

Architecture as Gamechanger



Dr Judit Kimpian
Architects' Council of Europe



**SUSTAINABLE
ENERGY WEEK**

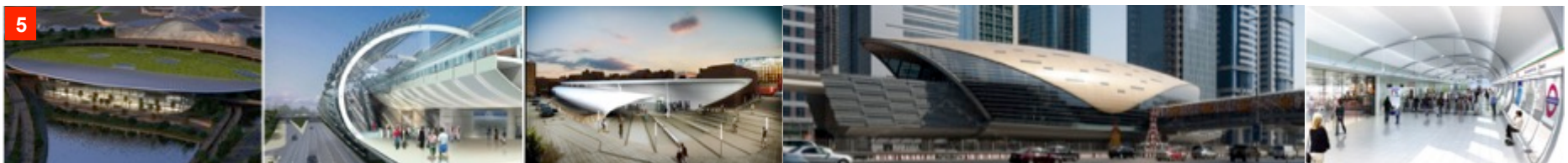
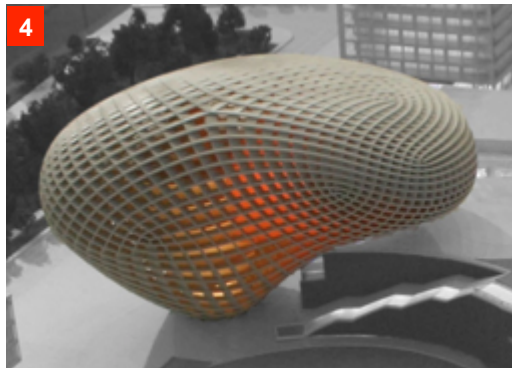
An initiative
of the



European
Commission

AHR R&D PROJECTS

1. AL BAHR TOWERS
2. KARACHI PORT TRUST TOWERS
3. TORONTO METRO
4. MASDAR CONFERENCE HALL
5. DUBAI METRO +



AHR INNOVATE UK BUILDING PERFORMANCE EVALUATIONS



ENERGY PERFORMANCE GAP | DATA AUDIT

BRUKL Output Document Compliance with England and Wales Building Regulations Part L

Project name
Loxford School As designed
 Date: Fri Jul 03 12:29:56 2009

Administrative information

Building details
 Address: Loxford Lane, Wford, IG1 2UT

Certification tool
 Calculation engine: Apache
 Calculation engine version: "5.9.0"
 Interface to calculation engine: IES Virtual Environment
 Interface to calculation engine version: 5.9.0
 BRUKL compliance check version: v3.1.a

Occupier details
 Name: Loxford School of Science and Technology
 Telephone number:
 Address: Loxford Lane, Wford, IG1 2UT

Certifier details
 Name: Max Fortham LLP
 Telephone number: 0207 267 5161
 Address: 4243 Gloucester Crescent, London, SW8 1TG

Criterion 1: Predicted CO2 emission from proposed building does not exceed the target

1.1	Calculated CO2 emission rate from notional building	28.8 kgCO2/m2 annum
1.2	Improvement factor	0.16
1.3	LZC benchmark	0.1
1.4	Target CO2 Emission Rate (TER)	21.6 kgCO2/m2 annum
1.5	Building CO2 Emission Rate (BER)	18.5 kgCO2/m2 annum
1.6	Are emissions from building less than or equal to the target?	BER <= TER
1.7	Are as built details the same as used in BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services systems should be no worse than the design limits

2.1 Are the U-values better than the design limits? **Better than design limits**

Element	U _{lim}	U _{max}	U _{min}	U _{max}	Surface where this maximum value occurs
Wglp**	0.35	0.35	0.7	0.35	ROOM0000 Surf(E)
Floor	0.25	0.25	0.7	0.25	ROOM0000 Surf(B)
Roof	0.25	0.25	0.35	0.25	ROOM0000 Surf(T)
Windows**†, roof windows, and rooflights	2.2	2.15	3.3	2.18	ROOM0001 Surf(E)
Personnel doors	2.2	0	3	0	No Personnel doors in building
Vehicle access & similar large doors	1.5	0	4	0	No Vehicle access doors in building
High usage entrance doors	6	0	6	0	No High usage entrance doors in building

U_{lim} = Limiting area-weighted average U-value [W/m2K]
 U_{max} = Calculated area-weighted average U-value [W/m2K]
 U_{min} = Limiting individual element U-value [W/m2K]
 U_{max} = Calculated individual element U-values [W/m2K]

* There might be more than one surface exceeding the limiting standards.
 ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standards are similar to those for windows.
 *** Display windows and similar glazing are not required to meet the standard given in this table.

Energy Performance Certificate Non-Domestic Building

Loxford School of Science & Technology
 Loxford Lane
 ILFORD
 IG1 2UT

Certificate Reference Number:
 0270-5964-0390-0480-0034

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information on the Government's website: www.communities.gov.uk/epbc.

Energy Performance Asset Rating



Technical information

Main heating fuel: Grid Supplied Electricity
 Building environment: Heating and Natural Ventilation
 Total useful floor area (m²): 15560.369
 Building complexity (NOS level): 5
 Building emission rate (kgCO₂/m²): 13.00

Benchmarks

Buildings similar to this one could have ratings as follows:
 46 if newly built
 80 if typical of the existing stock

Display Energy Certificate How efficiently is this building being used?

Loxford School of Science & Technology
 Loxford School of Science & Technology
 Loxford Lane
 ILFORD
 IG1 2UT

Certificate Reference Number:
 9503-1089-0699-0090-8495

This certificate indicates how much energy is being used to operate the building. The operational rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret the information on the Government's website: www.communities.gov.uk/dec.

Energy Performance Operational Rating



Previous Operational Ratings



Administrative information

This is a Display Energy Certificate as defined in SI 2007/681 as amended.

Assessment Software: DCLG, ORCAL v3.8.1
 Property Reference: 0364/00000
 EPC/Label Number: EPC/000000
 Assessor Name: LCE/000000
 Accreditation Scheme: GBCS Certification Limited
 Employer/Trading Name: ANSOL INDUSTRIES LTD
 Employer/Trading Address: 5-8 Highways Street, London, EC1R 6HG
 Issue Date: 28-11-2011
 Revalidation Date: 28-11-2011
 Valid Until: 27-11-2012
 Related Party Disclosure: Not related to the assessor
 Recommendations for improving the energy efficiency of the building are contained in the accompanying Advisory Report.

	Heating	Cooling
Annual Energy Use (kWh/m ² /year)	106	75
Typical Energy Use (kWh/m ² /year)	100	42
Energy from renewables	0%	0%

BRUKL

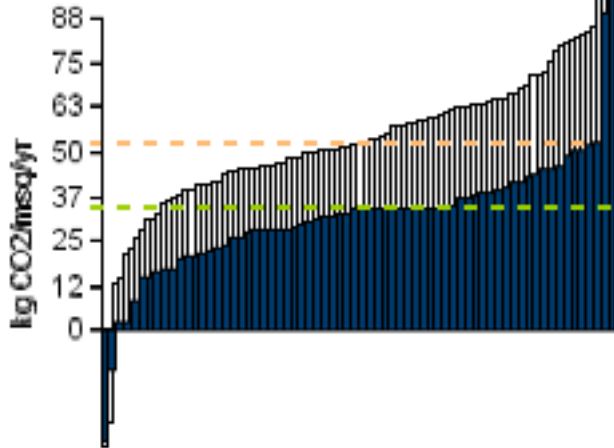
EPC

DEC

SECTOR BY SECTOR DATA | CALCULATED VS ACHIEVED PERFORMANCE



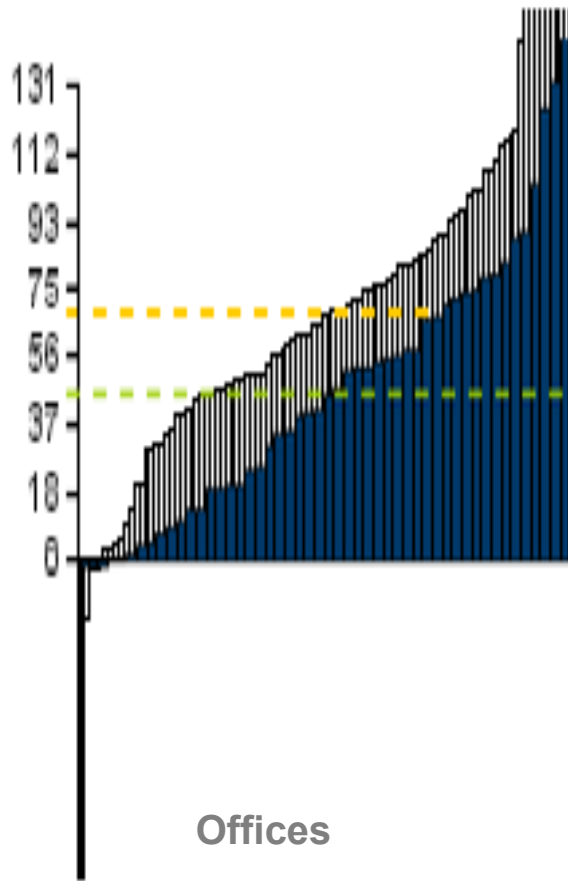
█ Calculated
▭ Actual



Schools

Heat: 1.48

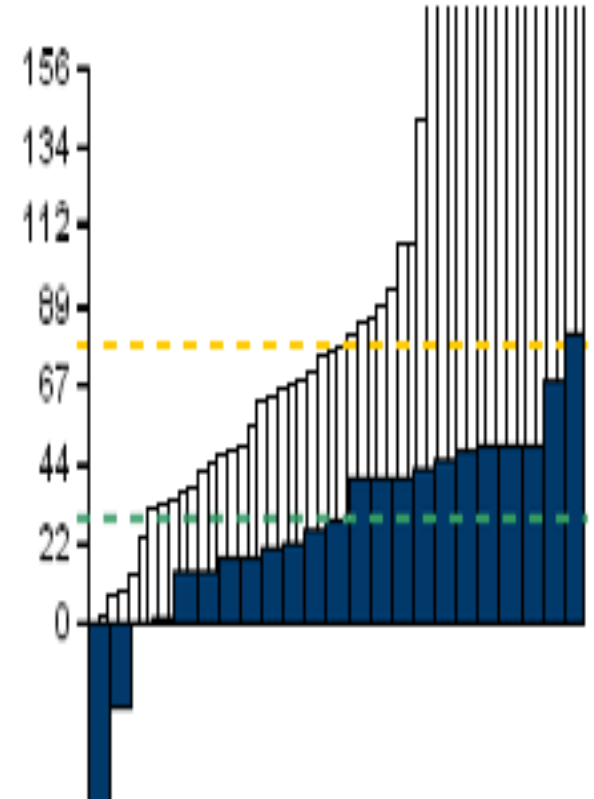
Electricity: 1.9



Offices

Heat: 1.59

Electricity: 1.71

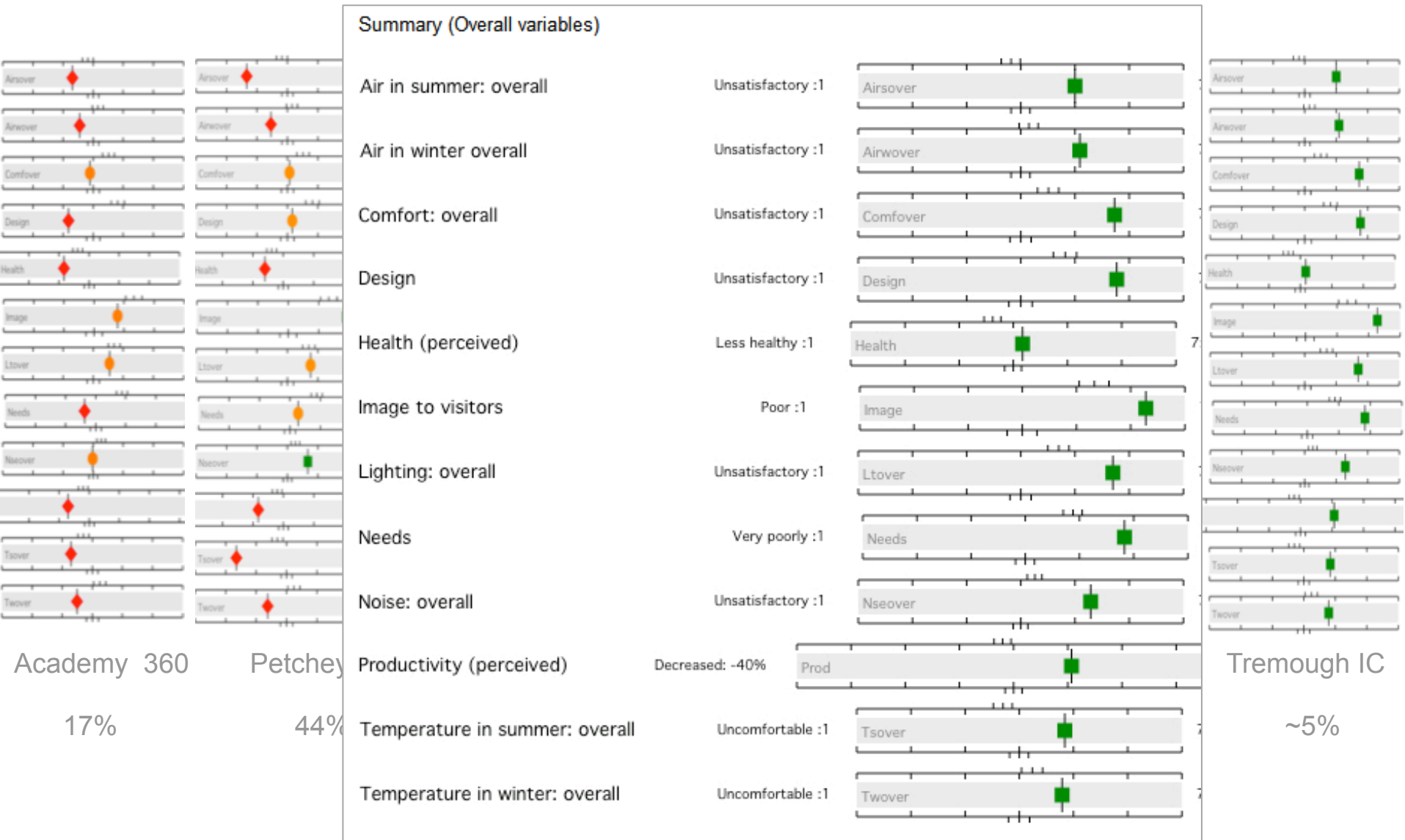


Universities

Heat: 1.2

Electricity: 2.3

FEEDBACK ON COMFORT | IMPACT OF ARCHITECTURE



THE 'THREE PILLARS' OF BUILDING PERFORMANCE



= ENERGY & RESOURCE USED + MEASURED IEQ + OCCUPANT EXPERIENCE



COSTS AND RISKS ASSOCIATED WITH THE PERFORMANCE GAP

Capital cost of unused/underutilised equipment: Metering, BMS, sensors and controls, AHU inverters, actuators, LZCs, etc. can amount to 2-5% of capital cost

Misplaced value engineering: fabric performance and air-tightness, all openings, floor to floor heights, thermal mass, entrance lobbies, seasonal commissioning, daylighting, controls, training, manuals & log book – compliance or architecture?

Increased management, maintenance and energy costs: between 15-44% of total annual energy costs could be saved amounting to potentially tens of thousands of pounds per year

Mitigation costs: ~ 50% of annual energy costs – Soft Landings with energy disclosure approximately 0.1% of construction budget

Profit loss of consultants and contractors

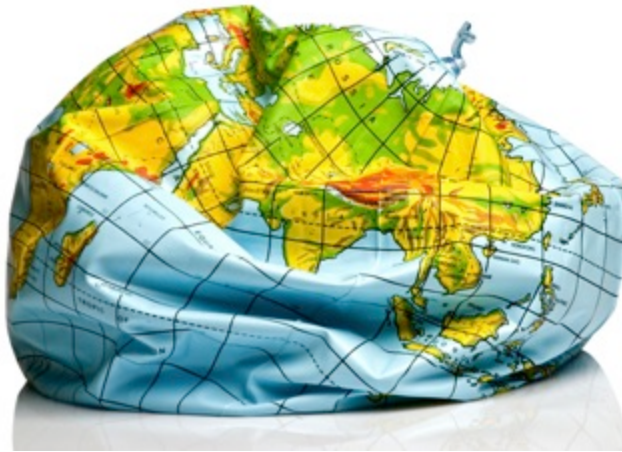
Productivity loss for occupiers and FM

Policy change is needed to encourage disclosure – reinforce DEC

THE END GAME



Health & comfort



Climate change
resilience



Life cycle cost
& value

ENHANCED ENVIRONMENT

Circular use of resources



Energy



Water

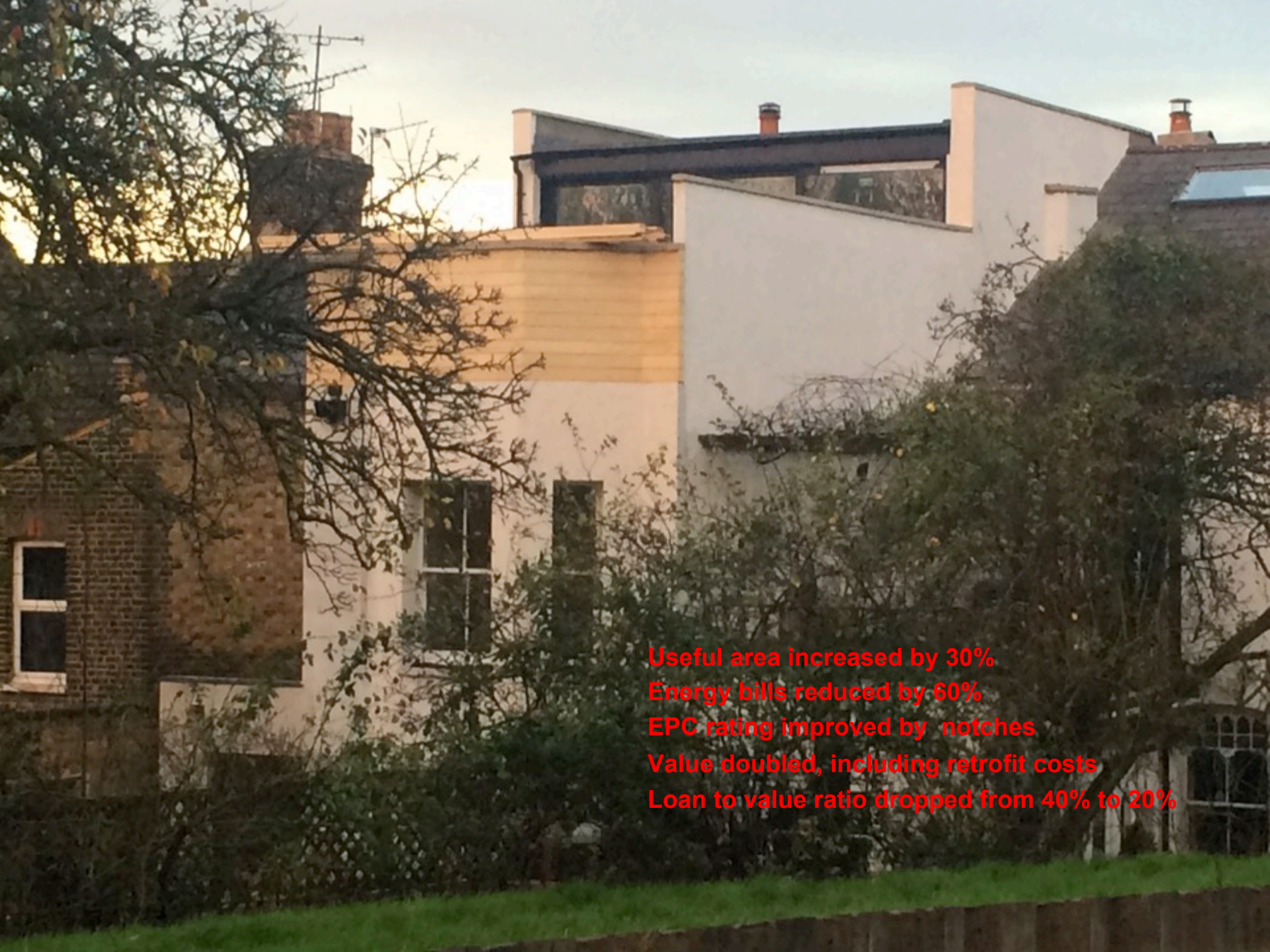


Source: Artist Maria Arceo

Materials

FUNCTIONAL AND PERFORMATIVE RETROFIT





Useful area increased by 30%
Energy bills reduced by 60%
EPC rating improved by notches
Value doubled, including retrofit costs
Loan to value ratio dropped from 40% to 20%

96%

Reduction in energy **££**

81%

GAS USE REDUCTION kWh

67%

ELECTRICITY USE REDUCTION kWh



QUALITY OF LIFE QUALITY OUTCOMES

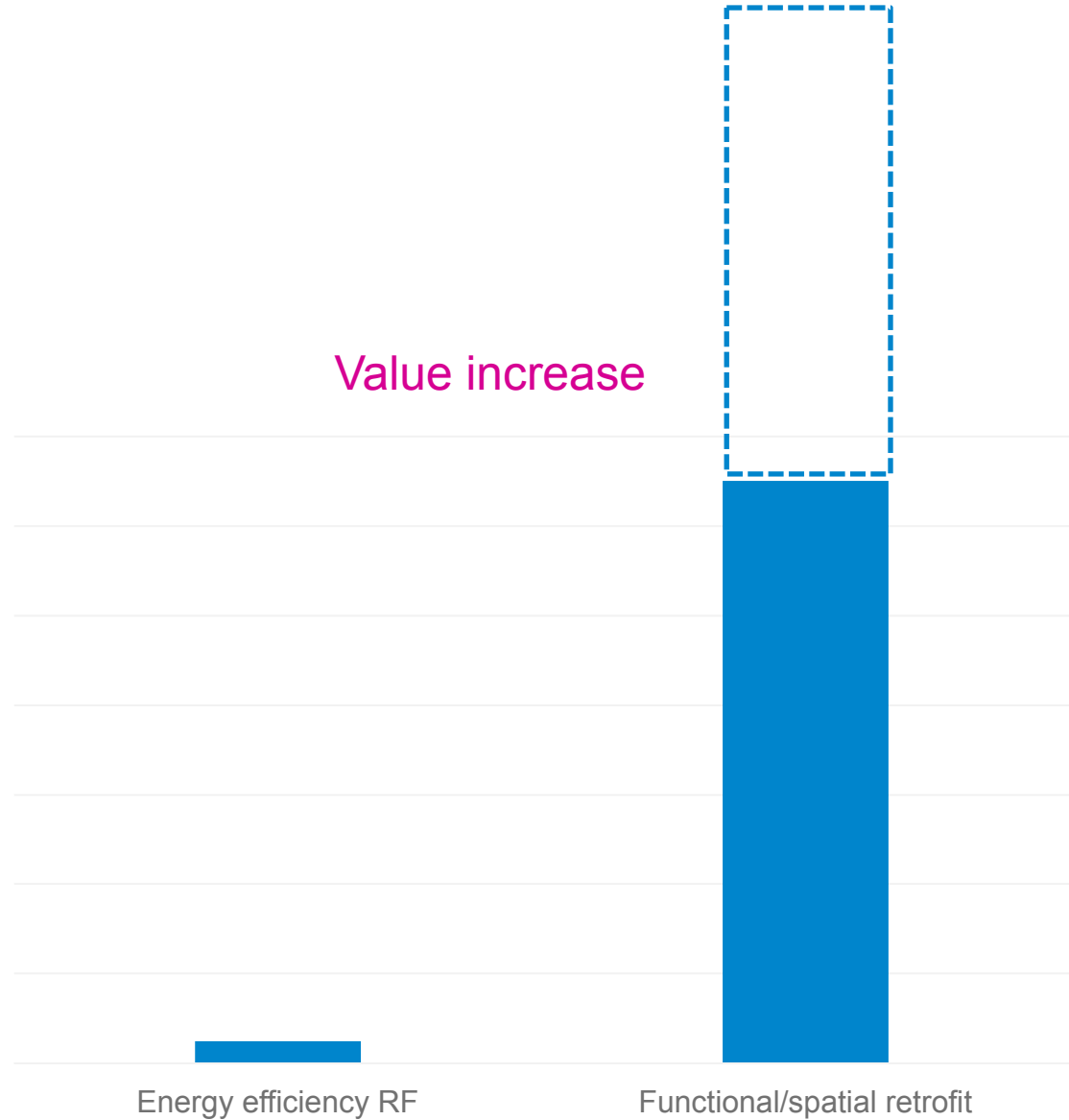
Pupil detentions significantly reduced



THINK BIG

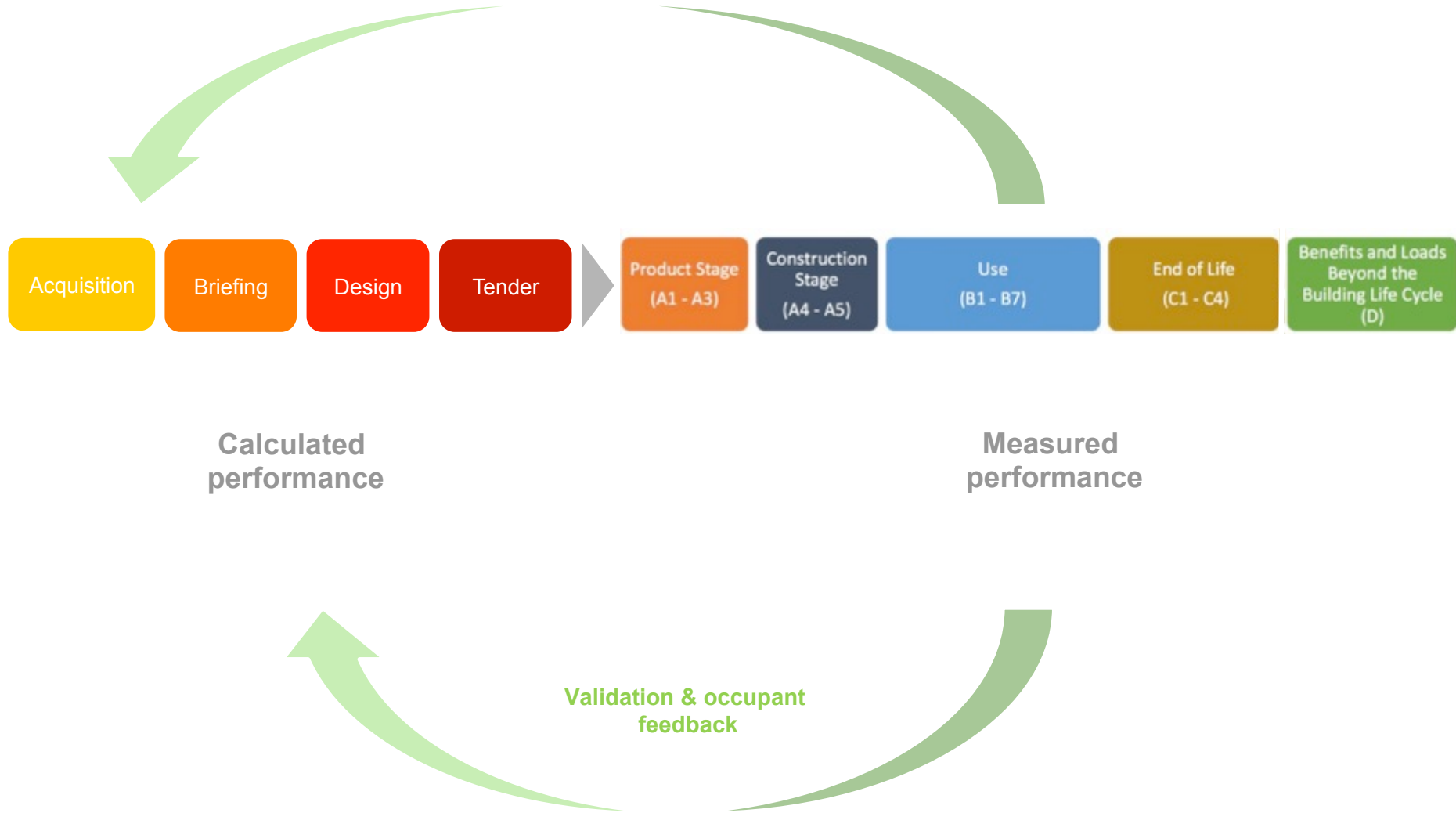


A DESIGN PROBLEM | ARCHITECTURE AS GAME-CHANGER | UNLOCK VALUE



We need more data!

VALIDATION | THE ROLE OF FEEDBACK IN CONTINUOUS IMPROVEMENT



MACRO-OBJECTIVES & INDICATORS

1. GHG Emissions

Along the building lifecycle

Primary & Delivered Energy consumption in use: kWh/m²/yr

Global Warming Potential
embodied CO₂ eq./m²

2. Material Impacts

Low impact material life cycles

Bill of Materials:
Abiotic fossil fuels, minerals and metals, Biotic materials

Waste Flows: kg/m²
Disposed, reused, recycled, E recovery

3. Water Use

Circular use of water resources

Use Phase Consumption:
m³/occupant/yr

4. IEQ

Healthy & comfortable spaces

Indoor Air Quality: ventilation rate l/s/m²; CO₂ ppm; RH %
Pollutants: TVOC, CVOC, RI VOC, formaldehyde, benzene, PM_{2.5} & 10
Thermal Comfort: % time out of range degree days or hours

Light
Acoustic
Visual

5. Climate Change

Adaptation, resilience & impact

Extreme weather events under future climate scenarios:
Thermal Comfort: % time out of range degree days or hours 2030/2050
Flood Risk: surface water runoff; flood risk area

Sun Rain
Wind Snow
Sea level

6. Cost & Value

Optimised over whole life

Life cycle costs
EUR/m²/yr

Value Creation & Risk Factors:
Data quality of indicators

Service Life
Adaptability
Deconstruction/Reuse/
recyclability

Other LCA Criteria:
ozone depletion, acidification,
eutrophication, Photochemical
ozone creation

— EU RESEARCH – THINKING BIG!

- Architectural design as gamechanger
- Validation
- Disclosure
- Lifecycle approach

**CLEAN ENERGY
FOR ALL EUROPEANS**



**SUSTAINABLE
ENERGY WEEK**

An initiative of the  European Commission