NATIONAL ENERGY FOUNDATION

improving the use of energy in buildings

BBSA Members' Day

The Proven Benefits of Solar Shading

Federico Seguro

Energy Specialist | National Energy Foundation

Seguro, F., Palmer, J., (2016) "Solar Shading Impact. Business Case, Strategic Vision, Action Plan". NEF

Aim

Missed opportunities

Steer to best practice

Unlock full potential

NATIONAL ENERGY FOUNDATION

Agenda

a. Proven benefits of shading

b. Analysis of Costs and Benefits

c. Barriers to overcome

NATIONAL ENERGY FOUNDATION

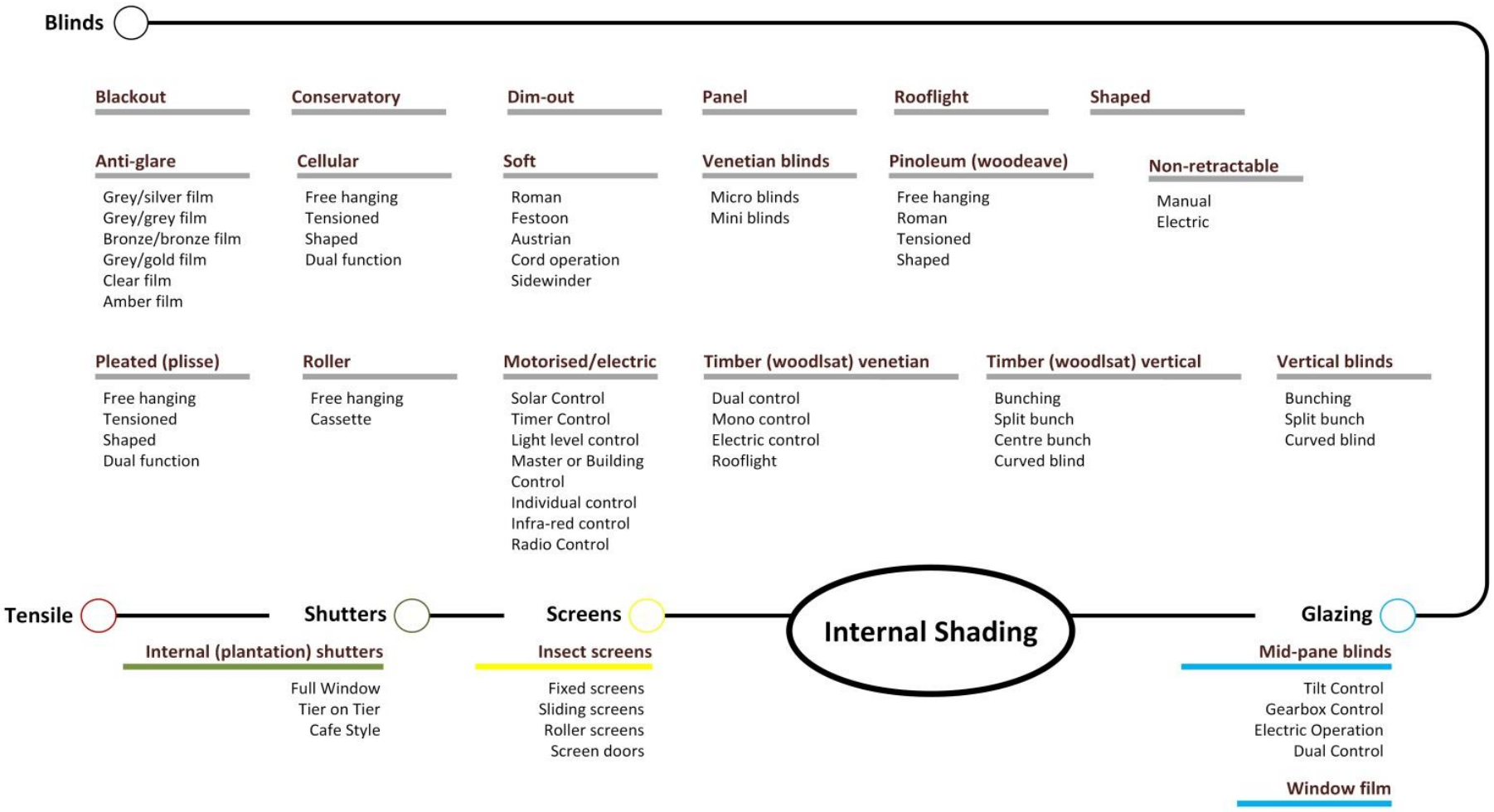
Definition

Incoming solar radiation regulation systems

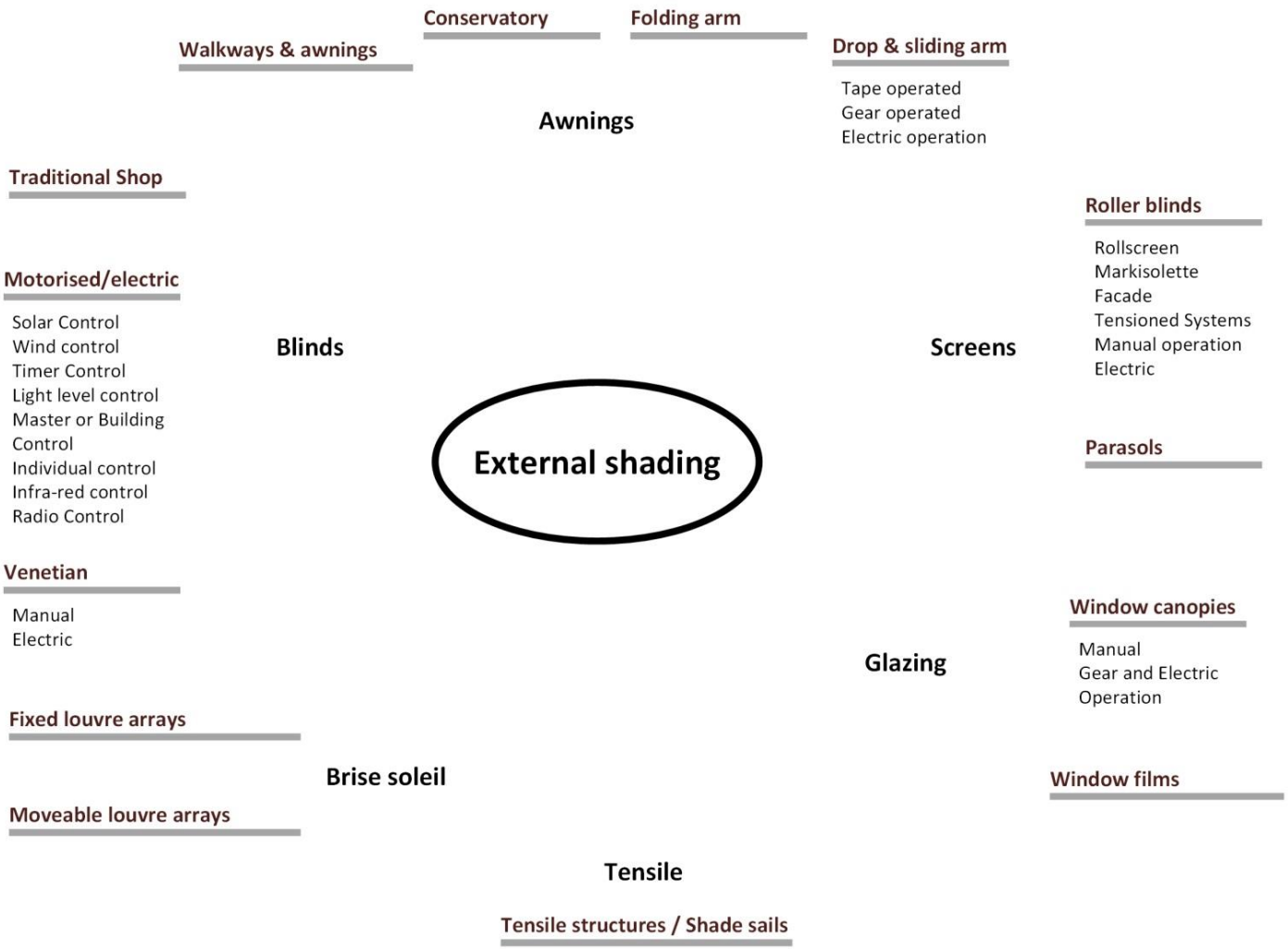
Not only summer, heating energy savings

Rich and varied market offer

NATIONAL ENERGY FOUNDATION



NATIONAL ENERGY FOUNDATION



NATIONAL ENERGY FOUNDATION

Proven benefits of shading

Analysis of Costs and Benefits

Barriers to overcome

NATIONAL ENERGY FOUNDATION

Benefits

Theoretical implications

Comfort
Occupant
Energy

Applications

The NYT Building
The Shard

NATIONAL ENERGY FOUNDATION

Comfort

Thermal comfort

Insulation of the transparent envelope
Surface and operative temperature
Balanced radiation flows

Visual comfort

More glass, circadian-effective daylight
Regulation of luminance levels
Glare

Acoustic comfort

Limited, but increased acoustic insulation
Reduced sound waves at the glass critical freq.

NATIONAL ENERGY FOUNDATION

Occupant

Indoor Air Quality

Perceived IAQ – lower gains i.e. temperatures
Low-pollutant emitting shading fabrics

Productivity

More glass, biophilia and daylight
Less sick leave and absenteeism

Security and privacy

Functional / visual separation & privacy
Anti-intrusion deterrent

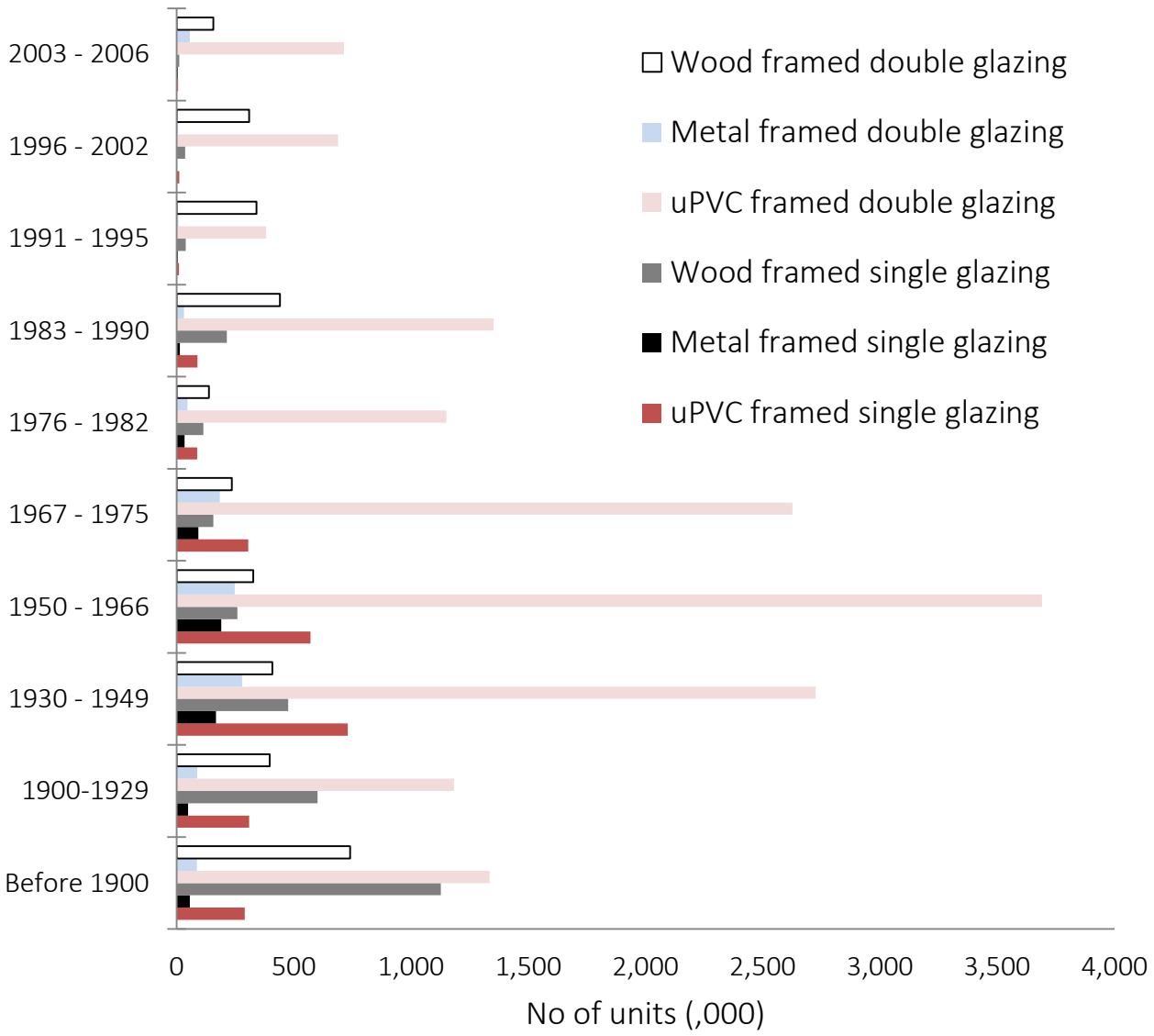
Controllability

Manual (shared) v automatic (un-owned)
Environment / occupant driven response

Energy

Glazing in England and Wales by house age

Cambridge Housing Model



+6m single glazing units

+20m first generation double glazing

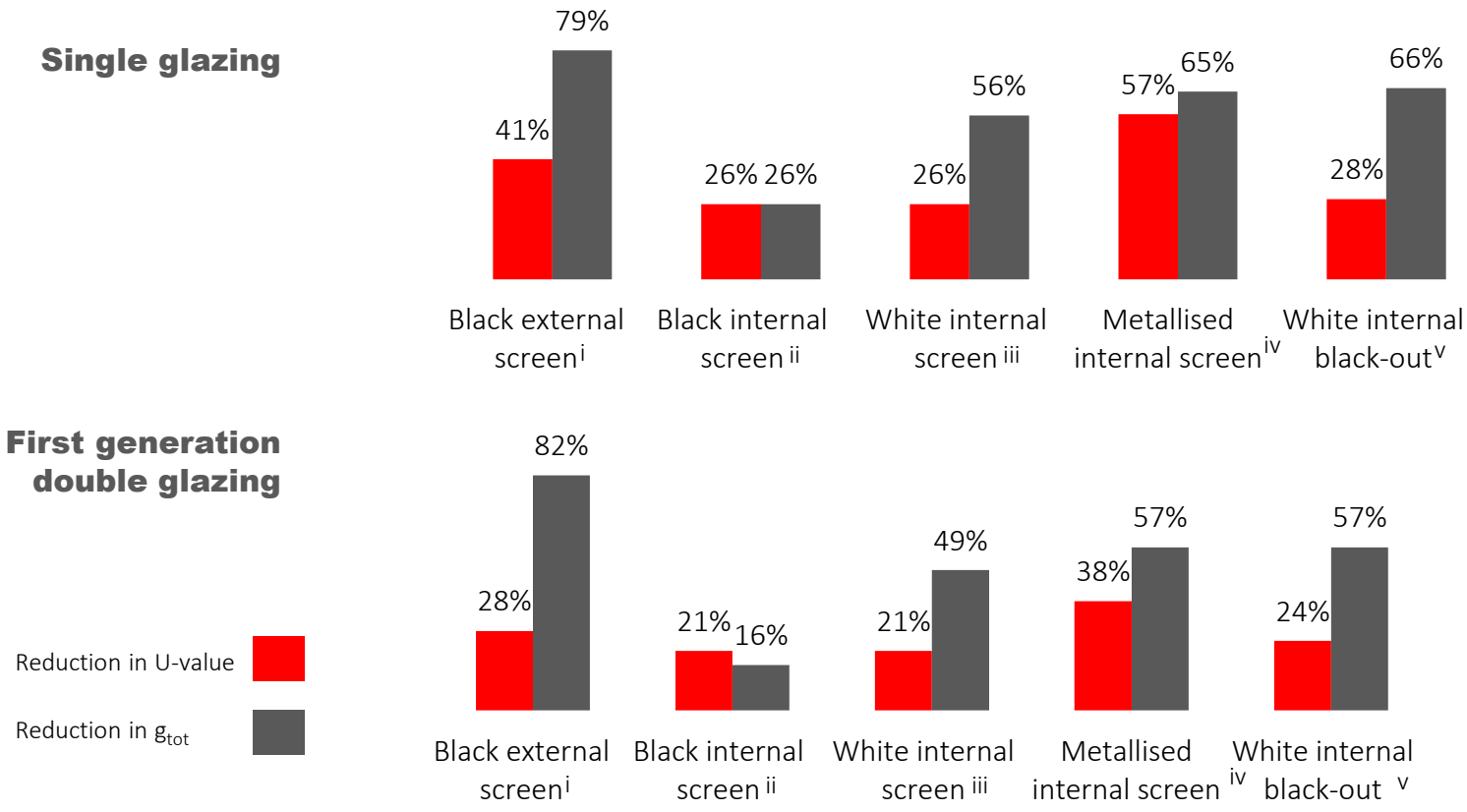
NATIONAL ENERGY FOUNDATION

U-values [g_{tot}] with/without shading

Reference Glazing		Black external screen[i]	Black internal screen[ii]	White internal screen[iii]	Metallised internal screen[iv]	White internal black-out[v]
Single clear (EN 14501)	5.80 [0.85]	3.40 [0.18]	4.30 [0.63]	4.30 [0.37]	2.50 [0.30]	4.20 [0.29]
Double clear (EN 14501)	2.90 [0.76]	2.10 [0.14]	2.30 [0.64]	2.30 [0.39]	1.80 [0.33]	2.20 [0.33]
Triple clear (EN 13363-1)	2.00 [0.65]	1.50 [0.11]	1.50 [0.57]	1.50 [0.38]	1.40 [0.34]	1.40 [0.34]
Double low-e (EN 13363-1)	1.60 [0.72]	1.30 [0.11]	1.40 [0.63]	1.40 [0.39]	1.20 [0.34]	1.40 [0.35]
Solar Control 1 (EN 14501)	1.20 [0.59]	1.00 [0.09]	1.10 [0.54]	1.10 [0.37]	1.00 [0.34]	1.10 [0.35]
Solar Control 2 (EN 14501)	1.10 [0.32]	1.00 [0.07]	1.00 [0.30]	1.00 [0.25]	0.90 [0.24]	1.00 [0.24]

[i] External screen fabric; colour black; τ=0.04; ρ=0.05, α=0.89, Class 2 Permeability.
[ii] Internal screen fabric; colour black; τ=0.04; ε=0.89, ρ=0.05, α=0.89, Class 2 Permeability.
[iii] Internal screen fabric; colour white; τ=0.04; ε=0.89, ρ=0.62, α=0.15, Class 2 Permeability.
[iv] Internal screen fabric; metallised; τ=0.03;ε=0.14, ρ=0.70, α=0.22, Class 2 Permeability.
[v] Internal black-out fabric; colour white; (τ=0.00);ε=0.90, ρ=0.68, α=0.32.

U-values [g_{tot}] with/without shading



[i] External screen fabric; colour black; τ=0.04; ρ=0.05, α=0.89, Class 2 Permeability.
[ii] Internal screen fabric; colour black; τ=0.04; ε=0.89, ρ=0.05, α=0.89, Class 2 Permeability.
[iii] Internal screen fabric; colour white; τ=0.04; ε=0.89, ρ=0.62, α=0.15, Class 2 Permeability.
[iv] Internal screen fabric; metallised; τ=0.03;ε=0.14, ρ=0.70, α=0.22, Class 2 Permeability.
[v] Internal black-out fabric; colour white; (τ=0.00);ε=0.90, ρ=0.68, α=0.32.

NATIONAL ENERGY FOUNDATION

Overheating

Background

Higher min/max temperatures expected in 30 years
x3 heat-related excess deaths by 2050
Occurrence also in winter for new builds

Solar shading

Cost-effective means of overheating mitigation
Reduced greenhouse effect
Reduced active cooling

NATIONAL ENERGY FOUNDATION

Case study review

The New York Times Building

- 52-storey tower
- 143,000m^2 of office space
- Desire to maximise daylight & views without glare
- Double-skin curtain walling with ceramic rods on three sides
- MechoSystems' auto-blinds, with SolarTrac control
- Estimated 24% saving in energy

The Shard

- 95-storey mixed-use building (110,000m^2)
- Triple glazing with ventilated cavity & motorised blinds
- Intelligent blinds lower according to sun path
- Narrow floor-plate brought challenges for services

NATIONAL ENERGY FOUNDATION

Proven benefits of shading

Analysis of Costs and Benefits

Barriers to overcome

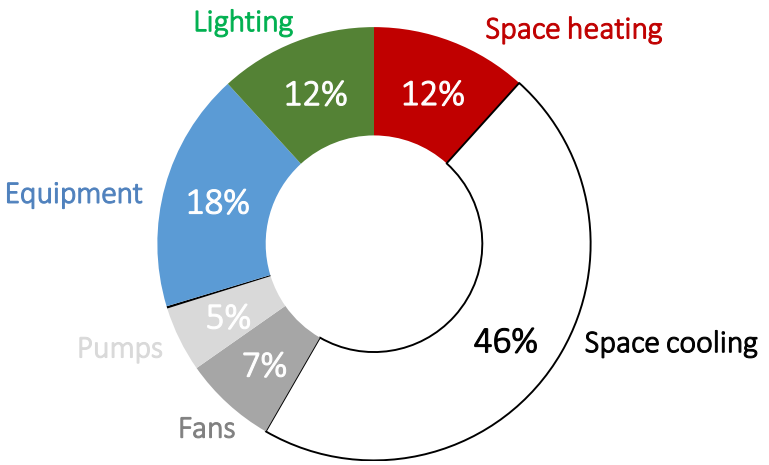
NATIONAL ENERGY FOUNDATION

Quantifying the impact

Energy modelling

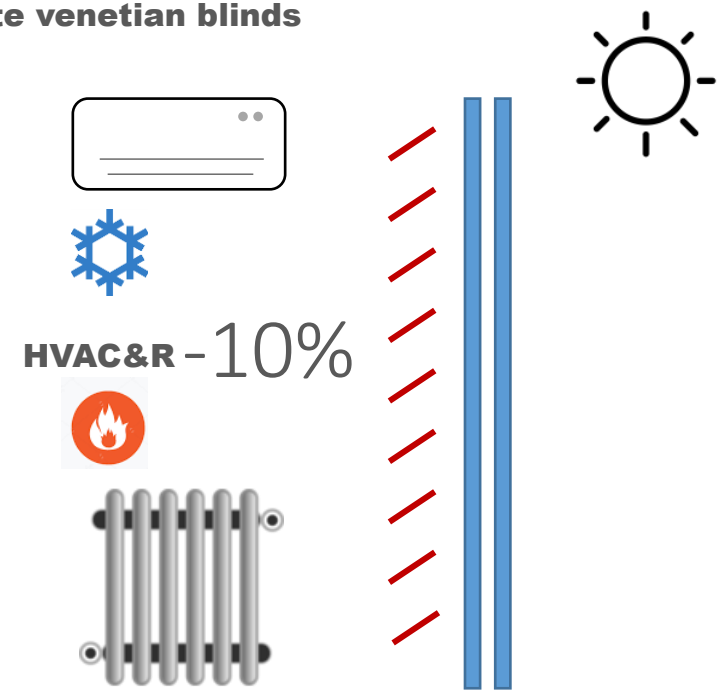
Highly-glazed office, EN14501 glazing ‘C’

Internal & external roller shades/blinds



Internal shading

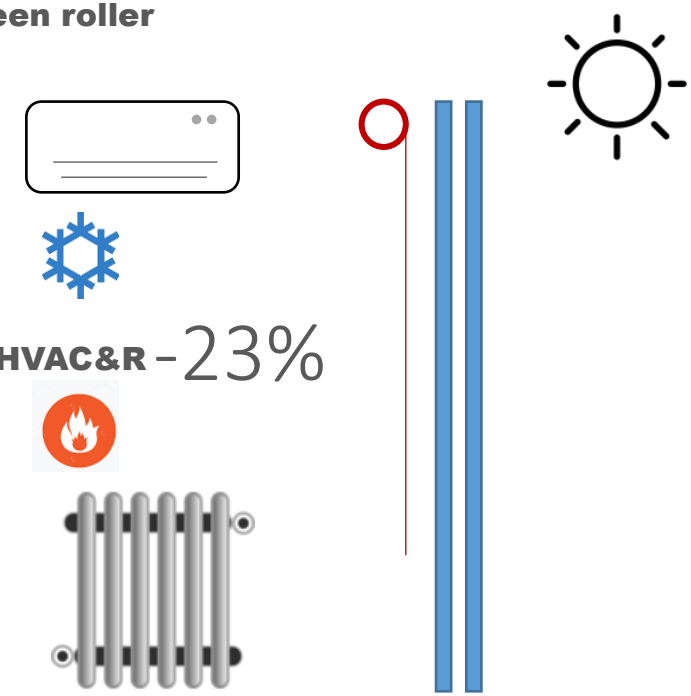
White venetian blinds



HVAC&R -10%

Savings £ -£1.7m^{-2} CO_2 -7 kgCO_2m^{-2}

Screen roller



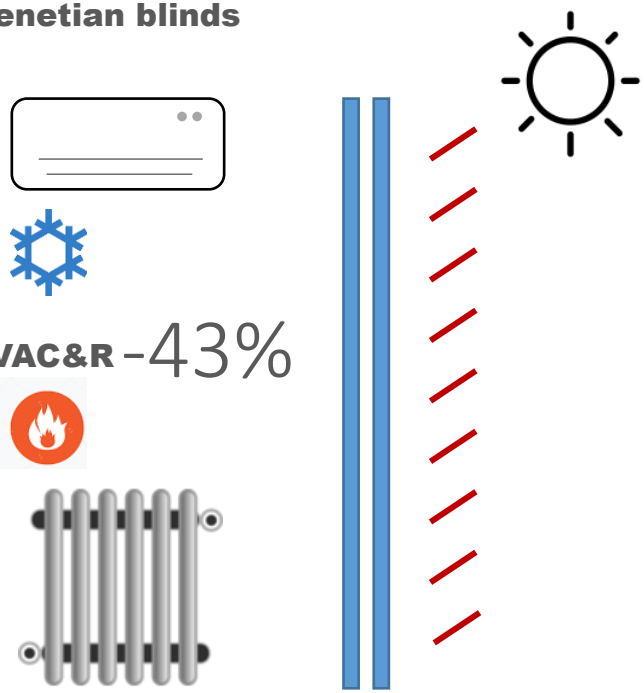
HVAC&R -23%

£ -£3.8m^{-2} CO_2 -16 kgCO_2m^{-2}

NATIONAL ENERGY FOUNDATION

External shading

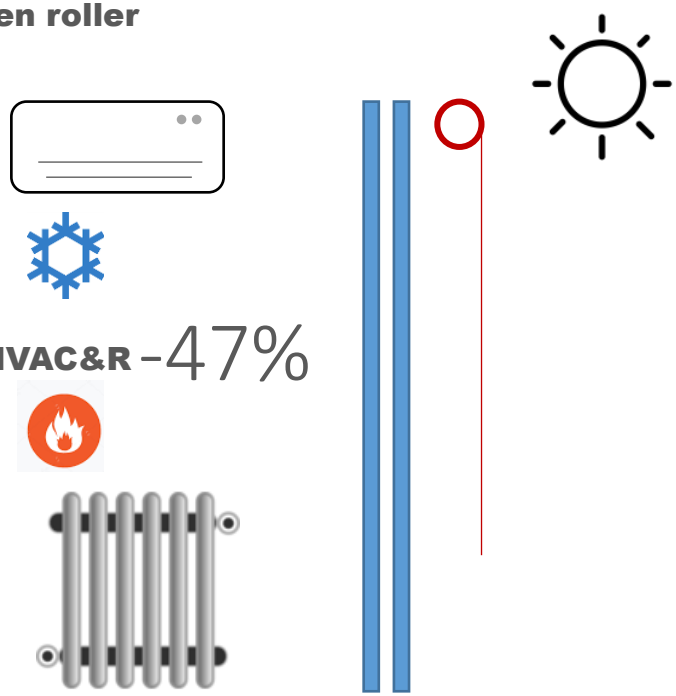
White venetian blinds



HVAC&R -43%

Savings £ -£7.5m^{-2} CO_2 -32 kgCO_2m^{-2}

Screen roller

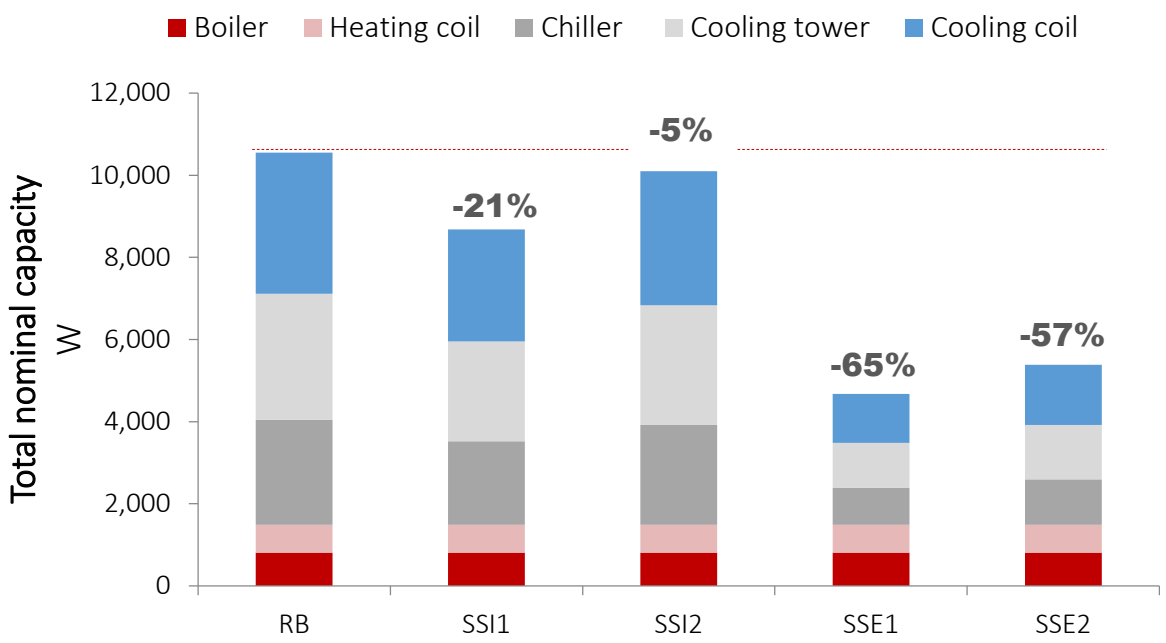


HVAC&R -47%

£ -£8.5m^{-2} CO_2 -35 kgCO_2m^{-2}

NATIONAL ENERGY FOUNDATION

System sizing



i.e. reduced investment costs

RB: shading-free reference building
SSI1: internal roller screen
SSI2: internal blind
SSE1: external roller screen
SSE2: external blind

Benefits

Thermal
Thermal insulation
Airtightness
Solar gain control
Winter comfort
Summer comfort
Condensation prevention
Ventilation

Functional
Window protection
Egress
Security
Control of noise
Acoustic absorption
Controllability and responsiveness

Operational
Installation
Durability and service life
Maintenance

Visual
Outdoor view
Visible transmission
Daylighting control
Glare control
Privacy

NATIONAL ENERGY FOUNDATION

Key messages

Myth busting – not only glare and overheating

No panacea – CBA on a building by building basis

Holistic thinking – whole building approach

NATIONAL ENERGY FOUNDATION

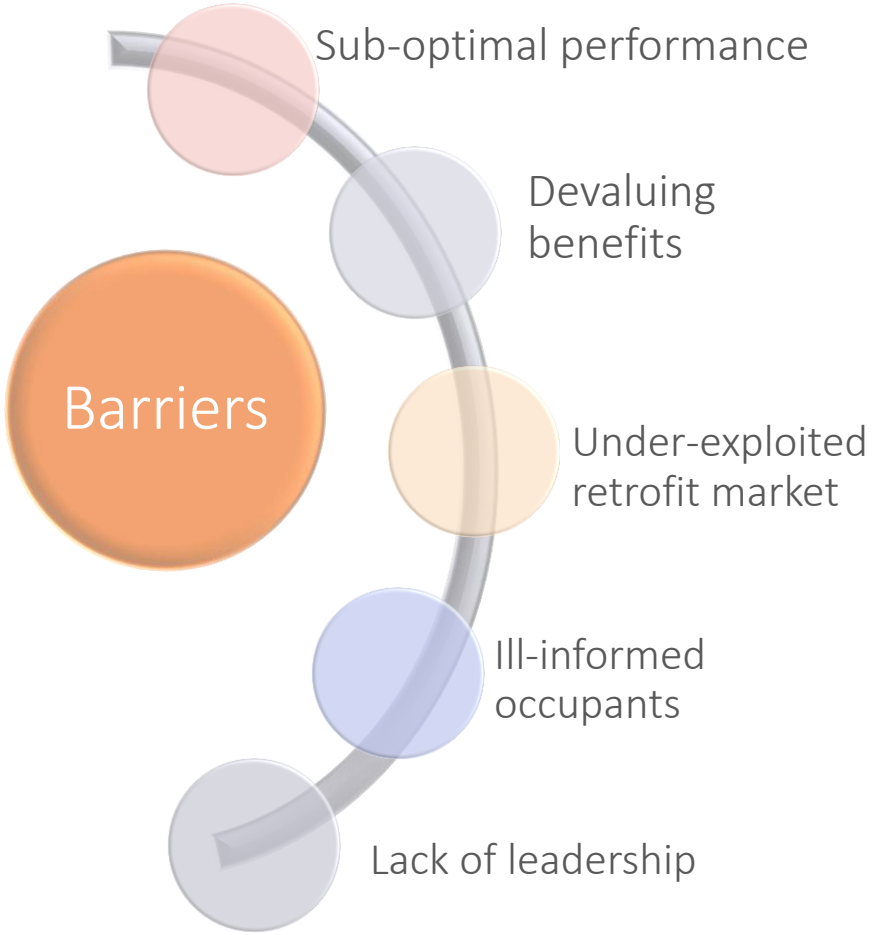
Proven benefits of shading

Analysis of Costs and Benefits

Barriers to overcome

NATIONAL ENERGY FOUNDATION

Key barriers



Business case

Action Plan

Strategic vision

Strategic vision

Recognition

Partnership with the government
Revised compliance tools
Roadmaps to nZEBs

NATIONAL ENERGY FOUNDATION

Strategic vision

Performance

Market demands best practice
Upskilling and training
Whole-building

NATIONAL ENERGY FOUNDATION

Strategic vision

Retrofit

Market unlocked
Metrics for ‘Soft’ benefits
Novel whole house retrofit approach

NATIONAL ENERGY FOUNDATION

Strategic vision

Occupant behaviour

Common language
Big data
DSM

NATIONAL ENERGY FOUNDATION

Strategic vision

Leadership

Involvement in Building Regs' revision process
Awareness raising and inspiration
Lobbying

Government…

Tax-breaks e.g., VAT; income tax incentives

Shift balance towards low carbon cooling

Align with EN performance metrics e.g. g_{tot}

Compliance checks

Industry…

Assemble robust quantitative evidence

Make the other benefits clearer

NATIONAL ENERGY FOUNDATION

Summary

Full study and report completed in May 2016

i. Evidence Base

ii. Quantifying the Impact

iii. Looking to the Future

NATIONAL ENERGY FOUNDATION

Thank you

federico.seguro@nef.org.uk

www.nef.org.uk