permeability 5.0 $m^3/(h \cdot m^2)$ (base 3.0)	87.9
03	Ancillary stores heated to 16 °C (base 5 °C)	79.5
04	All households home working	80.4
05a	Dwelling appliance use +25%	84.1
05b	Dwelling appliance use −25%	75.5
06a	Cooking energy +33%	81.3
06b	Cooking energy −33%	78.4

Results: All Scenarios, Net of PV Generation

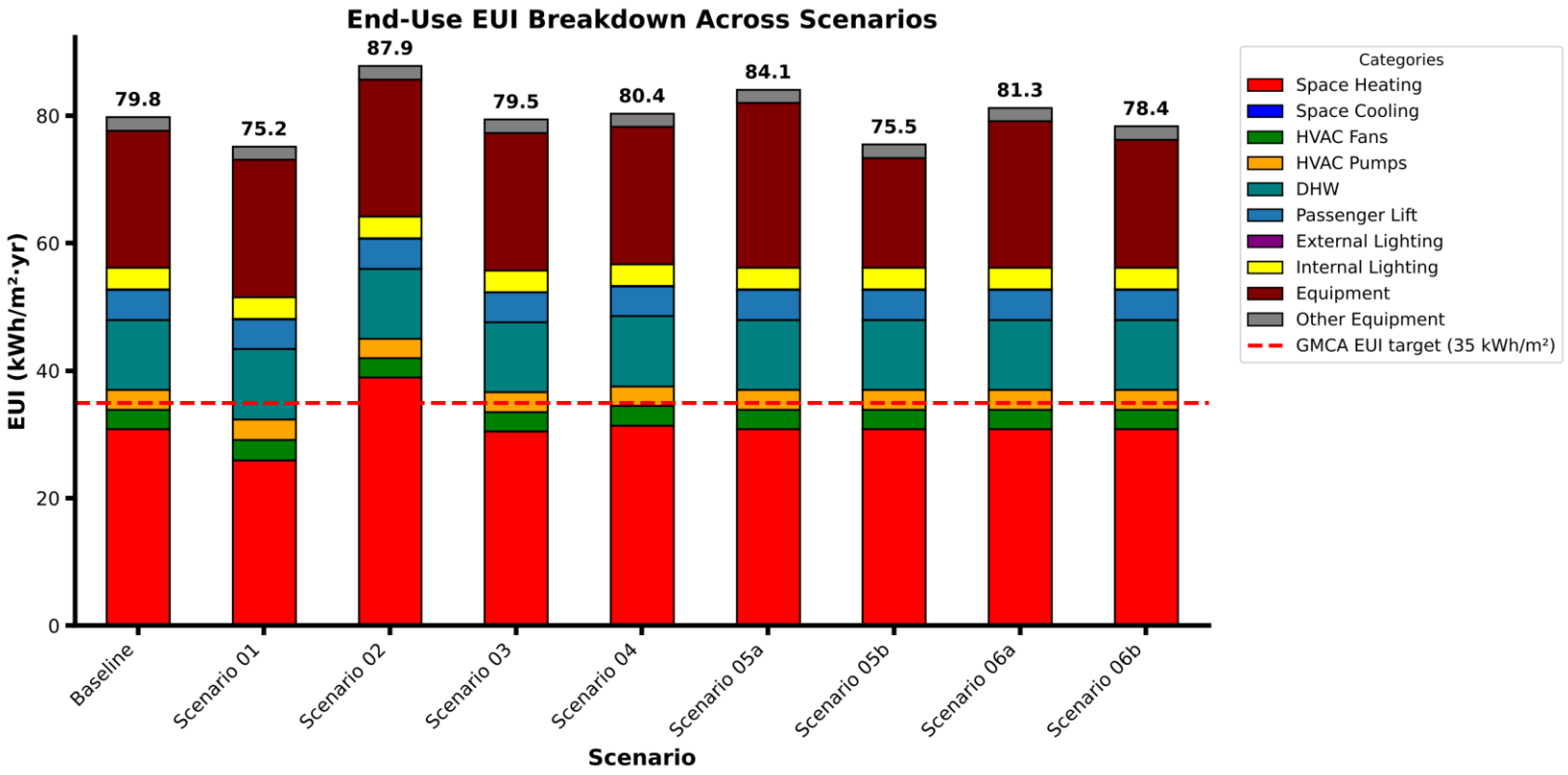
The same comparison with the 14.5 MWh/yr of PV generation (about 85 m², estimate) deducted: about 4.5 kWh/m²·yr in every scenario.



Scenario	Description	EUI net of PV
Baseline	Typical weather (CIBSE TRY), design as specified, realistic occupancy	75.3
01	Future weather (DSY1 2050, High, 50th percentile)	70.6
02	Air permeability 5.0 $m^3/(h \cdot m^2)$ (base 3.0)	83.4
03	Ancillary stores heated to 16 °C (base 5 °C)	75.0
04	All households home working	75.9
05a	Dwelling appliance use +25%	79.6
05b	Dwelling appliance use −25%	71.0
06a	Cooking energy +33%	76.8
06b	Cooking energy −33%	73.9

Results: End-Use EUI by Scenario

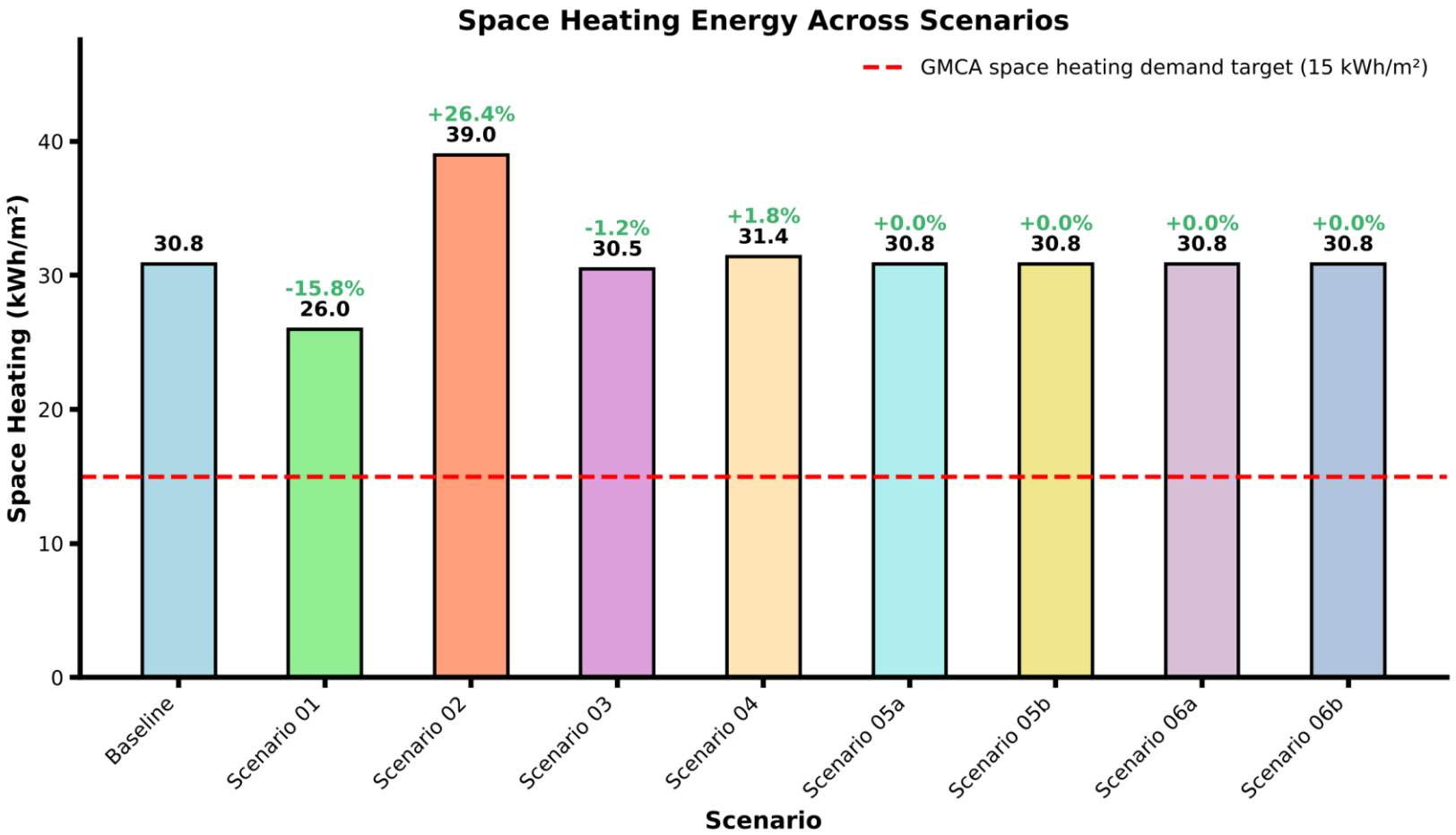
Each scenario's EUI broken into end uses, showing which loads change. Space heating and dwelling equipment account for most of the variation.



Scenario	Description	EUI (kWh/m²·yr)
Baseline	Typical weather (CIBSE TRY), design as specified, realistic occupancy	79.8
01	Future weather (DSY1 2050, High, 50th percentile)	75.2
02	Air permeability 5.0 $m^3/(h \cdot m^2)$ (base 3.0)	87.9
03	Ancillary stores heated to 16 °C (base 5 °C)	79.5
04	All households home working	80.4
05a	Dwelling appliance use +25%	84.1
05b	Dwelling appliance use −25%	75.5
06a	Cooking energy +33%	81.3
06b	Cooking energy −33%	78.4

Results: Space Heating

Space heating per m² against the GMCA value of 15 kWh/m²·yr; scenarios 05 and 06 are post-processed and do not change it.



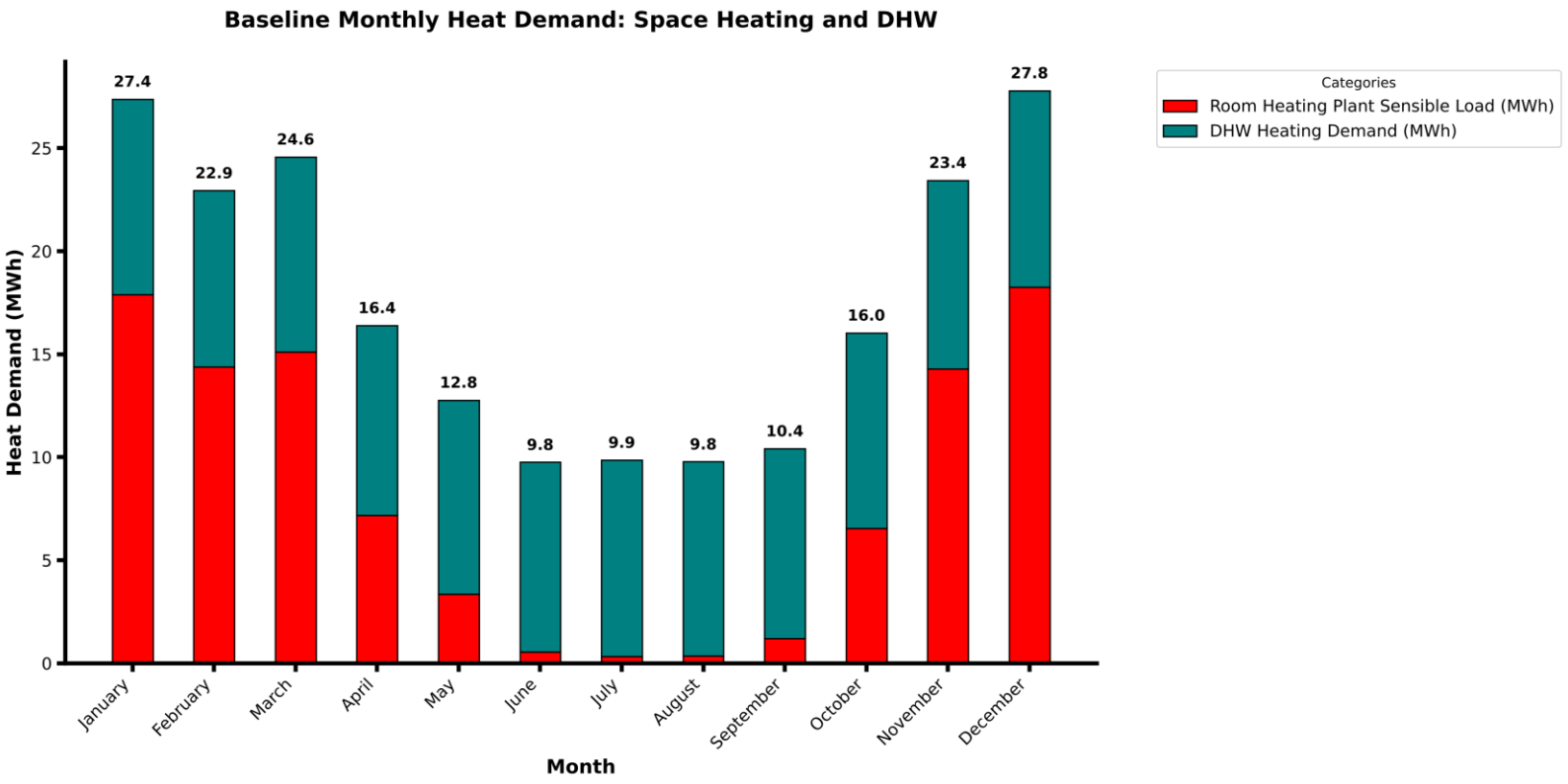
Scenario	Description	Space heating (kWh/m²·yr)
Baseline	Typical weather (CIBSE TRY), design as specified, realistic occupancy	30.8
01	Future weather (DSY1 2050, High, 50th percentile)	26.0
02	Air permeability 5.0 m³/(h·m²) (base 3.0)	39.0
03	Ancillary stores heated to 16 °C (base 5 °C)	30.5
04	All households home working	31.4
05a	Dwelling appliance use +25%	30.8
05b	Dwelling appliance use −25%	30.8
06a	Cooking energy +33%	30.8
06b	Cooking energy −33%	30.8

Results: Space Heating Discussion

- Baseline space heating is 30.8 kWh/m^2·yr, about 2.1 times the GMCA value. It includes the landlord heating: entrance, corridors at 18 °C around the clock, the L05 stair and frost protection.
- The future DSY1 2050 weather file reduces heating to 26.0 kWh/m^2·yr: milder winters lower the heating demand over the life of the building, although January is colder in this file than in the typical year.
- Air permeability of 5.0 m^3/(h·m^2) increases space heating to 39.0 kWh/m^2·yr (+26%), about 4.1 kWh/m^2·yr for each 1 m^3/(h·m^2).
- Home working adds 0.5 kWh/m^2·yr: longer heating hours are largely offset by higher internal gains in occupied rooms.
- Heating the ancillary stores to 16 °C gives 30.5 kWh/m^2·yr. Warmer stores lose less heat to the adjacent corridor, stair and first floor flats, and part of the store heating is met by heat recovery, so the change is not material.

Results: Heat Demand for PfE (Baseline)

Monthly heat demand from IES. Space heating demand is 99.5 MWh/yr (30.8 kWh/m²·yr) against the GMCA value of 15 kWh/m²·yr; with direct electric heating this equals the space heating energy.

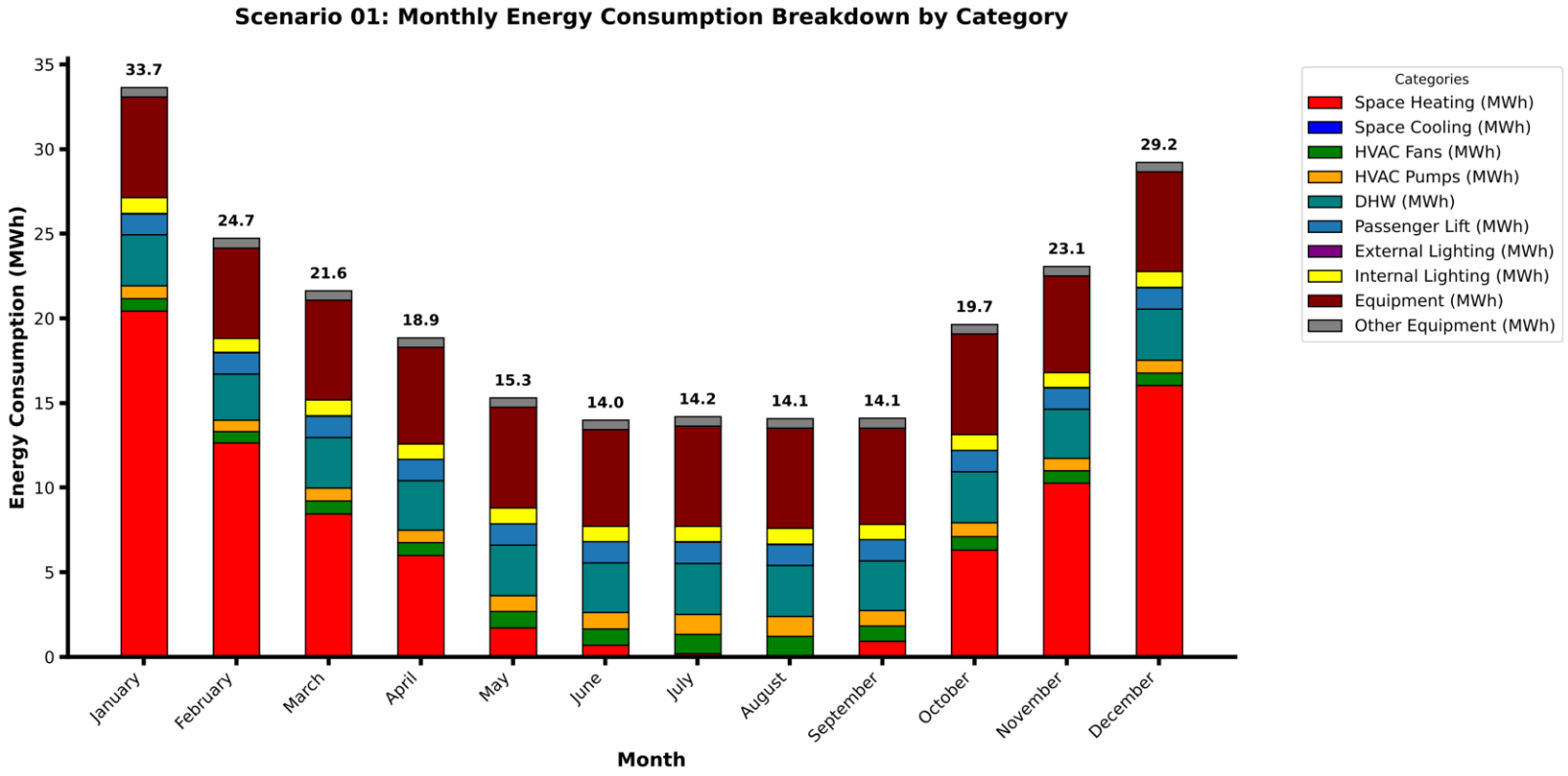


Month	Room heating plant sensible load (MWh)	DHW heating demand (MWh)
Jan	17.90	9.48
Feb	14.38	8.57
Mar	15.10	9.47
Apr	7.19	9.21
May	3.35	9.43
Jun	0.56	9.20
Jul	0.33	9.53
Aug	0.36	9.42
Sep	1.21	9.21
Oct	6.56	9.48
Nov	14.29	9.15
Dec	18.26	9.53
Total	99.49	111.67
kWh/m²·yr	30.8	34.6

DHW heat includes cylinder storage losses; the DHW electricity of 35.4 MWh/yr implies an overall COP of 3.15.

Results: Scenario 01 Monthly Consumption

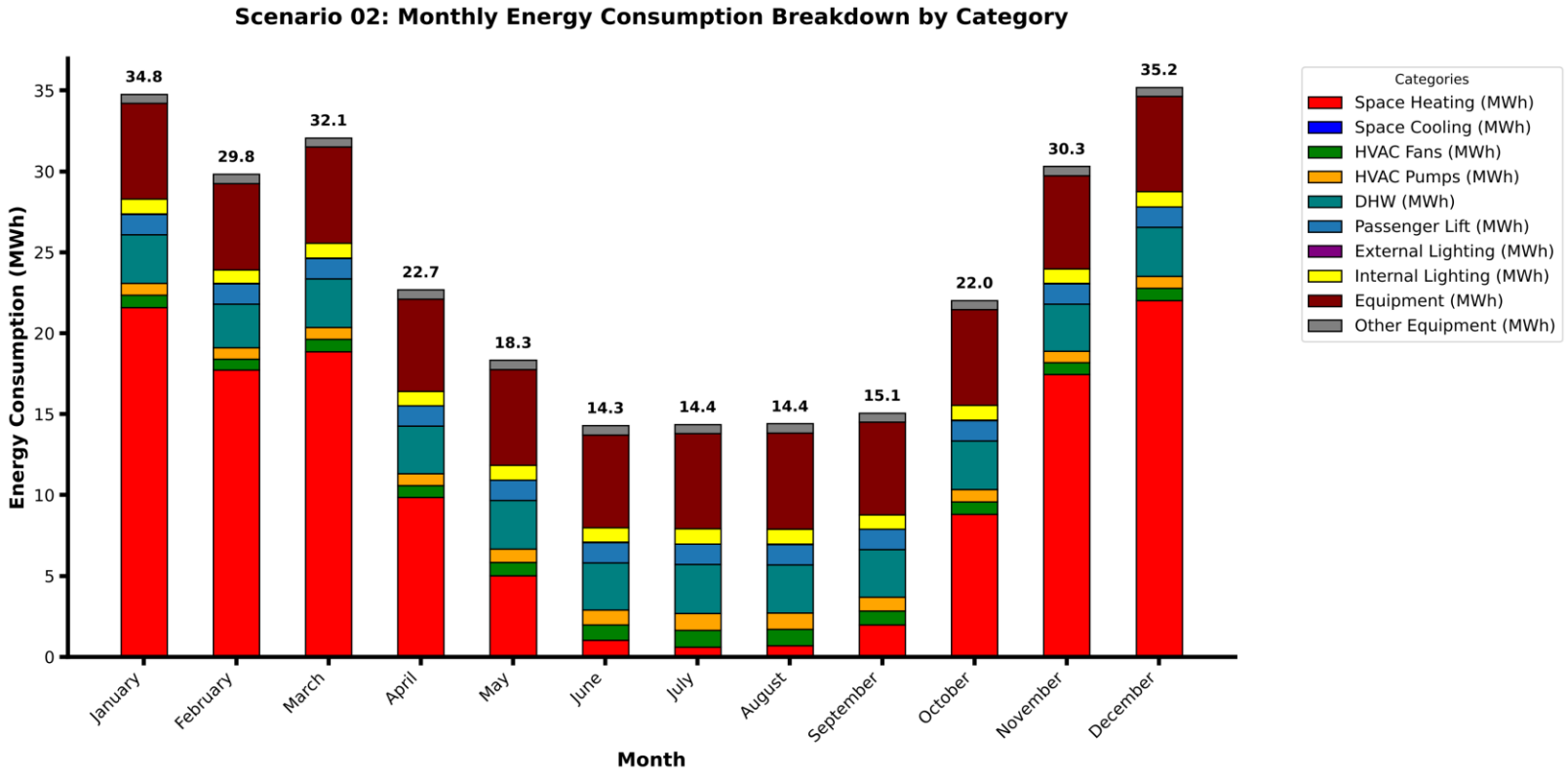
Scenario 01: Future weather (DSY1 2050, High, 50th percentile). Full description in section 2.10.



End use	Baseline (kWh/m²·yr)	Scenario 01 (kWh/m²·yr)	Change
Space Heating	30.8	26.0	-16%
HVAC Fans	3.1	3.2	+4%
HVAC Pumps	3.1	3.2	+4%
DHW	11.0	11.0	0%
Passenger Lift	4.7	4.7	0%
External Lighting	0.1	0.1	0%
Internal Lighting	3.4	3.4	0%
Equipment	21.6	21.6	0%
Other Equipment	2.1	2.1	0%
Total before PV	79.8	75.2	-5.8%

Results: Scenario 02 Monthly Consumption

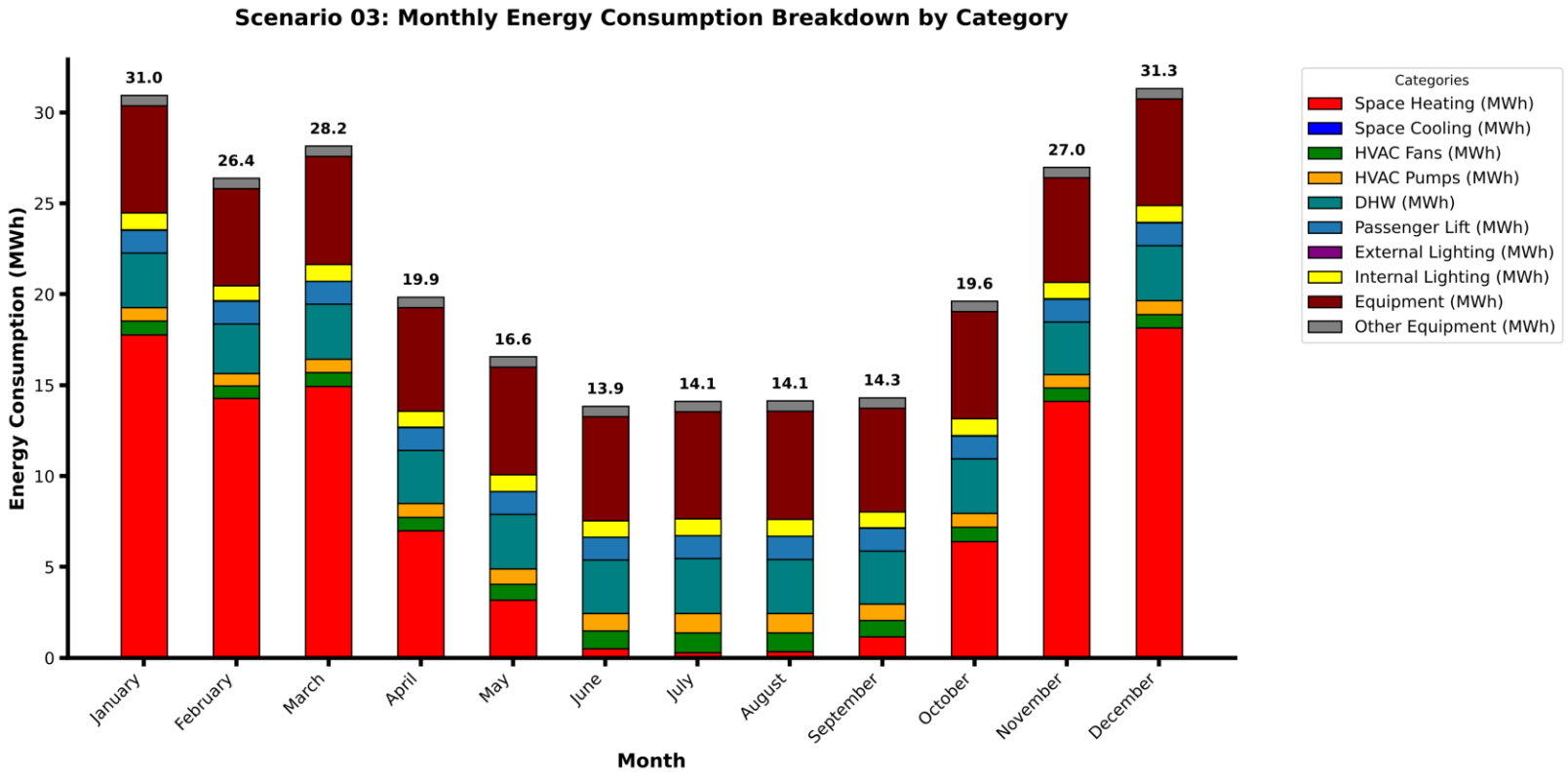
Scenario 02: Air permeability 5.0 $m^3/(h \cdot m^2)$ (base 3.0). Full description in section 2.10.



End use	Baseline (kWh/m²·yr)	Scenario 02 (kWh/m²·yr)	Change
Space Heating	30.8	39.0	+26%
HVAC Fans	3.1	3.0	-2%
HVAC Pumps	3.1	3.0	-2%
DHW	11.0	11.0	0%
Passenger Lift	4.7	4.7	0%
External Lighting	0.1	0.1	0%
Internal Lighting	3.4	3.4	0%
Equipment	21.6	21.6	0%
Other Equipment	2.1	2.1	0%
Total before PV	79.8	87.9	+10.1%

Results: Scenario 03 Monthly Consumption

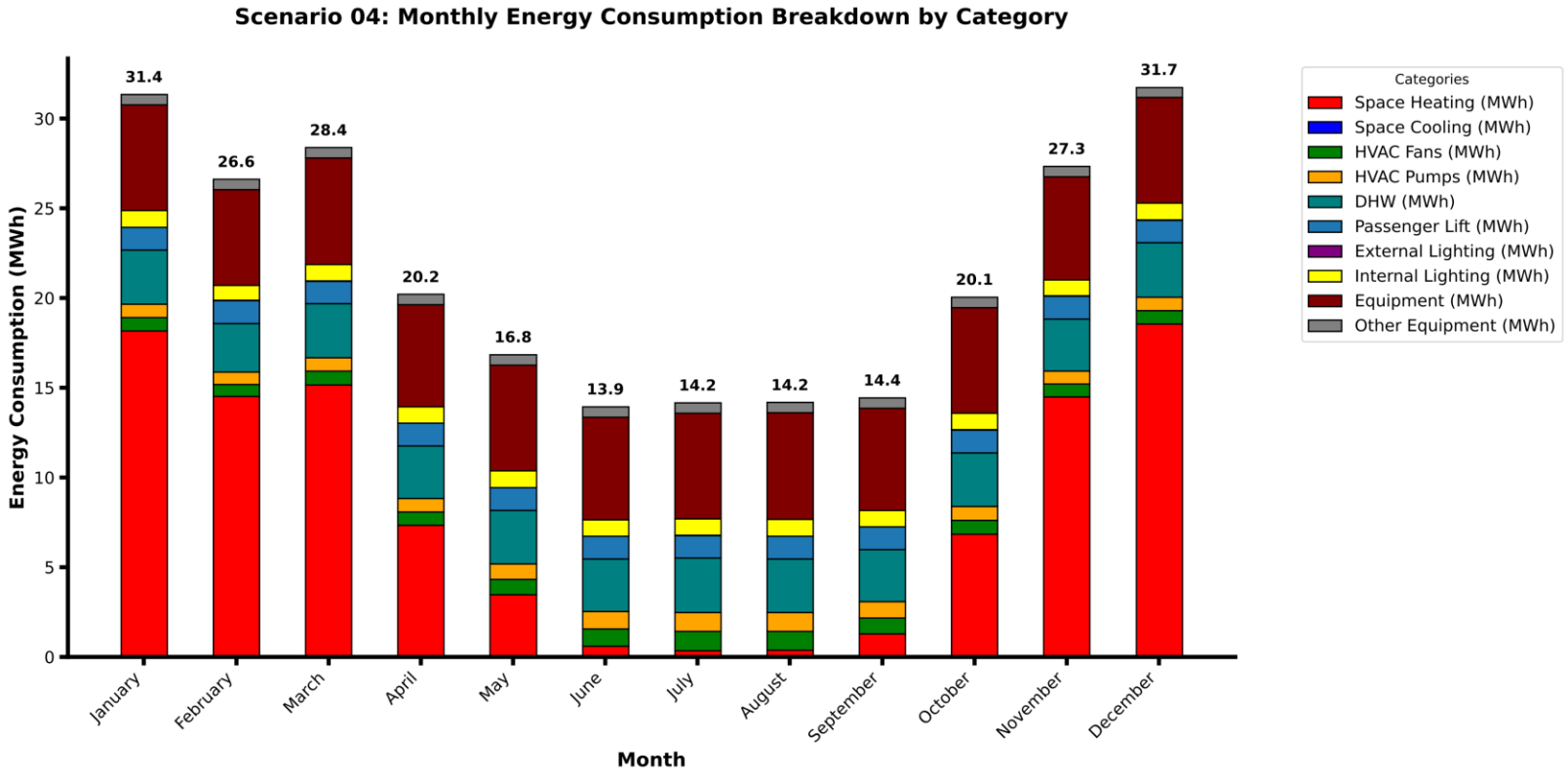
Scenario 03: Ancillary stores heated to 16 °C (base 5 °C). Full description in section 2.10.



End use	Baseline (kWh/m²·yr)	Scenario 03 (kWh/m²·yr)	Change
Space Heating	30.8	30.5	-1%
HVAC Fans	3.1	3.1	0%
HVAC Pumps	3.1	3.1	0%
DHW	11.0	11.0	0%
Passenger Lift	4.7	4.7	0%
External Lighting	0.1	0.1	0%
Internal Lighting	3.4	3.4	0%
Equipment	21.6	21.6	0%
Other Equipment	2.1	2.1	0%
Total before PV	79.8	79.5	-0.5%

Results: Scenario 04 Monthly Consumption

Scenario 04: All households home working. Full description in section 2.10.



End use	Baseline (kWh/m²·yr)	Scenario 04 (kWh/m²·yr)	Change
Space Heating	30.8	31.4	+2%
HVAC Fans	3.1	3.1	0%
HVAC Pumps	3.1	3.1	0%
DHW	11.0	11.0	0%
Passenger Lift	4.7	4.7	0%
External Lighting	0.1	0.1	0%
Internal Lighting	3.4	3.4	0%
Equipment	21.6	21.6	0%
Other Equipment	2.1	2.1	0%
Total before PV	79.8	80.4	+0.7%

Whole Building Results: Baseline (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	17,905	0	747	747	3,009	1,257	24	927	5,892	570	-387
Feb	14,377	0	678	678	2,719	1,257	20	838	5,336	570	-699
Mar	15,104	0	750	750	3,006	1,257	19	928	5,932	570	-1,115
Apr	7,186	0	744	744	2,923	1,257	15	897	5,700	570	-1,490
May	3,348	0	852	852	2,993	1,257	13	926	5,903	570	-2,011
Jun	556	0	969	969	2,920	1,257	11	899	5,740	570	-1,911
Jul	329	0	1,070	1,070	3,025	1,257	12	927	5,882	570	-2,107
Aug	363	0	1,046	1,046	2,990	1,257	14	928	5,943	570	-1,802
Sep	1,209	0	891	891	2,923	1,257	17	897	5,700	570	-1,374
Oct	6,556	0	771	771	3,009	1,257	20	927	5,892	570	-893
Nov	14,295	0	727	727	2,904	1,257	23	898	5,750	570	-400
Dec	18,260	0	747	747	3,025	1,257	25	927	5,882	570	-317
Total	**99,487**	**0**	**9,992**	**9,992**	**35,444**	**15,083**	**213**	**10,920**	**69,555**	**6,839**	**-14,506**

Base case: CIBSE TRY Manchester; realistic occupancy (41 dwellings, 73 residents); heating profiles H01 to H15; hot water per section 2.4; systems per section 2.2. Total before PV 257,524 kWh; EUI 79.8 kWh/m²·yr before PV and 75.3 kWh/m²·yr net of PV (3,226 m²).

Whole Building Results: Scenario 01 (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	20,429	0	748	748	3,009	1,257	24	928	5,943	570	-396
Feb	12,650	0	676	676	2,719	1,257	20	838	5,336	570	-559
Mar	8,456	0	760	760	3,006	1,257	19	927	5,882	570	-1,156
Apr	5,994	0	751	751	2,923	1,257	15	897	5,710	570	-1,355
May	1,730	0	944	944	2,993	1,257	13	928	5,932	570	-2,259
Jun	695	0	973	973	2,920	1,257	11	897	5,700	570	-1,845
Jul	189	0	1,164	1,164	3,025	1,257	12	926	5,903	570	-2,283
Aug	19	0	1,196	1,196	2,990	1,257	14	929	5,922	570	-1,932
Sep	941	0	902	902	2,923	1,257	17	897	5,700	570	-1,266
Oct	6,319	0	806	806	3,009	1,257	20	928	5,943	570	-958
Nov	10,282	0	725	725	2,904	1,257	23	897	5,700	570	-387
Dec	16,044	0	747	747	3,025	1,257	25	927	5,892	570	-288
Total	**83,749**	**0**	**10,393**	**10,393**	**35,444**	**15,083**	**213**	**10,919**	**69,565**	**6,839**	**-14,684**

Future hot summer: Manchester DSY1 2050 High emissions 50th percentile weather file. Total before PV 242,598 kWh; EUI 75.2 kWh/m²·yr before PV and 70.6 kWh/m²·yr net of PV (3,226 m²).

Whole Building Results: Scenario 02 (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	21,606	0	746	746	3,009	1,257	24	927	5,892	570	-387
Feb	17,745	0	676	676	2,719	1,257	20	838	5,336	570	-699
Mar	18,869	0	749	749	3,006	1,257	19	928	5,932	570	-1,115
Apr	9,862	0	737	737	2,923	1,257	15	897	5,700	570	-1,490
May	5,008	0	832	832	2,993	1,257	13	926	5,903	570	-2,011
Jun	1,036	0	934	934	2,920	1,257	11	899	5,740	570	-1,911
Jul	619	0	1,039	1,039	3,025	1,257	12	927	5,882	570	-2,107
Aug	684	0	1,011	1,011	2,990	1,257	14	928	5,943	570	-1,802
Sep	1,992	0	858	858	2,923	1,257	17	897	5,700	570	-1,374
Oct	8,830	0	763	763	3,009	1,257	20	927	5,892	570	-893
Nov	17,459	0	725	725	2,904	1,257	23	898	5,750	570	-400
Dec	22,027	0	747	747	3,025	1,257	25	927	5,882	570	-317
Total	**125,735**	**0**	**9,818**	**9,818**	**35,444**	**15,083**	**213**	**10,920**	**69,555**	**6,839**	**-14,506**

Air permeability 5.0 $m^3/(h \cdot m^2)$ at 50 Pa (base 3.0). Total before PV 283,425 kWh; EUI 87.9 $kWh/m^2 \cdot yr$ before PV and 83.4 $kWh/m^2 \cdot yr$ net of PV (3,226 m^2).

Whole Building Results: Scenario 03 (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	17,784	0	747	747	3,009	1,257	24	927	5,892	570	-387
Feb	14,297	0	678	678	2,719	1,257	20	838	5,336	570	-699
Mar	14,947	0	751	751	3,006	1,257	19	928	5,932	570	-1,115
Apr	7,008	0	745	745	2,923	1,257	15	897	5,700	570	-1,490
May	3,199	0	853	853	2,993	1,257	13	926	5,903	570	-2,011
Jun	521	0	970	970	2,920	1,257	11	899	5,740	570	-1,911
Jul	306	0	1,071	1,071	3,025	1,257	12	927	5,882	570	-2,107
Aug	351	0	1,046	1,046	2,990	1,257	14	928	5,943	570	-1,802
Sep	1,175	0	892	892	2,923	1,257	17	897	5,700	570	-1,374
Oct	6,410	0	771	771	3,009	1,257	20	927	5,892	570	-893
Nov	14,129	0	727	727	2,904	1,257	23	898	5,750	570	-400
Dec	18,161	0	747	747	3,025	1,257	25	927	5,882	570	-317
Total	**98,287**	**0**	**9,997**	**9,997**	**35,444**	**15,083**	**213**	**10,920**	**69,555**	**6,839**	**-14,506**

Landlord ancillary spaces (plant room, meter room, bin store, bike store) heated to 16 °C constant instead of 5 °C frost protection. Total before PV 256,334 kWh; EUI 79.5 kWh/m²·yr before PV and 75.0 kWh/m²·yr net of PV (3,226 m²).

Whole Building Results: Scenario 04 (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	18,178	0	747	747	3,009	1,257	24	927	5,892	570	-387
Feb	14,526	0	678	678	2,719	1,257	20	838	5,336	570	-699
Mar	15,174	0	750	750	3,006	1,257	19	928	5,932	570	-1,115
Apr	7,350	0	746	746	2,923	1,257	15	897	5,700	570	-1,490
May	3,478	0	855	855	2,993	1,257	13	926	5,903	570	-2,011
Jun	607	0	971	971	2,920	1,257	11	899	5,740	570	-1,911
Jul	348	0	1,071	1,071	3,025	1,257	12	927	5,882	570	-2,107
Aug	388	0	1,047	1,047	2,990	1,257	14	928	5,943	570	-1,802
Sep	1,290	0	894	894	2,923	1,257	17	897	5,700	570	-1,374
Oct	6,836	0	772	772	3,009	1,257	20	927	5,892	570	-893
Nov	14,487	0	727	727	2,904	1,257	23	898	5,750	570	-400
Dec	18,569	0	747	747	3,025	1,257	25	927	5,882	570	-317
Total	**101,232**	**0**	**10,006**	**10,006**	**35,444**	**15,083**	**213**	**10,920**	**69,555**	**6,839**	**-14,506**

All home working: all living room templates on profile H03; study bedrooms on H06 Monday to Friday; other profiles and gains as base. Total before PV 259,296 kWh; EUI 80.4 kWh/m²·yr before PV and 75.9 kWh/m²·yr net of PV (3,226 m²).

Whole Building Results: Scenario 05a (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	17,905	0	747	747	3,009	1,257	24	927	7,067	570	-387
Feb	14,377	0	678	678	2,719	1,257	20	838	6,400	570	-699
Mar	15,104	0	750	750	3,006	1,257	19	928	7,116	570	-1,115
Apr	7,186	0	744	744	2,923	1,257	15	897	6,836	570	-1,490
May	3,348	0	852	852	2,993	1,257	13	926	7,080	570	-2,011
Jun	556	0	969	969	2,920	1,257	11	899	6,885	570	-1,911
Jul	329	0	1,070	1,070	3,025	1,257	12	927	7,054	570	-2,107
Aug	363	0	1,046	1,046	2,990	1,257	14	928	7,129	570	-1,802
Sep	1,209	0	891	891	2,923	1,257	17	897	6,836	570	-1,374
Oct	6,556	0	771	771	3,009	1,257	20	927	7,067	570	-893
Nov	14,295	0	727	727	2,904	1,257	23	898	6,898	570	-400
Dec	18,260	0	747	747	3,025	1,257	25	927	7,054	570	-317
Total	**99,487**	**0**	**9,992**	**9,992**	**35,444**	**15,083**	**213**	**10,920**	**83,420**	**6,839**	**-14,506**

Appliances +25%: dwelling appliance electricity (IES 'Other Process') × 1.25, post-processed from the base run. Total before PV 271,389 kWh; EUI 84.1 kWh/m²·yr before PV and 79.6 kWh/m²·yr net of PV (3,226 m²).

Whole Building Results: Scenario 05b (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	17,905	0	747	747	3,009	1,257	24	927	4,718	570	-387
Feb	14,377	0	678	678	2,719	1,257	20	838	4,273	570	-699
Mar	15,104	0	750	750	3,006	1,257	19	928	4,749	570	-1,115
Apr	7,186	0	744	744	2,923	1,257	15	897	4,565	570	-1,490
May	3,348	0	852	852	2,993	1,257	13	926	4,725	570	-2,011
Jun	556	0	969	969	2,920	1,257	11	899	4,596	570	-1,911
Jul	329	0	1,070	1,070	3,025	1,257	12	927	4,711	570	-2,107
Aug	363	0	1,046	1,046	2,990	1,257	14	928	4,756	570	-1,802
Sep	1,209	0	891	891	2,923	1,257	17	897	4,565	570	-1,374
Oct	6,556	0	771	771	3,009	1,257	20	927	4,718	570	-893
Nov	14,295	0	727	727	2,904	1,257	23	898	4,603	570	-400
Dec	18,260	0	747	747	3,025	1,257	25	927	4,711	570	-317
Total	**99,487**	**0**	**9,992**	**9,992**	**35,444**	**15,083**	**213**	**10,920**	**55,689**	**6,839**	**-14,506**

Appliances −25%: dwelling appliance electricity × 0.75, post-processed from the base run. Total before PV 243,658 kWh; EUI 75.5 kWh/m²·yr before PV and 71.0 kWh/m²·yr net of PV (3,226 m²).

Whole Building Results: Scenario 06a (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	17,905	0	747	747	3,009	1,257	24	927	6,287	570	-387
Feb	14,377	0	678	678	2,719	1,257	20	838	5,693	570	-699
Mar	15,104	0	750	750	3,006	1,257	19	928	6,328	570	-1,115
Apr	7,186	0	744	744	2,923	1,257	15	897	6,082	570	-1,490
May	3,348	0	852	852	2,993	1,257	13	926	6,296	570	-2,011
Jun	556	0	969	969	2,920	1,257	11	899	6,124	570	-1,911
Jul	329	0	1,070	1,070	3,025	1,257	12	927	6,277	570	-2,107
Aug	363	0	1,046	1,046	2,990	1,257	14	928	6,338	570	-1,802
Sep	1,209	0	891	891	2,923	1,257	17	897	6,082	570	-1,374
Oct	6,556	0	771	771	3,009	1,257	20	927	6,287	570	-893
Nov	14,295	0	727	727	2,904	1,257	23	898	6,134	570	-400
Dec	18,260	0	747	747	3,025	1,257	25	927	6,277	570	-317
Total	**99,487**	**0**	**9,992**	**9,992**	**35,444**	**15,083**	**213**	**10,920**	**74,206**	**6,839**	**-14,506**

Cooking +33%: cooking electricity × 1.33 (upper end of the Powering the Nation 2 range), post-processed from the base run. Total before PV 262,175 kWh; EUI 81.3 kWh/m²·yr before PV and 76.8 kWh/m²·yr net of PV (3,226 m²).

Whole Building Results: Scenario 06b (kWh)

CWC

Month	Space heating	Space cooling	HVAC fans	HVAC pumps	DHW	Passenger lift	External lighting	Internal lighting	Equipment	Other equipment	PV (grid displaced)
Jan	17,905	0	747	747	3,009	1,257	24	927	5,498	570	-387
Feb	14,377	0	678	678	2,719	1,257	20	838	4,980	570	-699
Mar	15,104	0	750	750	3,006	1,257	19	928	5,537	570	-1,115
Apr	7,186	0	744	744	2,923	1,257	15	897	5,318	570	-1,490
May	3,348	0	852	852	2,993	1,257	13	926	5,509	570	-2,011
Jun	556	0	969	969	2,920	1,257	11	899	5,357	570	-1,911
Jul	329	0	1,070	1,070	3,025	1,257	12	927	5,487	570	-2,107
Aug	363	0	1,046	1,046	2,990	1,257	14	928	5,547	570	-1,802
Sep	1,209	0	891	891	2,923	1,257	17	897	5,318	570	-1,374
Oct	6,556	0	771	771	3,009	1,257	20	927	5,498	570	-893
Nov	14,295	0	727	727	2,904	1,257	23	898	5,367	570	-400
Dec	18,260	0	747	747	3,025	1,257	25	927	5,487	570	-317
Total	**99,487**	**0**	**9,992**	**9,992**	**35,444**	**15,083**	**213**	**10,920**	**64,904**	**6,839**	**-14,506**

Cooking −33%: cooking electricity × 0.67, post-processed from the base run. Total before PV 252,873 kWh; EUI 78.4 kWh/m²·yr before PV and 73.9 kWh/m²·yr net of PV (3,226 m²).

CWC

3.1 Discussion

TM54 Results Discussion

CWC

What drives the energy use

- Space heating (39%) is the largest end use because the panel heaters convert electricity to heat one for one. The enhanced fabric and MVHR keep the heat demand moderate, but without a heat pump it passes directly into the EUI.
- Appliances and cooking (27%) are unregulated and depend on residents. At 21.6 kWh/m^2·yr they alone use about two thirds of the GMCA EUI value, so the remaining loads would need to total about 13 kWh/m^2·yr.
- Hot water (14%): the heat supplied to the cylinders (112 MWh/yr) is about twice the hot water drawn (about 52 MWh/yr), so cylinder standing losses are a significant part of the DHW energy.
- The lift (4.7 kWh/m^2·yr) and MVHR fans (3.1 kWh/m^2·yr) are the largest landlord and ventilation loads.

Scenario findings

- Airtightness is the most influential design and construction variable tested. The future 2050 weather file lowers heating demand by about 16%.
- Resident behaviour (appliances ±25%, cooking ±33%, home working) moves the EUI by up to about 5%, showing a realistic range for the building in use.

4 Conclusion and Recommendations

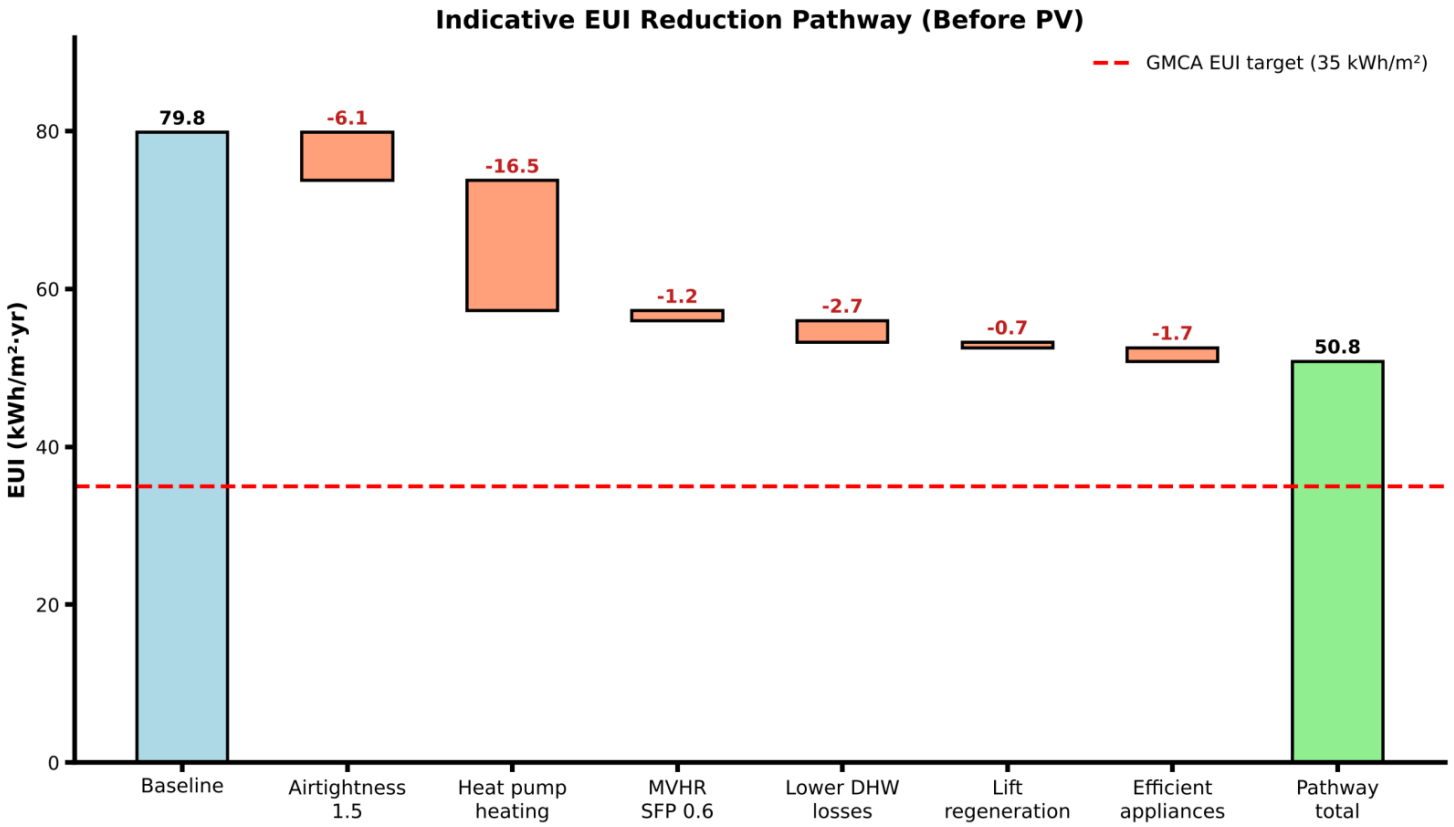
Conclusion: Key Findings

- Baseline: 258 MWh/yr; EUI 79.8 kWh/m^2·yr before PV and 75.3 kWh/m^2·yr net of 14.5 MWh/yr PV generation.
- Space heating 30.8, appliances and cooking 21.6, hot water 11.0 and lift 4.7 kWh/m^2·yr are the main end uses.
- Scenario range 75.2 to 87.9 kWh/m^2·yr before PV; airtightness of 5.0 m^3/(h·m^2) gives the highest result.
- The predicted EUI and space heating are above the GMCA guidance values of 35 and 15 kWh/m^2·yr; direct electric space heating is the main reason.

79.8	30.8	≈ 51	≈ 46
EUI before PV, kWh/m^2·yr (GMCA value 35)	Space heating, kWh/m^2·yr (GMCA value 15)	EUI with recommended measures, kWh/m^2·yr	With measures, net of PV, kWh/m^2·yr

Recommended EUI Reduction Pathway

Measures applied in order, each allowing for those before it. Savings are indicative, to be confirmed by modelling.



Measure	Basis of estimate	Saving	EUI after
Airtightness 1.5 $m^3/(h \cdot m^2)$	Scenario 02: 4.1 kWh/m^2 per unit	-6.1	73.7
Heat pump space heating (SCOP 3.0)	Space heating electricity ÷ 3	-16.5	57.2
MVHR SFP 0.6 W/(l/s)	Fan energy × 0.6 / 1.0	-1.2	56.0
DHW heat demand −25%	DHW electricity × 0.75	-2.7	53.2
Lift regenerative drive	NABERS α 0.26 to 0.37	-0.7	52.6
Efficient appliances −10%	Appliance energy × 0.9 (Scenario 05b scaled)	-1.7	50.8
Pathway total (before PV)		**-29.0**	**50.8**
Net of PV (≈ 85 m^2)		**-4.5**	**46.3**

Further saving not yet included: occupancy-linked heating control

Outside their heating periods, dwelling rooms are modelled at a 16 °C set-back (profiles H01 to H11) rather than off, and spare bedrooms are held at 16 °C throughout; with direct electric heaters, any heat used to keep empty rooms at 16 °C is paid for one for one in electricity. Heaters set to follow occupancy, on from about an hour before to an hour after each occupied period and off otherwise, would reduce space heating below the pathway values. This relies on schedules pre-set in the Adax app at handover and residents being shown how to use them (measure 10); the saving is to be quantified in IES.

Recommendations: Space Heating

CWC

1. Change from direct electric to heat pump space heating (largest saving)

- Space heating is 30.8 kWh/m^2·yr of electricity because each panel heater delivers one unit of heat per unit of electricity. A heat pump system with a seasonal COP of about 3 would use around a third of the electricity, saving in the order of 16 to 21 kWh/m^2·yr. No other single measure comes close.
- Options for the design team to appraise: individual air-to-water heat pumps with low temperature radiators that also heat the hot water; a communal air source heat pump or ambient loop with heat interface units; or exhaust air heat pumps combining MVHR, heating and hot water. Plant space, external units, acoustics, cost and residents' running costs should be compared.

Recommendations: Space Heating Cont.

CWC

2. Improve airtightness to 1.5 $m^3/(h \cdot m^2)$

- Scenario 02 shows space heating changes by about 4.1 $kWh/m^2 \cdot yr$ for each 1 $m^3/(h \cdot m^2)$. Targeting 1.5 instead of 3.0 saves about 6 $kWh/m^2 \cdot yr$ with the current heating (about 2 with a heat pump). This needs an airtightness strategy at Stage 4, a continuous air barrier, sealed service penetrations and testing at first fix as well as completion.

3. Reduce landlord heating

- Corridors are heated to 18 °C around the clock. Internal corridors between heated flats with MVHR rarely need full heating; a lower set-point (for example 16 °C) with time control, or frost protection only, should be tested in the model.

4. Test further fabric improvements

- Triple glazing (about 0.8 W/m^2K) and improved junction details (lower ψ-values at balconies, lintels and floor edges) should be modelled to quantify their effect before cost is considered.

Recommendations: DHW, MVHR and Landlord

CWC

5. Reduce hot water storage losses

- Hot water uses 11.0 kWh/m^2·yr, and the heat supplied to the cylinders is about twice the hot water drawn. Size cylinders to need (a one-person flat uses about 45 litres a day), specify the lowest declared standing losses, insulate all primary and hot water pipework and fit low-flow showers and taps. A 25% cut in DHW heat demand saves about 3.3 kWh/m^2·yr.
- Waste water heat recovery on showers is a further option for the flats and duplexes.

6. Specify low-power MVHR and commission it

- The model uses an in-use SFP of 1.0 W/(l/s). Units in this range achieve 0.4 to 0.6 W/(l/s) at normal rates. Short, low-resistance duct runs, commissioning to the design flow and accessible filters should achieve about 0.6, saving about 1.3 kWh/m^2·yr.

7. Lift with regenerative drive and low standby

- Crediting a regenerative drive in the NABERS method (α 0.37 instead of 0.26) saves about 2,200 kWh/yr (0.7 kWh/m^2·yr). Specify standby mode for the car lighting and fan.

8. Landlord systems

- Select the booster set with variable speed pumps and low standby power, and limit always-on landlord loads (alarm, access control, data) in the electrical specification.

Recommendations: Appliances, Residents, PV

CWC

9. Specify efficient appliances in the fit-out

- Appliances and cooking are 21.6 kWh/m²·yr, the second largest end use. Where the developer supplies white goods, specify heat pump washer dryers (or a washing machine with a heat pump dryer), top-rated fridge freezers and dishwashers, and induction hobs. Scenario 05b shows a 25% cut in appliance use saves 4.3 kWh/m²·yr; a 10% cut from an efficient fit-out saves about 1.8.

10. Heating schedules and resident guidance

- The model holds unoccupied rooms at a 16 °C set-back. Pre-set each dwelling's heater schedules in the Adax app at handover to follow typical occupancy (on about an hour before and after occupied periods, off otherwise) and show residents how to adjust them. Provide a home user guide covering the app, MVHR boost and summer bypass, and window opening in hot weather, plus smart meters with in-home displays. Resident behaviour moved the EUI by up to 5% in the scenarios.

11. Maximise the PV on the available roof

- The 85 m² of unshaded roof generates about 14.5 MWh/yr (4.5 kWh/m²·yr). High efficiency modules and a layout compatible with the sedum roof (biosolar) will maximise the output. PV does not reduce the GMCA EUI but reduces the net energy and residents' bills.

12. Outlook against the GMCA value

- Measures 1 to 9 together give an indicative EUI of about 51 kWh/m²·yr before PV and 46 net of PV; occupancy-linked heating schedules (measure 10) would reduce this further. The remaining gap to 35 is mostly appliance and cooking use, which the design cannot fully control. The pathway should be shared with the GMCA as the design response.

Recommended Next Steps

CWC

- Model the recommended measures in IES as additional scenarios (heat pump space heating options, airtightness 1.5, corridor set-point, occupancy-linked dwelling heating without the 16 °C set-back, triple glazing, MVHR SFP 0.6, lower cylinder losses) to confirm the savings and their interactions.
- Hold a design team workshop to appraise the heat pump options against plant space, acoustics, cost and residents' running costs.
- Obtain the declared standing losses for the selected hot water cylinders, confirm cylinder sizes for each dwelling type and update the model.
- M&E engineer to confirm the PV layout on the approximately 85 m^2 of unshaded roof, and the resulting capacity and generation.
- Confirm the lift (regenerative drive, standby), MVHR selections and booster set duty, and the developer's appliance schedule.
- Confirm the GIA from the accommodation schedule and update the report at Stage 4 and at handover for in-use monitoring.

CWC

4.1 Further Work

Further Work: In-Use Monitoring

CWC

Buildings rarely perform exactly as modelled once occupied. Comparing metered energy with the prediction helps to find and fix problems early and to report performance to the GMCA.

- Use the landlord sub-meters (lift, BCWS, lighting, heating) and, with consent, a sample of dwelling smart meter data.
- Compare monthly metered energy with the model, adjusted for the actual weather and occupancy.
- Identify unusual patterns, such as high night-time use, heaters running in summer or MVHR stuck on boost.
- Adjust controls and settings, and give residents guidance on the heater app and MVHR controls.
- Recalibrate the model with measured data to support future design decisions.

Appendix A: Risks

Appendix A: Risks

Input	Details	Risk
Fabric	Enhanced U-values and air permeability 3.0	Workmanship and thermal bridging can increase heat loss; airtightness is the most sensitive input (scenario 02)
HVAC	Panel heaters, air source hot water cylinders, MVHR; SFP and SCOP as section 2.2	Equipment selections, commissioning and maintenance (filters, bypass) affect fan and heating energy
Hot water	SAP / EST volume, SCOP 3.5, storage losses as entered	Declared losses, immersion use and resident behaviour are uncertain (TM54 range ±30%)
Occupancy	73 residents, household types and presence profiles	Actual occupancy may differ; full bedspace occupancy would increase loads
Equipment	Itemised appliances from product data and HES	Residents choose their own appliances; ±25% tested
Landlord loads	Lift (NABERS method), pumps and systems standby as assessor estimates	To be replaced by the selected equipment
Floor area	GIA 3,226 m^2	Intensities change if the GIA changes as the design develops
IES:VE	Dynamic simulation to CIBSE TM54	A model cannot replicate the building exactly; results guide decisions to reduce energy use

CWC

Appendix B: Profile Tables

Appendix B: People Profiles

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LKD: 1B Commuter (max. 1 person)	Mon to Thu	5	0	0	0	0	0	5	45	25	8	8	8	8	8	8	8	8	30	70	75	75	70	35	15
	Fri to Sat	20	5	0	0	0	0	0	25	30	30	30	30	30	25	25	25	25	40	55	50	50	50	40	30
	Sun	15	0	0	0	0	0	0	0	25	50	55	55	55	45	45	45	45	70	85	85	85	75	35	10
LKD: 1B Hybrid (max. 1 person)	Mon to Thu	5	0	0	0	0	0	5	45	45	48	48	48	48	48	48	48	48	50	70	75	75	70	35	15
	Fri to Sat	20	5	0	0	0	0	0	25	30	60	60	60	60	55	55	55	25	40	55	50	50	50	40	30
	Sun	15	0	0	0	0	0	0	0	25	50	55	55	55	45	45	45	45	70	85	85	85	75	35	10
LKD: 1B Home (max. 1 person)	Mon to Thu	10	0	0	0	0	0	0	35	70	80	80	80	85	70	70	70	70	85	90	90	90	85	40	15
	Fri to Sat	15	0	0	0	0	0	0	30	60	65	65	65	75	60	60	60	60	75	80	80	80	80	50	25
	Sun	15	0	0	0	0	0	0	0	25	50	55	55	55	45	45	45	45	70	85	85	85	75	35	10
LKD: 2B Commuter (max. 2 people)	Mon to Thu	5	0	0	0	0	0	5	45	25	8	8	8	8	8	8	8	8	30	70	75	75	70	35	15
	Fri to Sat	20	5	0	0	0	0	0	25	30	30	30	30	30	25	25	25	25	40	55	50	50	50	40	30
	Sun	15	0	0	0	0	0	0	0	25	50	55	55	55	45	45	45	45	70	85	85	85	75	35	10
LKD: 2B Hybrid (max. 2 people)	Mon to Thu	5	0	0	0	0	0	5	45	35	8	8	8	28	8	8	8	8	30	70	75	75	70	35	15
	Fri to Sat	20	5	0	0	0	0	0	25	30	30	30	30	45	25	25	25	25	40	55	50	50	50	40	30
	Sun	15	0	0	0	0	0	0	0	25	50	55	55	55	45	45	45	45	70	85	85	85	75	35	10
LKD: 2B Home (max. 3 people)	Mon to Thu	2	0	0	0	0	0	20	63	63	46	43	43	58	38	41	48	48	70	75	53	55	53	25	8
	Fri to Sat	7	2	0	0	0	0	18	55	65	46	44	44	60	32	42	45	45	68	70	47	43	43	28	17
	Sun	5	0	0	0	0	0	20	50	65	55	54	54	63	47	48	52	52	82	80	60	57	53	23	7
LKD: DX2B Family (max. 3 people)	Mon to Thu	3	0	0	0	0	0	3	45	37	20	20	20	20	20	20	32	35	47	72	67	57	48	23	10
	Fri to Sat	13	3	0	0	0	0	0	25	33	38	38	38	45	33	33	38	32	45	63	53	48	38	27	20
	Sun	10	0	0	0	0	0	0	0	27	47	50	50	57	53	42	42	42	67	85	73	63	50	23	7

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: People Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LKD: DX3B Family (max. 4 people)	Mon to Thu	2	0	0	0	0	0	2	45	38	16	16	16	16	16	16	34	39	50	72	62	48	38	18	8
	Fri to Sat	10	2	0	0	0	0	0	25	35	35	35	35	45	30	30	38	35	48	68	55	48	32	20	15
	Sun	8	0	0	0	0	0	0	0	28	45	48	48	58	57	40	40	40	65	85	68	52	38	18	5
LKD: DX4B Family (max. 5 people)	Mon to Thu	2	0	0	0	0	0	2	45	38	13	13	13	13	13	13	35	41	52	73	60	42	31	14	6
	Fri to Sat	8	2	0	0	0	0	0	25	36	33	33	33	45	28	28	37	37	49	70	56	47	29	16	12
	Sun	6	0	0	0	0	0	0	0	28	44	46	46	58	60	39	39	39	64	85	64	46	30	14	4
Main bedroom: 1B Commuter (max. 1 person)	Mon to Thu	92	100	100	100	100	100	80	25	5	0	0	0	0	0	0	0	0	5	5	5	5	5	45	80
	Fri to Sat	60	85	100	100	100	100	100	65	45	15	3	3	3	0	0	0	0	0	0	0	0	0	15	40
	Sun	70	95	100	100	100	100	100	100	60	30	5	5	5	5	5	5	5	0	5	5	5	5	50	85
Main bedroom: 1B Hybrid (max. 1 person)	Mon to Thu	92	100	100	100	100	100	80	25	5	0	0	0	0	0	0	0	0	5	5	5	5	5	45	80
	Fri to Sat	60	85	100	100	100	100	100	65	45	15	3	3	3	0	0	0	0	0	0	0	0	0	15	40
	Sun	70	95	100	100	100	100	100	100	60	30	5	5	5	5	5	5	5	0	5	5	5	5	50	85
Main bedroom: 1B Home (max. 1 person)	Mon to Thu	90	100	100	100	100	100	85	50	15	0	0	0	0	0	0	0	0	0	0	0	0	0	45	80
	Fri to Sat	80	100	100	100	100	100	100	60	25	0	0	0	0	0	0	0	0	0	0	0	0	0	35	70
	Sun	70	95	100	100	100	100	100	100	60	30	5	5	5	5	5	5	5	0	5	5	5	5	50	85
Main bedroom: 2B Commuter (max. 2 people)	Mon to Thu	92	100	100	100	100	100	80	25	5	0	0	0	0	0	0	0	0	5	5	5	5	5	45	80
	Fri to Sat	60	85	100	100	100	100	100	65	45	15	3	3	3	0	0	0	0	0	0	0	0	0	15	40
	Sun	70	95	100	100	100	100	100	100	60	30	5	5	5	5	5	5	5	0	5	5	5	5	50	85
Main bedroom: 2B Hybrid (max. 2 people)	Mon to Thu	92	100	100	100	100	100	80	25	5	0	0	0	0	0	0	0	0	5	5	5	5	5	45	80
	Fri to Sat	60	85	100	100	100	100	100	65	45	15	3	3	3	0	0	0	0	0	0	0	0	0	15	40
	Sun	70	95	100	100	100	100	100	100	60	30	5	5	5	5	5	5	5	0	5	5	5	5	50	85

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: People Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Main bedroom: 2B Home (max. 2 people)	Mon to Thu	96	100	100	100	100	100	73	20	2	0	0	0	0	0	0	0	0	2	2	12	2	2	48	82
	Fri to Sat	80	92	100	100	100	100	85	45	22	8	2	2	2	0	0	0	0	0	0	0	0	0	28	57
	Sun	85	98	100	100	100	100	80	55	30	15	2	2	2	2	2	2	2	0	2	2	2	2	50	85
Main bedroom: DX2B Family (max. 2 people)	Mon to Thu	92	100	100	100	100	100	80	25	5	0	0	0	0	0	0	0	0	5	5	5	5	5	45	80
	Fri to Sat	60	85	100	100	100	100	100	65	45	15	3	3	3	0	0	0	0	0	0	0	0	0	15	40
	Sun	70	95	100	100	100	100	100	100	60	30	5	5	5	5	5	5	5	0	5	5	5	5	50	85
Main bedroom: DX3B Family (max. 2 people)	Mon to Thu	92	100	100	100	100	100	80	25	5	0	0	0	0	0	0	0	0	5	5	5	5	5	45	80
	Fri to Sat	60	85	100	100	100	100	100	65	45	15	3	3	3	0	0	0	0	0	0	0	0	0	15	40
	Sun	70	95	100	100	100	100	100	100	60	30	5	5	5	5	5	5	5	0	5	5	5	5	50	85
Main bedroom: DX4B Family (max. 2 people)	Mon to Thu	92	100	100	100	100	100	80	25	5	0	0	0	0	0	0	0	0	5	5	5	5	5	45	80
	Fri to Sat	60	85	100	100	100	100	100	65	45	15	3	3	3	0	0	0	0	0	0	0	0	0	15	40
	Sun	70	95	100	100	100	100	100	100	60	30	5	5	5	5	5	5	5	0	5	5	5	5	50	85
2B Hybrid: Bedroom 2 (study)	Mon to Thu	0	0	0	0	0	0	0	0	0	40	40	40	0	40	40	40	40	20	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	30	30	30	0	30	30	30	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2B Home: Bedroom 2 (pre-school child)	Mon to Thu	100	100	100	100	100	100	60	0	0	0	0	0	0	70	30	0	0	0	0	90	100	100	100	100
	Fri to Sat	100	100	100	100	100	100	60	0	0	0	0	0	0	70	30	0	0	0	0	90	100	100	100	100
	Sun	100	100	100	100	100	100	60	0	0	0	0	0	0	70	30	0	0	0	0	90	100	100	100	100
DX2B Family: Bedroom 2 (school-age child)	Mon to Thu	100	100	100	100	100	100	100	40	0	0	0	0	0	0	0	10	30	25	5	30	70	90	100	100
	Fri to Sat	100	100	100	100	100	100	100	65	40	15	15	15	0	15	15	20	30	25	5	25	40	80	95	100
	Sun	100	100	100	100	100	100	100	100	60	20	20	20	0	0	20	20	20	20	0	30	70	95	100	100

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: People Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
DX3B Family: Bedroom 2 (school-age child)	Mon to Thu	100	100	100	100	100	100	100	40	0	0	0	0	0	0	0	10	30	25	5	30	70	90	100	100
	Fri to Sat	100	100	100	100	100	100	100	65	40	15	15	15	0	15	15	20	30	25	5	25	40	80	95	100
	Sun	100	100	100	100	100	100	100	100	60	20	20	20	0	0	20	20	20	20	0	30	70	95	100	100
DX3B Family: Bedroom 3 (school-age child)	Mon to Thu	100	100	100	100	100	100	100	40	0	0	0	0	0	0	0	10	30	25	5	30	70	90	100	100
	Fri to Sat	100	100	100	100	100	100	100	65	40	15	15	15	0	15	15	20	30	25	5	25	40	80	95	100
	Sun	100	100	100	100	100	100	100	100	60	20	20	20	0	0	20	20	20	20	0	30	70	95	100	100
DX4B Family: Bedroom 2 (school-age child)	Mon to Thu	100	100	100	100	100	100	100	40	0	0	0	0	0	0	0	10	30	25	5	30	70	90	100	100
	Fri to Sat	100	100	100	100	100	100	100	65	40	15	15	15	0	15	15	20	30	25	5	25	40	80	95	100
	Sun	100	100	100	100	100	100	100	100	60	20	20	20	0	0	20	20	20	20	0	30	70	95	100	100
DX4B Family: Bedroom 3 (school-age child)	Mon to Thu	100	100	100	100	100	100	100	40	0	0	0	0	0	0	0	10	30	25	5	30	70	90	100	100
	Fri to Sat	100	100	100	100	100	100	100	65	40	15	15	15	0	15	15	20	30	25	5	25	40	80	95	100
	Sun	100	100	100	100	100	100	100	100	60	20	20	20	0	0	20	20	20	20	0	30	70	95	100	100
DX4B Family: Bedroom 4 (school-age child)	Mon to Thu	100	100	100	100	100	100	100	40	0	0	0	0	0	0	0	10	30	25	5	30	70	90	100	100
	Fri to Sat	100	100	100	100	100	100	100	65	40	15	15	15	0	15	15	20	30	25	5	25	40	80	95	100
	Sun	100	100	100	100	100	100	100	100	60	20	20	20	0	0	20	20	20	20	0	30	70	95	100	100
Bathroom: 1B Commuter (per bathroom)	Mon to Thu	0	0	0	0	0	0	15	25	5	0	0	0	0	0	0	0	0	0	3	0	0	5	10	3
	Fri to Sat	0	0	0	0	0	0	0	10	10	5	0	0	0	0	0	0	0	0	3	0	0	0	5	0
	Sun	0	0	0	0	0	0	0	0	10	15	0	0	0	0	0	0	0	0	0	0	0	10	10	0
Bathroom: 1B Hybrid (per bathroom)	Mon to Thu	0	0	0	0	0	0	15	25	8	0	0	0	0	0	0	0	0	0	3	0	0	5	10	3
	Fri to Sat	0	0	0	0	0	0	0	10	10	5	0	0	0	0	0	0	0	0	3	0	0	0	5	0
	Sun	0	0	0	0	0	0	0	0	10	15	0	0	0	0	0	0	0	0	0	0	0	10	10	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: People Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Bathroom: 1B Home (per bathroom)	Mon to Thu	0	0	0	0	0	0	10	15	10	0	0	0	0	0	0	0	0	0	0	0	0	5	10	0
	Fri to Sat	0	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
	Sun	0	0	0	0	0	0	0	0	10	15	0	0	0	0	0	0	0	0	0	0	0	10	10	0
Bathroom: 2B Commuter (per bathroom)	Mon to Thu	0	0	0	0	0	0	15	25	5	0	0	0	0	0	0	0	0	0	3	0	0	5	10	3
	Fri to Sat	0	0	0	0	0	0	0	10	10	5	0	0	0	0	0	0	0	0	3	0	0	0	5	0
	Sun	0	0	0	0	0	0	0	0	10	15	0	0	0	0	0	0	0	0	0	0	0	10	10	0
Bathroom: 2B Hybrid (per bathroom)	Mon to Thu	0	0	0	0	0	0	15	25	6	0	0	0	0	0	0	0	0	0	3	0	0	5	10	3
	Fri to Sat	0	0	0	0	0	0	0	10	10	5	0	0	0	0	0	0	0	0	3	0	0	0	5	0
	Sun	0	0	0	0	0	0	0	0	10	15	0	0	0	0	0	0	0	0	0	0	0	10	10	0
Bathroom: 2B Home (per bathroom)	Mon to Thu	0	0	0	0	0	0	18	30	5	0	0	0	0	0	0	0	0	0	19	0	0	2	10	2
	Fri to Sat	0	0	0	0	0	0	8	20	8	2	0	0	0	0	0	0	0	0	19	0	0	0	8	0
	Sun	0	0	0	0	0	0	10	18	5	8	0	0	0	0	0	0	0	0	18	0	0	5	10	0
Bathroom: DX2B Family (per bathroom)	Mon to Thu	0	0	0	0	0	0	15	32	9	0	0	0	0	0	0	0	0	0	8	5	2	5	10	3
	Fri to Sat	0	0	0	0	0	0	0	15	15	5	0	0	0	0	0	0	0	0	8	5	2	0	5	0
	Sun	0	0	0	0	0	0	0	0	15	15	0	0	0	0	0	0	0	0	5	8	0	10	10	0
Bathroom: DX3B Family (per bathroom)	Mon to Thu	0	0	0	0	0	0	10	27	8	0	0	0	0	0	0	0	0	0	9	7	3	3	7	2
	Fri to Sat	0	0	0	0	0	0	0	13	13	3	0	0	0	0	0	0	0	0	9	7	3	0	3	0
	Sun	0	0	0	0	0	0	0	0	13	10	0	0	0	0	0	0	0	0	7	10	0	7	7	0
Bathroom: DX4B Family (per bathroom)	Mon to Thu	0	0	0	0	0	0	10	32	9	0	0	0	0	0	0	0	0	0	12	10	5	3	7	2
	Fri to Sat	0	0	0	0	0	0	0	17	17	3	0	0	0	0	0	0	0	0	12	10	5	0	3	0
	Sun	0	0	0	0	0	0	0	0	17	10	0	0	0	0	0	0	0	0	10	15	0	7	7	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LKD, winter: 1B Commuter	Mon to Thu	4	0	0	0	0	0	4	33	13	2	2	2	2	2	2	3	5	21	55	60	60	56	28	12
	Fri to Sat	16	4	0	0	0	0	0	18	16	9	6	6	6	5	5	11	14	28	43	40	40	40	32	24
	Sun	12	0	0	0	0	0	0	0	13	14	11	11	11	9	10	19	26	49	67	68	68	60	28	8
LKD, winter: 1B Hybrid	Mon to Thu	4	0	0	0	0	0	4	33	24	14	10	10	10	10	10	20	27	35	55	60	60	56	28	12
	Fri to Sat	16	4	0	0	0	0	0	18	16	17	12	12	12	11	12	23	14	28	43	40	40	40	32	24
	Sun	12	0	0	0	0	0	0	0	13	14	11	11	11	9	10	19	26	49	67	68	68	60	28	8
LKD, winter: 1B Home	Mon to Thu	8	0	0	0	0	0	0	26	37	23	16	16	17	14	15	30	40	59	71	72	72	68	32	12
	Fri to Sat	12	0	0	0	0	0	0	22	32	19	13	13	15	12	13	26	34	52	63	64	64	64	40	20
	Sun	12	0	0	0	0	0	0	0	13	14	11	11	11	9	10	19	26	49	67	68	68	60	28	8
LKD, winter: 2B Commuter	Mon to Thu	8	0	0	0	0	0	8	51	23	4	3	3	3	3	3	7	9	36	72	75	75	73	46	22
	Fri to Sat	29	8	0	0	0	0	0	32	27	15	10	10	10	9	9	19	25	45	63	60	60	60	51	41
	Sun	22	0	0	0	0	0	0	0	23	22	16	16	16	14	15	30	40	63	77	78	78	75	46	15
LKD, winter: 2B Hybrid	Mon to Thu	8	0	0	0	0	0	8	51	31	4	3	3	10	3	3	7	9	36	72	75	75	73	46	22
	Fri to Sat	29	8	0	0	0	0	0	32	27	15	10	10	14	9	9	19	25	45	63	60	60	60	51	41
	Sun	22	0	0	0	0	0	0	0	23	22	16	16	16	14	15	30	40	63	77	78	78	75	46	15
LKD, winter: 2B Home	Mon to Thu	4	0	0	0	0	0	40	71	52	26	17	17	19	18	18	39	52	69	78	76	78	78	49	19
	Fri to Sat	16	4	0	0	0	0	38	69	52	25	17	17	19	14	18	36	49	69	77	73	72	72	54	35
	Sun	12	0	0	0	0	0	41	69	52	26	18	18	19	18	19	38	51	69	78	78	78	77	46	15
LKD, winter: DX2B Family	Mon to Thu	8	0	0	0	0	0	8	61	40	15	11	11	11	11	12	30	44	60	77	78	76	73	46	22
	Fri to Sat	29	8	0	0	0	0	0	43	38	23	16	16	17	15	16	33	40	58	76	72	69	63	51	41
	Sun	22	0	0	0	0	0	0	0	32	24	18	18	18	18	17	34	46	67	79	79	79	75	46	15
LKD, winter: DX3B Family	Mon to Thu	8	0	0	0	0	0	8	67	45	16	11	11	11	11	12	35	50	66	79	79	77	74	46	22
	Fri to Sat	29	8	0	0	0	0	0	50	44	24	17	17	18	16	17	37	47	65	78	77	74	66	51	41
	Sun	22	0	0	0	0	0	0	0	39	26	19	19	19	19	19	37	50	69	79	80	79	75	46	15

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LKD, winter: DX4B Family	Mon to Thu	8	0	0	0	0	0	8	70	49	16	11	11	11	11	12	38	54	68	79	79	77	74	46	22
	Fri to Sat	29	8	0	0	0	0	0	56	48	25	18	18	19	17	18	39	52	67	79	79	77	68	51	41
	Sun	22	0	0	0	0	0	0	0	43	27	19	19	20	20	20	39	52	69	79	80	79	75	46	15
LKD, summer: 1B Commuter	Mon to Thu	4	0	0	0	0	0	2	6	1	0	0	0	0	0	0	0	0	1	5	19	44	56	28	12
	Fri to Sat	16	4	0	0	0	0	0	3	1	1	1	1	1	1	1	1	1	2	4	13	29	40	32	24
	Sun	12	0	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2	3	7	22	50	60	28	8
LKD, summer: 1B Hybrid	Mon to Thu	4	0	0	0	0	0	2	6	2	2	2	2	2	2	2	2	2	2	5	19	44	56	28	12
	Fri to Sat	16	4	0	0	0	0	0	3	1	2	2	2	2	2	2	2	1	2	4	13	29	40	32	24
	Sun	12	0	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2	3	7	22	50	60	28	8
LKD, summer: 1B Home	Mon to Thu	8	0	0	0	0	0	0	5	3	3	3	3	3	3	3	3	3	3	7	23	52	68	32	12
	Fri to Sat	12	0	0	0	0	0	0	4	2	3	3	3	3	2	2	2	2	3	6	20	47	64	40	20
	Sun	12	0	0	0	0	0	0	0	1	2	2	2	2	2	2	2	2	3	7	22	50	60	28	8
LKD, summer: 2B Commuter	Mon to Thu	8	0	0	0	0	0	4	9	2	1	1	1	1	1	1	1	1	2	7	24	55	73	46	22
	Fri to Sat	29	8	0	0	0	0	0	6	2	2	2	2	2	2	2	2	2	3	6	19	44	60	51	41
	Sun	22	0	0	0	0	0	0	0	2	3	3	3	3	3	3	3	3	4	8	25	57	75	46	15
LKD, summer: 2B Hybrid	Mon to Thu	8	0	0	0	0	0	4	9	2	1	1	1	2	1	1	1	1	2	7	24	55	73	46	22
	Fri to Sat	29	8	0	0	0	0	0	6	2	2	2	2	3	2	2	2	2	3	6	19	44	60	51	41
	Sun	22	0	0	0	0	0	0	0	2	3	3	3	3	3	3	3	3	4	8	25	57	75	46	15
LKD, summer: 2B Home	Mon to Thu	4	0	0	0	0	0	20	12	4	4	3	3	4	4	3	4	4	4	8	24	57	78	49	19
	Fri to Sat	16	4	0	0	0	0	19	12	4	3	3	3	4	3	3	3	3	4	8	23	52	72	54	35
	Sun	12	0	0	0	0	0	20	12	4	4	4	4	4	4	3	4	4	4	8	25	57	77	46	15
LKD, summer: DX2B Family	Mon to Thu	8	0	0	0	0	0	4	11	3	2	2	2	2	2	2	3	3	3	8	25	55	73	46	22
	Fri to Sat	29	8	0	0	0	0	0	7	3	3	3	3	3	3	3	3	3	3	7	23	50	63	51	41
	Sun	22	0	0	0	0	0	0	0	2	3	4	4	4	4	3	3	3	4	8	25	57	75	46	15

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
LKD, summer: DX3B Family	Mon to Thu	8	0	0	0	0	0	4	12	3	2	2	2	2	2	2	3	4	4	8	25	56	74	46	22
	Fri to Sat	29	8	0	0	0	0	0	9	3	3	3	3	4	3	3	3	3	4	8	24	54	66	51	41
	Sun	22	0	0	0	0	0	0	0	3	4	4	4	4	4	3	3	3	4	8	25	57	75	46	15
LKD, summer: DX4B Family	Mon to Thu	8	0	0	0	0	0	4	12	4	2	2	2	2	2	2	4	4	4	8	25	56	74	46	22
	Fri to Sat	29	8	0	0	0	0	0	10	4	4	4	4	4	3	3	4	4	4	8	25	56	68	51	41
	Sun	22	0	0	0	0	0	0	0	3	4	4	4	4	4	4	4	4	4	8	25	58	75	46	15
Main bedroom, winter: 1B Commuter	Mon to Thu	0	0	0	0	0	0	5	14	3	0	0	0	0	0	0	0	0	4	5	5	5	5	15	5
	Fri to Sat	5	0	0	0	0	0	0	5	3	1	0	0	0	0	0	0	0	0	0	0	0	0	5	5
	Sun	0	0	0	0	0	0	0	0	0	3	1	1	1	1	1	2	3	0	5	5	5	5	15	5
Main bedroom, winter: 1B Hybrid	Mon to Thu	0	0	0	0	0	0	5	14	3	0	0	0	0	0	0	0	0	4	5	5	5	5	15	5
	Fri to Sat	5	0	0	0	0	0	0	5	3	1	0	0	0	0	0	0	0	0	0	0	0	0	5	5
	Sun	0	0	0	0	0	0	0	0	0	3	1	1	1	1	1	2	3	0	5	5	5	5	15	5
Main bedroom, winter: 1B Home	Mon to Thu	0	0	0	0	0	0	0	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
	Fri to Sat	0	0	0	0	0	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
	Sun	0	0	0	0	0	0	0	0	0	3	1	1	1	1	1	2	3	0	5	5	5	5	15	5
Main bedroom, winter: 2B Commuter	Mon to Thu	0	0	0	0	0	0	10	25	6	0	0	0	0	0	0	0	0	8	10	10	10	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	9	6	3	1	1	1	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	5	1	1	1	1	2	5	7	0	10	10	10	10	28	10
Main bedroom, winter: 2B Hybrid	Mon to Thu	0	0	0	0	0	0	10	25	6	0	0	0	0	0	0	0	0	8	10	10	10	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	9	6	3	1	1	1	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	5	1	1	1	1	2	5	7	0	10	10	10	10	28	10
Main bedroom, winter: 2B Home	Mon to Thu	0	0	0	0	0	0	10	21	3	0	0	0	0	0	0	0	0	4	5	24	5	5	24	5
	Fri to Sat	5	0	0	0	0	0	0	9	3	1	0	0	0	0	0	0	0	0	0	0	0	0	15	5
	Sun	0	0	0	0	0	0	0	0	0	3	1	1	1	1	1	2	3	0	5	5	5	5	24	5

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Main bedroom, winter: DX2B Family	Mon to Thu	0	0	0	0	0	0	10	25	6	0	0	0	0	0	0	0	0	8	10	10	10	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	9	6	3	1	1	1	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	5	1	1	1	1	2	5	7	0	10	10	10	10	28	10
Main bedroom, winter: DX3B Family	Mon to Thu	0	0	0	0	0	0	10	25	6	0	0	0	0	0	0	0	0	8	10	10	10	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	9	6	3	1	1	1	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	5	1	1	1	1	2	5	7	0	10	10	10	10	28	10
Main bedroom, winter: DX4B Family	Mon to Thu	0	0	0	0	0	0	10	25	6	0	0	0	0	0	0	0	0	8	10	10	10	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	9	6	3	1	1	1	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	5	1	1	1	1	2	5	7	0	10	10	10	10	28	10
Main bedroom, summer: 1B Commuter	Mon to Thu	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	2	4	5	15	5
	Fri to Sat	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	5	15	5
Main bedroom, summer: 1B Hybrid	Mon to Thu	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	2	4	5	15	5
	Fri to Sat	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	5	15	5
Main bedroom, summer: 1B Home	Mon to Thu	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
	Fri to Sat	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	5	15	5
Main bedroom, summer: 2B Commuter	Mon to Thu	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	1	3	7	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	7	10	28	10
Main bedroom, summer: 2B Hybrid	Mon to Thu	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	1	3	7	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	7	10	28	10

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Main bedroom, summer: 2B Home	Mon to Thu	0	0	0	0	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	7	4	5	24	5
	Fri to Sat	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	5
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	5	24	5
Main bedroom, summer: DX2B Family	Mon to Thu	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	1	3	7	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	7	10	28	10
Main bedroom, summer: DX3B Family	Mon to Thu	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	1	3	7	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	7	10	28	10
Main bedroom, summer: DX4B Family	Mon to Thu	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	1	3	7	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	3	7	10	28	10
Winter: 2B Commuter: Bedroom 2	Mon to Thu	0	0	0	0	0	0	2	4	2	0	0	0	0	0	0	0	1	2	5	5	5	5	4	2
	Fri to Sat	2	0	0	0	0	0	0	3	2	1	0	0	0	0	0	1	1	3	4	4	4	4	4	3
	Sun	1	0	0	0	0	0	0	0	2	1	1	1	1	1	1	2	3	4	5	5	5	5	4	1
Winter: 2B Hybrid: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	0	0	11	6	6	0	6	7	19	27	17	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	8	5	5	0	5	5	14	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Winter: 2B Home: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
Winter: DX2B Family: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	5	20	21	5	30	40	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	5	6	4	2	2	0	2	3	9	20	21	5	25	40	40	15	5
	Sun	0	0	0	0	0	0	0	0	6	5	3	3	0	0	3	9	14	17	0	30	40	20	5	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Winter: DX3B Family: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	5	20	21	5	30	40	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	5	6	4	2	2	0	2	3	9	20	21	5	25	40	40	15	5
	Sun	0	0	0	0	0	0	0	0	6	5	3	3	0	0	3	9	14	17	0	30	40	20	5	0
Winter: DX3B Family: Bedroom 3	Mon to Thu	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	5	20	21	5	30	40	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	5	6	4	2	2	0	2	3	9	20	21	5	25	40	40	15	5
	Sun	0	0	0	0	0	0	0	0	6	5	3	3	0	0	3	9	14	17	0	30	40	20	5	0
Winter: DX4B Family: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	5	20	21	5	30	40	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	5	6	4	2	2	0	2	3	9	20	21	5	25	40	40	15	5
	Sun	0	0	0	0	0	0	0	0	6	5	3	3	0	0	3	9	14	17	0	30	40	20	5	0
Winter: DX4B Family: Bedroom 3	Mon to Thu	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	5	20	21	5	30	40	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	5	6	4	2	2	0	2	3	9	20	21	5	25	40	40	15	5
	Sun	0	0	0	0	0	0	0	0	6	5	3	3	0	0	3	9	14	17	0	30	40	20	5	0
Winter: DX4B Family: Bedroom 4	Mon to Thu	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	5	20	21	5	30	40	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	5	6	4	2	2	0	2	3	9	20	21	5	25	40	40	15	5
	Sun	0	0	0	0	0	0	0	0	6	5	3	3	0	0	3	9	14	17	0	30	40	20	5	0
Summer: 2B Commuter: Bedroom 2	Mon to Thu	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	3	5	4	2
	Fri to Sat	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	4	4	3
	Sun	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	5	4	1
Summer: 2B Hybrid: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Summer: 2B Home: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Summer: DX2B Family: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	9	29	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	8	29	40	15	5
	Sun	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	9	29	20	5	0
Summer: DX3B Family: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	9	29	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	8	29	40	15	5
	Sun	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	9	29	20	5	0
Summer: DX3B Family: Bedroom 3	Mon to Thu	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	9	29	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	8	29	40	15	5
	Sun	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	9	29	20	5	0
Summer: DX4B Family: Bedroom 2	Mon to Thu	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	9	29	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	8	29	40	15	5
	Sun	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	9	29	20	5	0
Summer: DX4B Family: Bedroom 3	Mon to Thu	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	9	29	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	8	29	40	15	5
	Sun	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	9	29	20	5	0
Summer: DX4B Family: Bedroom 4	Mon to Thu	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	9	29	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	8	29	40	15	5
	Sun	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	0	9	29	20	5	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Bathroom: 1B Commuter	Mon to Thu	0	0	0	0	0	0	20	32	6	0	0	0	0	0	0	0	0	0	4	0	0	6	13	4
	Fri to Sat	0	0	0	0	0	0	0	13	13	6	0	0	0	0	0	0	0	0	4	0	0	0	6	0
	Sun	0	0	0	0	0	0	0	0	13	20	0	0	0	0	0	0	0	0	0	0	0	13	13	0
Bathroom: 1B Hybrid	Mon to Thu	0	0	0	0	0	0	20	32	10	0	0	0	0	0	0	0	0	0	4	0	0	6	13	4
	Fri to Sat	0	0	0	0	0	0	0	13	13	6	0	0	0	0	0	0	0	0	4	0	0	0	6	0
	Sun	0	0	0	0	0	0	0	0	13	20	0	0	0	0	0	0	0	0	0	0	0	13	13	0
Bathroom: 1B Home	Mon to Thu	0	0	0	0	0	0	13	20	13	0	0	0	0	0	0	0	0	0	0	0	0	6	13	0
	Fri to Sat	0	0	0	0	0	0	0	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0
	Sun	0	0	0	0	0	0	0	0	13	20	0	0	0	0	0	0	0	0	0	0	0	13	13	0
Bathroom: 2B Commuter	Mon to Thu	0	0	0	0	0	0	20	32	6	0	0	0	0	0	0	0	0	0	4	0	0	6	13	4
	Fri to Sat	0	0	0	0	0	0	0	13	13	6	0	0	0	0	0	0	0	0	4	0	0	0	6	0
	Sun	0	0	0	0	0	0	0	0	13	20	0	0	0	0	0	0	0	0	0	0	0	13	13	0
Bathroom: 2B Hybrid	Mon to Thu	0	0	0	0	0	0	20	32	8	0	0	0	0	0	0	0	0	0	4	0	0	6	13	4
	Fri to Sat	0	0	0	0	0	0	0	13	13	6	0	0	0	0	0	0	0	0	4	0	0	0	6	0
	Sun	0	0	0	0	0	0	0	0	13	20	0	0	0	0	0	0	0	0	0	0	0	13	13	0
Bathroom: 2B Home	Mon to Thu	0	0	0	0	0	0	23	39	6	0	0	0	0	0	0	0	0	0	25	0	0	3	13	2
	Fri to Sat	0	0	0	0	0	0	10	26	10	3	0	0	0	0	0	0	0	0	25	0	0	0	10	0
	Sun	0	0	0	0	0	0	13	23	6	10	0	0	0	0	0	0	0	0	23	0	0	6	13	0
Bathroom: DX2B Family	Mon to Thu	0	0	0	0	0	0	20	42	12	0	0	0	0	0	0	0	0	0	10	6	3	6	13	4
	Fri to Sat	0	0	0	0	0	0	0	20	20	6	0	0	0	0	0	0	0	0	10	6	3	0	6	0
	Sun	0	0	0	0	0	0	0	0	20	20	0	0	0	0	0	0	0	0	6	10	0	13	13	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Bathroom: DX3B Family	Mon to Thu	0	0	0	0	0	0	13	35	10	0	0	0	0	0	0	0	0	0	11	9	4	4	9	3
	Fri to Sat	0	0	0	0	0	0	0	17	17	4	0	0	0	0	0	0	0	0	11	9	4	0	4	0
	Sun	0	0	0	0	0	0	0	0	17	13	0	0	0	0	0	0	0	0	9	13	0	9	9	0
Bathroom: DX4B Family	Mon to Thu	0	0	0	0	0	0	13	41	12	0	0	0	0	0	0	0	0	0	16	13	7	4	9	3
	Fri to Sat	0	0	0	0	0	0	0	22	22	4	0	0	0	0	0	0	0	0	16	13	7	0	4	0
	Sun	0	0	0	0	0	0	0	0	22	13	0	0	0	0	0	0	0	0	13	20	0	9	9	0
1B Commuter: Utility cupboard	Mon to Thu	0	0	0	0	0	0	1	3	1	0	0	0	0	0	0	0	0	1	3	3	3	3	2	1
	Fri to Sat	1	0	0	0	0	0	0	2	2	2	1	1	1	1	1	1	1	2	2	2	2	2	2	1
	Sun	1	0	0	0	0	0	0	0	1	3	2	2	2	2	2	2	2	3	4	4	4	4	2	1
1B Hybrid: Utility cupboard	Mon to Thu	0	0	0	0	0	0	1	3	2	2	2	2	2	2	2	2	2	2	3	3	3	3	2	1
	Fri to Sat	1	0	0	0	0	0	0	2	2	3	3	3	3	2	2	2	1	2	2	2	2	2	2	1
	Sun	1	0	0	0	0	0	0	0	1	3	2	2	2	2	2	2	2	3	4	4	4	4	2	1
1B Home: Utility cupboard	Mon to Thu	0	0	0	0	0	0	0	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	2	1
	Fri to Sat	1	0	0	0	0	0	0	2	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3	1
	Sun	1	0	0	0	0	0	0	0	1	3	2	2	2	2	2	2	2	3	4	4	4	4	2	1
2B Commuter: Utility cupboard	Mon to Thu	0	0	0	0	0	0	2	4	2	1	1	1	1	1	1	1	1	2	4	4	4	4	3	2
	Fri to Sat	2	0	0	0	0	0	0	3	3	3	2	2	2	2	2	2	2	3	3	3	3	3	3	2
	Sun	1	0	0	0	0	0	0	0	2	4	3	3	3	3	3	3	3	4	4	4	4	4	3	1
2B Hybrid: Utility cupboard	Mon to Thu	0	0	0	0	0	0	2	4	3	2	2	2	2	2	2	2	2	3	4	4	4	4	3	2
	Fri to Sat	2	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	Sun	1	0	0	0	0	0	0	0	2	4	3	3	3	3	3	3	3	4	4	4	4	4	3	1

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Dwelling Lighting Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2B Home: Utility cupboard	Mon to Thu	0	0	0	0	0	0	3	4	4	4	3	3	4	4	3	4	4	4	4	4	4	4	3	1
	Fri to Sat	1	0	0	0	0	0	2	4	4	4	3	3	4	3	3	3	3	4	4	4	4	4	3	2
	Sun	1	0	0	0	0	0	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	1
DX2B Family: Hall and stairs	Mon to Thu	2	0	0	0	0	0	11	25	21	13	13	13	13	13	13	19	23	24	25	25	25	24	21	10
	Fri to Sat	11	2	0	0	0	0	0	20	22	22	21	21	22	20	20	21	21	23	25	25	24	22	20	15
	Sun	7	0	0	0	0	0	0	0	20	24	23	23	23	23	22	22	22	25	25	25	25	25	21	7
DX2B Family: Utility cupboard	Mon to Thu	0	0	0	0	0	0	2	4	3	2	2	2	2	2	2	3	4	4	4	4	4	4	3	2
	Fri to Sat	2	0	0	0	0	0	0	3	4	4	3	3	3	3	3	3	3	4	4	4	4	4	3	2
	Sun	1	0	0	0	0	0	0	0	3	4	4	4	4	4	4	4	4	4	4	4	4	4	3	1
DX3B Family: Hall and stairs	Mon to Thu	2	0	0	0	0	0	11	25	23	14	14	14	14	14	14	22	25	25	25	25	25	24	21	10
	Fri to Sat	11	2	0	0	0	0	0	22	24	23	23	23	23	21	21	23	24	25	25	25	25	24	20	15
	Sun	7	0	0	0	0	0	0	0	22	25	24	24	24	24	24	24	24	25	25	25	25	25	21	7
DX3B Family: Utility cupboard	Mon to Thu	0	0	0	0	0	0	2	4	4	2	2	2	2	2	2	4	4	4	4	4	4	4	3	2
	Fri to Sat	2	0	0	0	0	0	0	3	4	4	4	4	4	3	3	4	4	4	4	4	4	4	3	2
	Sun	1	0	0	0	0	0	0	0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	1
DX4B Family: Hall and stairs	Mon to Thu	2	0	0	0	0	0	11	25	24	14	14	14	14	14	14	24	25	25	25	25	25	25	22	10
	Fri to Sat	11	2	0	0	0	0	0	23	25	24	24	24	24	23	23	24	25	25	25	25	25	24	21	16
	Sun	7	0	0	0	0	0	0	0	24	25	25	25	25	25	24	24	24	25	25	25	25	25	22	7
DX4B Family: Utility cupboard	Mon to Thu	0	0	0	0	0	0	2	4	4	2	2	2	2	2	2	4	4	4	4	4	4	4	3	2
	Fri to Sat	2	0	0	0	0	0	0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3
	Sun	1	0	0	0	0	0	0	0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	1

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Landlord Lighting Profiles

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Corridor traffic	Mon to Thu	5	3	3	3	3	5	15	35	35	15	12	12	15	12	12	15	20	30	35	30	25	20	15	8
	Fri to Sat	8	5	3	3	3	3	8	20	25	25	20	20	20	20	20	20	20	25	30	30	25	20	15	10
	Sun	8	5	3	3	3	3	5	10	20	25	25	25	25	20	20	20	20	25	30	25	20	15	10	5
Entrance traffic	Mon to Thu	8	5	5	5	5	8	20	45	45	25	20	20	25	20	20	25	30	40	45	40	30	25	20	12
	Fri to Sat	10	8	5	5	5	5	10	25	30	30	30	30	30	30	30	30	30	35	40	40	35	30	20	15
	Sun	10	8	5	5	5	5	8	15	25	30	30	30	30	30	25	25	25	30	35	30	25	20	15	8
Stair use	Mon to Thu	0	0	0	0	0	0	2	6	6	3	2	2	3	2	2	3	4	6	6	4	3	2	1	0
	Fri to Sat	0	0	0	0	0	0	2	6	6	3	2	2	3	2	2	3	4	6	6	4	3	2	1	0
	Sun	0	0	0	0	0	0	2	6	6	3	2	2	3	2	2	3	4	6	6	4	3	2	1	0
Plant room visits	Mon to Thu	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meter room visits	Mon to Thu	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bin store use	Mon to Thu	0	0	0	0	0	0	0	10	15	5	2	2	3	2	2	3	5	10	15	15	10	5	2	0
	Fri to Sat	0	0	0	0	0	0	0	5	10	10	5	5	5	5	5	5	5	10	10	10	8	5	2	0
	Sun	0	0	0	0	0	0	0	3	5	10	10	8	5	5	5	5	5	8	10	10	8	5	2	0
Bike store use	Mon to Thu	0	0	0	0	0	0	5	20	20	5	2	2	2	2	2	3	8	20	20	10	5	2	1	0
	Fri to Sat	0	0	0	0	0	0	2	10	15	15	10	8	8	8	8	8	10	15	15	10	5	2	1	0
	Sun	0	0	0	0	0	0	0	3	8	15	15	10	8	8	8	10	10	10	8	5	3	2	0	0
Parcel store use	Mon to Thu	0	0	0	0	0	0	0	2	5	3	3	3	5	3	3	5	8	12	15	12	8	4	1	0
	Fri to Sat	0	0	0	0	0	0	0	2	5	5	5	5	5	5	5	5	8	10	10	8	5	2	0	0
	Sun	0	0	0	0	0	0	0	0	2	3	3	3	3	3	3	3	5	5	5	3	2	1	0	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Appliance Profiles

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Commuter: Oven	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	39	23	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	8	28	19	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	24	17	0	0	0	9	30	0	0	0	0	0
Commuter: Induction hob	Mon to Thu	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	6	39	28	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	4	0	0	8	2	0	0	0	8	28	19	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	9	3	0	21	11	0	0	0	0	35	20	0	0	0	0
Commuter: Microwave	Mon to Thu	0	0	0	0	0	0	0	6	0	0	0	0	2	1	0	0	0	0	13	14	9	4	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	3	0	0	0	9	3	0	0	0	0	8	9	6	5	2	0
	Sun	0	0	0	0	0	0	0	0	0	5	0	0	10	6	0	0	0	0	15	12	10	5	0	0
Commuter: Air fryer	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	35	19	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	10	24	12	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	18	35	0	0	0	0	0
Commuter: Kettle	Mon to Thu	0	0	0	0	0	0	0	6	2	0	0	0	1	0	0	0	0	2	7	6	5	4	1	0
	Fri to Sat	0	0	0	0	0	0	0	0	3	3	2	2	2	1	1	1	1	2	5	4	3	2	2	0
	Sun	0	0	0	0	0	0	0	0	2	6	4	3	4	3	2	2	2	4	7	5	5	4	1	0
Commuter: Toaster	Mon to Thu	0	0	0	0	0	0	0	34	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	13	13	4	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	6	25	17	0	0	0	0	0	0	0	0	0	0	0	0	0
Commuter: Coffee machine	Mon to Thu	0	0	0	0	0	0	0	28	6	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	11	11	4	0	0	0	3	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	25	21	0	0	0	6	0	0	0	0	0	0	0	0	0
Commuter: Laptop (personal use)	Mon to Thu	5	0	0	0	0	0	5	45	25	8	8	8	8	8	8	8	8	30	70	75	75	70	35	15
	Fri to Sat	20	5	0	0	0	0	0	25	30	30	30	30	30	25	25	25	25	40	55	50	50	50	40	30
	Sun	15	0	0	0	0	0	0	0	25	50	55	55	55	45	45	45	45	70	85	85	85	75	35	10

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Appliance Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Commuter: Games console	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	33	31	9	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	16	22	22	12	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	0	0	20	25	0	0	0
Commuter: Steam iron	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	0	0	0
Hybrid: Oven	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	39	23	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	8	28	19	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	24	17	0	0	0	9	30	0	0	0	0	0
Hybrid: Induction hob	Mon to Thu	0	0	0	0	0	0	0	3	0	0	0	0	6	0	0	0	0	9	39	28	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	8	0	0	15	3	0	0	0	8	28	19	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	9	3	0	21	11	0	0	0	0	35	20	0	0	0	0
Hybrid: Microwave	Mon to Thu	0	0	0	0	0	0	0	6	0	0	0	0	15	6	0	0	0	0	13	14	9	4	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	3	0	0	0	19	7	0	0	0	0	8	9	6	5	2	0
	Sun	0	0	0	0	0	0	0	0	0	5	0	0	10	6	0	0	0	0	15	12	10	5	0	0
Hybrid: Air fryer	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	35	19	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	10	24	12	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	18	35	0	0	0	0	0
Hybrid: Kettle	Mon to Thu	0	0	0	0	0	0	0	6	3	0	2	2	4	2	2	2	2	3	7	6	5	4	1	0
	Fri to Sat	0	0	0	0	0	0	0	0	3	6	4	3	4	3	2	2	1	2	5	4	3	2	2	0
	Sun	0	0	0	0	0	0	0	0	2	6	4	3	4	3	2	2	2	4	7	5	5	4	1	0
Hybrid: Toaster	Mon to Thu	0	0	0	0	0	0	0	34	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	13	26	8	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	6	25	17	0	0	0	0	0	0	0	0	0	0	0	0	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Appliance Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Hybrid: Coffee machine	Mon to Thu	0	0	0	0	0	0	0	28	11	0	0	0	0	6	0	6	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	11	22	8	0	0	0	7	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	25	21	0	0	0	6	0	0	0	0	0	0	0	0	0
Hybrid: Laptop (personal use)	Mon to Thu	5	0	0	0	0	0	5	45	45	48	48	48	48	48	48	48	48	50	70	75	75	70	35	15
	Fri to Sat	20	5	0	0	0	0	0	25	30	60	60	60	60	55	55	55	25	40	55	50	50	50	40	30
	Sun	15	0	0	0	0	0	0	0	25	50	55	55	55	45	45	45	45	70	85	85	85	75	35	10
Hybrid: Games console	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	33	31	9	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10	0	0	0	16	22	22	12	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	0	0	20	25	0	0	0
Hybrid: Steam iron	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	0	0	0
Home-based: Oven	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	45	25	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	14	40	30	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	24	17	0	0	0	9	30	0	0	0	0	0
Home-based: Induction hob	Mon to Thu	0	0	0	0	0	0	0	2	0	0	0	0	10	0	0	0	0	15	45	30	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	8	0	0	19	4	0	0	0	14	40	30	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	9	3	0	21	11	0	0	0	0	35	20	0	0	0	0
Home-based: Microwave	Mon to Thu	0	0	0	0	0	0	0	4	0	0	0	0	25	9	0	0	0	0	15	15	10	5	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	6	0	0	0	23	8	0	0	0	0	12	15	10	8	3	0
	Sun	0	0	0	0	0	0	0	0	0	5	0	0	10	6	0	0	0	0	15	12	10	5	0	0
Home-based: Air fryer	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	40	20	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	19	35	20	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	18	35	0	0	0	0	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Appliance Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Home-based: Kettle	Mon to Thu	0	0	0	0	0	0	0	4	5	0	3	3	6	3	3	3	3	5	8	6	5	4	2	0
	Fri to Sat	0	0	0	0	0	0	0	0	6	6	4	3	6	3	2	2	2	5	7	6	5	4	2	0
	Sun	0	0	0	0	0	0	0	0	2	6	4	3	4	3	2	2	2	4	7	5	5	4	1	0
Home-based: Toaster	Mon to Thu	0	0	0	0	0	0	0	26	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	26	28	8	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	6	25	17	0	0	0	0	0	0	0	0	0	0	0	0	0
Home-based: Coffee machine	Mon to Thu	0	0	0	0	0	0	0	22	18	0	0	0	0	9	0	9	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	22	24	8	0	0	0	8	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	25	21	0	0	0	6	0	0	0	0	0	0	0	0	0
Home-based: Laptop (personal use)	Mon to Thu	10	0	0	0	0	0	0	35	70	80	80	80	85	70	70	70	70	85	90	90	90	85	40	15
	Fri to Sat	15	0	0	0	0	0	0	30	60	65	65	65	75	60	60	60	60	75	80	80	80	80	50	25
	Sun	15	0	0	0	0	0	0	0	25	50	55	55	55	45	45	45	45	70	85	85	85	75	35	10
Home-based: Games console	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	35	35	10	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	0	0	0	25	35	35	16	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	11	0	0	20	25	0	0	0
Home-based: Steam iron	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	0	0	0
Family: Oven	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	45	25	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	15	40	30	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	35	30	0	0	0	10	30	0	0	0	0	0
Family: Induction hob	Mon to Thu	0	0	0	0	0	0	0	5	0	0	0	0	7	0	0	0	0	15	45	30	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	10	0	0	20	5	0	0	0	15	40	30	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	15	5	0	30	20	0	0	0	0	35	20	0	0	0	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Appliance Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Family: Microwave	Mon to Thu	0	0	0	0	0	0	0	10	0	0	0	0	17	7	0	0	0	0	15	15	10	5	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	8	0	0	0	25	10	0	0	0	0	12	15	10	8	4	0
	Sun	0	0	0	0	0	0	0	0	0	8	0	0	15	10	0	0	0	0	15	12	10	5	0	0
Family: Air fryer	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	40	20	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	20	35	20	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	20	35	0	0	0	0	0
Family: Kettle	Mon to Thu	0	0	0	0	0	0	0	10	6	0	2	2	4	2	2	3	3	5	8	6	5	4	2	0
	Fri to Sat	0	0	0	0	0	0	0	0	8	8	5	4	6	4	3	3	3	5	7	6	5	4	2	0
	Sun	0	0	0	0	0	0	0	0	5	10	6	4	6	6	3	3	4	5	7	5	5	4	2	0
Family: Toaster	Mon to Thu	0	0	0	0	0	0	0	60	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	35	35	10	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	18	40	25	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Coffee machine	Mon to Thu	0	0	0	0	0	0	0	50	20	0	0	0	0	7	0	10	0	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	30	30	10	0	0	0	10	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	40	30	0	0	0	10	0	0	0	0	0	0	0	0	0
Family: Laptop (personal use)	Mon to Thu	10	0	0	0	0	0	10	91	85	55	55	55	55	55	55	83	88	94	99	98	96	92	58	28
	Fri to Sat	36	10	0	0	0	0	0	68	82	84	84	84	92	78	78	86	83	93	99	96	92	82	64	51
	Sun	28	0	0	0	0	0	0	0	72	91	93	93	97	97	87	87	87	99	100	99	99	94	58	19
Family: Steam iron	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	10	5	0	0	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	0	0	0
All households: Continuous: fridge freezer, router, standby	Mon to Thu	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Fri to Sat	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Sun	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Appliance Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
All households: Cordless vacuum charging	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	20	20	10	0	0	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	25	25	15	0	0	0	0	0	0	0	0	0	0
All households: Dishwasher	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	45	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	45	40	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	60	0	0	0
All households: Washer dryer: washing	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	40	25	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	35	40	25	0	0	0	0	0	0	10	10	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	40	45	35	20	0	0	0	0	0	0	0	0	0	0
All households: Washer dryer: drying	Mon to Thu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	40	25
	Fri to Sat	0	0	0	0	0	0	0	0	0	0	0	0	35	40	25	0	0	0	0	0	0	10	10	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	40	45	35	20	0	0	0	0	0	0	0	0
All households: Phone charging	Mon to Thu	100	70	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	70
	Fri to Sat	100	70	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	70
	Sun	100	70	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	70
All households: Hair dryer	Mon to Thu	0	0	0	0	0	0	25	55	15	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
	Fri to Sat	0	0	0	0	0	0	0	20	35	25	0	0	0	0	0	0	0	0	15	0	0	0	5	0
	Sun	0	0	0	0	0	0	0	0	25	45	25	0	0	0	0	0	0	0	0	0	0	0	5	0
TV: 1B Commuter	Mon to Thu	4	0	0	0	0	0	0	13	8	2	2	2	2	2	2	2	2	9	56	60	60	56	28	12
	Fri to Sat	16	0	0	0	0	0	0	8	9	17	17	17	17	14	14	14	14	22	44	40	40	40	32	24
	Sun	12	0	0	0	0	0	0	0	8	28	30	30	30	25	25	25	25	38	68	68	68	60	28	8
TV: 1B Hybrid	Mon to Thu	4	0	0	0	0	0	0	13	13	14	14	14	14	14	14	14	14	15	56	60	60	56	28	12
	Fri to Sat	16	0	0	0	0	0	0	8	9	33	33	33	33	30	30	30	14	22	44	40	40	40	32	24
	Sun	12	0	0	0	0	0	0	0	8	28	30	30	30	25	25	25	25	38	68	68	68	60	28	8

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Appliance Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
TV: 1B Home	Mon to Thu	8	0	0	0	0	0	0	10	21	24	24	24	26	21	21	21	21	26	72	72	72	68	32	12
	Fri to Sat	12	0	0	0	0	0	0	9	18	36	36	36	41	33	33	33	33	41	64	64	64	64	40	20
	Sun	12	0	0	0	0	0	0	0	8	28	30	30	30	25	25	25	25	38	68	68	68	60	28	8
TV: 2B Commuter	Mon to Thu	8	0	0	0	0	0	0	21	13	5	5	5	5	5	5	5	5	15	73	75	75	73	46	22
	Fri to Sat	29	0	0	0	0	0	0	13	15	28	28	28	28	24	24	24	24	35	64	60	60	60	51	41
	Sun	22	0	0	0	0	0	0	0	13	41	44	44	44	38	38	38	38	50	78	78	78	75	46	15
TV: 2B Hybrid	Mon to Thu	8	0	0	0	0	0	0	21	18	5	5	5	16	5	5	5	5	15	73	75	75	73	46	22
	Fri to Sat	29	0	0	0	0	0	0	13	15	28	28	28	40	24	24	24	24	35	64	60	60	60	51	41
	Sun	22	0	0	0	0	0	0	0	13	41	44	44	44	38	38	38	38	50	78	78	78	75	46	15
TV: 2B Home	Mon to Thu	4	0	0	0	0	0	0	29	29	27	26	26	29	27	25	27	27	30	79	76	78	78	49	19
	Fri to Sat	16	0	0	0	0	0	0	28	29	47	46	46	53	38	45	47	47	54	78	73	72	72	54	35
	Sun	12	0	0	0	0	0	0	28	29	50	50	50	53	49	47	49	49	55	79	78	78	77	46	15
TV: DX2B Family	Mon to Thu	8	0	0	0	0	0	0	25	23	16	16	16	16	16	16	21	23	26	78	78	76	73	46	22
	Fri to Sat	29	0	0	0	0	0	0	17	21	43	43	43	47	40	40	43	38	46	77	72	69	63	51	41
	Sun	22	0	0	0	0	0	0	0	18	47	48	48	51	50	44	44	44	53	80	79	79	75	46	15
TV: DX3B Family	Mon to Thu	8	0	0	0	0	0	0	27	26	16	16	16	16	16	16	25	26	28	80	79	77	74	46	22
	Fri to Sat	29	0	0	0	0	0	0	21	25	46	46	46	50	43	43	47	46	51	79	77	74	66	51	41
	Sun	22	0	0	0	0	0	0	0	22	50	51	51	53	54	48	48	48	54	80	80	79	75	46	15
TV: DX4B Family	Mon to Thu	8	0	0	0	0	0	0	28	27	17	17	17	17	17	17	27	28	29	80	79	77	74	46	22
	Fri to Sat	29	0	0	0	0	0	0	23	27	49	49	49	52	45	45	50	50	53	80	79	77	68	51	41
	Sun	22	0	0	0	0	0	0	0	24	52	53	53	54	55	50	50	50	55	80	80	79	75	46	15
Bedroom lamp, tablet, speaker (1B Commuter + 1 other)	Mon to Thu	0	0	0	0	0	0	5	15	5	0	0	0	0	0	0	0	0	5	5	5	5	5	15	5
	Fri to Sat	5	0	0	0	0	0	0	5	5	5	3	3	3	0	0	0	0	0	0	0	0	0	5	5
	Sun	0	0	0	0	0	0	0	0	0	10	5	5	5	5	5	5	5	0	5	5	5	5	15	5

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Appliance Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Home working: laptop and monitor (1B Hybrid + 3 others)	Mon to Thu	0	0	0	0	0	0	0	0	0	36	36	36	0	36	36	36	36	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	27	27	27	0	27	27	27	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Home working: laptop and monitor (1B Home)	Mon to Thu	0	0	0	0	0	0	0	0	0	32	32	32	0	28	28	28	28	0	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	26	26	26	0	24	24	24	24	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bedroom lamp, tablet, speaker (1B Home)	Mon to Thu	0	0	0	0	0	0	0	10	5	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
	Fri to Sat	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
	Sun	0	0	0	0	0	0	0	0	0	10	5	5	5	5	5	5	5	0	5	5	5	5	15	5
Bedroom lamp, tablet, speaker (2B Commuter + 4 others)	Mon to Thu	0	0	0	0	0	0	10	28	10	0	0	0	0	0	0	0	0	10	10	10	10	10	28	10
	Fri to Sat	10	0	0	0	0	0	0	10	10	10	6	6	6	0	0	0	0	0	0	0	0	0	10	10
	Sun	0	0	0	0	0	0	0	0	0	19	10	10	10	10	10	10	10	0	10	10	10	10	28	10
Home working: laptop and monitor (2B Hybrid)	Mon to Thu	0	0	0	0	0	0	0	0	0	40	40	40	0	40	40	40	40	20	0	0	0	0	0	0
	Fri to Sat	0	0	0	0	0	0	0	0	0	30	30	30	0	30	30	30	0	0	0	0	0	0	0	0
	Sun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bedroom lamp, tablet, speaker (2B Home)	Mon to Thu	0	0	0	0	0	0	10	24	5	0	0	0	0	0	0	0	0	5	5	24	5	5	24	5
	Fri to Sat	5	0	0	0	0	0	0	10	5	5	3	3	3	0	0	0	0	0	0	0	0	0	15	5
	Sun	0	0	0	0	0	0	0	0	0	10	5	5	5	5	5	5	5	0	5	5	5	5	24	5
Child: games console (DX2B Family + 5 others)	Mon to Thu	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	12	10	2	12	16	8	2	0
	Fri to Sat	0	0	0	0	0	0	0	2	4	6	6	6	0	6	6	8	12	10	2	10	16	16	6	2
	Sun	0	0	0	0	0	0	0	0	4	8	8	8	0	0	8	8	8	8	0	12	16	8	2	0
Child: laptop, tablet, phone (DX2B Family + 5 others)	Mon to Thu	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	10	30	25	5	30	40	20	5	0
	Fri to Sat	0	0	0	0	0	0	0	5	10	15	15	15	0	15	15	20	30	25	5	25	40	40	15	5
	Sun	0	0	0	0	0	0	0	0	10	20	20	20	0	0	20	20	20	20	0	30	40	20	5	0

Values are the percentage of the maximum (modulating value × 100) for each hour beginning at the time shown.

Appendix B: Hot Water Draw Profiles

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1B Commuter (45 l/day)	Mon to Thu	0.1	0.0	0.0	0.0	0.0	0.0	9.0	15.8	3.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.7	3.4	1.7	1.7	4.5	6.7	2.1
	Fri to Sat	0.5	0.1	0.0	0.0	0.0	0.0	0.0	6.5	6.6	3.6	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.9	3.0	1.1	1.1	1.1	3.9	0.7
	Sun	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	10.0	1.3	1.3	1.3	1.0	1.0	1.0	1.0	1.6	1.9	1.9	1.9	7.6	6.7	0.2
1B Hybrid (45 l/day)	Mon to Thu	0.1	0.0	0.0	0.0	0.0	0.0	8.6	15.0	5.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	2.8	1.2	1.2	4.0	6.3	1.9
	Fri to Sat	0.3	0.1	0.0	0.0	0.0	0.0	0.0	6.1	6.2	3.8	0.9	0.9	0.9	0.9	0.9	0.9	0.4	0.6	2.6	0.8	0.8	0.8	3.5	0.5
	Sun	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	9.3	0.9	0.9	0.9	0.7	0.7	0.7	0.7	1.1	1.3	1.3	1.3	6.9	6.3	0.2
1B Home (45 l/day)	Mon to Thu	0.1	0.0	0.0	0.0	0.0	0.0	7.2	11.3	8.1	1.0	1.0	1.0	1.0	0.8	0.8	0.8	0.8	1.0	1.1	1.1	1.1	4.6	7.7	0.2
	Fri to Sat	0.2	0.0	0.0	0.0	0.0	0.0	0.0	7.6	8.0	0.8	0.8	0.8	0.9	0.7	0.7	0.7	0.7	0.9	1.0	1.0	1.0	1.0	7.8	0.3
	Sun	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	11.5	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.8	1.0	1.0	1.0	8.1	7.7	0.1
2B Commuter (64 l/day)	Mon to Thu	0.2	0.0	0.0	0.0	0.0	0.0	12.6	22.2	5.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	1.0	4.7	2.4	2.4	6.4	9.4	3.0
	Fri to Sat	0.6	0.2	0.0	0.0	0.0	0.0	0.0	9.1	9.3	5.1	1.0	1.0	1.0	0.8	0.8	0.8	0.8	1.3	4.3	1.6	1.6	1.6	5.4	1.0
	Sun	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	14.1	1.8	1.8	1.8	1.4	1.4	1.4	1.4	2.2	2.7	2.7	2.7	10.7	9.4	0.3
2B Hybrid (64 l/day)	Mon to Thu	0.2	0.0	0.0	0.0	0.0	0.0	12.4	21.8	6.4	0.2	0.2	0.2	0.9	0.2	0.2	0.2	0.2	0.9	4.6	2.3	2.3	6.3	9.3	2.9
	Fri to Sat	0.6	0.2	0.0	0.0	0.0	0.0	0.0	8.9	9.1	5.0	0.9	0.9	1.4	0.8	0.8	0.8	0.8	1.2	4.2	1.5	1.5	1.5	5.3	0.9
	Sun	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	13.8	1.7	1.7	1.7	1.4	1.4	1.4	1.4	2.2	2.6	2.6	2.6	10.5	9.3	0.3

Values are litres per hour per dwelling at 60 °C for each hour beginning at the time shown.

Appendix B: Hot Water Draw Profiles Cont.

CWC

Profile	Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2B Home (82 l/day)	Mon to Thu	0.0	0.0	0.0	0.0	0.0	0.0	13.5	24.1	5.5	1.3	1.2	1.2	1.7	1.1	1.2	1.4	1.4	2.0	16.2	1.5	1.6	3.4	8.1	1.4
	Fri to Sat	0.2	0.0	0.0	0.0	0.0	0.0	6.1	16.4	7.4	3.2	1.3	1.3	1.7	0.9	1.2	1.3	1.3	2.0	16.1	1.3	1.3	1.3	6.4	0.5
	Sun	0.1	0.0	0.0	0.0	0.0	0.0	8.0	14.4	5.6	7.1	1.5	1.5	1.8	1.3	1.4	1.5	1.5	2.4	15.3	1.7	1.6	5.2	8.1	0.2
DX2B Family (82 l/day)	Mon to Thu	0.1	0.0	0.0	0.0	0.0	0.0	11.4	26.2	8.2	0.8	0.8	0.8	0.8	0.8	0.8	1.2	1.4	1.8	8.8	6.3	4.0	5.6	8.4	2.6
	Fri to Sat	0.5	0.1	0.0	0.0	0.0	0.0	0.0	12.3	12.6	5.2	1.5	1.5	1.7	1.3	1.3	1.5	1.2	1.7	8.4	5.8	3.7	1.5	4.8	0.8
	Sun	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.3	13.1	1.9	1.9	2.2	2.0	1.6	1.6	1.6	2.5	7.0	8.5	2.4	9.4	8.4	0.3
DX3B Family (101 l/day)	Mon to Thu	0.1	0.0	0.0	0.0	0.0	0.0	10.9	31.0	10.1	0.8	0.8	0.8	0.8	0.8	0.8	1.7	2.0	2.5	13.0	10.3	6.0	5.5	8.1	2.5
	Fri to Sat	0.5	0.1	0.0	0.0	0.0	0.0	0.0	15.6	16.1	5.3	1.8	1.8	2.3	1.5	1.5	1.9	1.8	2.4	12.7	9.9	6.0	1.6	4.6	0.8
	Sun	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.7	13.0	2.4	2.4	2.9	2.9	2.0	2.0	2.0	3.3	11.4	14.2	2.6	9.1	8.1	0.3
DX4B Family (119 l/day)	Mon to Thu	0.1	0.0	0.0	0.0	0.0	0.0	10.6	35.8	12.1	0.8	0.8	0.8	0.8	0.8	0.8	2.2	2.6	3.2	17.0	14.1	7.8	5.4	7.8	2.5
	Fri to Sat	0.5	0.1	0.0	0.0	0.0	0.0	0.0	18.9	19.6	5.5	2.0	2.0	2.8	1.7	1.7	2.3	2.3	3.0	16.9	13.9	8.1	1.8	4.5	0.7
	Sun	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.1	13.2	2.8	2.8	3.6	3.7	2.4	2.4	2.4	4.0	15.7	19.6	2.8	8.8	7.8	0.2

Values are litres per hour per dwelling at 60 °C for each hour beginning at the time shown.

CWC

Appendix C: References

Appendix C: References

- CIBSE TM54:2022 Evaluating operational energy use at the design stage.
- CIBSE Guide A (2015) Environmental design: Table 1.5, Table 5.10 and chapter 6.
- CIBSE TM59 (2017) Design methodology for the assessment of overheating risk in homes.
- CIBSE Guide G (2014) Table 2.11; BSRIA BG 85/2024 Rules of Thumb.
- Energy Saving Trust (2008) Measurement of domestic hot water consumption in dwellings; SAP 2012 Appendix J.
- Household Electricity Survey: Powering the Nation 2; English Housing Survey energy use data.
- NABERS UK Guide to Design for Performance, Appendix A.4.
- Approved Documents F, G, L and O (2021 editions, England).
- GMCA Places for Everyone policy JP-S2 and Net Zero Buildings guidance (March 2025).
- Kers Weatherby product specification sheet; Vent-Axia Sentinel Econiq data (SAP PCDB).