

MIKA KIM

“WATTS PER PERSON” PARADIGM TO
DESIGN NET ZERO ENERGY BUILDINGS

Examining Technology Interventions
Integrated with Behavioral Modifications to
Reduce Plug Loads in Commercial Buildings



HYPOTHESES

1: Technology to Reduce Energy

Implementation of PL Control Devices will
Reduce PL Energy Use

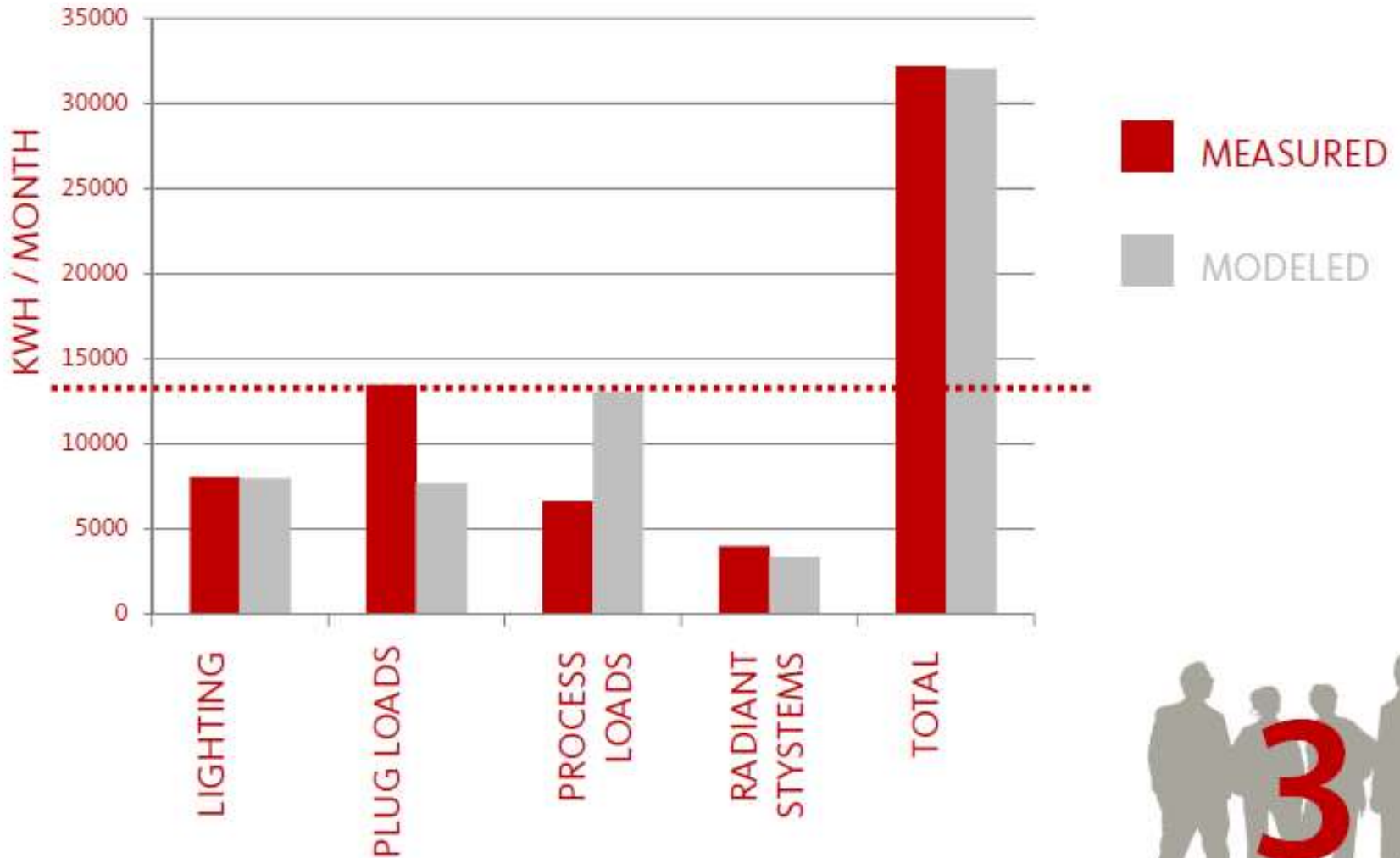
2: Feedback to Influence Behavior

When Given the Objective to Reduce PL
Energy Use, Occupants Given Feedback on
PL Energy Footprint Reduces More PL Use
than Occupants Without Feedback

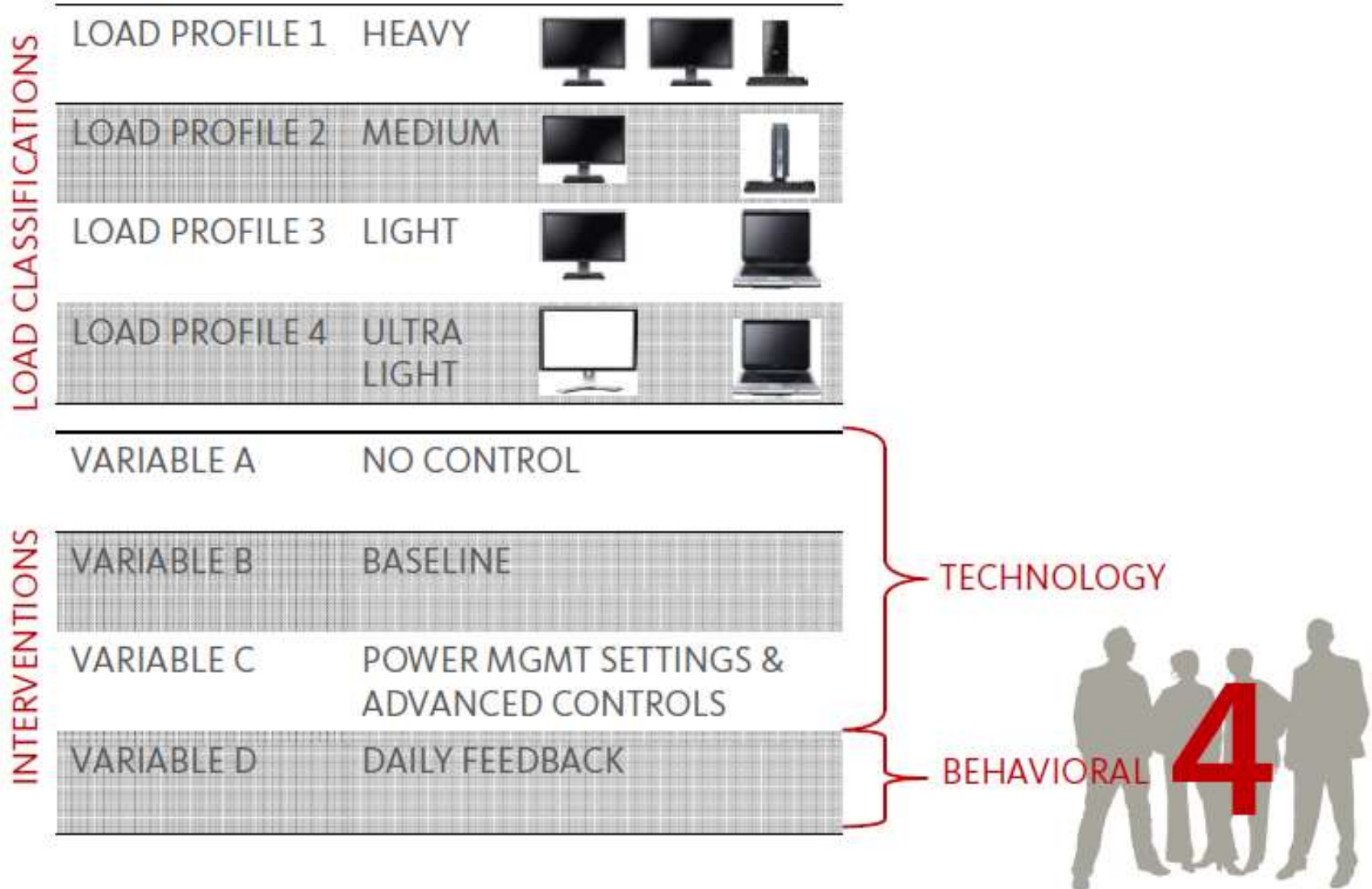
*Excludes Rewards Structure for Conducting the Study



BACKGROUND RESEARCH

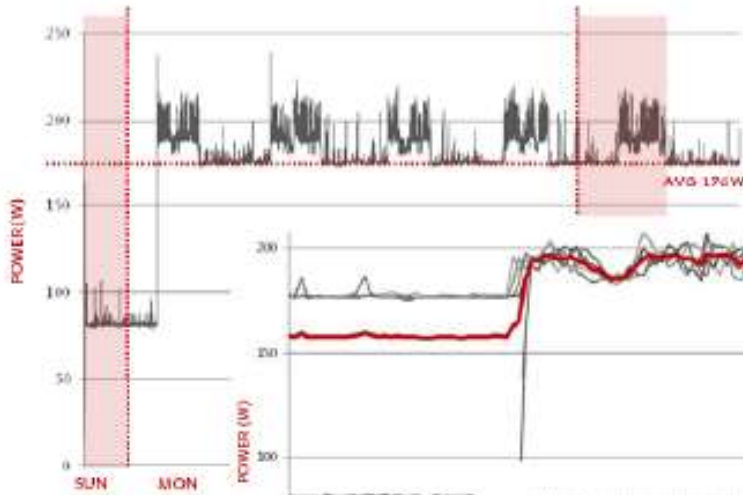


METHODOLOGY

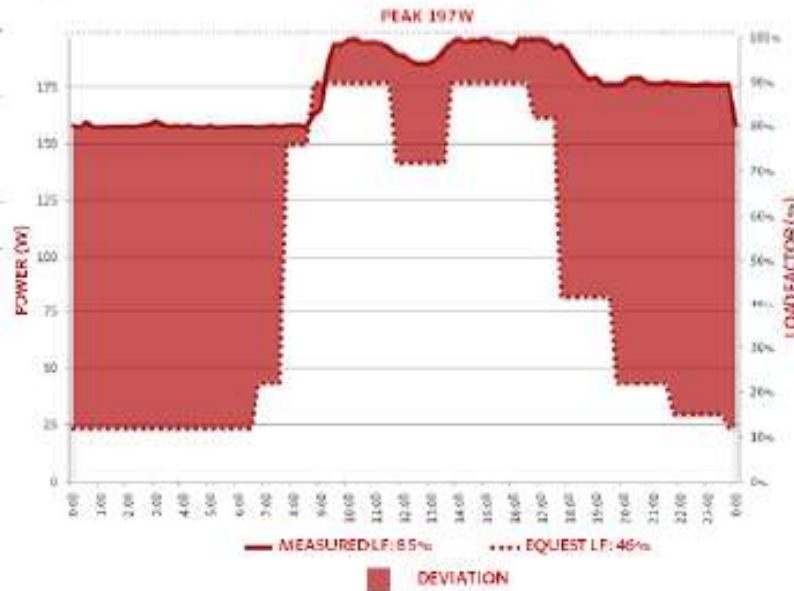
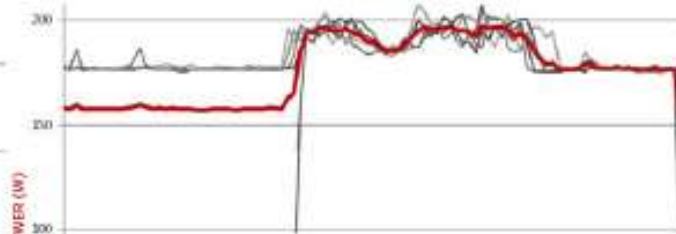


PROCESS

WEEK ANALYSIS



DAILY ANALYSIS (WEEKDAYS)

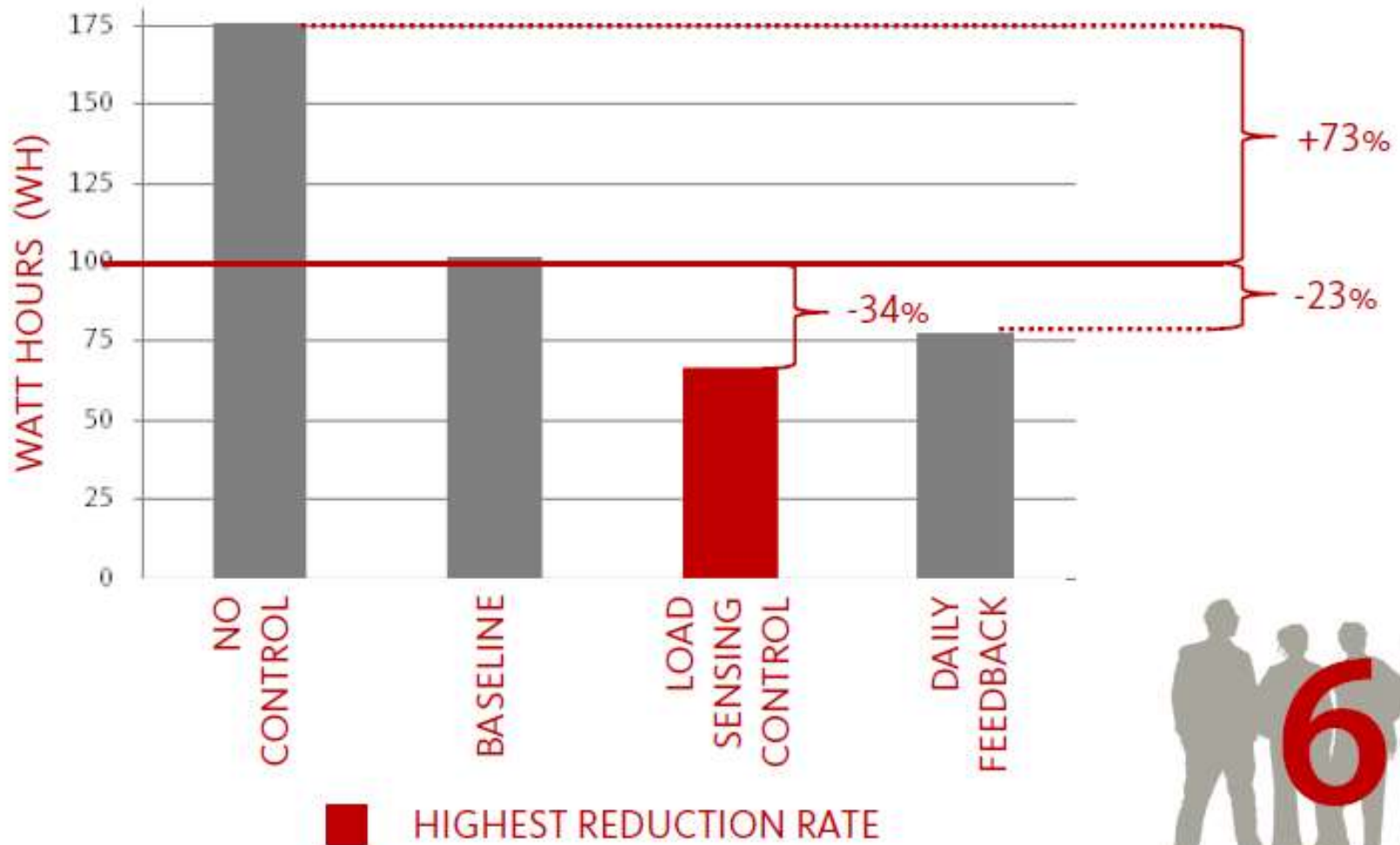


AVG DAILY &
STD LOAD PROFILE
COMPARATIVE
ANALYSIS



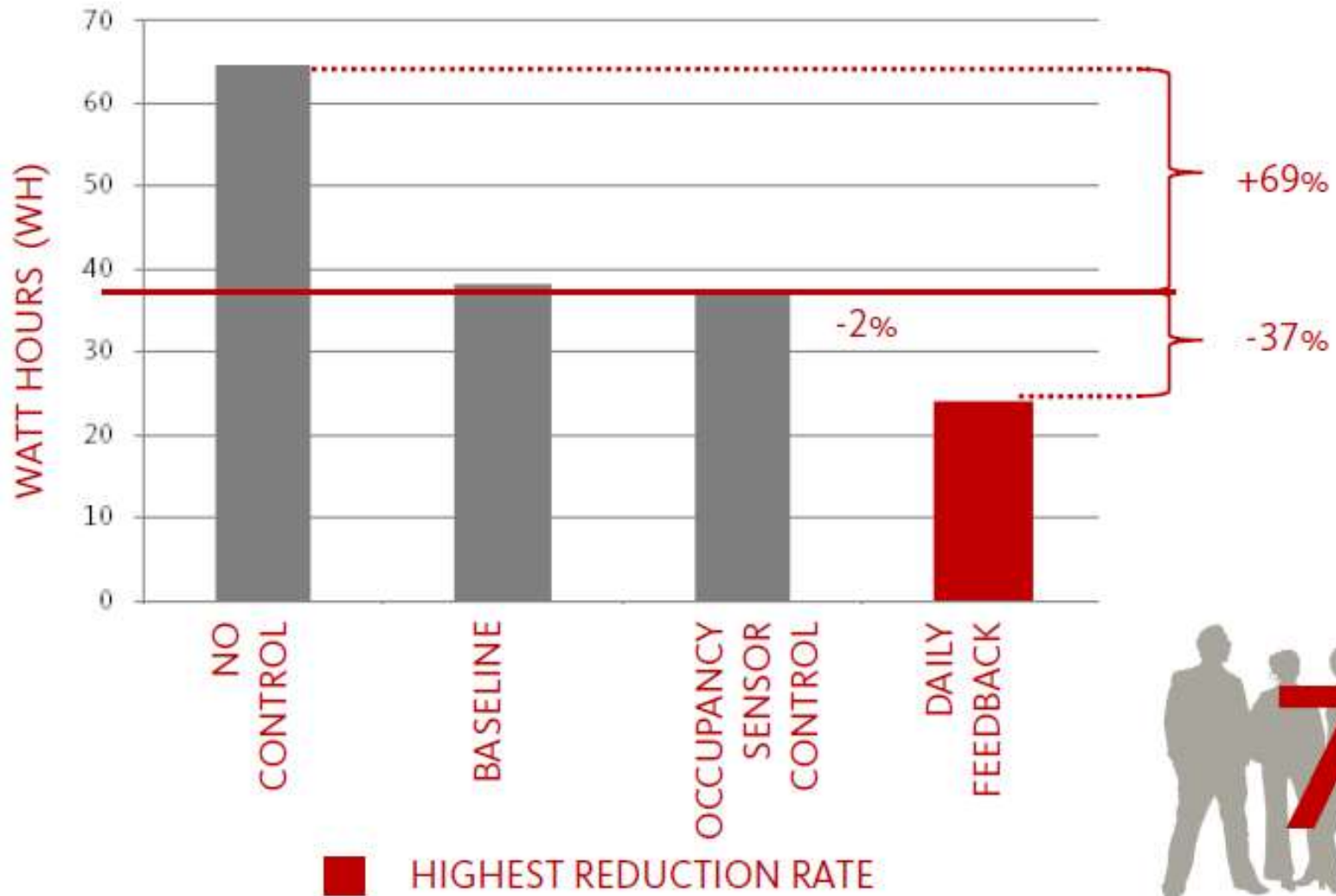
HEAVY LOAD PROFILE

LOAD PROFILE 1 & VARIABLE A, B, C & D



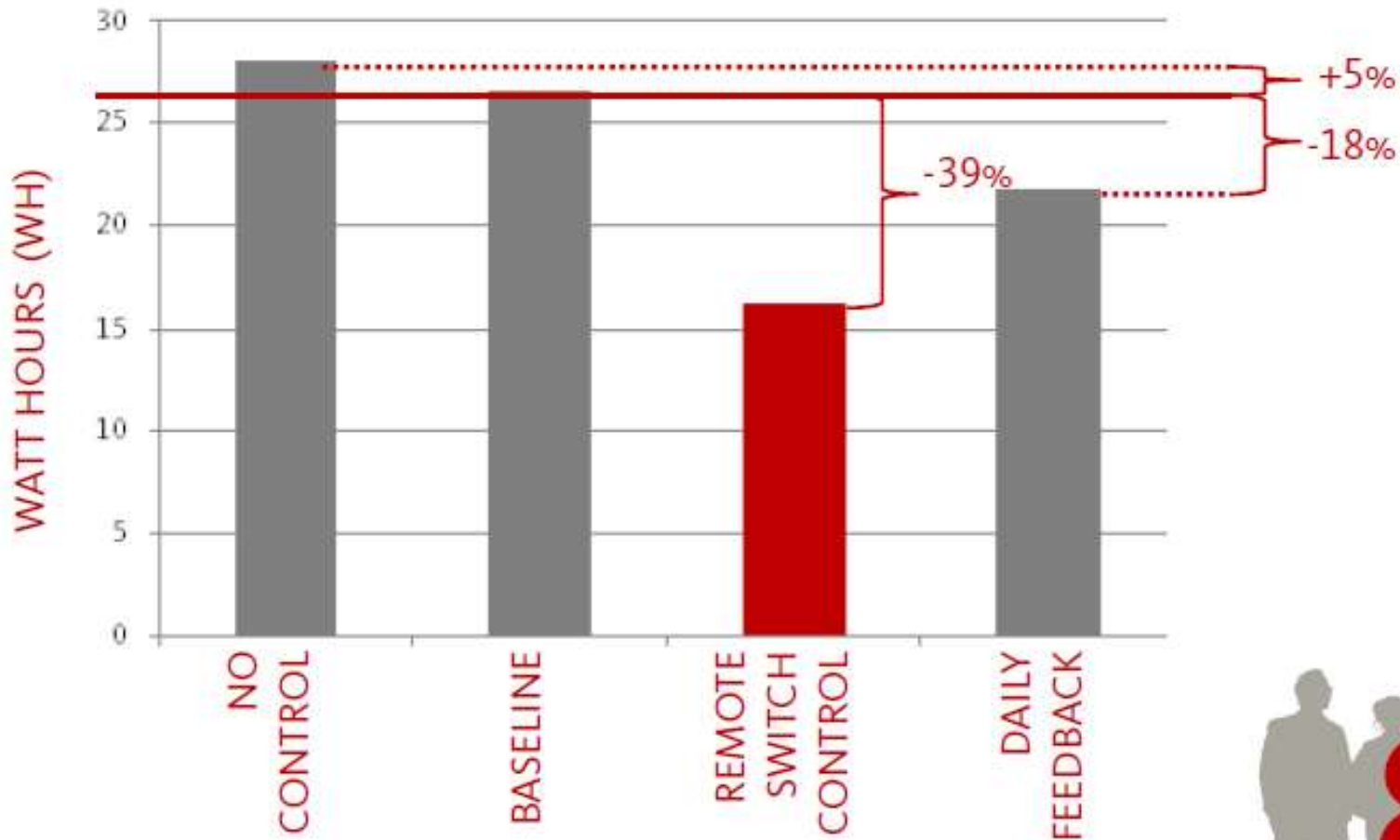
MEDIUM LOAD PROFILE

LOAD PROFILE 2 & VARIABLE A, B, C & D



LIGHT LOAD PROFILE

LOAD PROFILE 3 & VARIABLE A, B, C & D

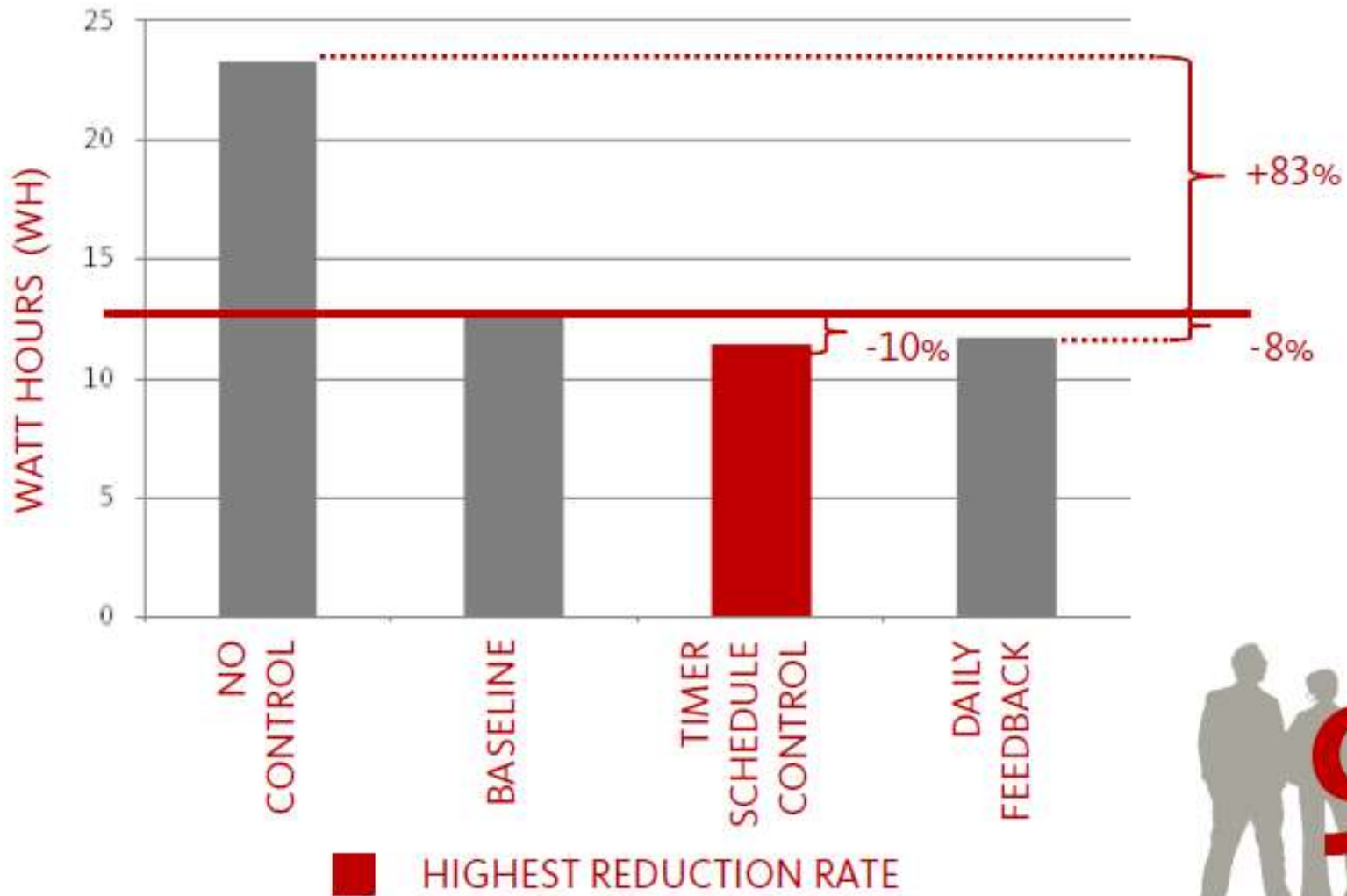


 HIGHEST REDUCTION RATE

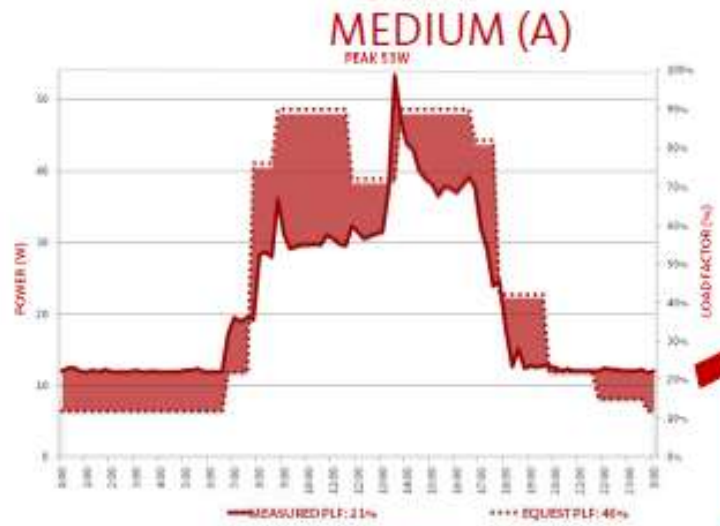
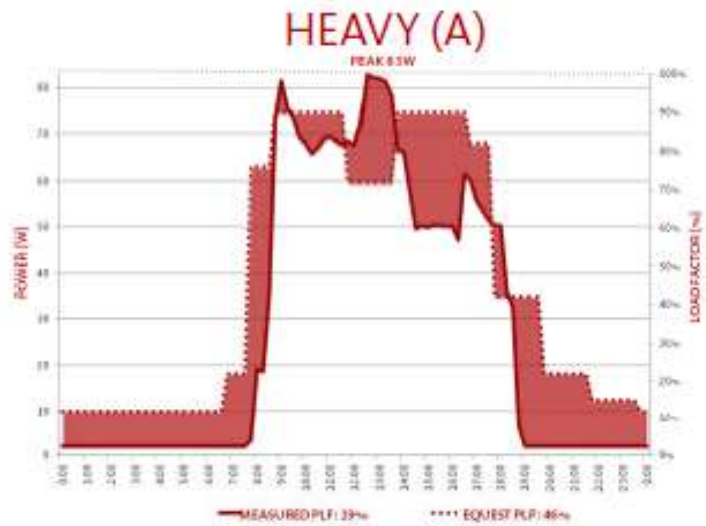
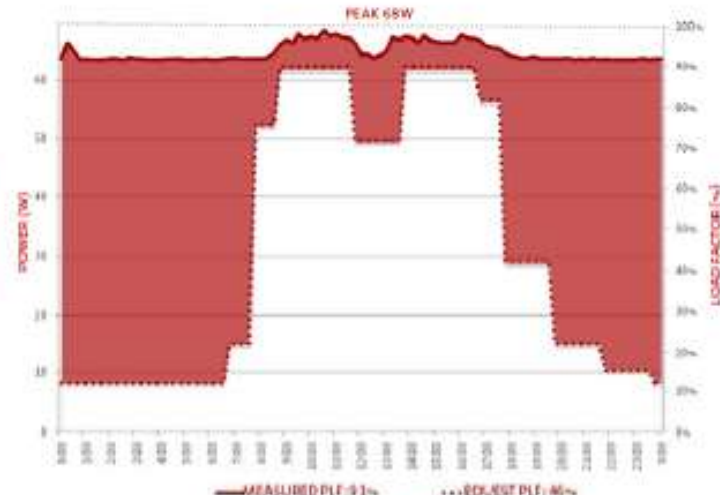
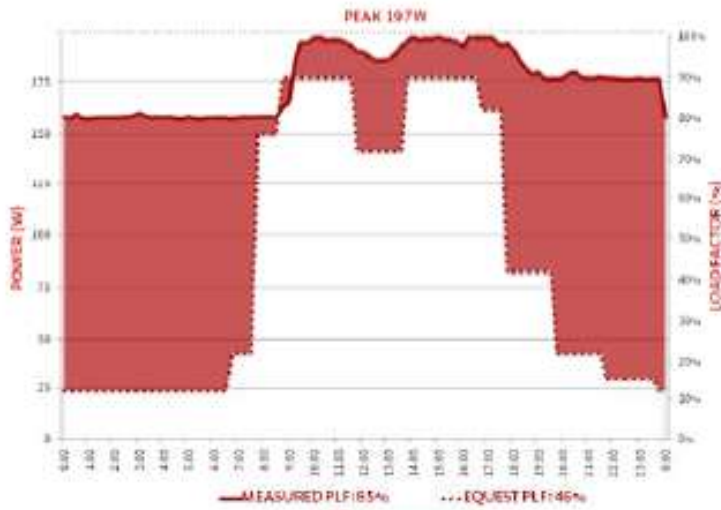


ULTRA LIGHTLOAD PROFILE

LOAD PROFILE 2 & VARIABLE A, B, C & D



RESULTS LOAD PROFILE 1, 2, 3 & 4 / VARIABLE A

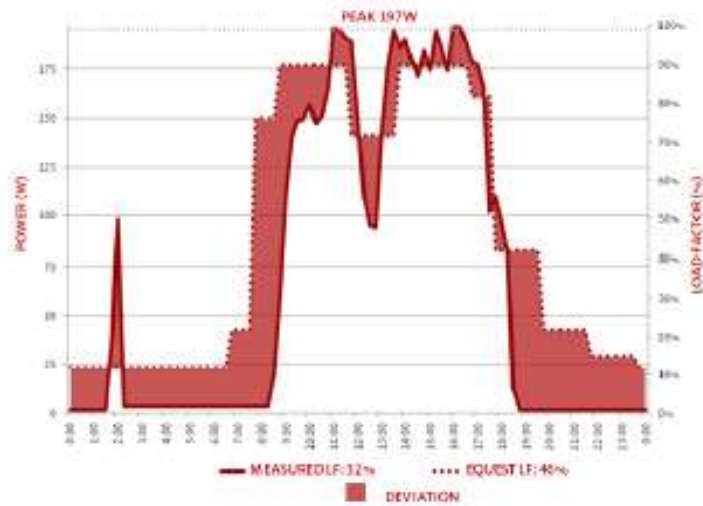


LIGHT (A)

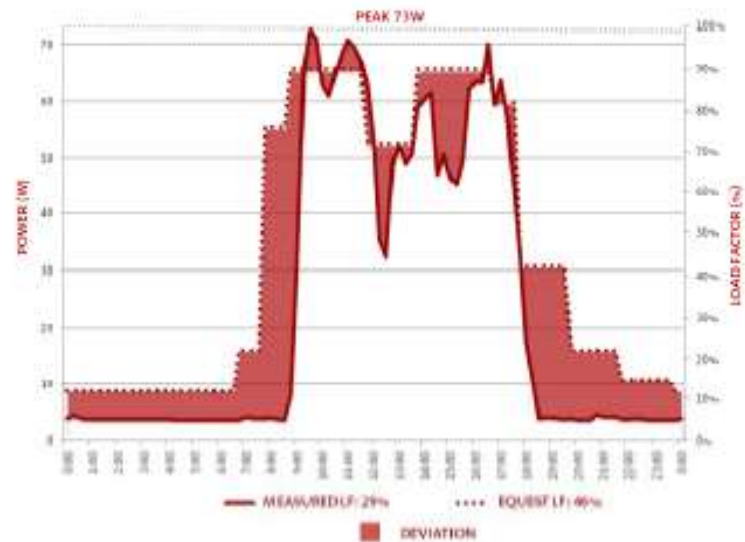
ULTRA LIGHT(A)



RESULTS LOAD PROFILE 1, 2, 3 & 4 / VARIABLE C & D



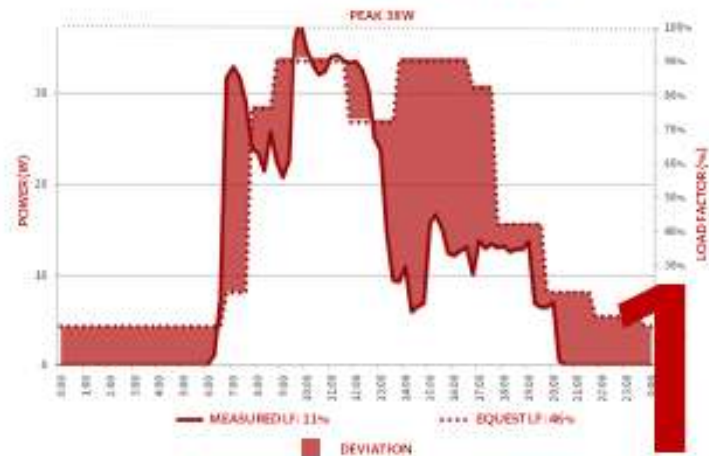
HEAVY (C)



MEDIUM (D)



LIGHT (C)

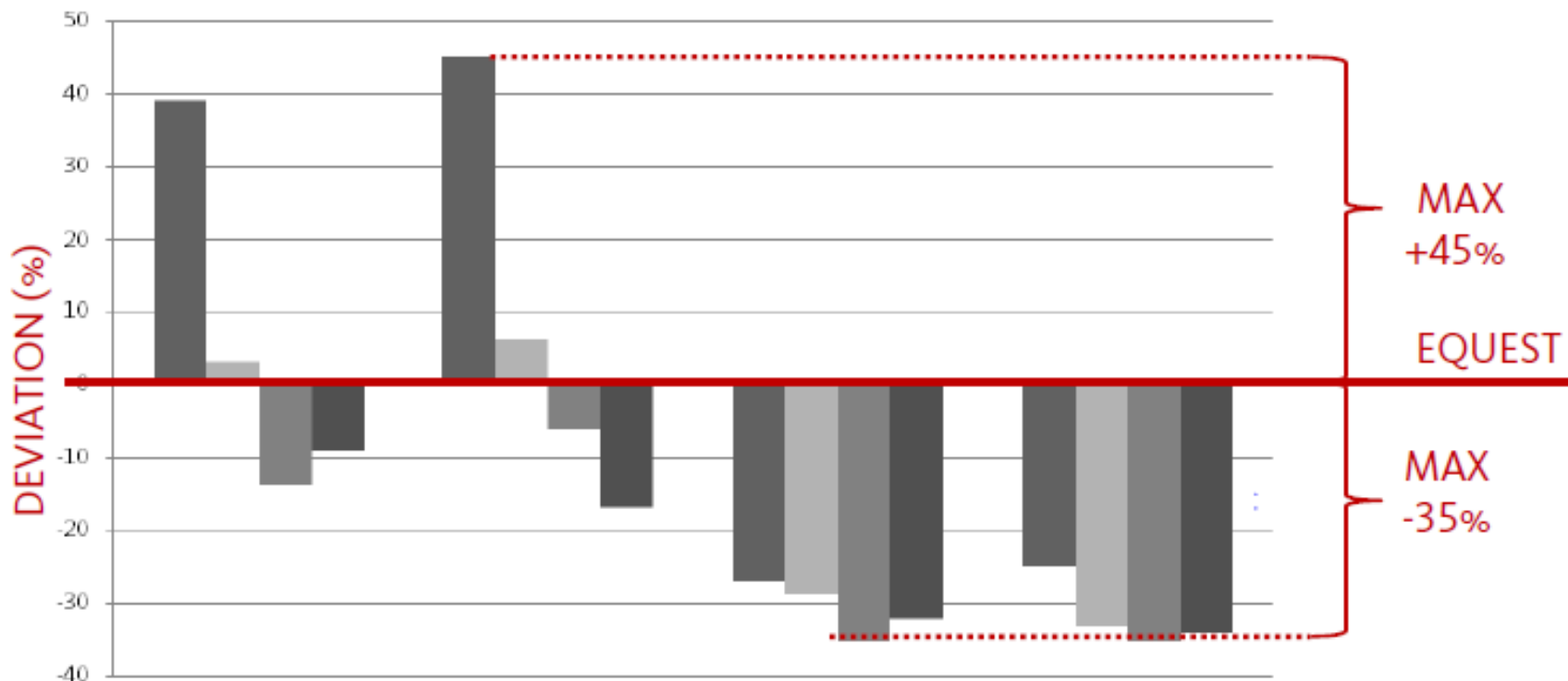


ULTRA LIGHT (C)



KEY FINDINGS (PART 1 OF 4)

LOAD PROFILE 1, 2, 3 & 4 WITH VARIABLE A, B, C & D



HEAVY

MEDIUM

LIGHT

ULTRA LIGHT

NO CONTROL

BASELINE

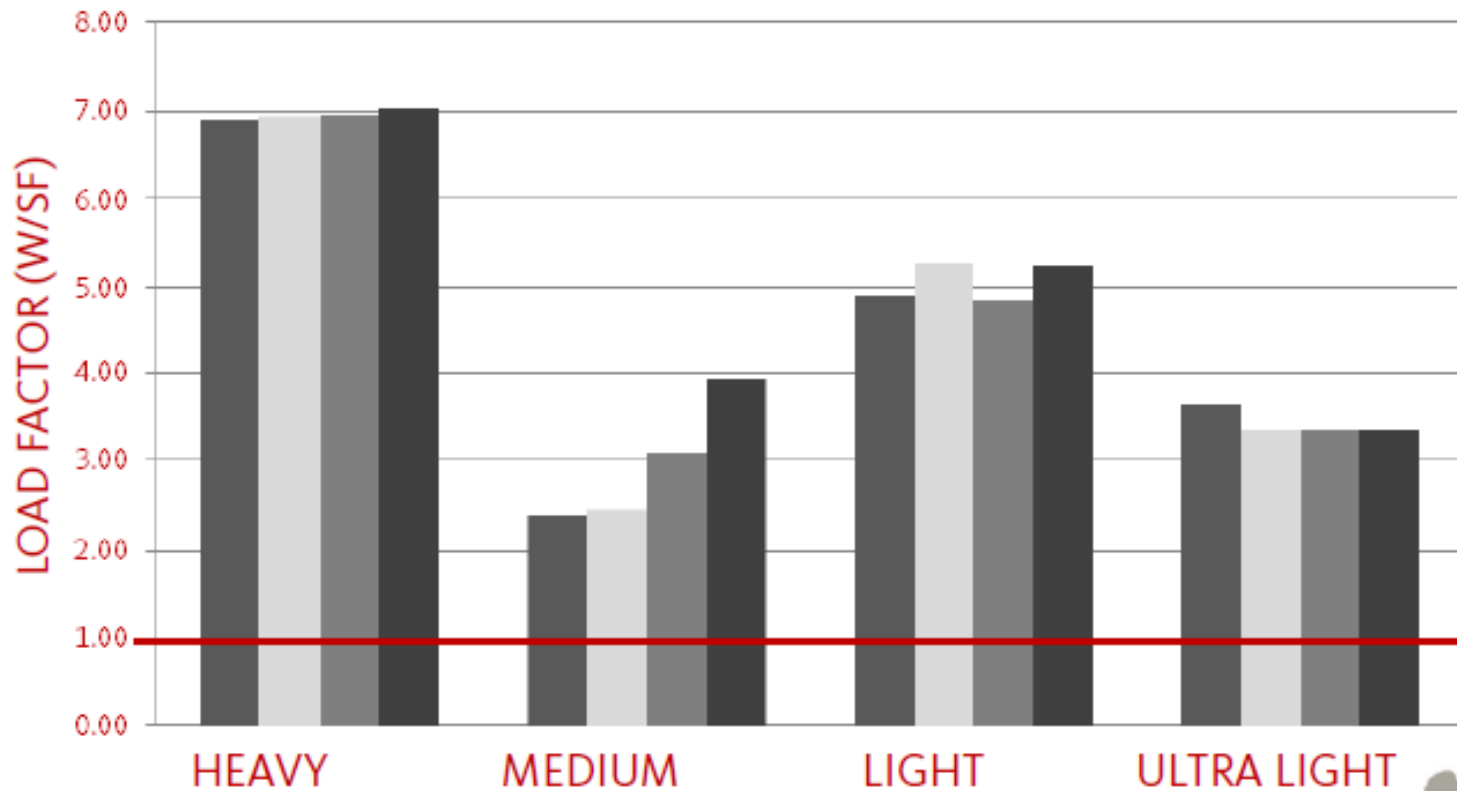
CONTROL

DAILY
FEEDBACK



KEY FINDINGS (PART 2 OF 4)

LOAD FACTOR ANALYSIS



■ NO CONTROL ■ BASELINE ■ CONTROL ■ DAILY FEEDBACK



KEY FINDINGS (PART 3 OF 4)

W/PERSON ANALYSIS

	POOR	STANDARD	HIGH PERFORMANCE	BEST
	190+	190	100	60
HEAVY	102+	102	78	67
MEDIUM	38+	38	37	34
LIGHT	27+	27	22	16
ULTRA LIGHT	13+	13	12	11

WATTS/PERSON



KEY FINDINGS (PART 4 OF 4)

ARCHITECTS/ DESIGNERS	USE OF W/PERSON APPROACH CAN HELP TO UNDERSTAND PL EFFICIENCY
ENGINEERS/ ENERGY MODELERS	TYPICAL OFFICE EQUIPMENT LOAD PROFILES ARE SUITED FOR ESTIMATING DESKTOP COMPUTERS
BUILDING OWNERS/ TENANTS	REPLACING DESKTOP COMPUTERS WITH LAPTOP S CAN REDUCE UP TO 150 W/PERSON
UTILITY COMPANIES	FOR INCENTIVES/REBATES, EXPAND PL CONTROLS BEYOND OCCUPANCY SENSOR TYPES
RESEARCHERS	USE AVERAGE 15 MIN INTERVALS WHEN METERING DEVICES
ALL	NOT ALL ADVANCED CONTROLS ARE APPROPRIATE FOR ALL DEVICES

