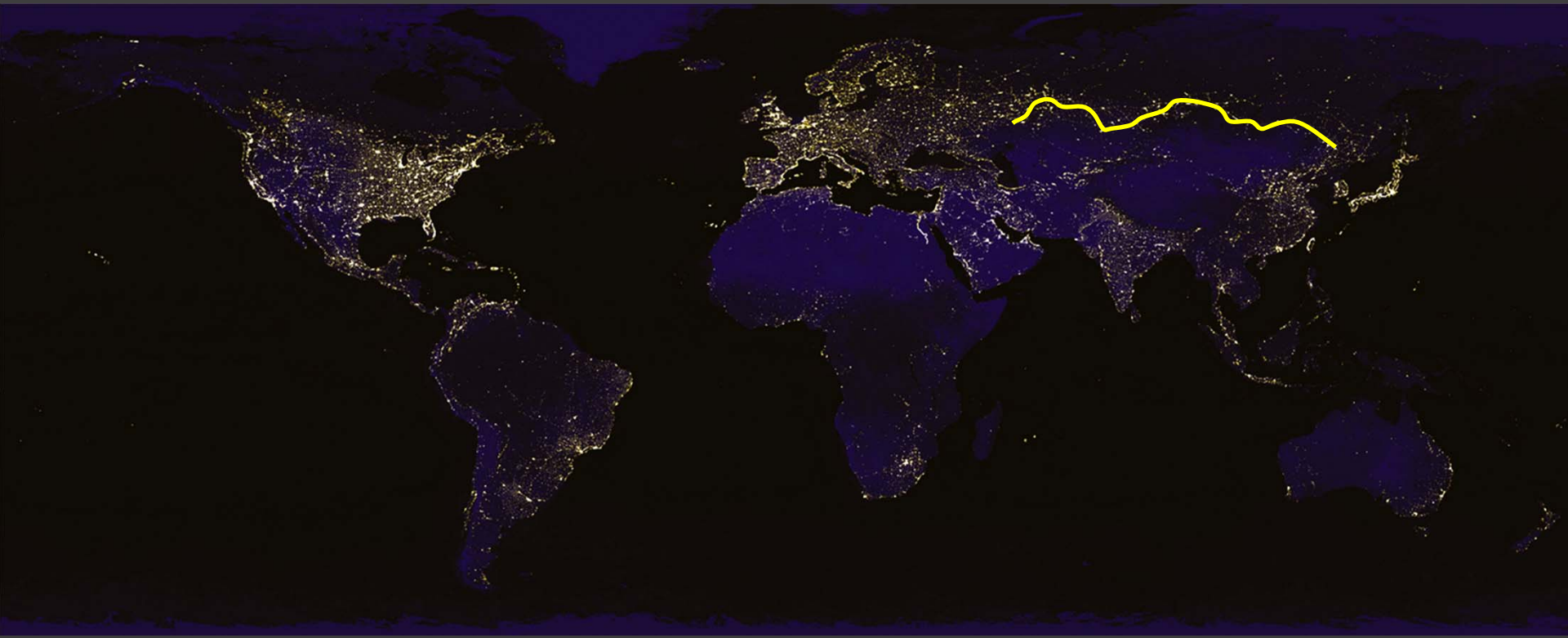
Monday, December 10, 2012

SIXTH SHADE

Rajan
Rawal

Measurable means to achieve impeccable built environment

Earth lights at night

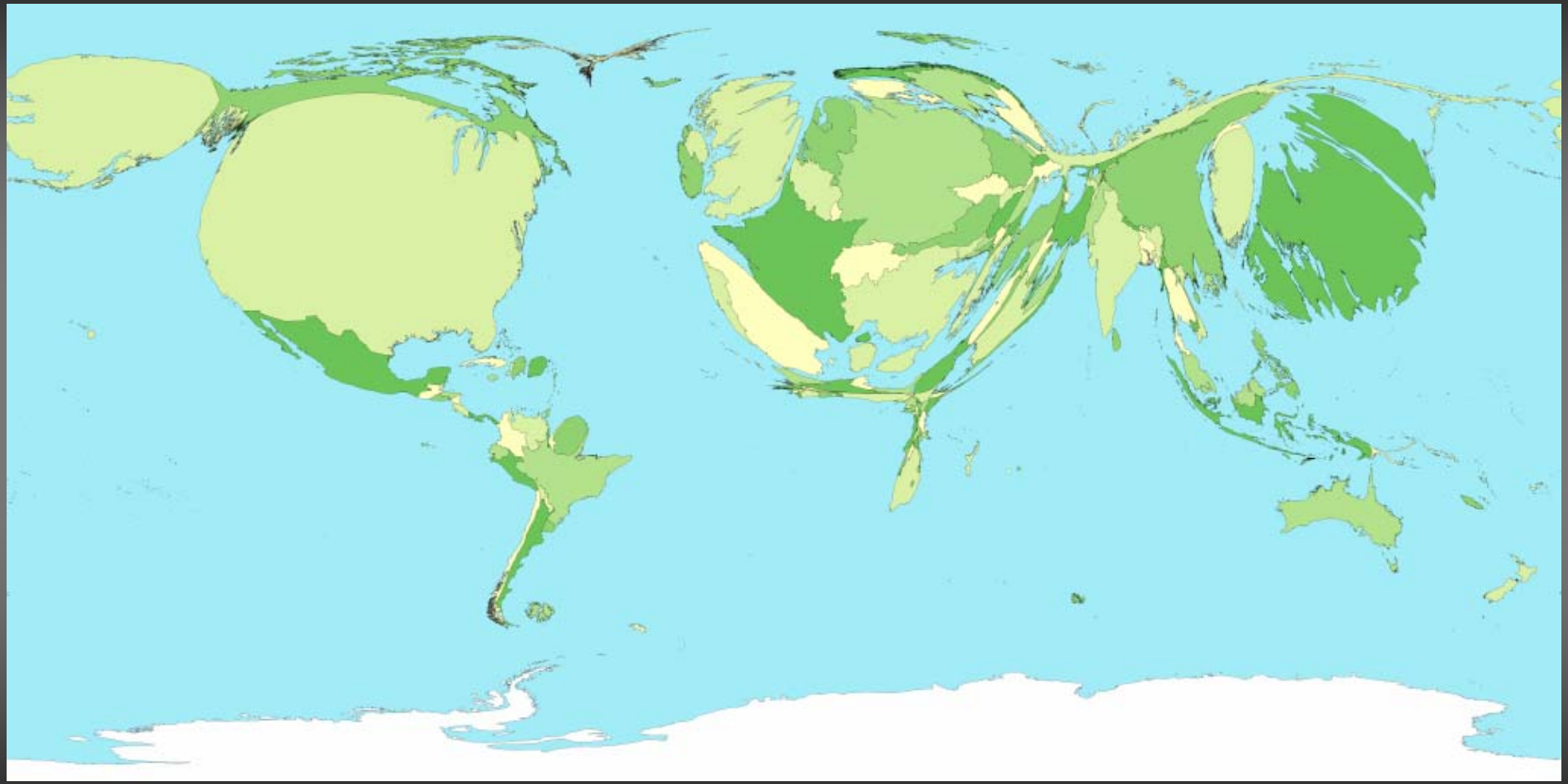


Source: NASA Scientific Visualization Studio Collection

Our Population

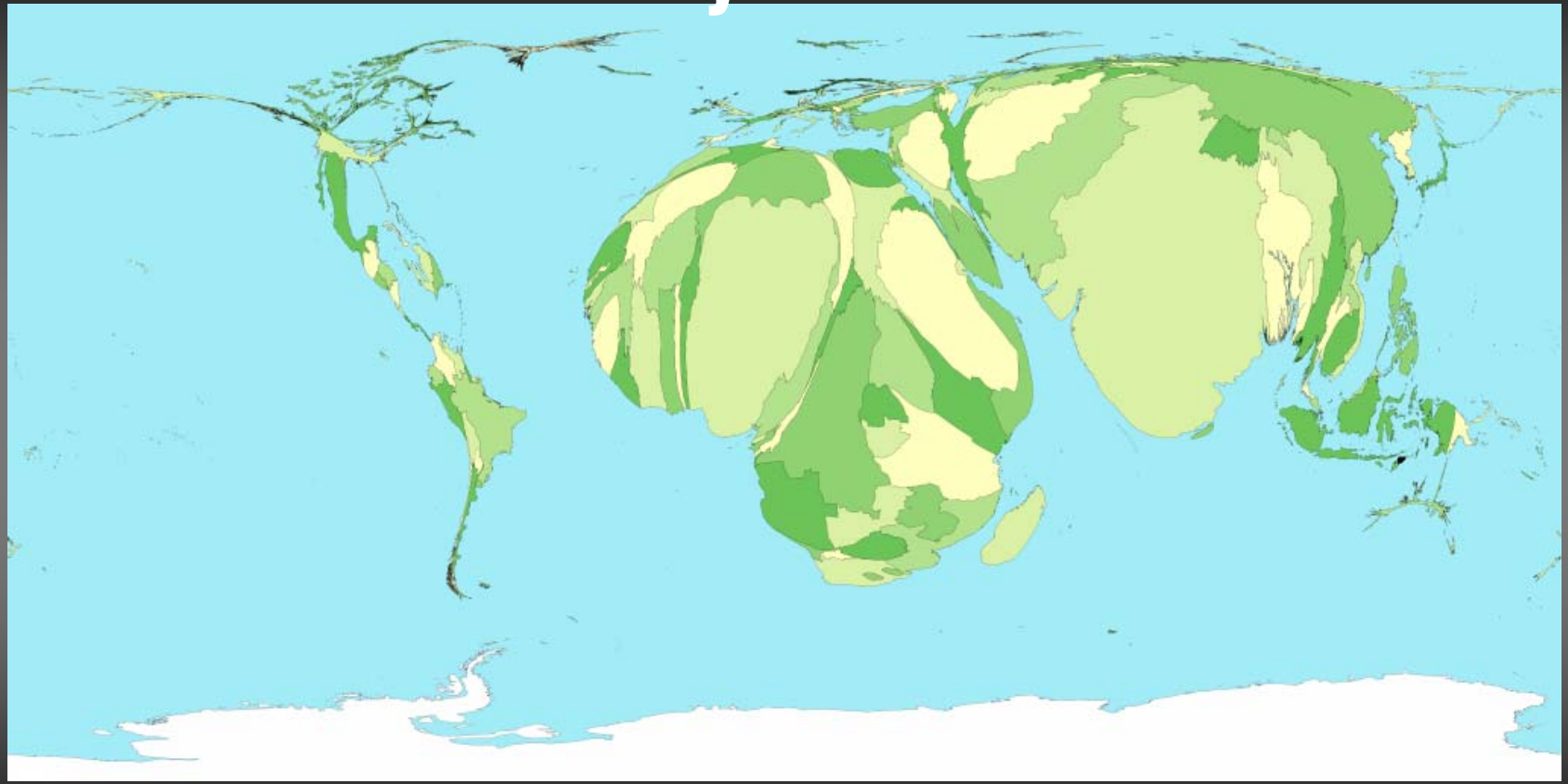
Source: http://www-personal.umich.edu/~mejn/cartograms/population1024x512.png

Our Gross Domestic Product



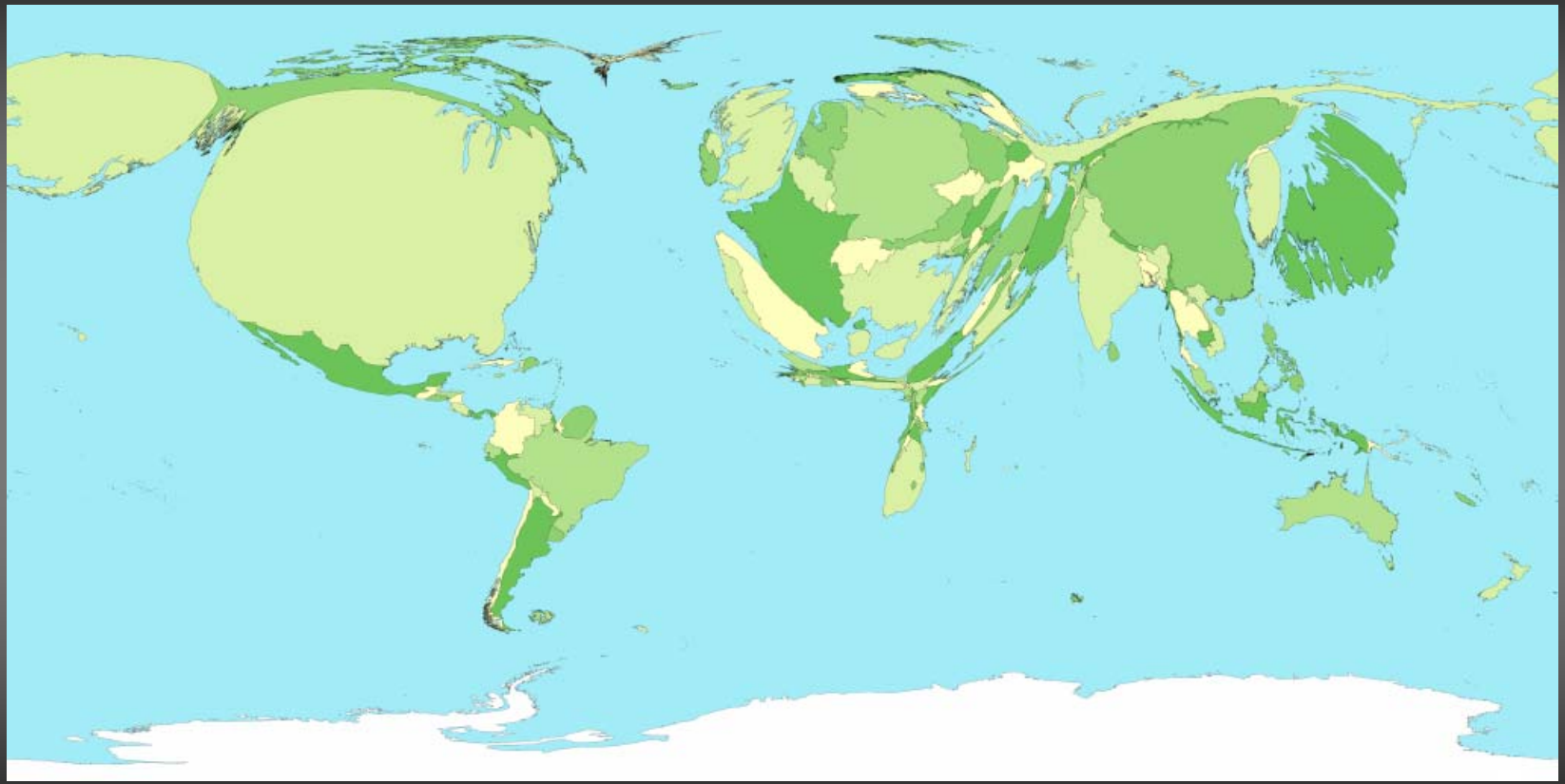
Source: http://www-personal.umich.edu/~mejn/cartograms/population1024x512.png

Our Child Mortality



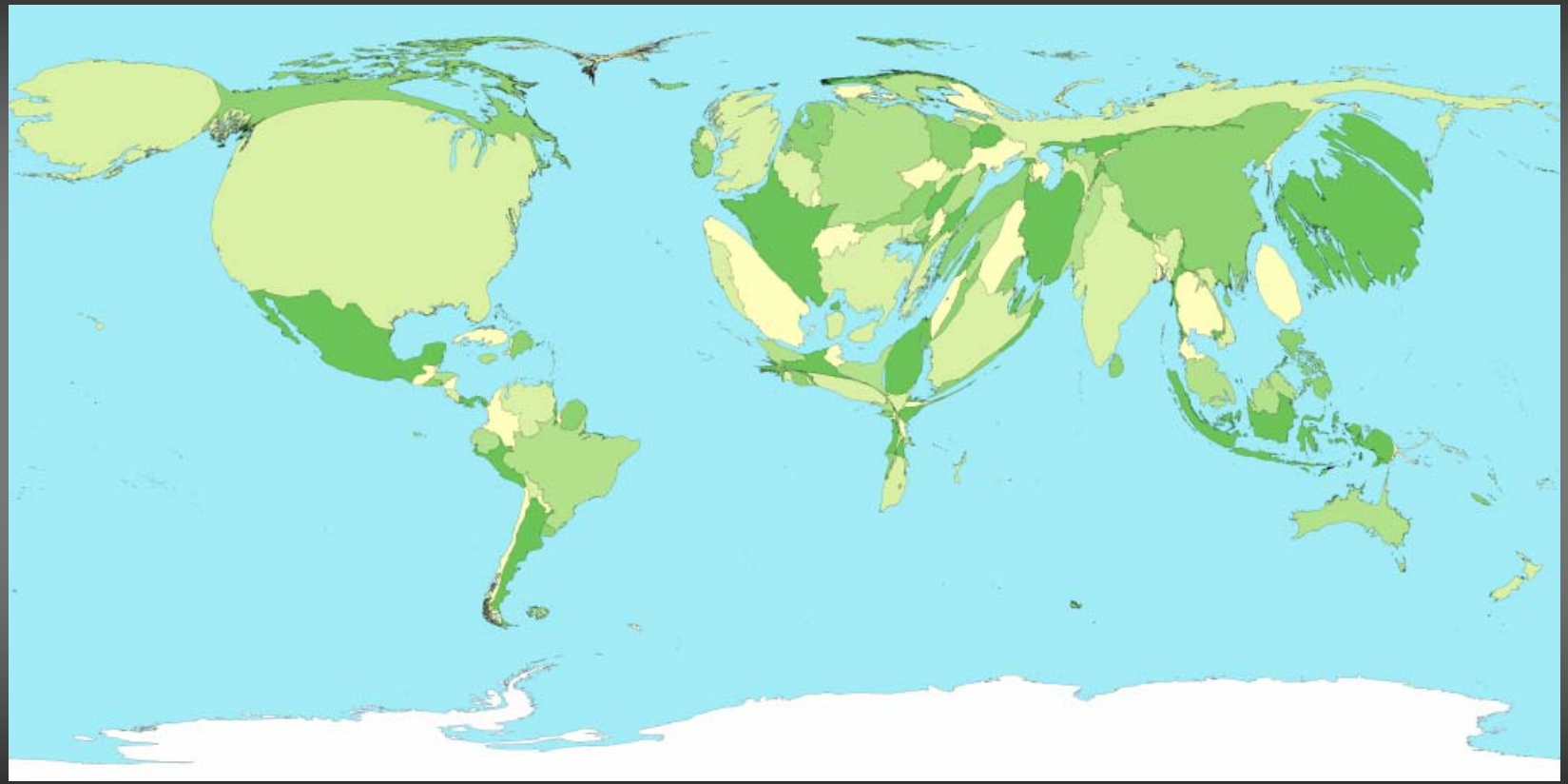
Source: http://www-personal.umich.edu/~mejn/cartograms/population1024x512.png

Our Total Spending on Heath care



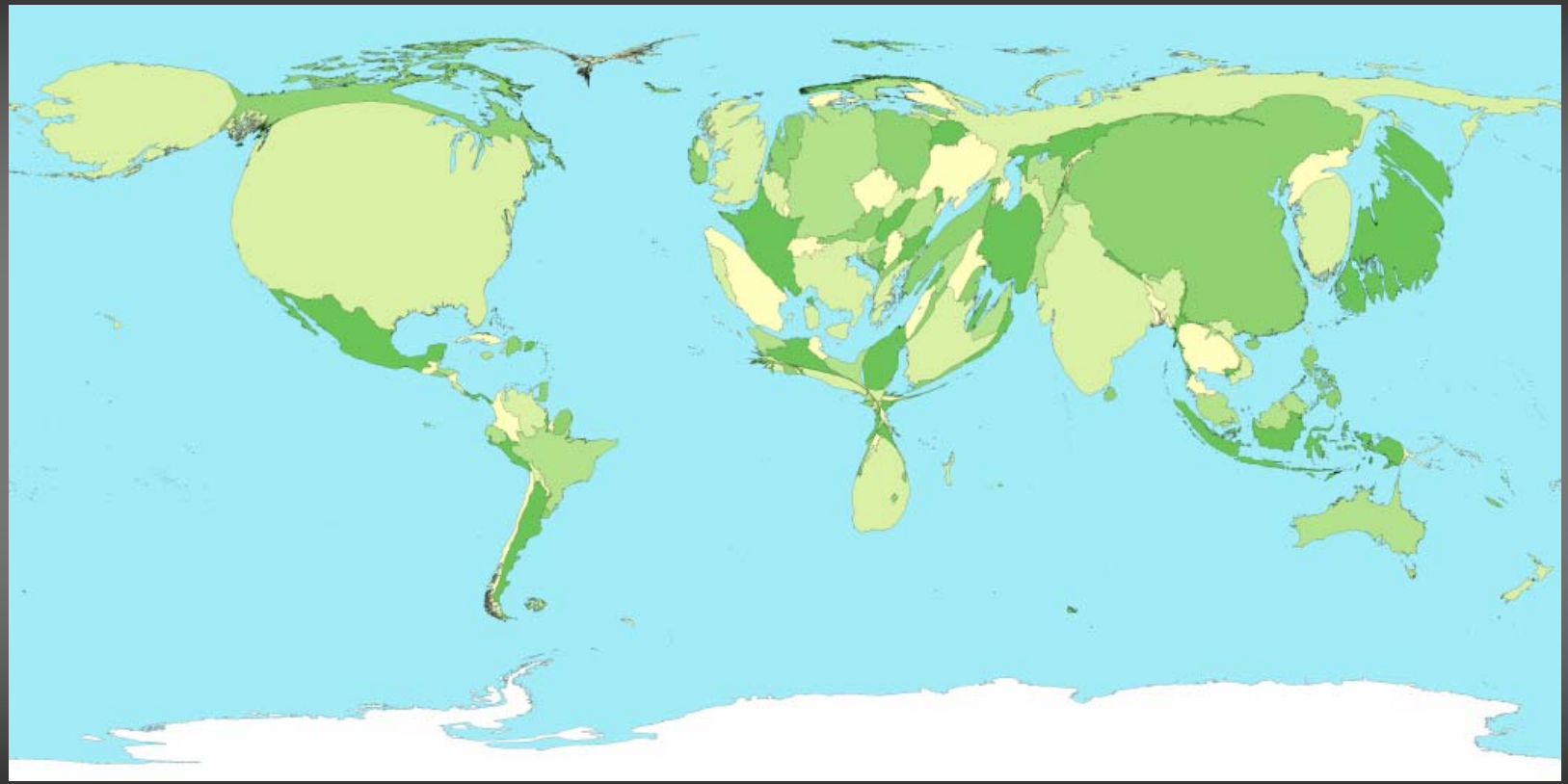
Source: http://www-personal.umich.edu/~mejn/cartograms/population1024x512.png

Our Energy Consumption

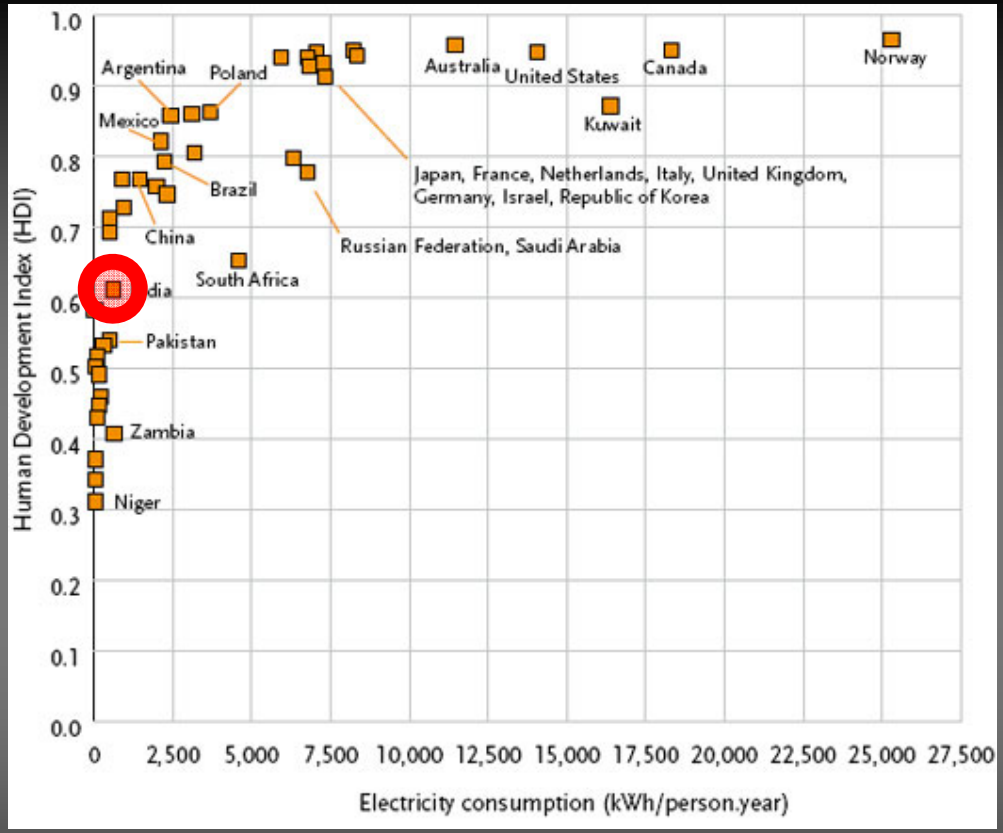


Source: http://www-personal.umich.edu/~mejn/cartograms/population1024x512.png

Our Green House Gas Emission



Source: http://www-personal.umich.edu/~mejn/cartograms/population1024x512.png



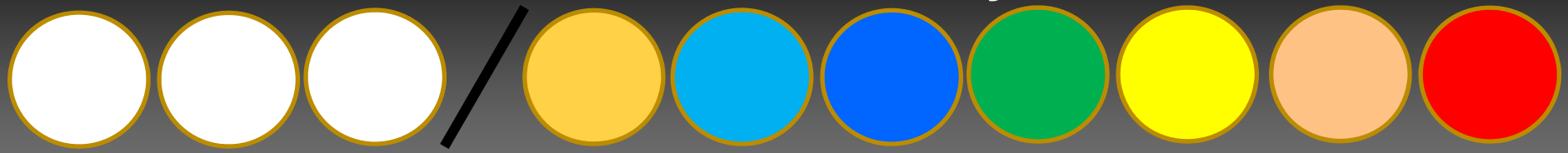
Move Up
But
Without Moving
to
Right Side

Access to Energy and Human Development Index

Source: http://www.interacademycouncil.net/CMS/Reports/11840/11901/11907.aspx

Buildings and Cities provide shelter, facilitate our activities & interactions,
and
represent our desires and provide cultural expression.

70 % of the India of 2030 is yet to be built

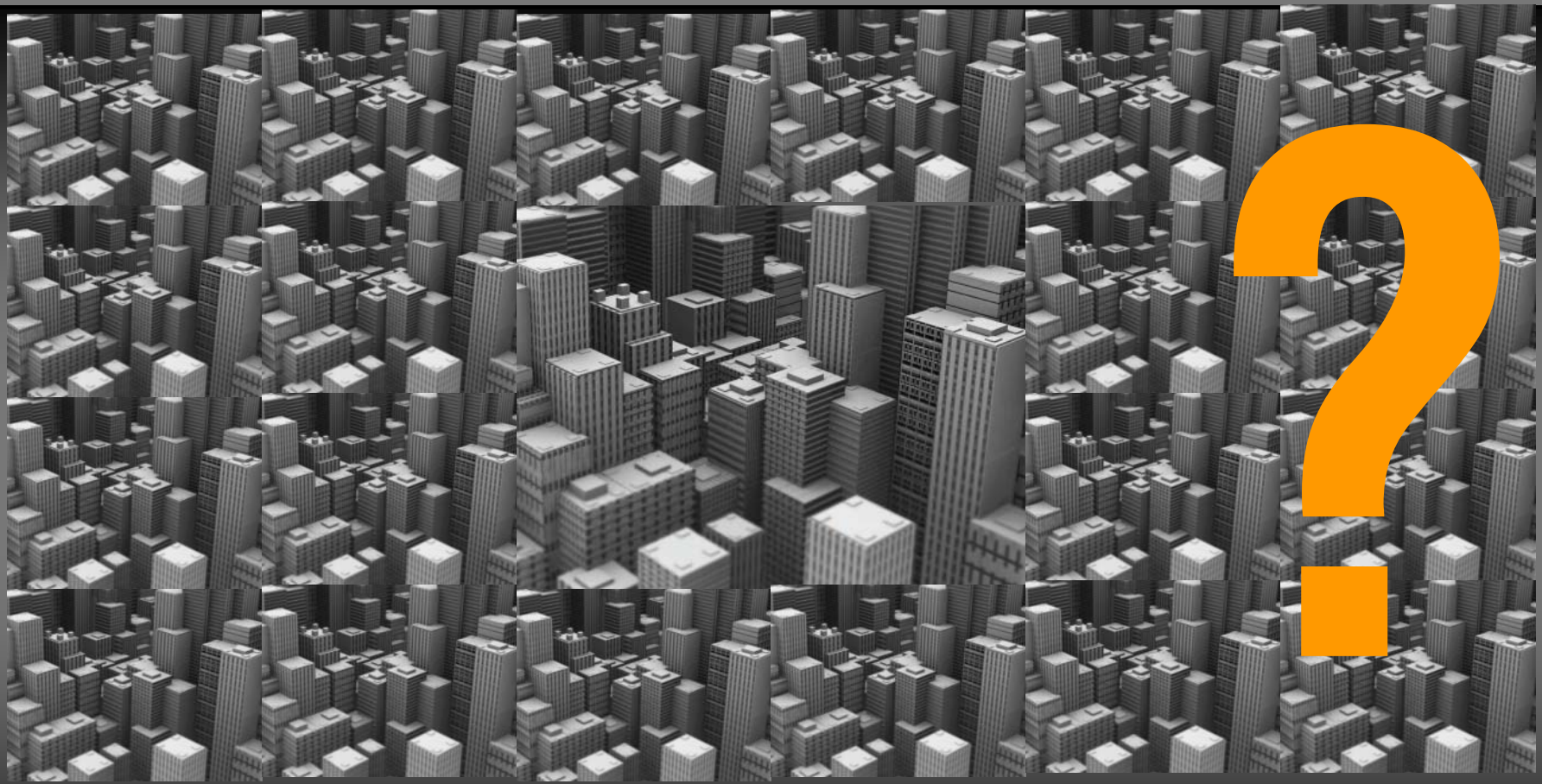


.....2030

Electricity Demand , exceeds available supply

.....Commercial buildings accounts for about 8% of the total electricity supplied by utilities - Growing annually at about 11-12% - resulting to peak shortages of about 8.3% and 12.3%.....

Source: Rajan Rawal



Pace versus Speed .....

5 W 1 H

When : Where : Why : Who : What : How

AIR

WATER

EARTH

WIND

EITHER

5 Elements

How do we use them favorably?

SIGHT

HEARING

TOUCH

SMELL

TASTE

5 Senses

How do we use them effectively?

IMAGINE

CONCEPTUALIZE

MATERIALIZE

OPERATE

DESTROY

5 Senses

How do we measure their impact?

MEASURE

Material
Cost
Time
Structural strength
Water – Sanitation

ENERGY ? (Can not rely only on common sense approach)

6th Shade

NOT ONLY INTUTION BUT SCIENTIFIC PREDICTION

EXPERIMENT – LEARN – DOCUMENT – DISSEMINATE - INGRAINED

“A great building must begin with the unmeasurable,
must go through measurable means when it is being designed and
in the end must be unmeasurable.”

Source: *thinkexist.com/quotation/a_great_building_must_begin_with_the_unmeasurable/213937.html*

Centre for Advanced Studies in Building Science and Energy

CEPT University, Ahmedabad

(Centre for Building Energy Efficiency – USAID)

(Centre for Solar passive Architecture and Green Building Technologies – Govt. of India)

(Centre for Building Energy Research and Development in collaboration with LBNL)

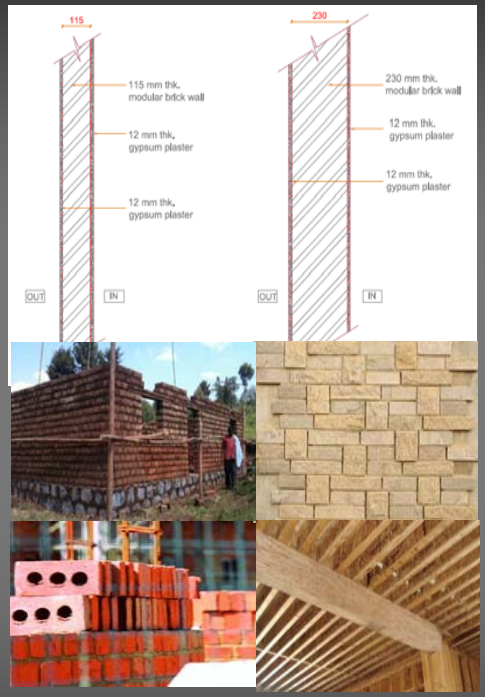
Building Design & Simulation

Building Material
&
Component Characterization

Building Policy Research

Snapshot of Work

Construction Material Database: Material Characterization : Wall - Roof



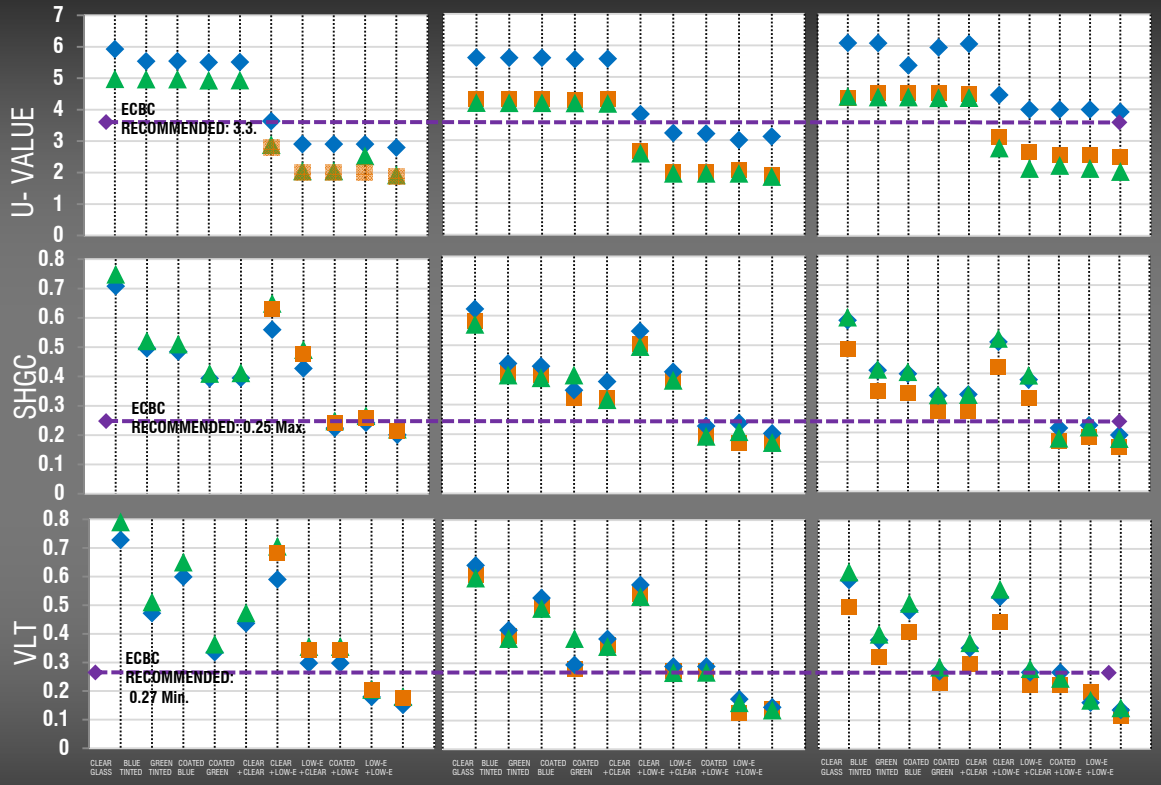
250 Building Material Characterized

Building Construction Assemblies – Online Database – U Factor/Thermal Conductivity – Specific Heat – Density

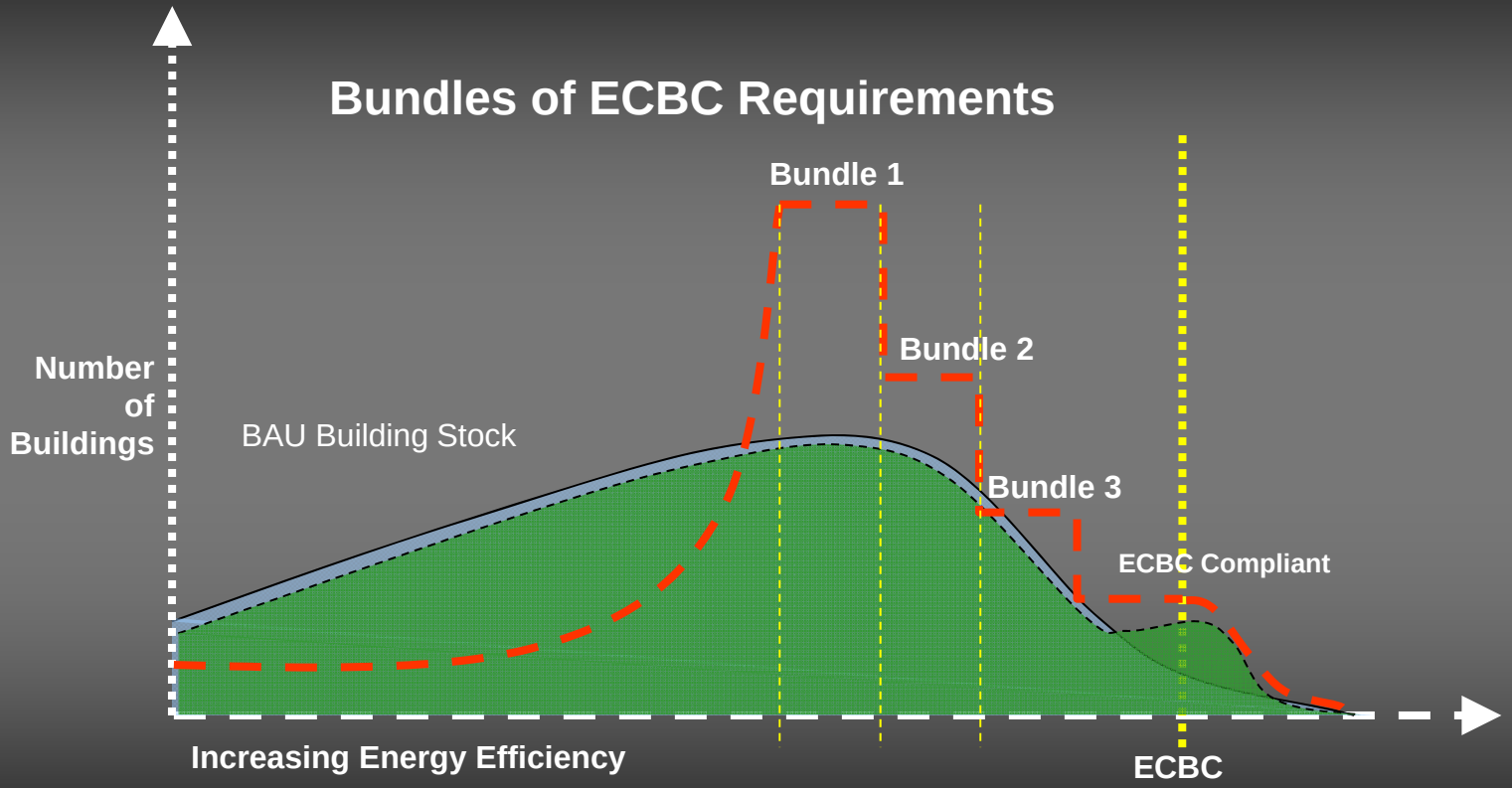
Online Calculator

Coupling with EPI tool of BEE

Construction Material Database: Material Characterization : Fenestration



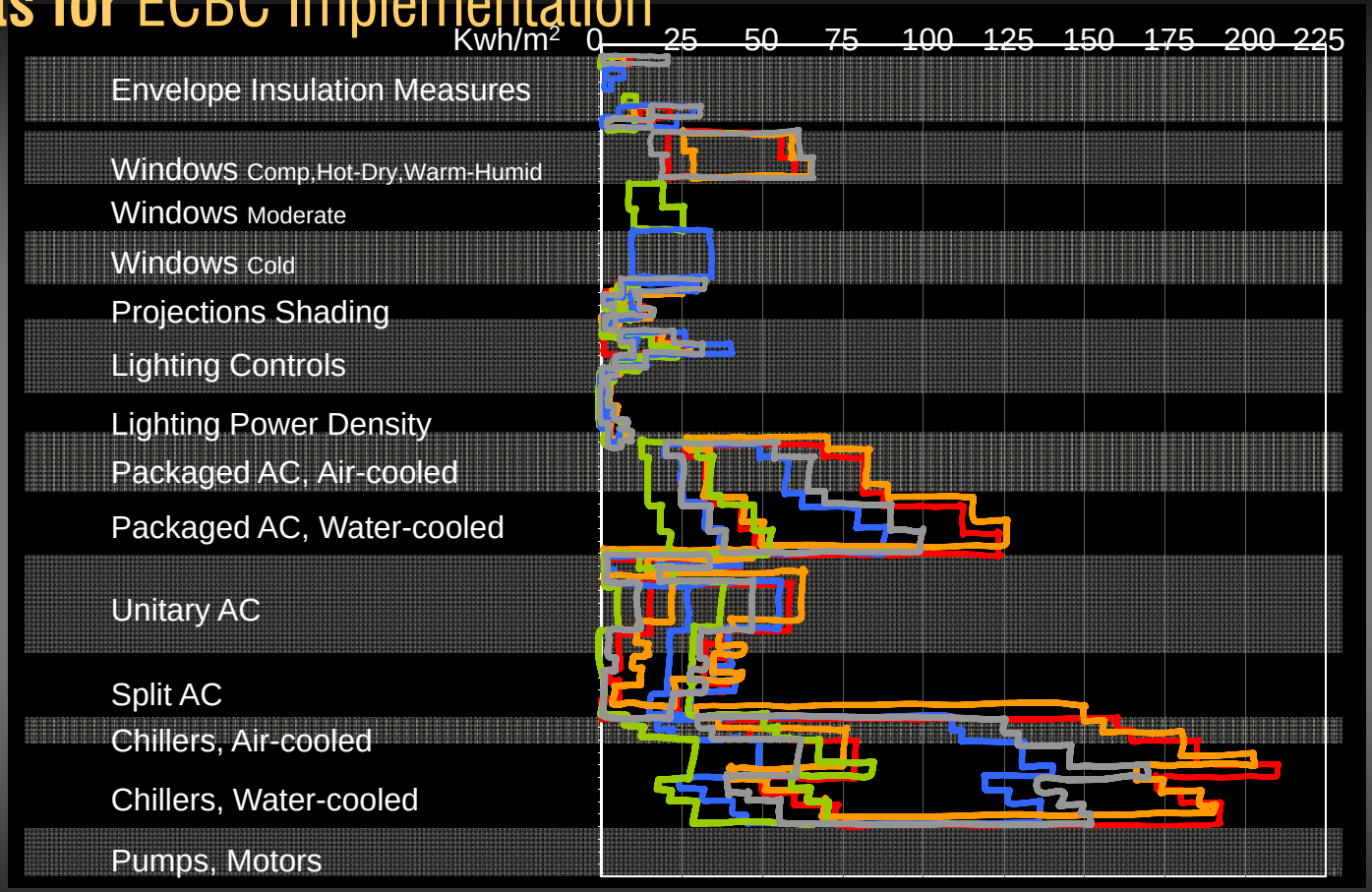
Technical inputs for ECBC Implementation



Source: CEPT-The Weidt Group Study

Technical inputs for ECBC Implementation

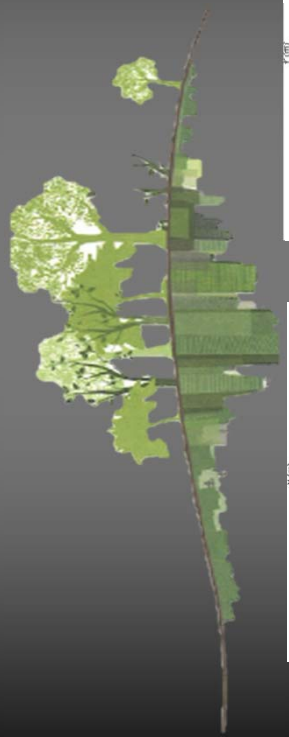
Savings Patterns

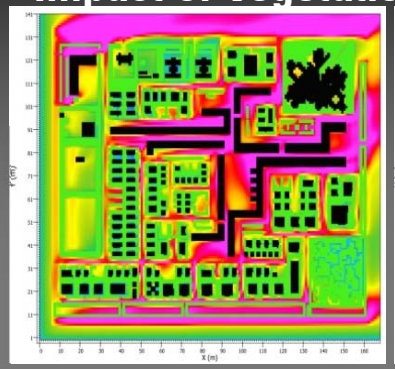


Source: CEPT-The Weidt Group Study

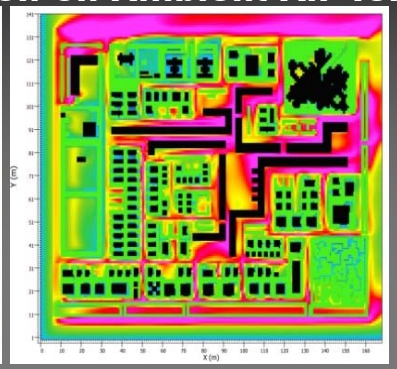
Technical inputs for Building laws for Gandhinagar for Tree Plantation

Impact of Vegetation on Ambient Air Temperature

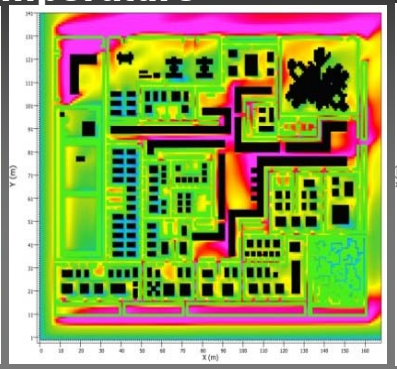




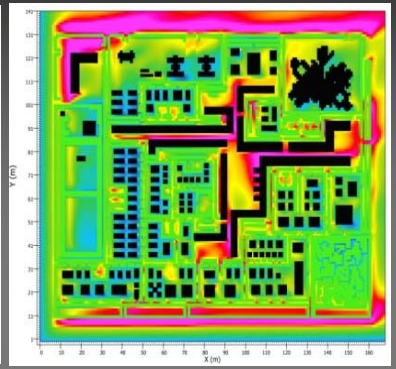
Case 1 (Plot plantation)



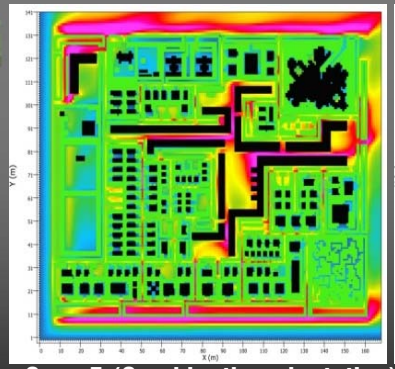
Case 2 (Plot plantation)



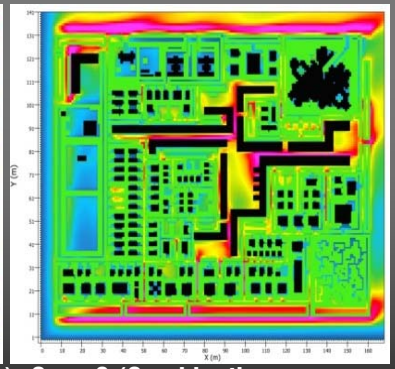
Case 3 (Road plantation)



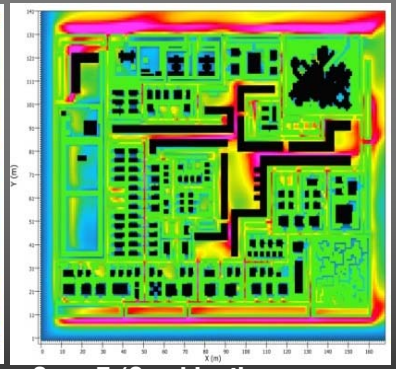
Case 4 (Road plantation)



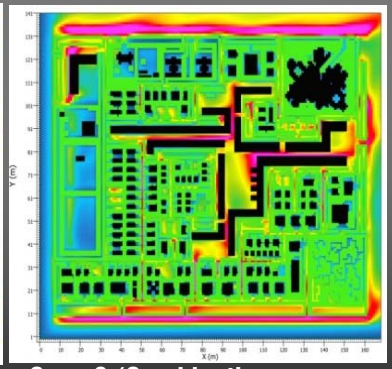
Case 5 (Combination plantation)



Case 6 (Combination plantation)



Case 7 (Combination plantation)

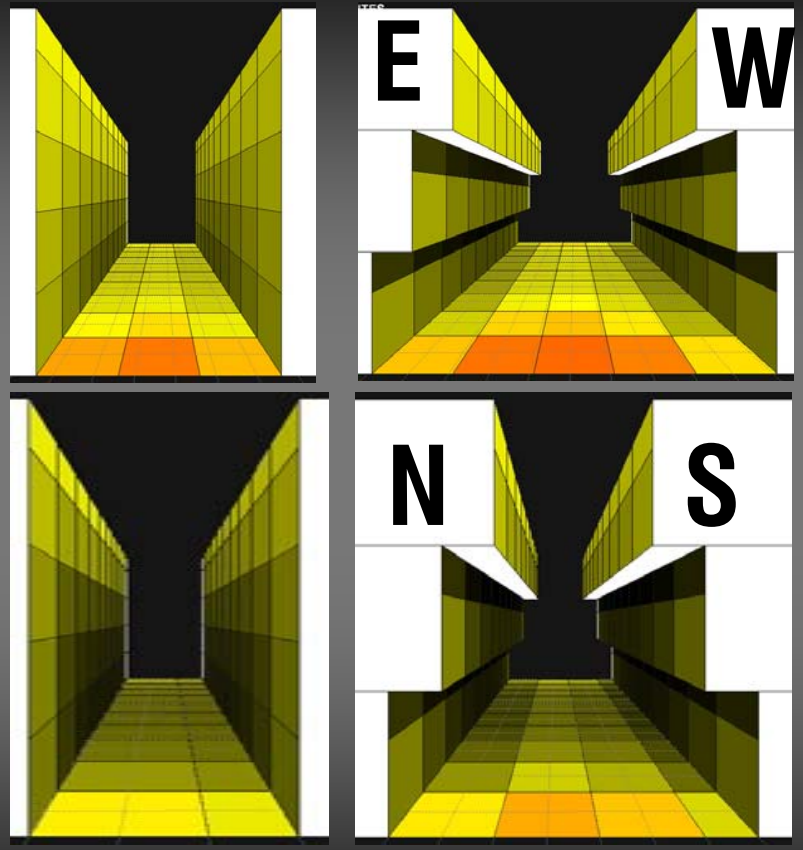


Case 8 (Combination plantation)

Technical inputs for Town Planning Scheme for Gujarat

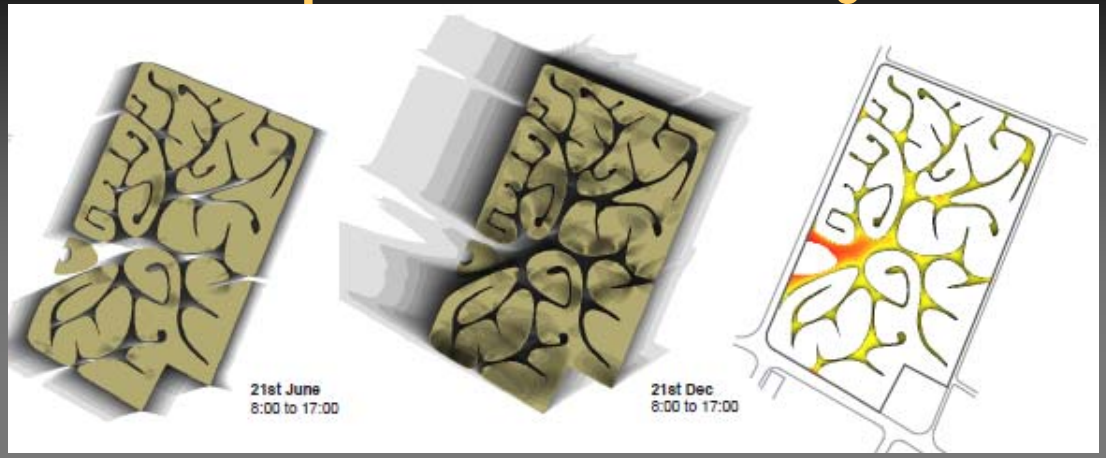
	Obstruction angle 50°,H/W ratio 1.2	Obstruction angle 60°,H/W ratio 1.7	Obstruction angle 70°,H/W ratio 2.6	Obstruction angle 80°,H/W ratio 5.7
N-S	74% shaded	81% shaded	87% shaded	94% shaded
E-W	52% shaded	61% shaded	71% shaded	82% shaded
NW-SE NE-SW	68% shaded	76% shaded	84% shaded	93% shaded
Street Hierarchy		Main road	Secondary	Inner Street

Incident Solar radiation received on street



Source: Kanika Agrawal, CEPT University

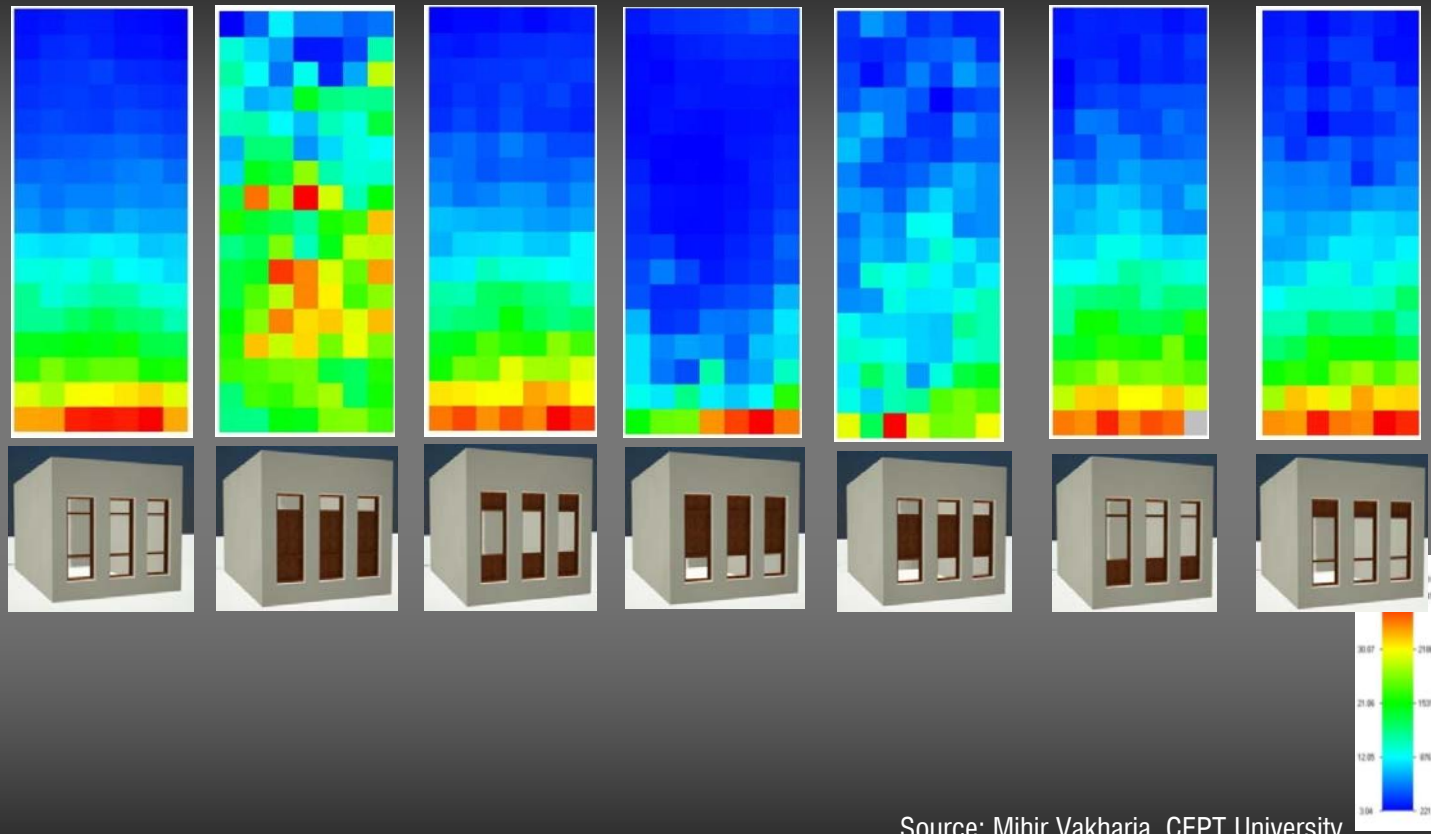
Technical inputs for Town Planning Scheme for Gujarat



Design development – Mutual Shading Shade and radiation analysis: Resultant built mass models Diagrammatic representation

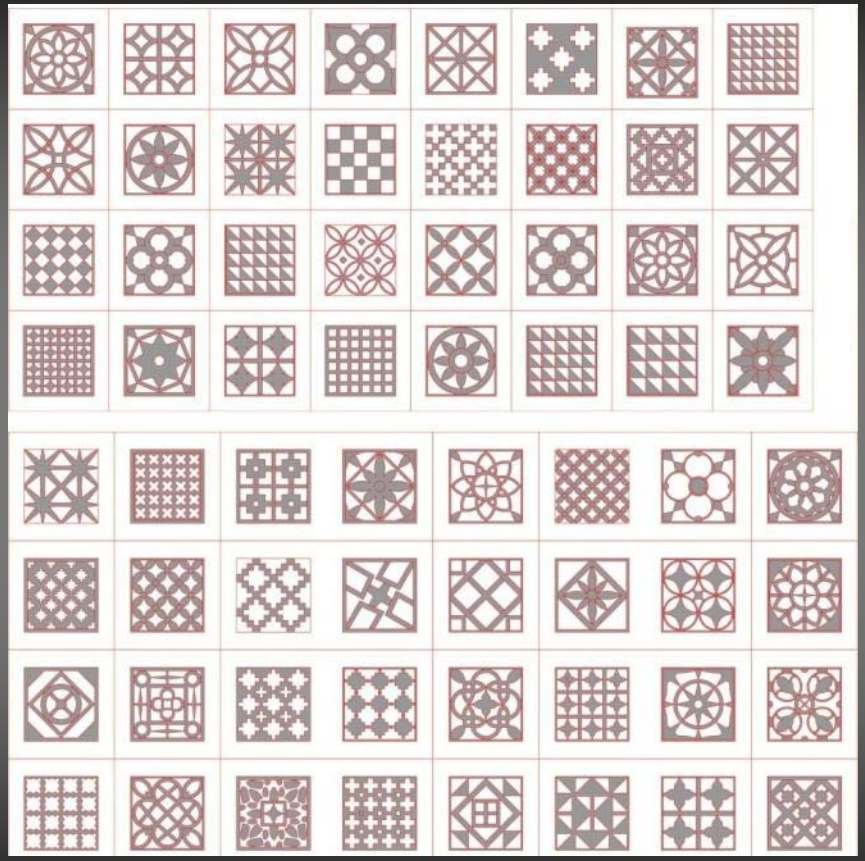
Source: Kanika Agrawal, CEPT University

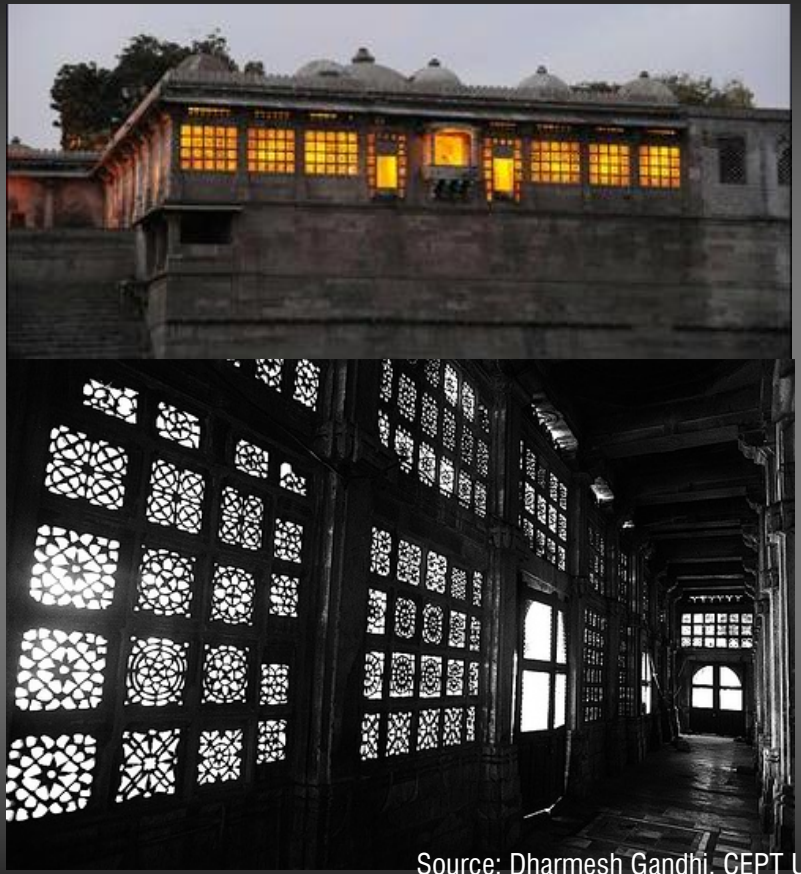
Understanding Vernacular Architecture : Window Configurations



Source: Mihir Vakharia, CEPT University

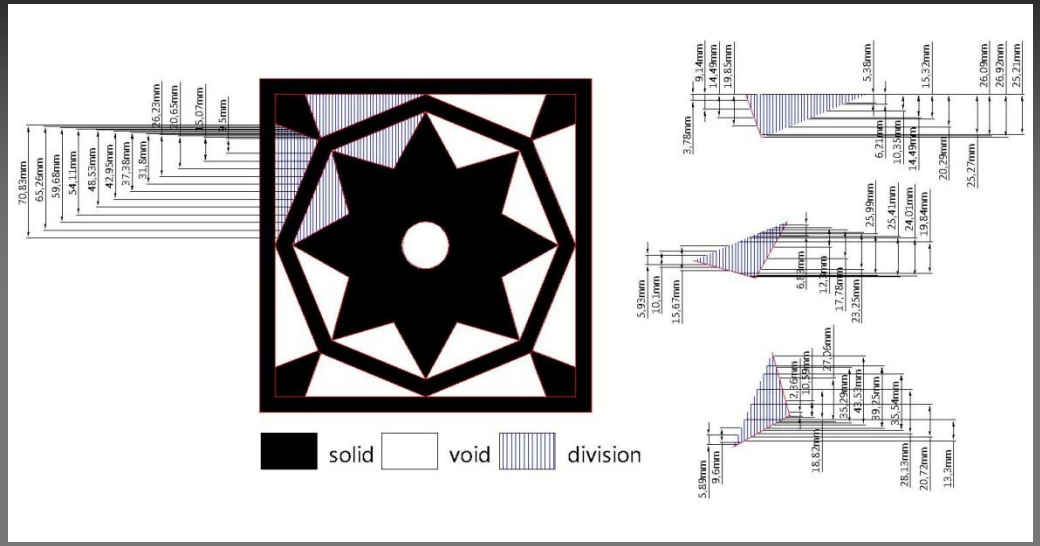
Understanding Vernacular Architecture: Daylight Performance of Trellis: Lattice '*Jali*'

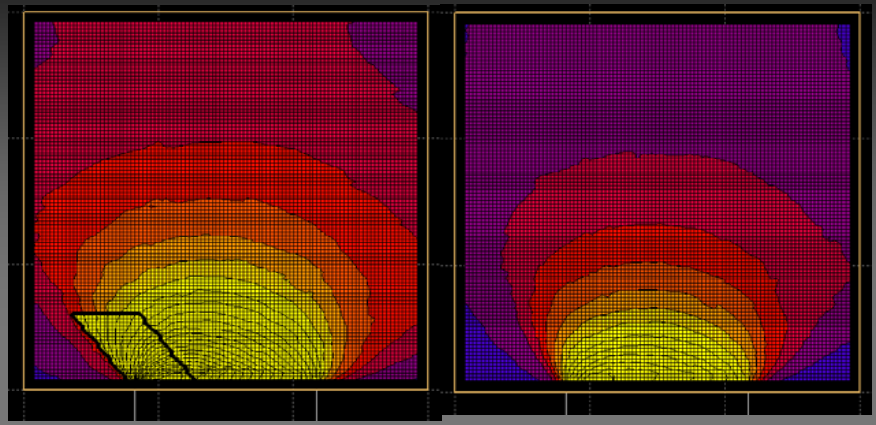


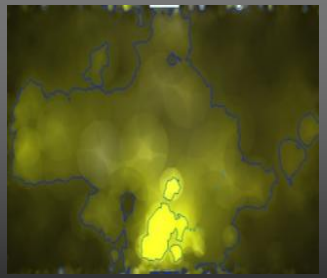


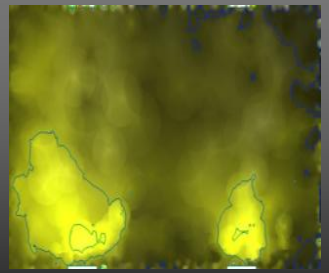
Source: Dharmesh Gandhi, CEPT University

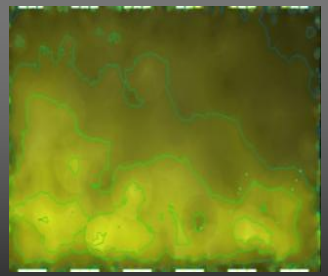
Understanding Vernacular Architecture: Daylight Performance of Trellis: Lattice '*Jali*'











Source: Dharmesh Gandhi, CEPT University

Adaptive Thermal Comfort Model for India: On Going Work

ASHRAE 55 Adaptive thermal comfort model

Five Climate Zone

Air-conditioned – Mixed Mode and Naturally ventilated Buildings

Winter – Summer – Monsoon

Indian benchmark - International Benchmark

9000 Occupants across five climate zones

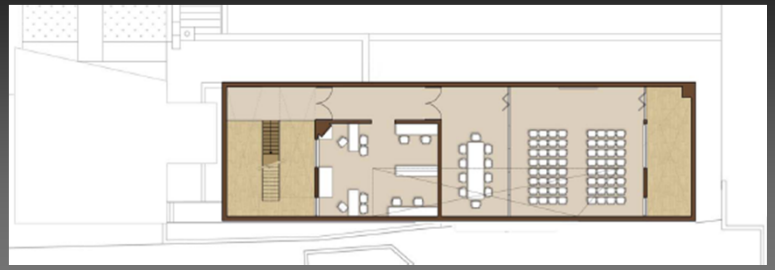
Centre for Advanced Studies in Building Science and Energy

CEPT University, Ahmedabad

Near Net Zero Energy Building

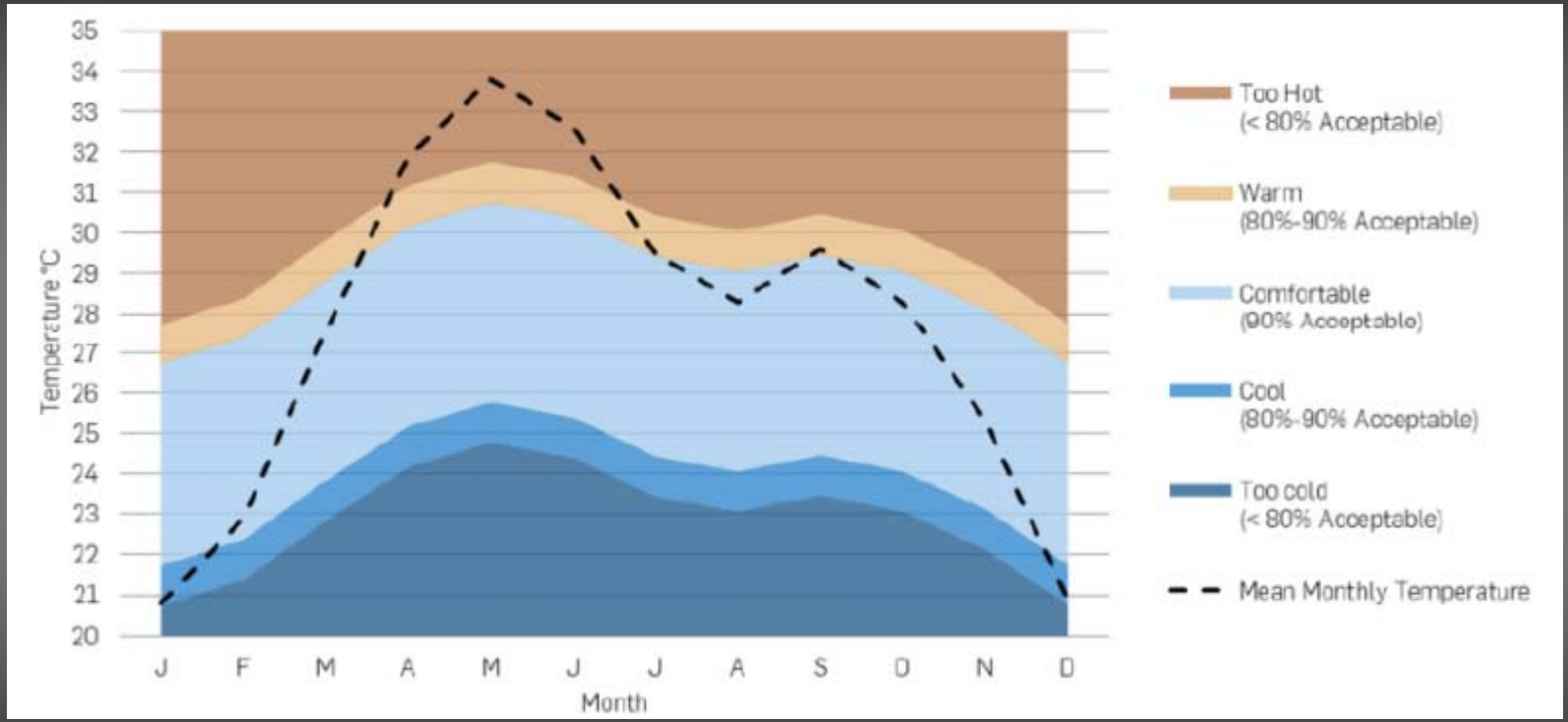
A Living Laboratory

Net / Near Zero Energy Building – A Living Laboratory



Net / Near Zero Energy Building – A Living Laboratory

Typical Annual ASHRAE 55 Operative Temperature Comfort Bands for Naturally Ventilated in Ahmedabad , India

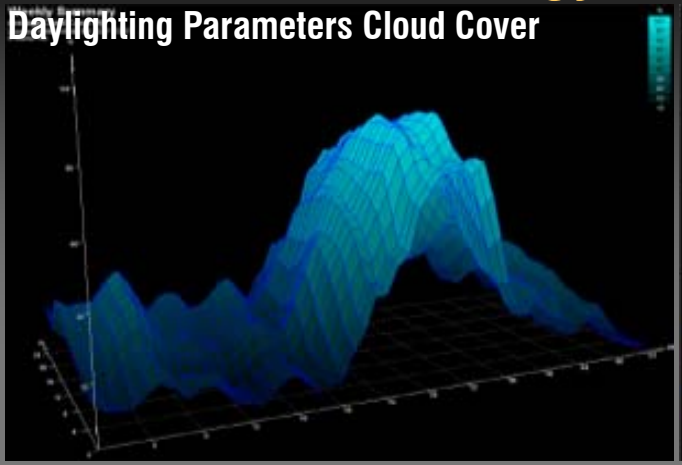


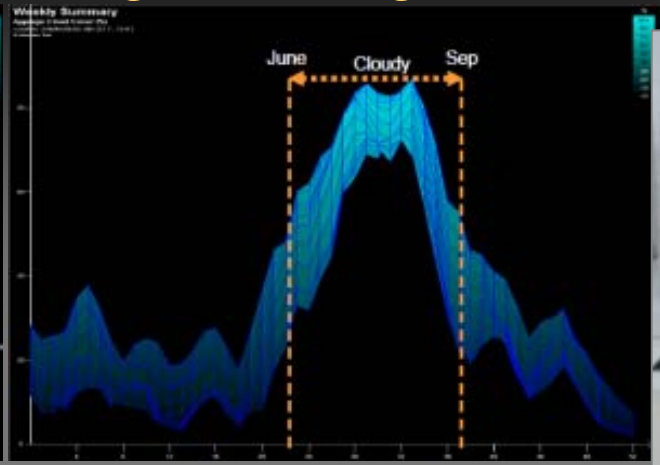
ASHRAE 55 thermal comfort based on the mean monthly temperature for Ahmedabad, India

Source: Built Ecology,

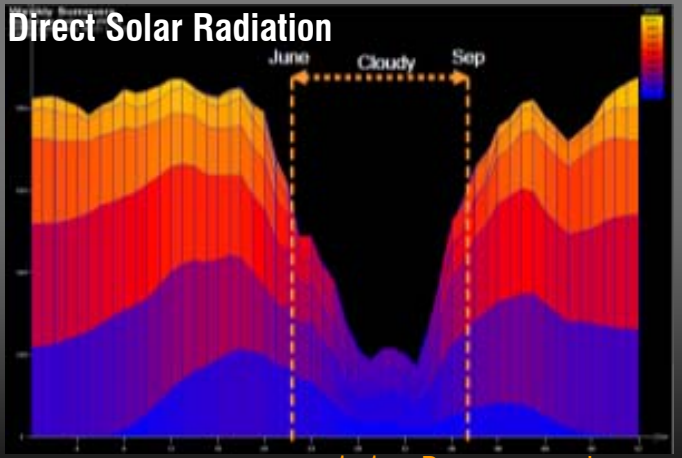
Net / Near Zero Energy Building – A Living Laboratory

Daylighting Parameters Cloud Cover

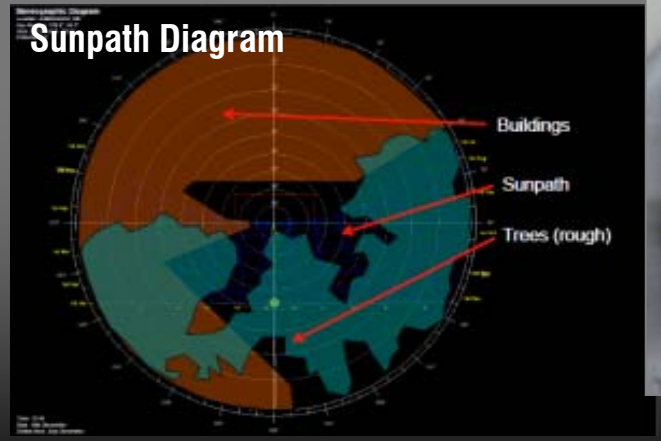




Direct Solar Radiation



Sunpath Diagram



Source: ECOIII, The Weidt group, CEPT University

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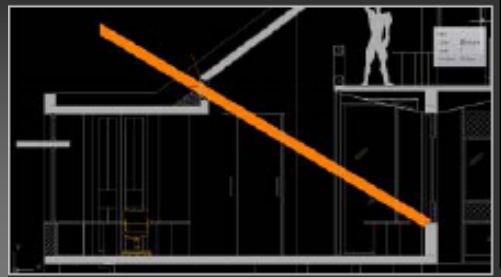
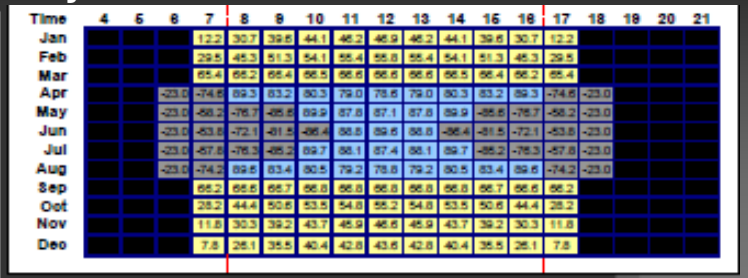
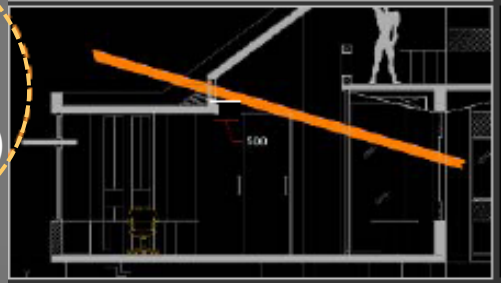
Sun Control Analysis South Facing Clerestory

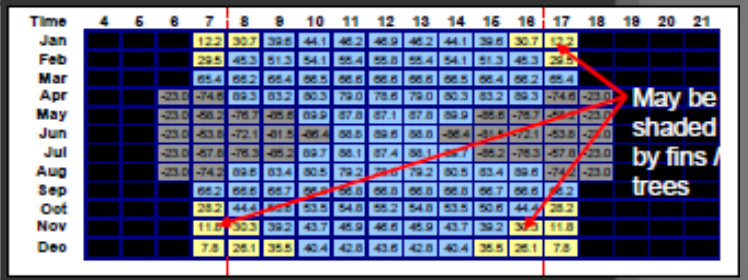
Base Case
No light shelf
(70 deg cut-off)



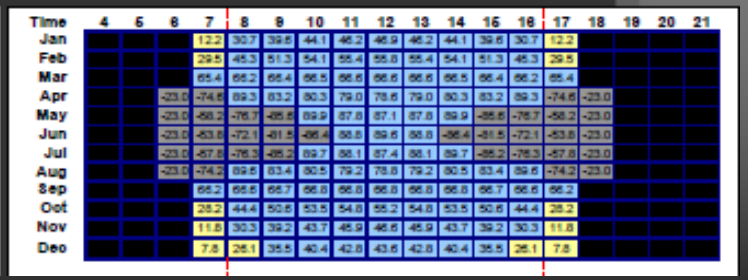


Option 1
500 light shelf
(39 deg cut-off)





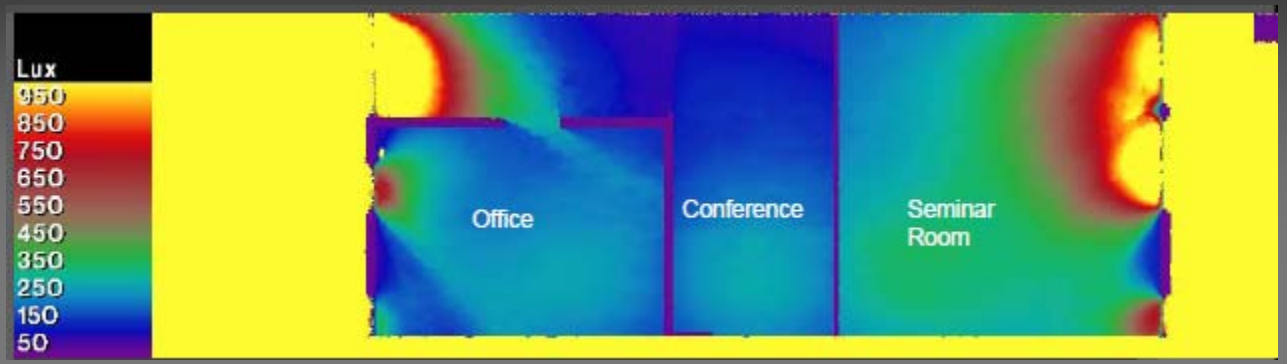
Option 2
800 light shelf
(30 deg cut-off)



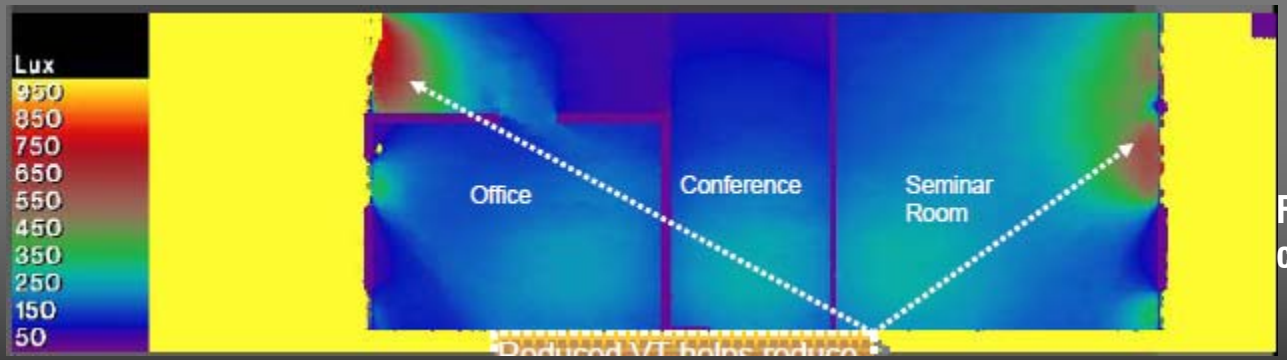
Source: ECOIII, The Weidt group, CEPT University

Net / Near Zero Energy Building – A Living Laboratory

Illuminance of floor plan under clear sky Basement level



With 67% VT on East & West



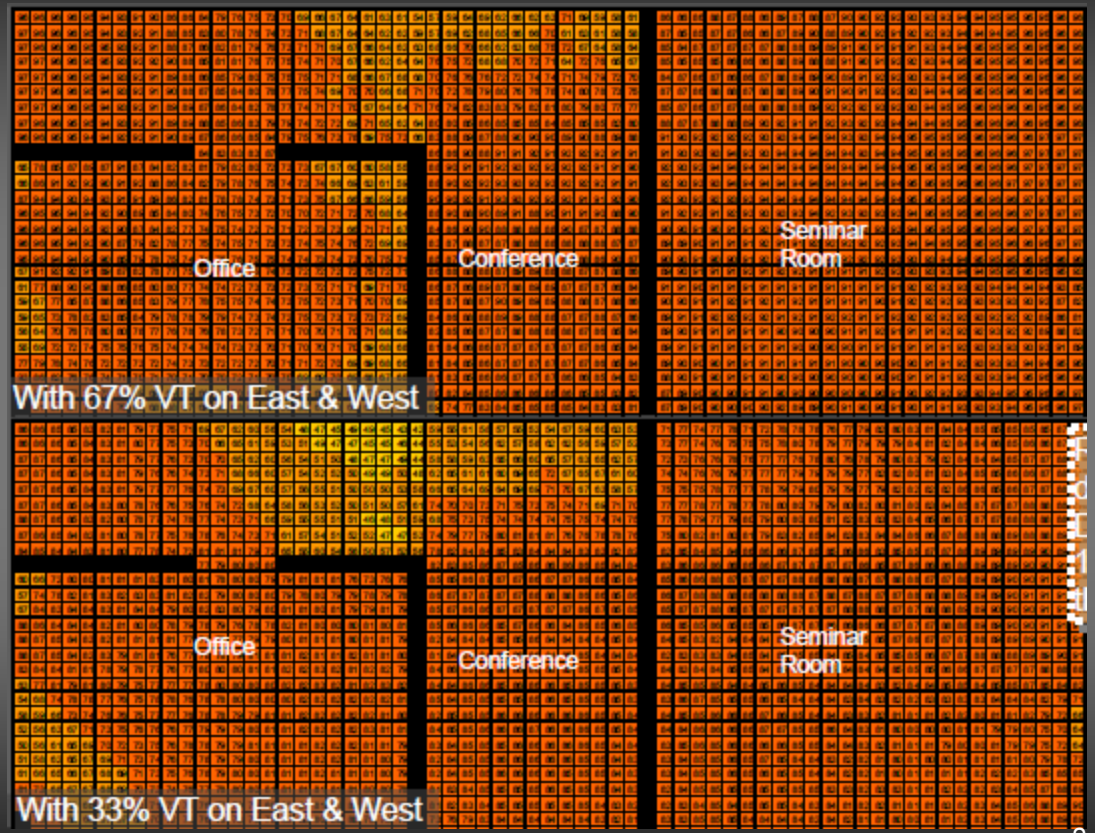
With 33% VT on East & West

Reduced VT helps reduce high contrast/glare near windows

Source: ECOIII, The Weidt group, CEPT University

Net / Near Zero Energy Building – A Living Laboratory

Continuous Daylight Autonomy (300 lux) on Work Plane Basement level

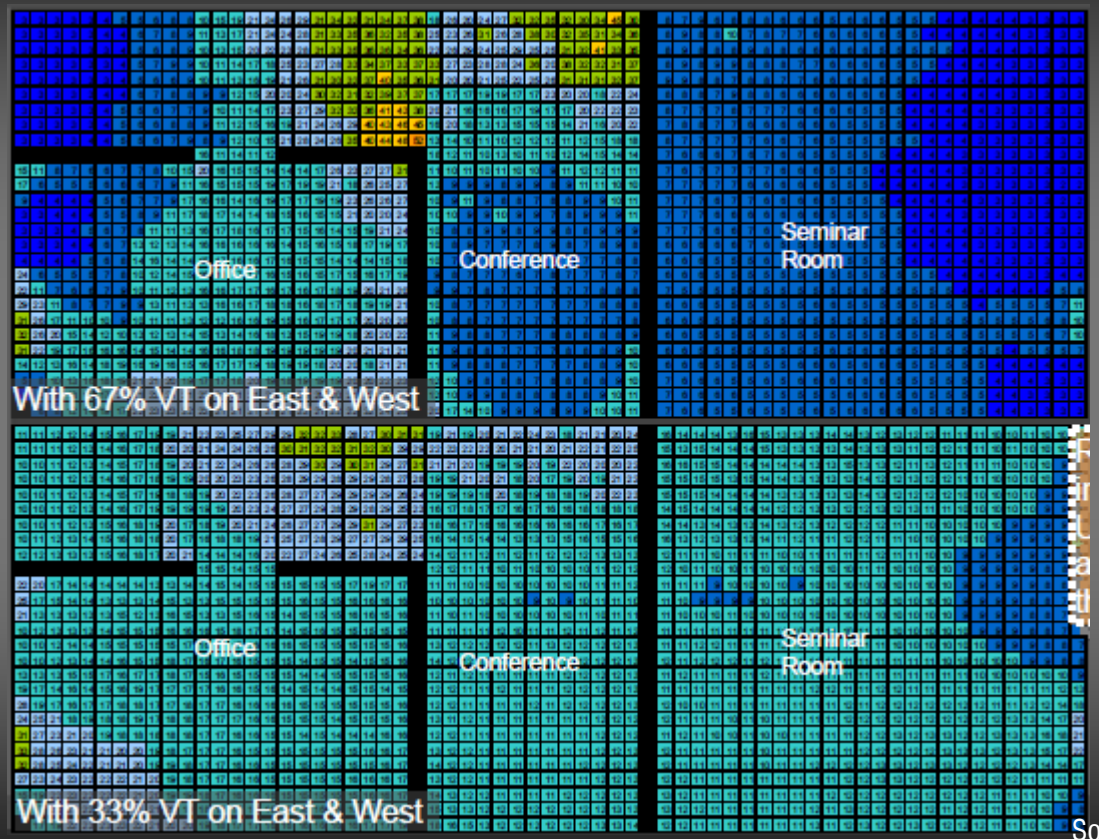


Reduced VLT decreases DA by about 10% throughout

Source: ECOIII, The Weidt group, CEPT University

Net / Near Zero Energy Building – A Living Laboratory

Useful Daylight Index (<100) on Work Plane Basement level

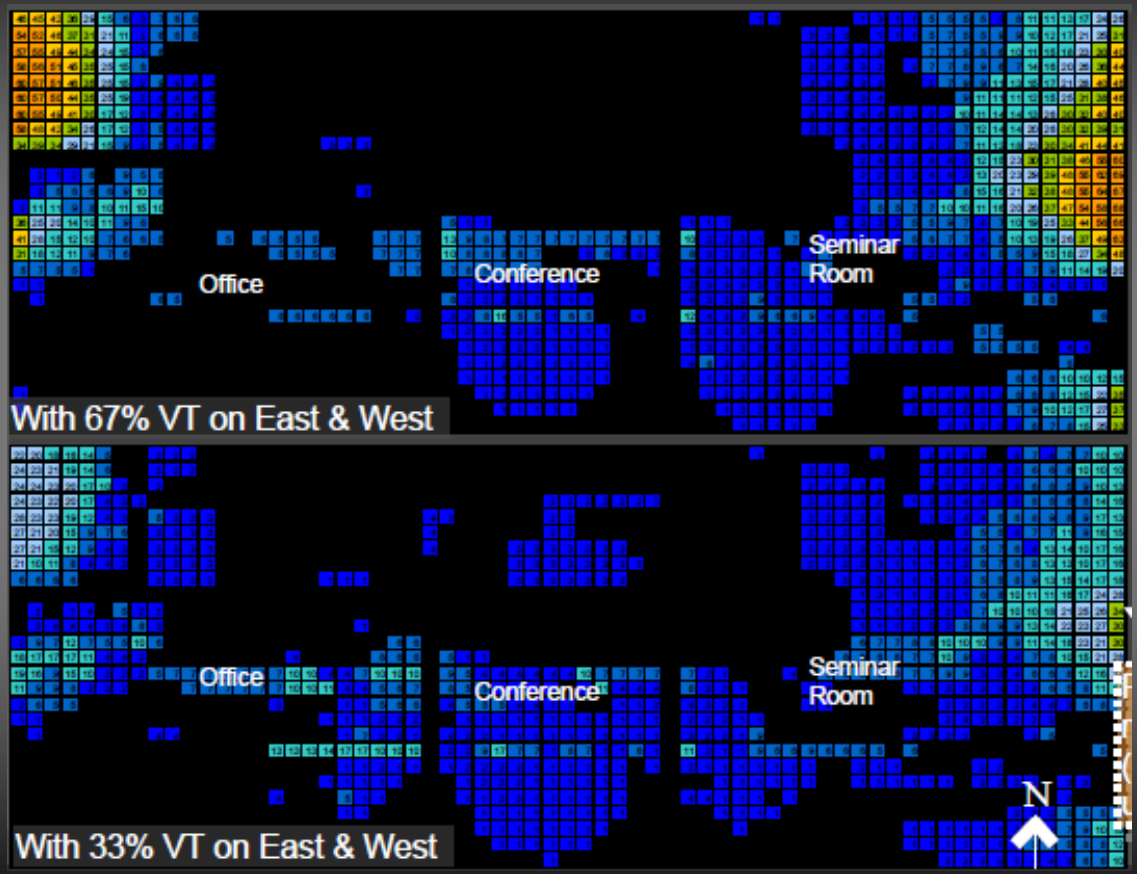


Reduced VLT increases UDI(<100) by about 6% throughout

Source: ECOIII, The Weidt group, CEPT University

Net / Near Zero Energy Building – A Living Laboratory

Useful Daylight Index (>2000) on Work Plane Basement level



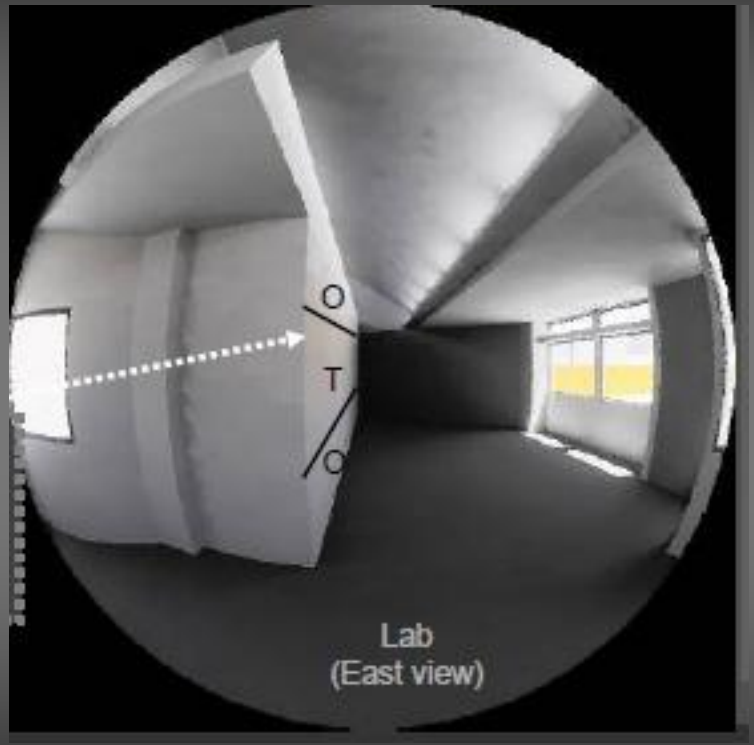
Reduced VT reduced UDI(>2000) by UP TO 30% !

Source: ECOIII, The Weidt group, CEPT University

Net / Near Zero Energy Building – A Living Laboratory

Luminance views under clear sky I Floor

With glass partition wall



With opaque partition wall

Source: ECOIII, The Weidt group, CEPT University

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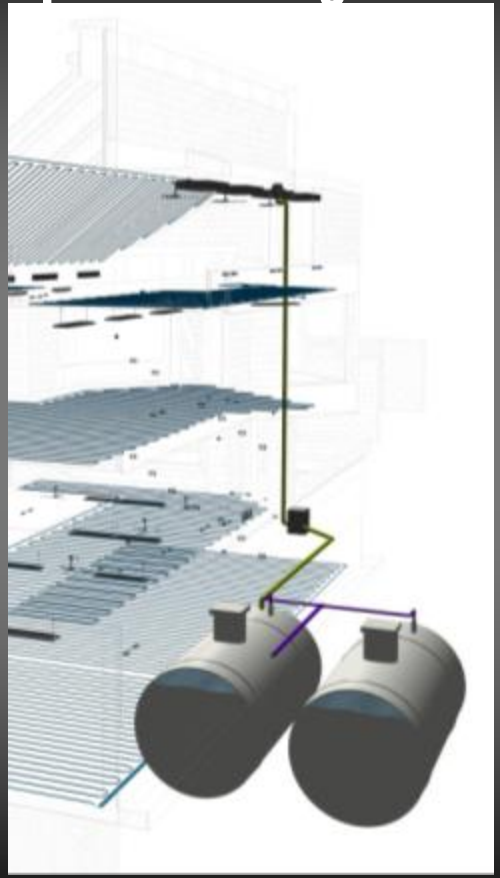
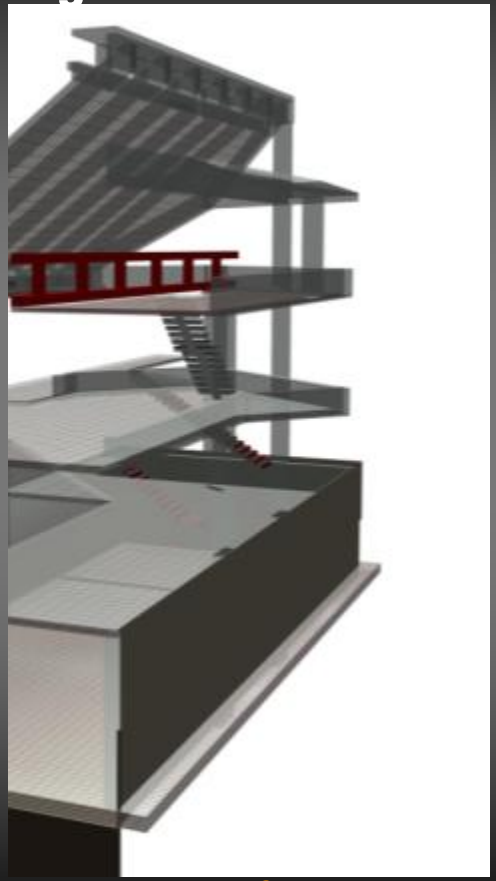
Integrated Disciplines: Progress Images





Source: London Info,
CEPT University

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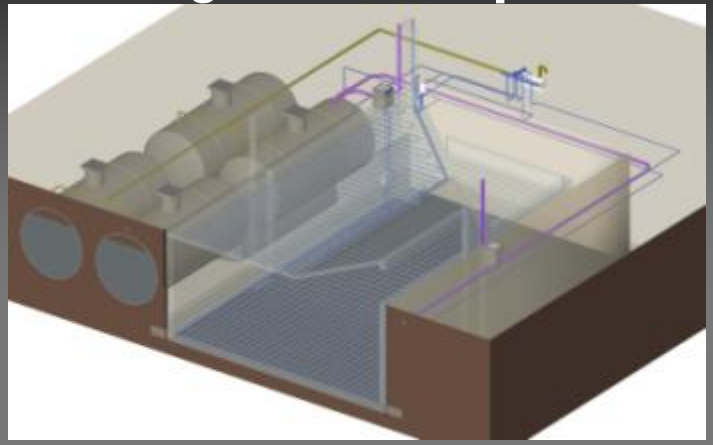
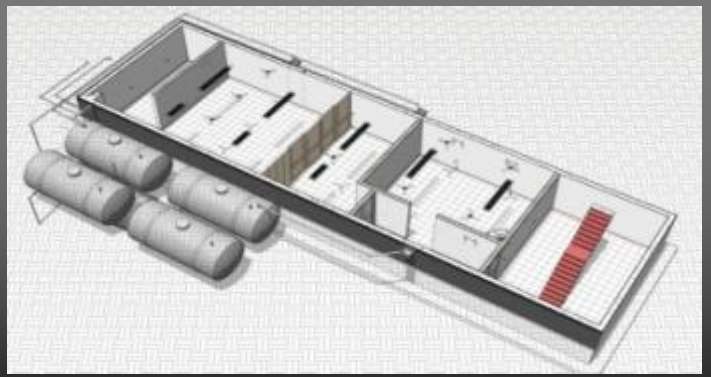
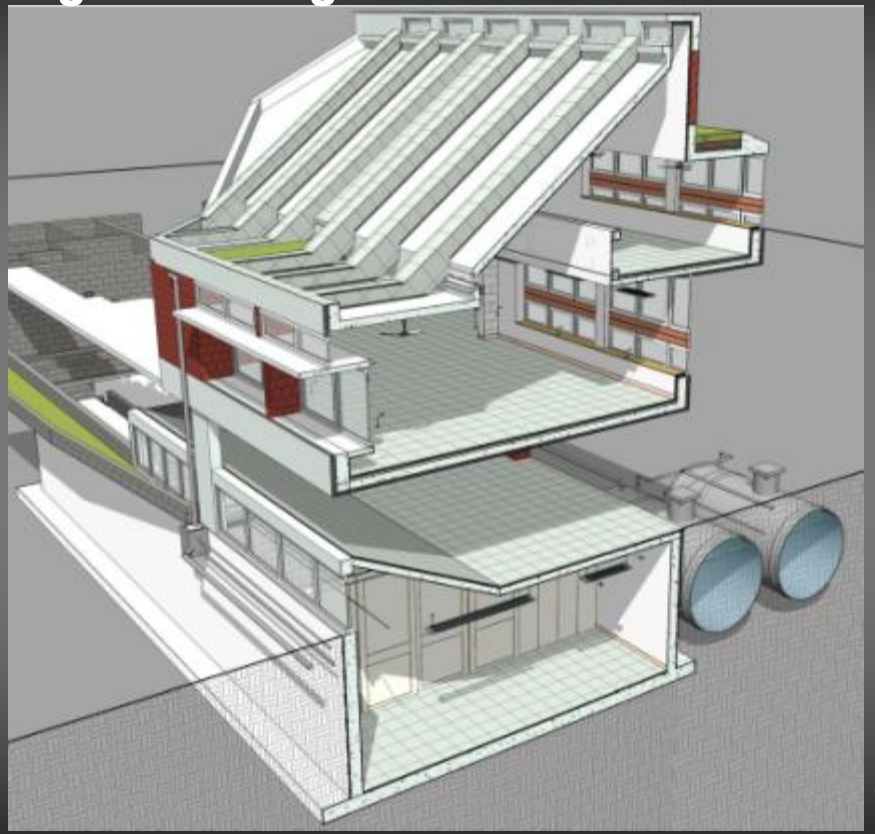
Integrated Disciplines: Progress Images







Source: London Info, CEPT University

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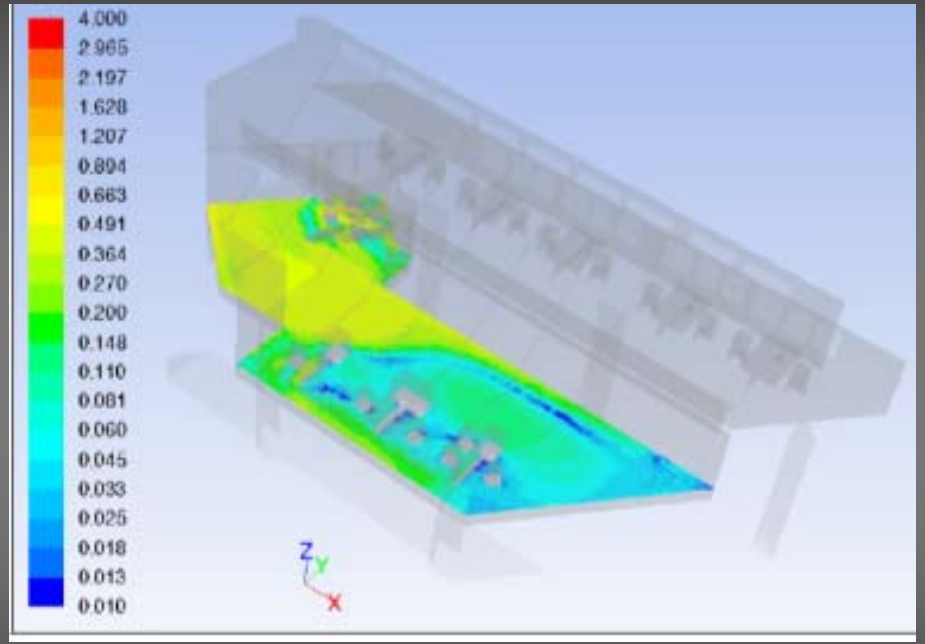
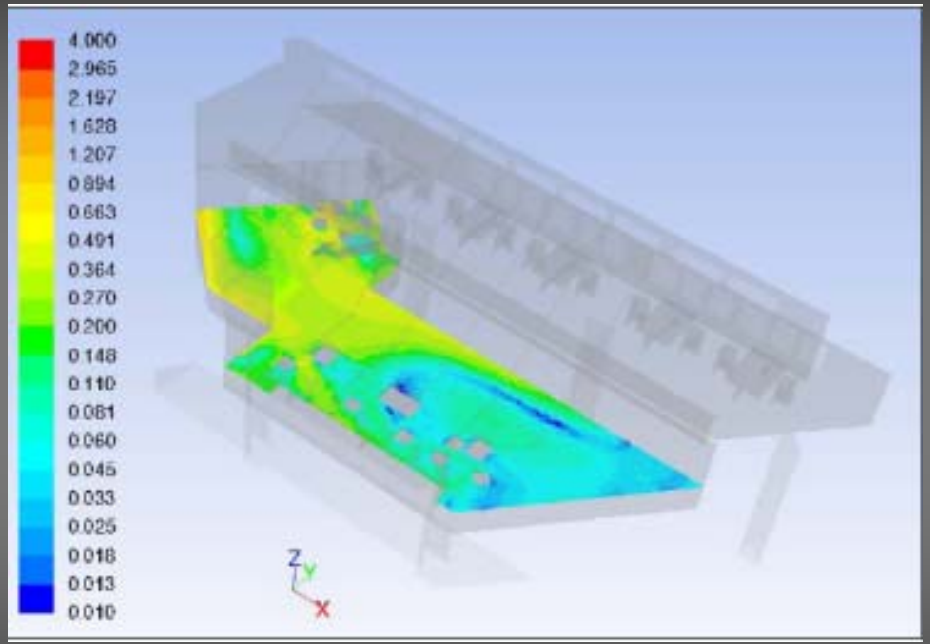
Thermal Comfort Analysis: Velocity Contours



Velocity Contours : at 0.5 meter height



Velocity Contours : at 1.2 meter height

Source: Mecharts,
& CEPT University

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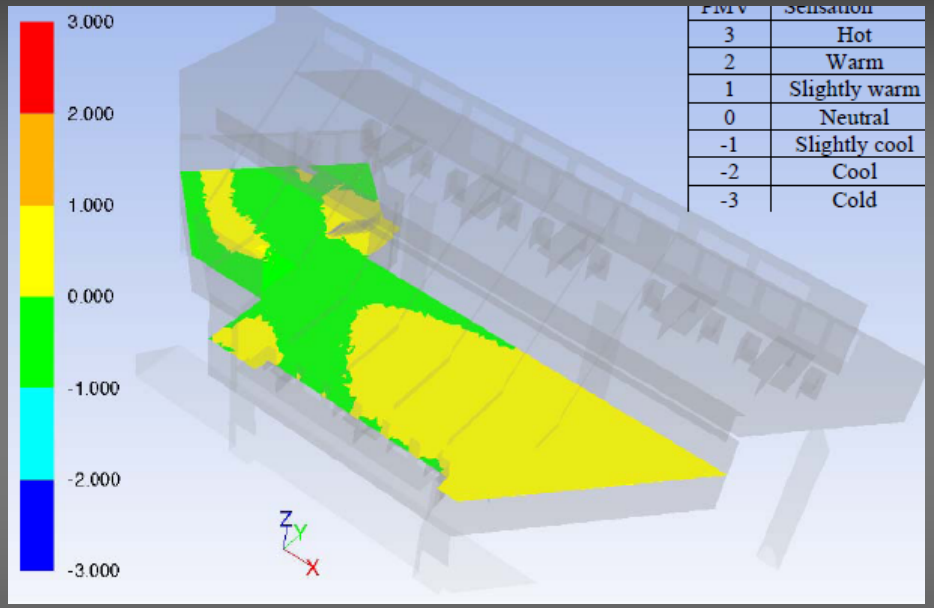
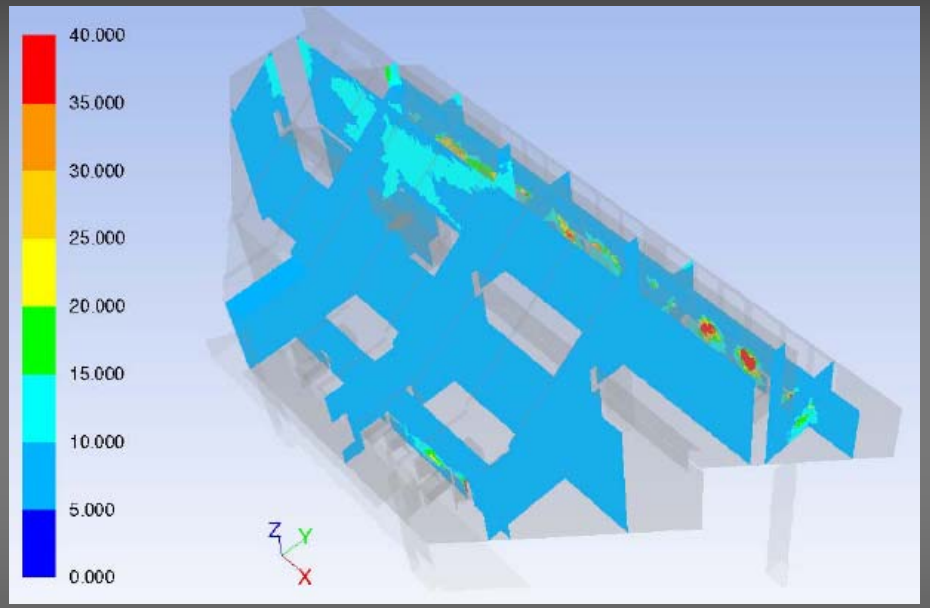
Thermal Comfort Analysis: Predicted mean Vote and Percentage People Dissatisfied



PMV at 1.0 meter height



PPD at 1.0 meter height

Source: Mecharts, & CEPT University

When you can measure what you are speaking about, and express it in numbers,
You know something about it,
but when you cannot measure it, when you cannot express it in numbers,
your knowledge is of a meagre and unsatisfactory kind

Lord William Thomson Kelvin

THANK YOU

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