DR ALI GHAFFARIAN
DR AMIRHOSEIN GHAFFARIAN

RESPONSIVE + GREEN RG UBE
URBAN BUILT ENVIRONMENT LAB

BUILT ENVIRONMENT ENGINEERING
AUT

FROM INTELLIGENT PROTOTYPES TO AN ENERGY EFFICIENT FUTURE

SUSTAINABILITY

SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

COP21/CMP11
Paris France
SECRETAIRE EXECUTIVE CCNUCC
PRESIDENT
SECRETAIRE

SUSTAINABILITY

Hardware VS Software

HARDWARE

- **INTELLIGENT BUILDINGS**
  - **BMS**
    - SMART & ENERGY EFFICIENT DEVICES
    - ENERGY EFFICIENT MANAGEMENT & CONTROL

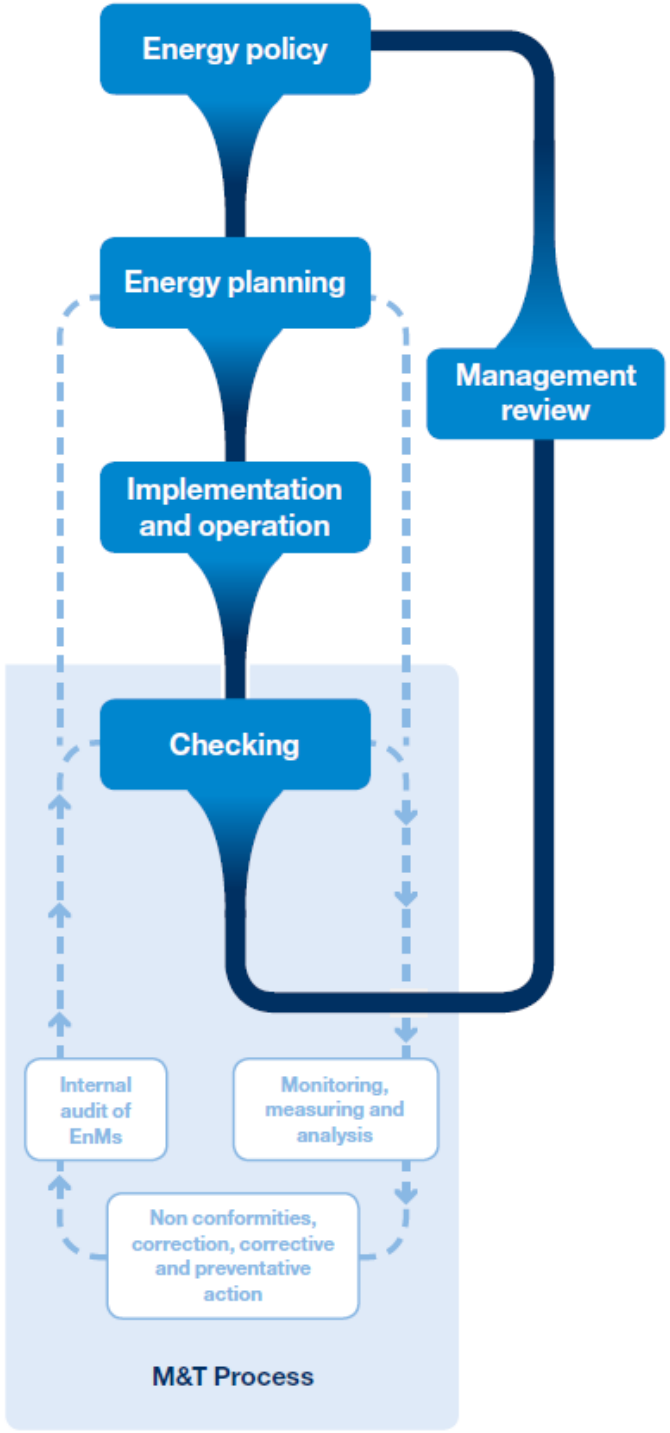

Image source: https://www.eecabusiness.govt.nz/assets/Resources-Business/EEC3652-EECA-Management-Guide-Monitoring-and-Targeting_v6.0-web2.pdf

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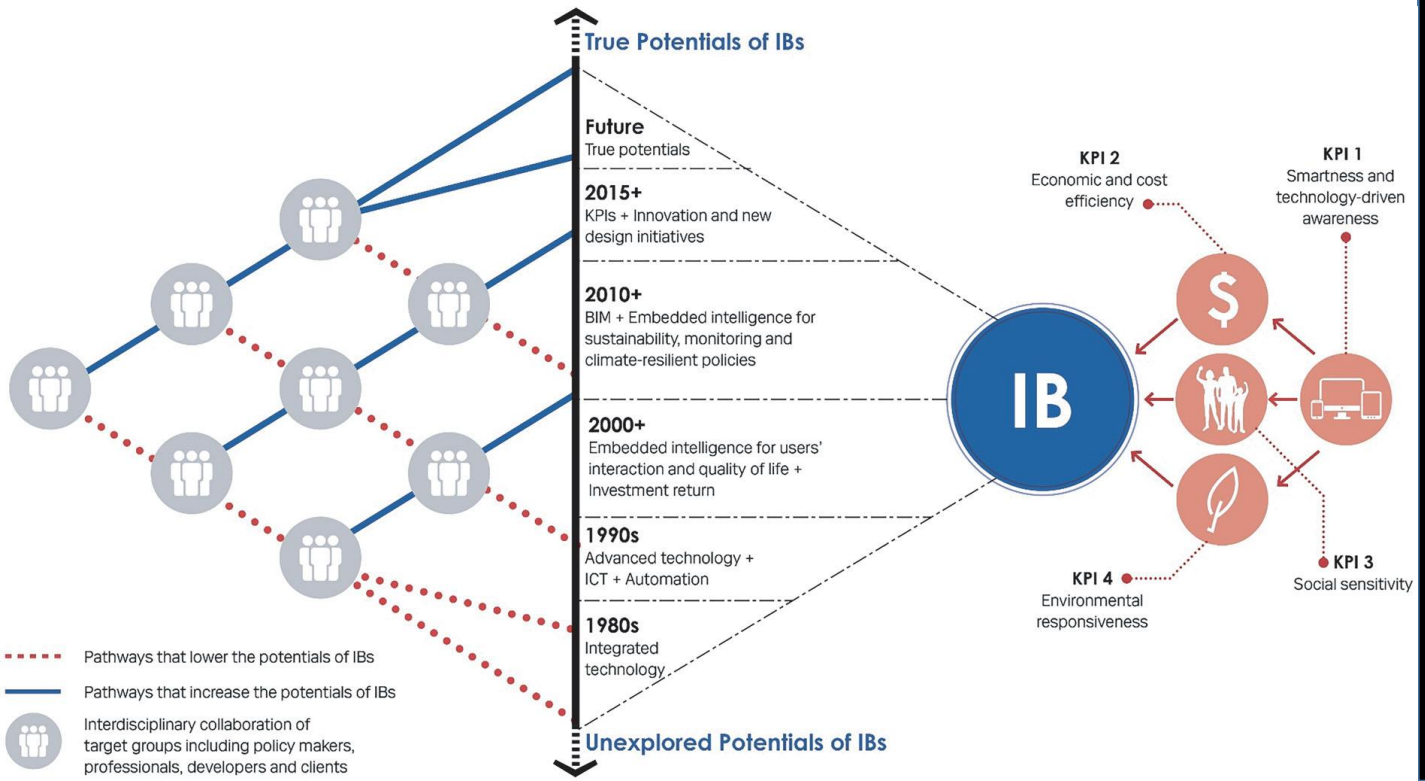
SOFTWARE

- **INTELLIGENT SYSTEMS**
  - **BIM**
    - INTEGRATED INFORMATION MANAGEMENT
    - SMART MONITORING & CONTROL



Ghaffarianhoseini, AH., Berardi, U., AlWaer, H., Chang, S., Halawa, E., Ghaffarianhoseini, A., & Clements-Croome, D. (2016). What is an intelligent building? Analysis of recent interpretations from an international perspective. *Architectural Science Review*, *59*(5), 338-357.

INTEGRATING

Hardware & Software

INDUSTRY

Renewable and Sustainable Energy Reviews 72 (2017) 935–949

Contents lists available at ScienceDirect

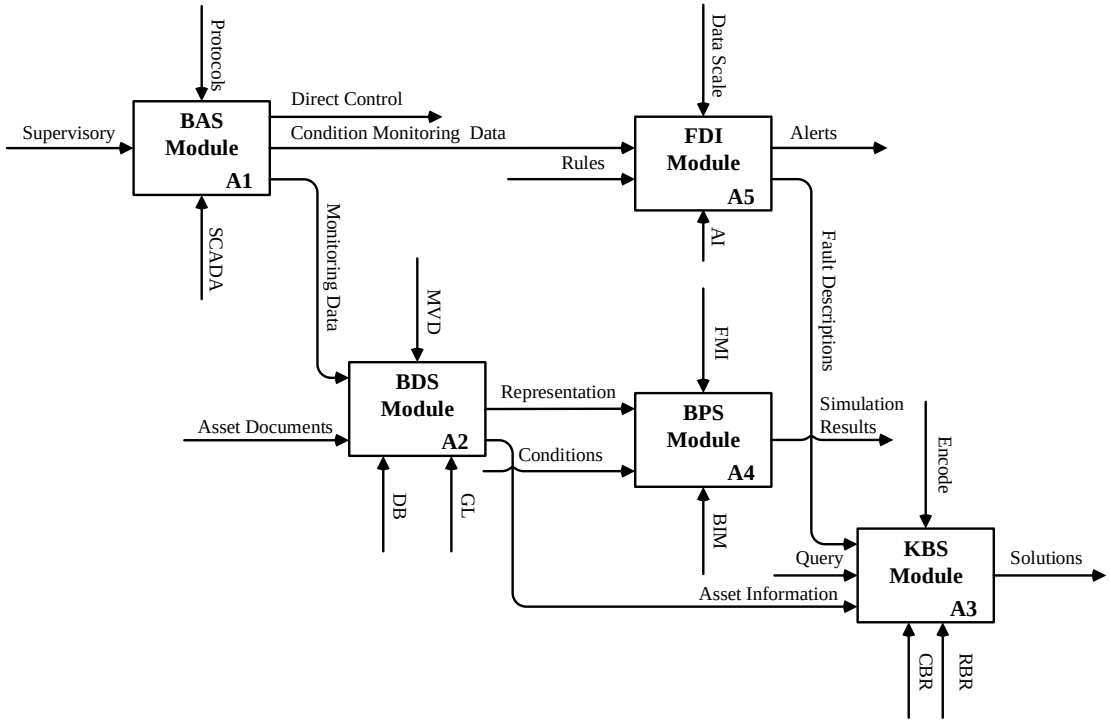
Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

Application of nD BIM Integrated Knowledge-based Building Management System (BIM-IKBMS) for inspecting post-construction energy efficiency

Ali GhaffarianHoseini[a,*], Tongrui Zhang[a], Okechukwu Nwadigo[a], Amirhosein GhaffarianHoseini[b,c], Nicola Naismith[a], John Tookey[a], Kaamran Raahemifar[b]

[a] Department of Built Environment Engineering, School of Engineering, Computer and Mathematical Sciences, AUT University, Auckland, New Zealand
[b] Faculty of Engineering and Architectural Science, Ryerson University, Toronto, Canada
[c] Faculty of Arts and Social Sciences, University of Malaya (UM), Kuala Lumpur, Malaysia



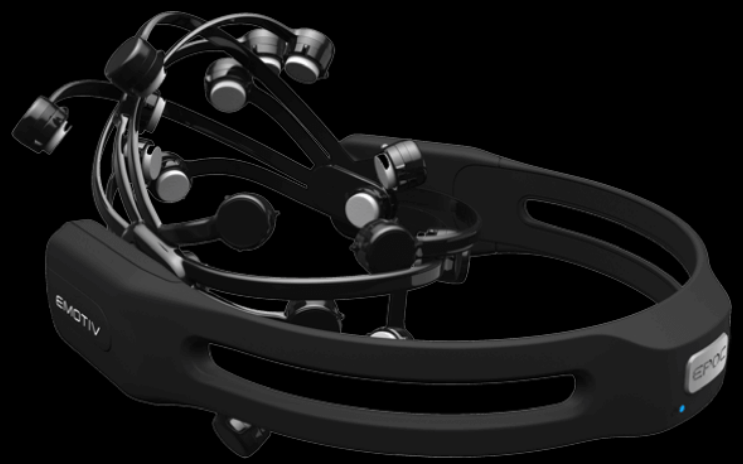
ACADEMIA

FUTURE PROOFING

- **TECHNICAL YET INDIRECT**
  - **HOLO-PORTATION**
    - SMART & ENERGY EFFICIENT BUILDINGS
    - SMART OFFICES
    - NUMEROUS GREEN POTENTIALS
    - FROM VIRTUALITY TO REALITY

Image source: https://www.microsoft.com/en-us/hololens/hardware

- **BEYOND PHYSICS**
  - **PSYCHOLOGICAL SUSTAINABILITY**
    - ELECTROENCEPHALOGRAM (EEG)



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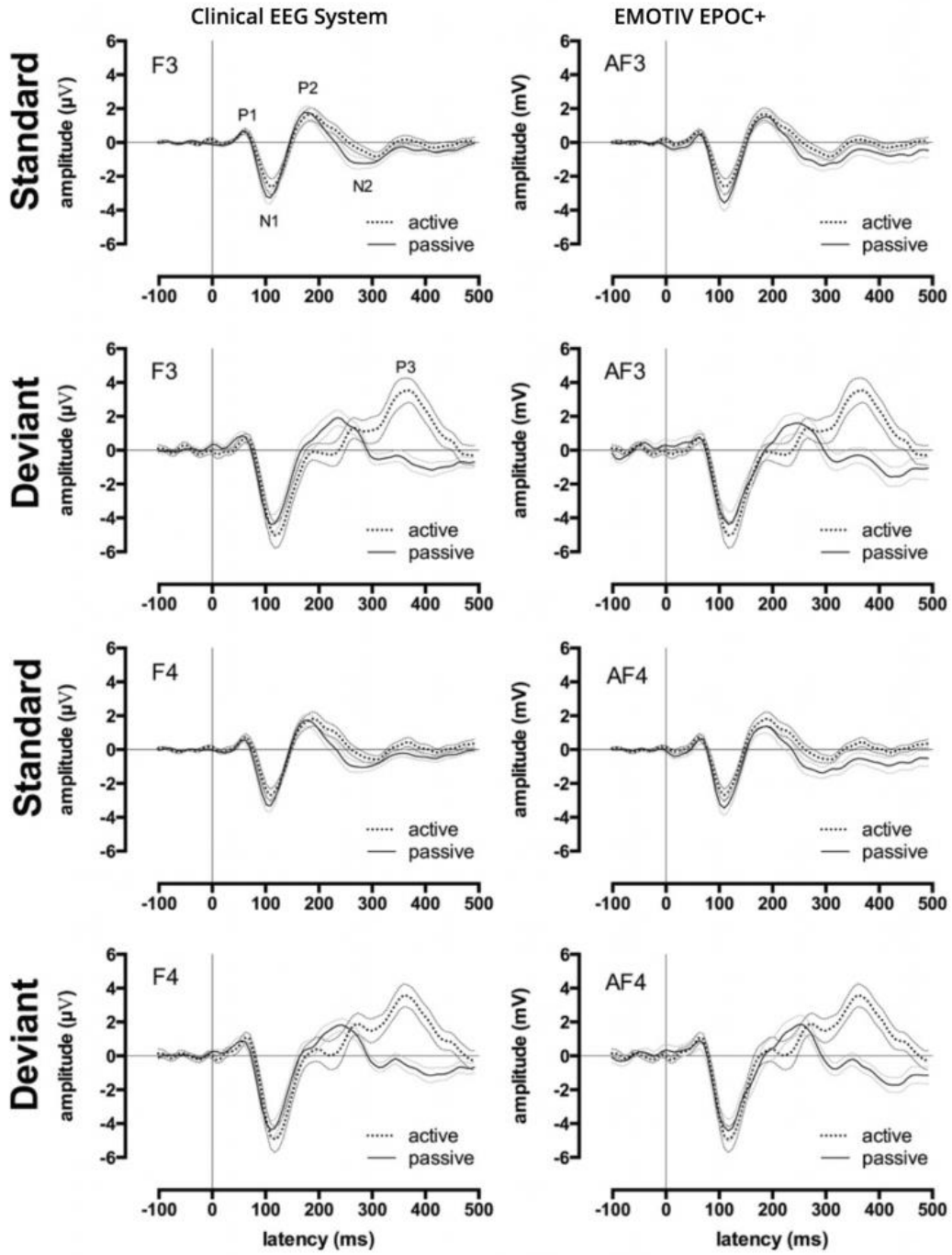
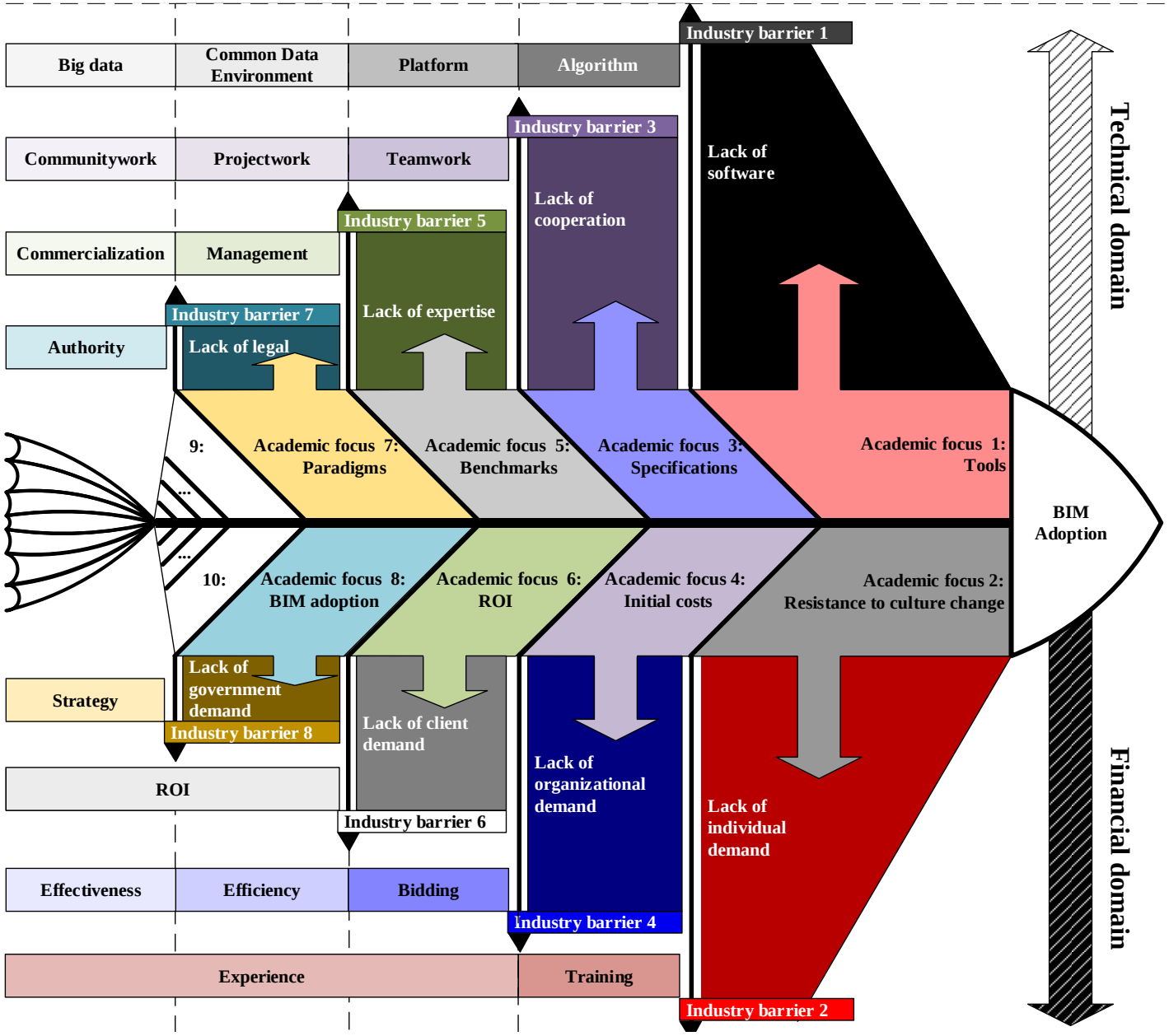


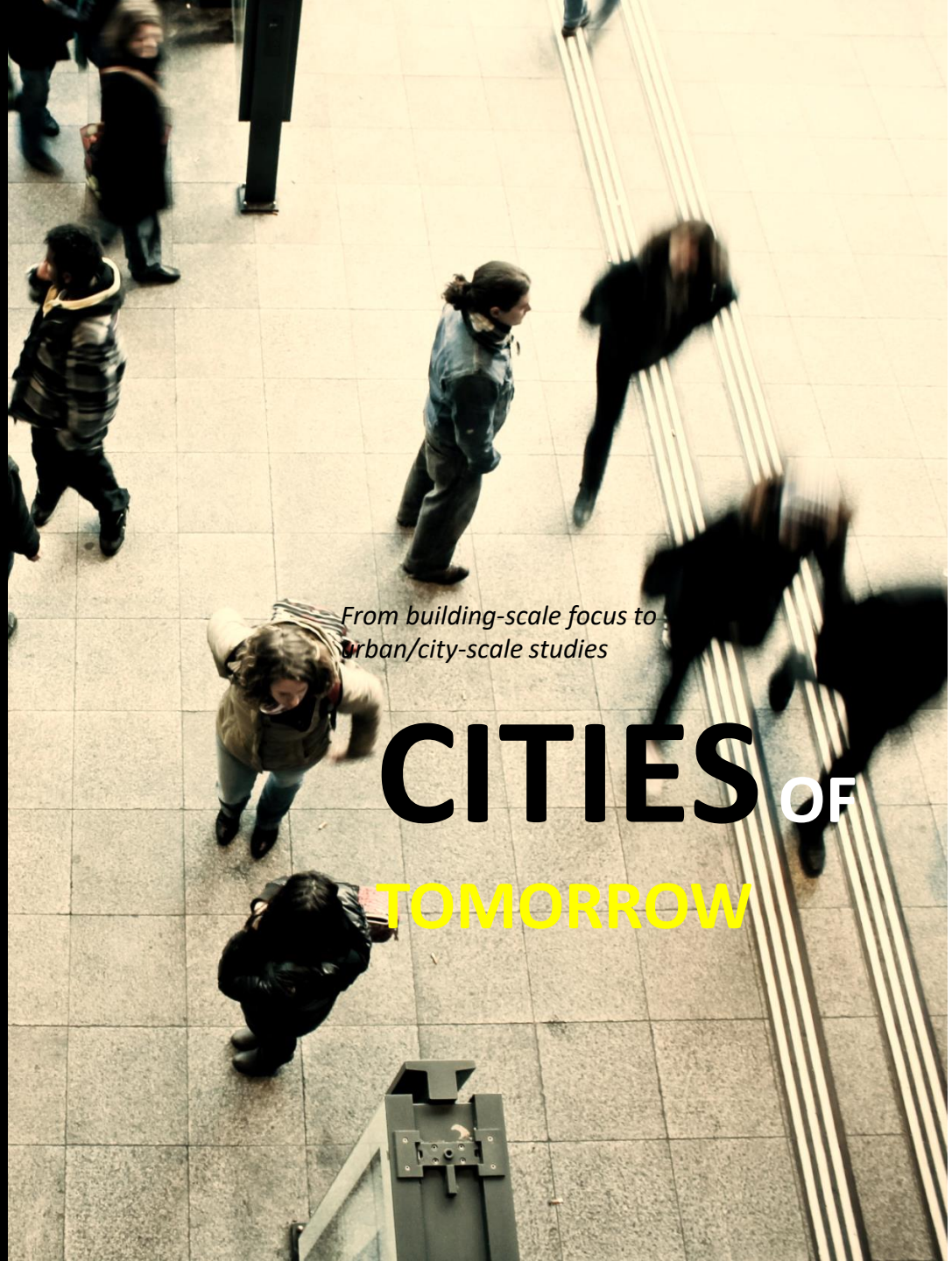
Image source: https://www.emotiv.com/the-science/



INTEGRATING ALL!

THINK EFFECTIVELY BEFORE ACTING SO!

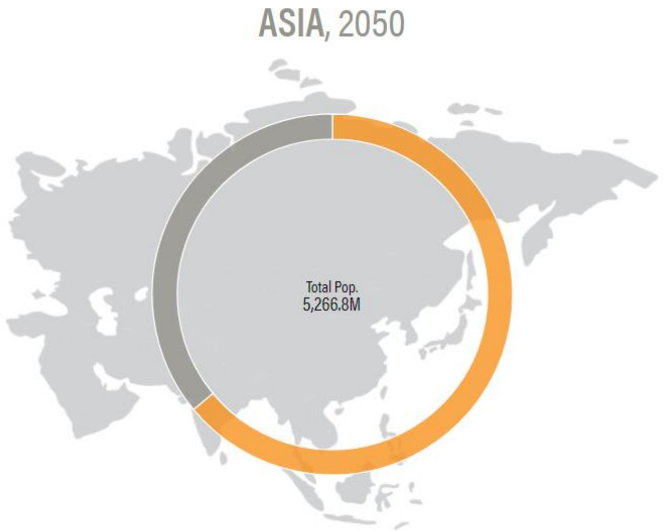
Integrating all of the above yet avoiding to become a **victim of technology!**

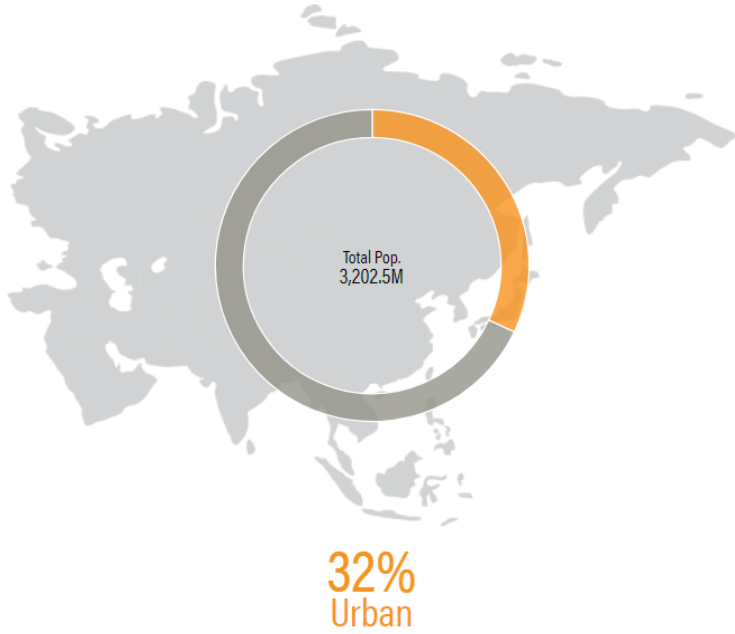


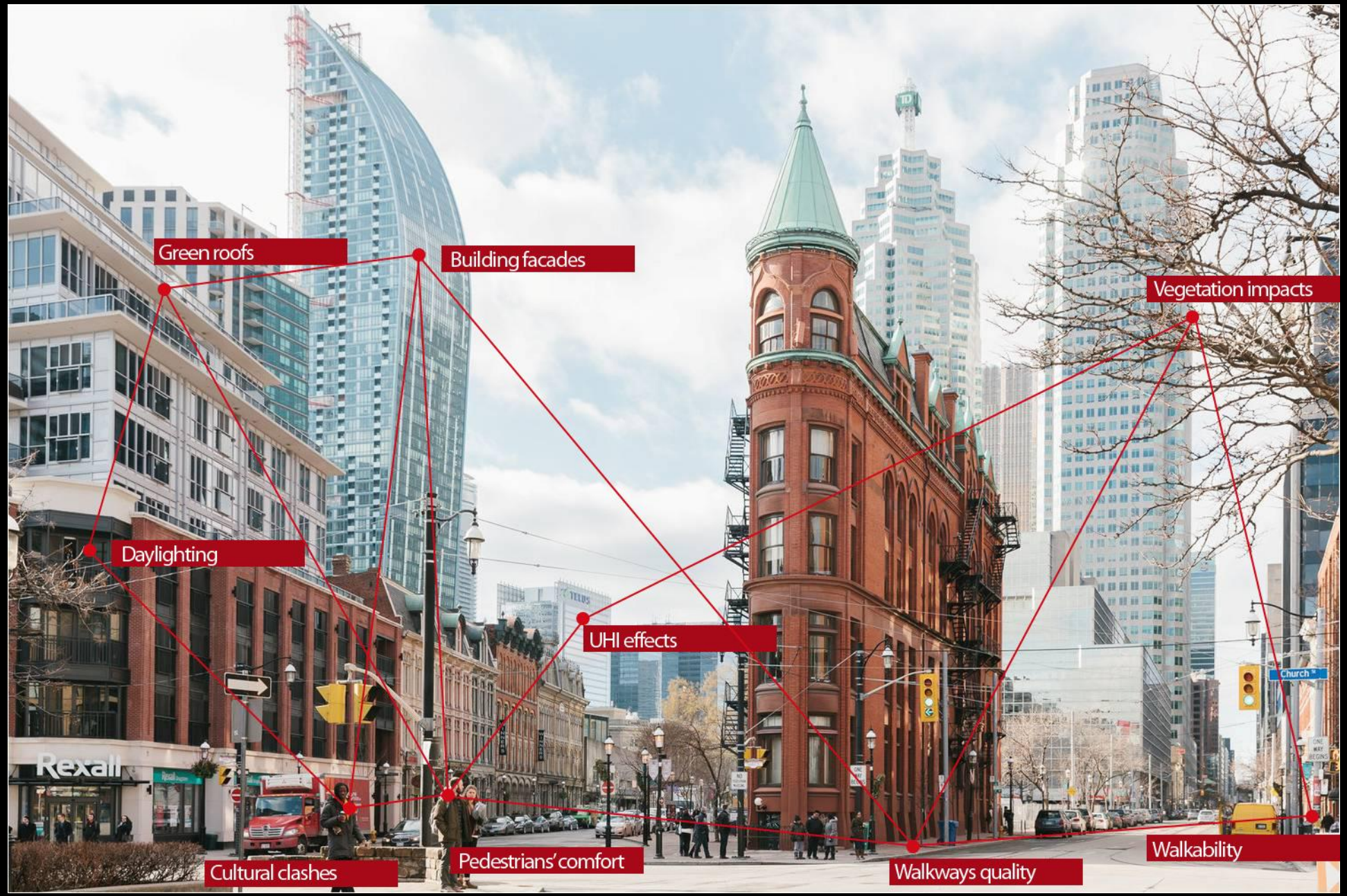
From building-scale focus to urban/city-scale studies

CITIES OF TOMORROW

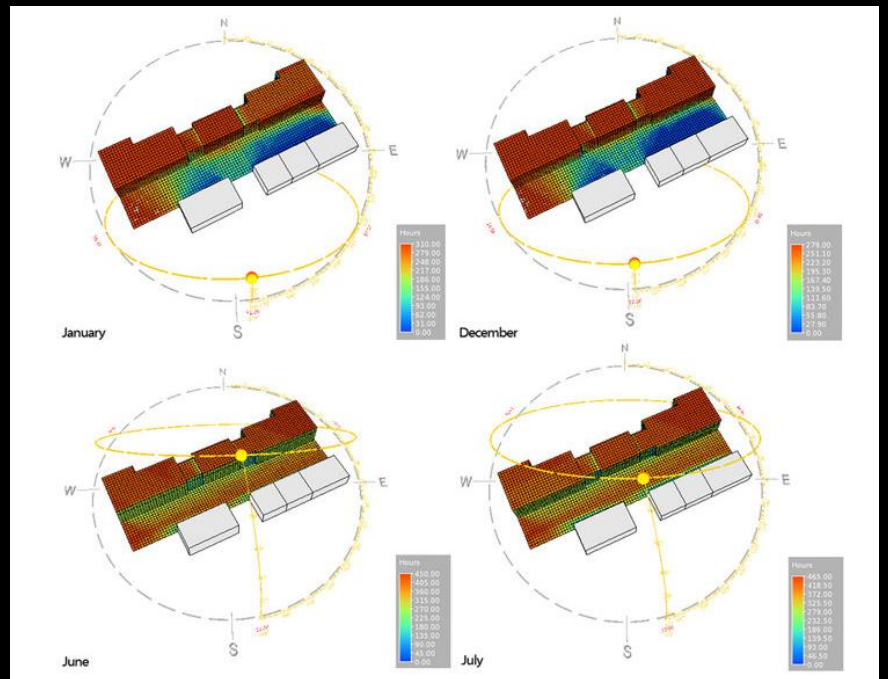
Image source: http://publications.wri.org/buildingefficiency/






Green roofs
Building facades
Vegetation impacts
Daylighting
UHI effects
Cultural clashes
Pedestrians' comfort
Walkways quality
Walkability
Rexall
Church St

Energy Efficient
Sustainable
Zero-Energy
Env-Friendly
Zero-Carbon
Sustainability Assessment Tools
LEED, BREEAM,...
Health-related Assessment Tools
WELL,...
Green Buildings
Intelligent Buildings
Healthy Buildings
Smart Buildings
Satisfaction & Health
Happiness
Productivity
Social Well-being
Transition to City Level
Intelligence
Smartness
Smart Mobility
Smart Governance
Digital Tech & ICT
Internet of Things
Virtual Tech
Smart Citizens
Smart Infrastructure
Emerging Areas
Unexplored Potentials
Intelligent Cities
Smart Cities



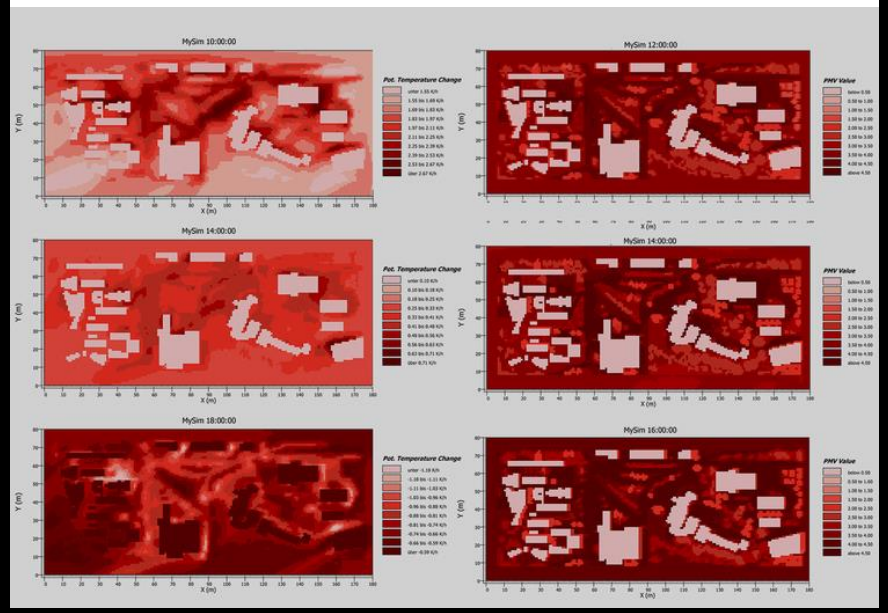


Image source: ARUP DESIGN YEAR BOOK + WGBC

WORLD GREEN BUILDING COUNCIL

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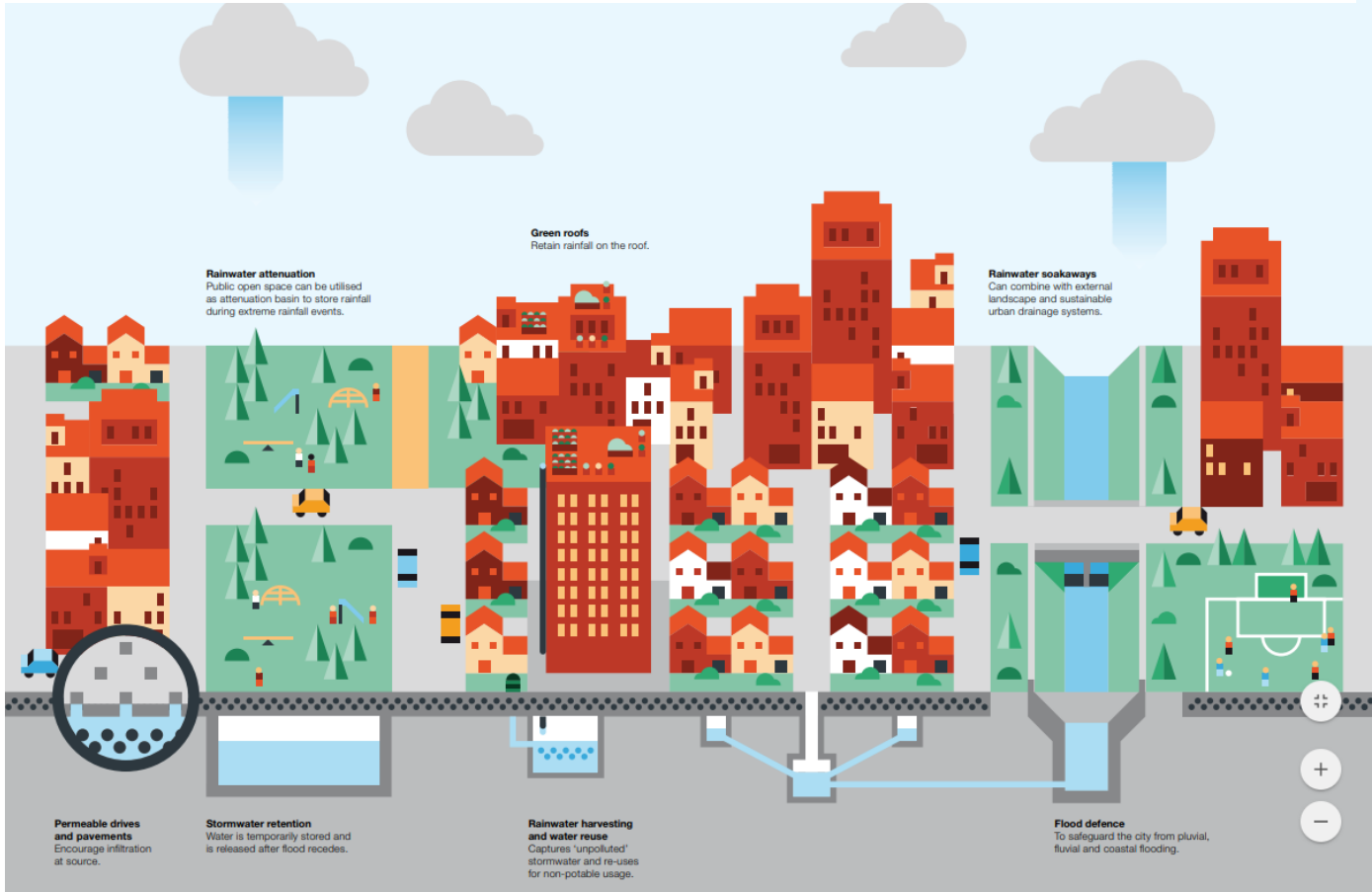
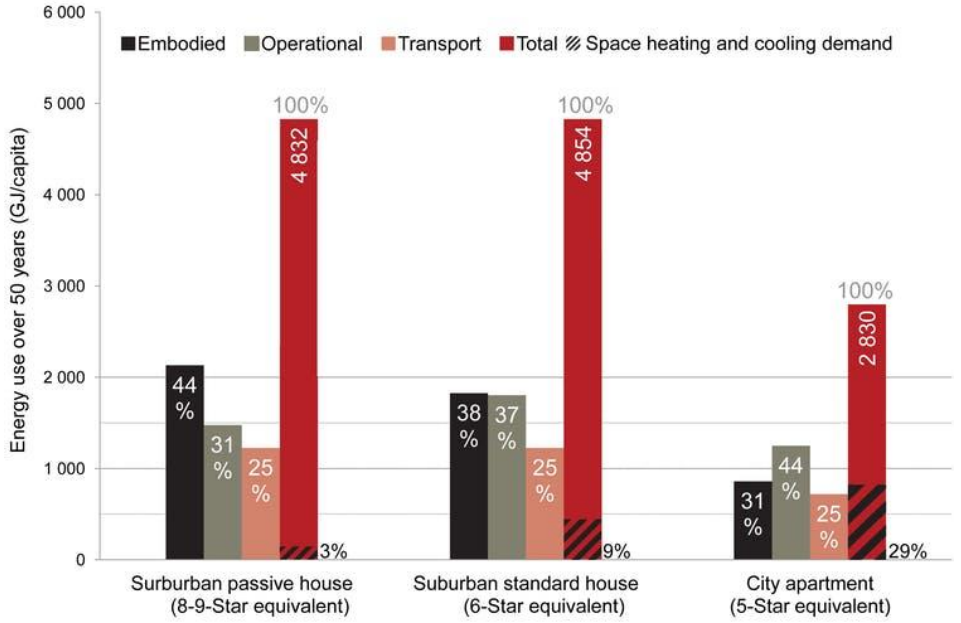
Home > News & Media > Every building on the planet must be 'net zero carbon' by 2050 to keep global warming below 2°C - New report

Every building on the planet must be 'net zero carbon' by 2050 to keep global warming below 2°C - New report





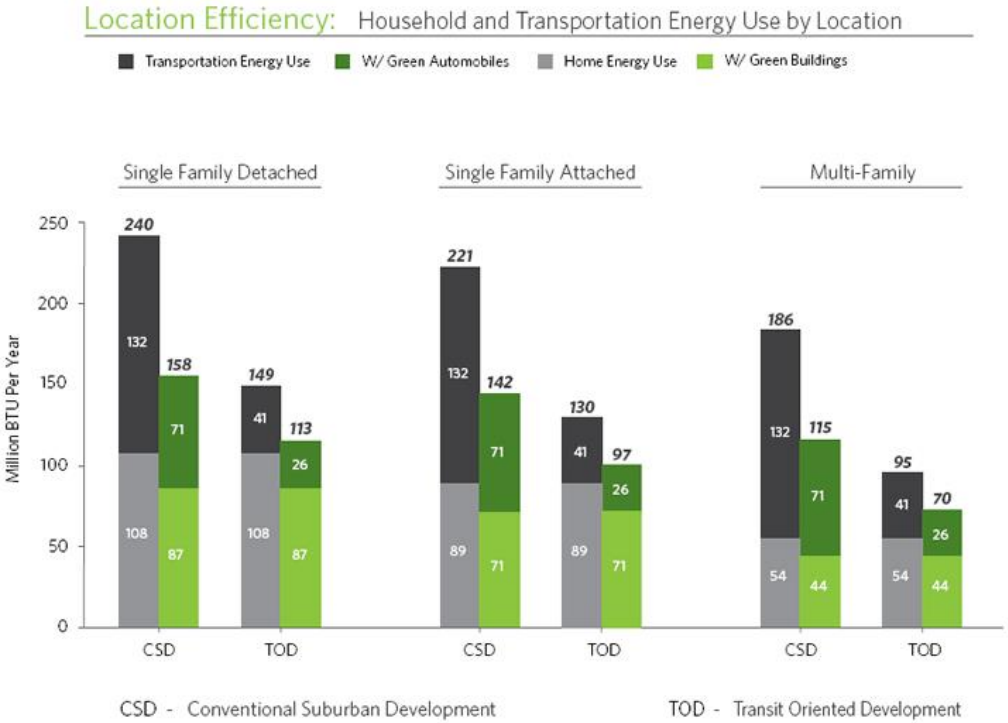
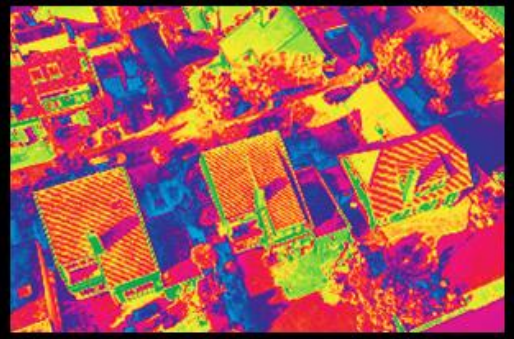
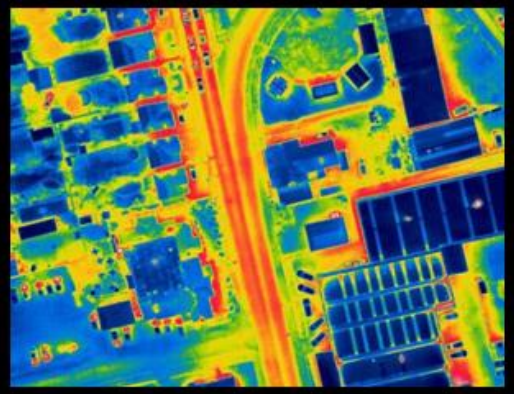
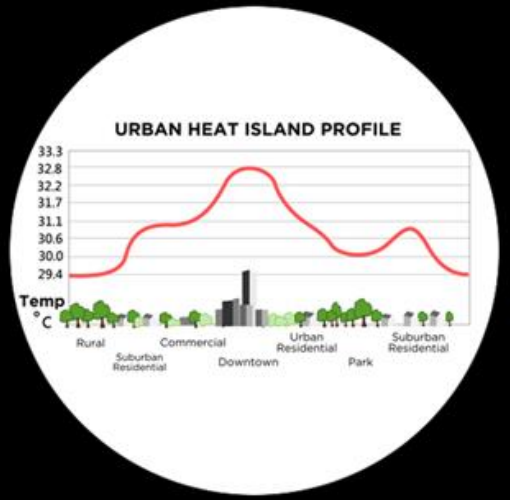


Image source: https://www.treehugger.com + http://theconversation.com







What is UHI?

Oversimplified Definition of UHI

Diurnal & seasonal variability
Dependence on UCZ models
Surface vs. air temperature heat island
Geographic and topographic causations
Other climatic parameters: i.e. RH, Tmrt, PET

Do we adequately care?

STATE-OF-THE-ART ANALYSIS OF THE ENVIRONMENTAL BENEFITS OF GREEN ROOFS

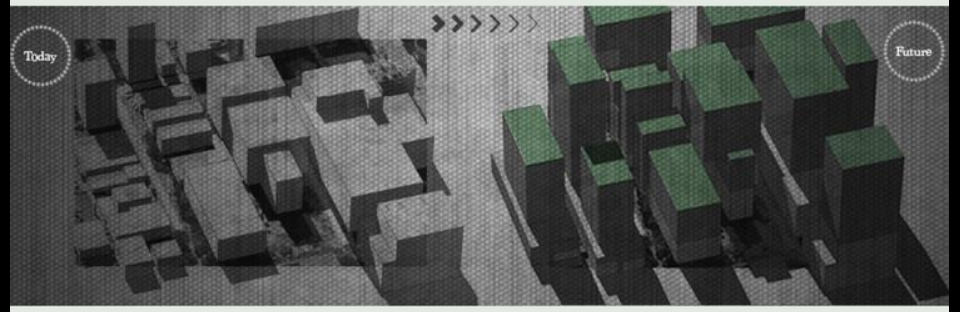
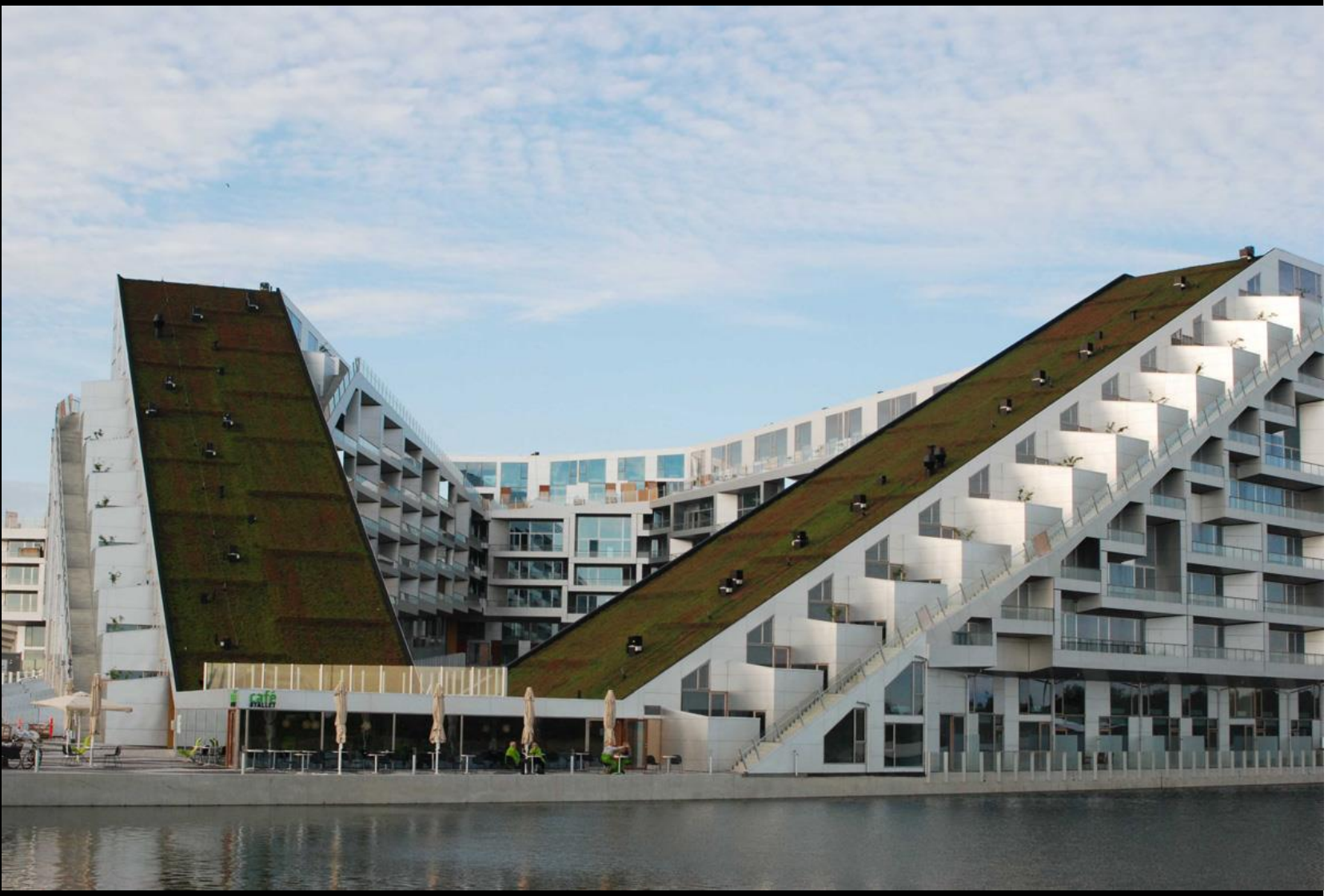
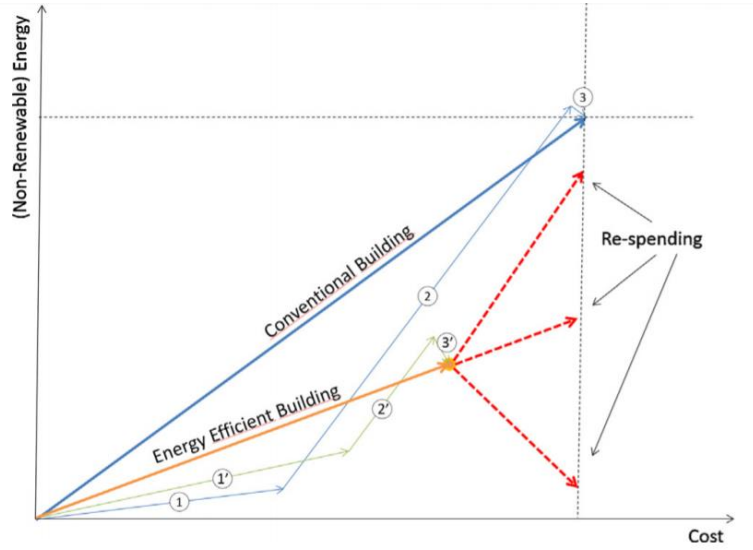


Image source: https://modernfarmer.com

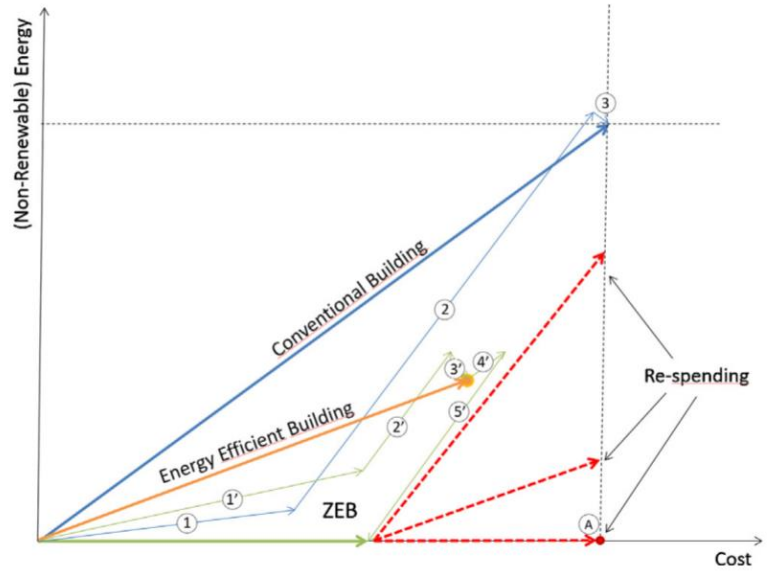


BIG's 8 House Wins the 2010 Scandinavian Green Roof Award

Image source: http://www.architecturelist.com



Possible rebound effects resulting from the cumulative life cycle energy/cost of a reference building and an energy efficient building. All vectors are E2 vectors illustrating the relationship between cost and non-renewable energy for the different building phases: Manufacturing/transportation/construction (1 and 1′),



Partial re-spending in renewable energy supply technologies leading to ZEBs. Manufacturing/transportation/installation of renewable energy supply systems (4′) and renewable energy fed back into the grid (5′).

Towards a sustainable + healthy urban future...

BUILT ENVIRONMENT ENGINEERING

AUT

DR ALI GHAFFARIAN + DR AMIRHOSEIN GHAFFARIAN