HONG KONG HOUSING SOCIETY
香港房屋協會

Building a SMART and LIVEABLE CITY for an AGEING COMMUNITY
建設樂齡智慧宜居城市。
2-3•11•2018

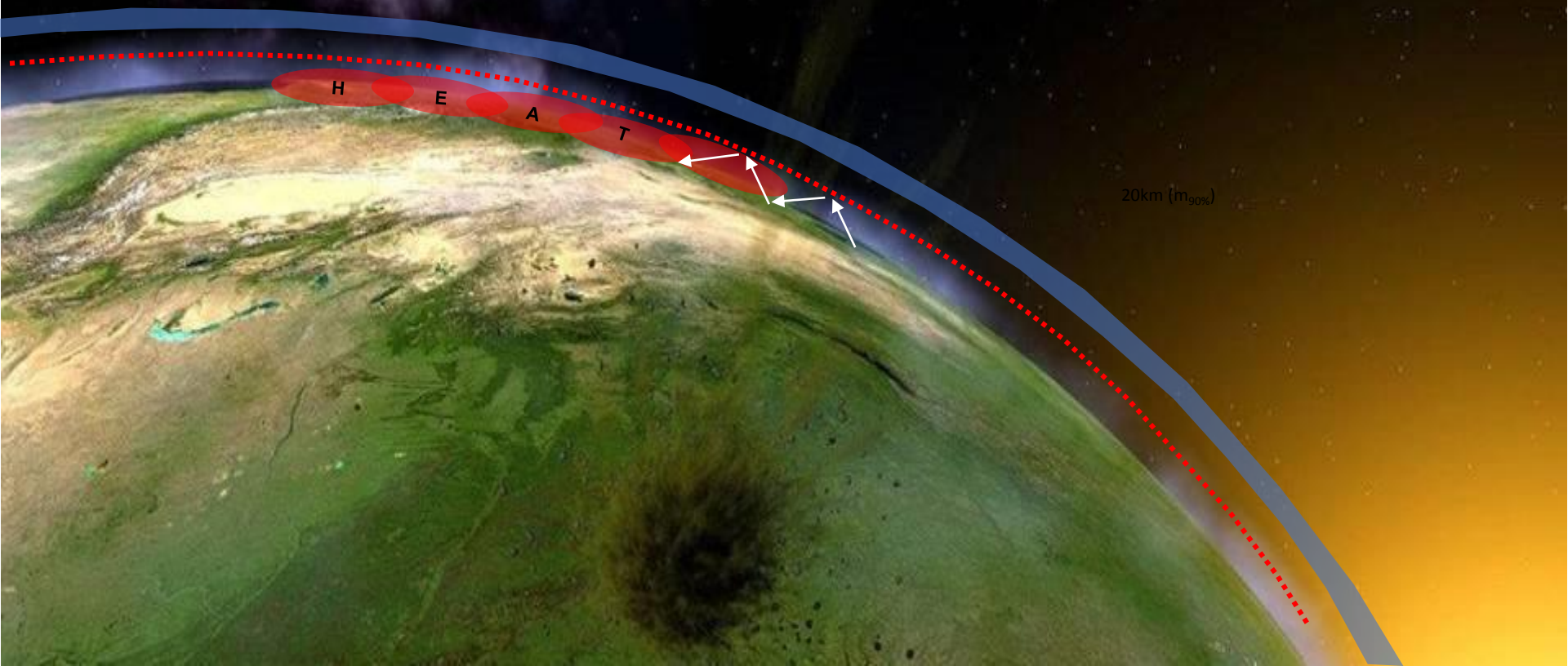
Green Buildings; Green Cities
Why so long?

Phil Jones

Global warming < 1.5°C by 2050 based on pre industrial times

Built environment a major target for reducing CO2 emissions

- **A major source of CO2 emissions**
- **Climate change impact, especially vulnerable groups**



LOW ENERGY TO ZERO CARBON

1970's → 2018

Low energy design:

- Energy efficient design
- Thermal insulation
- Air tightness
- Efficient HVAC

Passive design:

+

- Solar
- Daylight
- Natural ventilation
- Thermal mass

Sustainable design:

+

- Materials
- Renewable energy
- Community

Zero Carbon design:

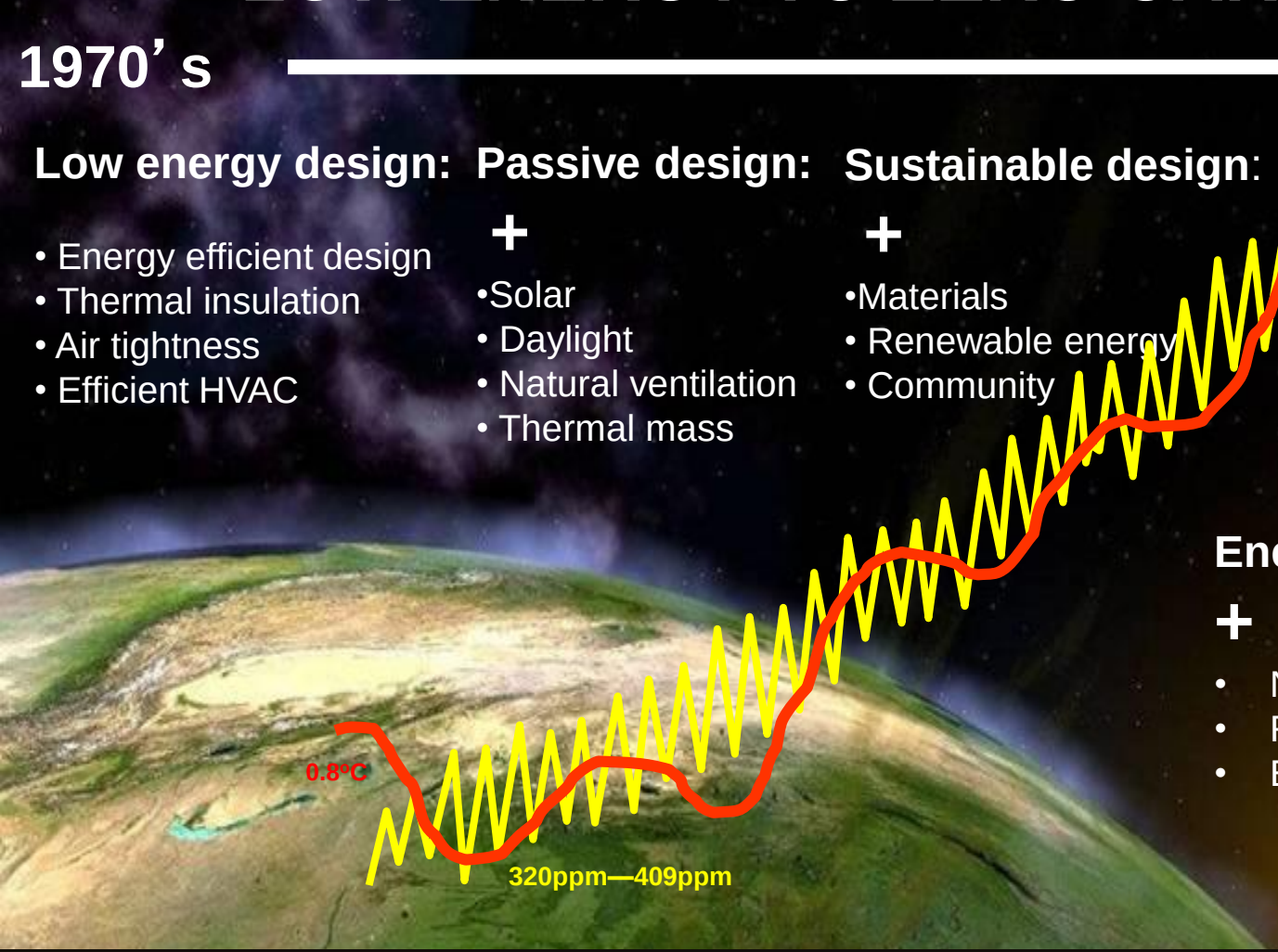
+

- Reduce energy demand
- Renewable energy supply
- Appliance energy
- Low embodied energy

Energy Positive design

+

- Nearly zero energy demand
- Renewable energy supply
- Energy storage



Building → City Scale

New Build → Retrofit

POLICY

EUROPE

2020 Targets
- 20% cut in **greenhouse gas** emissi… …rom 1990 levels)
- 20% of … energy from **renewa**…
- 20% ir… …in **energy**…

2030 …
- Reduci… …40% (from 1990 levels)
- Increasing the… …least 27%
- Continued i… …27%)

2040 t…
- Reduci… …reenhouse gas emissions by 60…

2050 targets:
- Reducing greenhouse gas emissions by 80%

BUILT ENVIRONMENT MAIN TARGET

POLICY

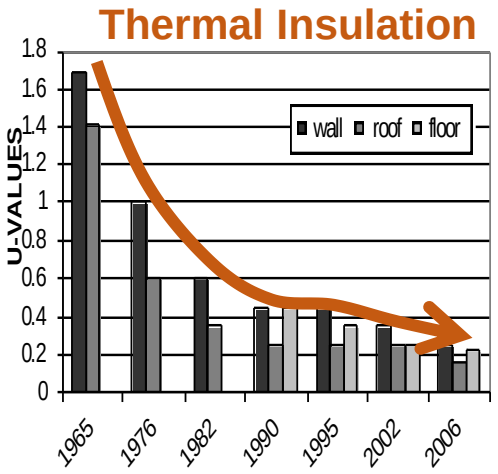
Nearly Zero Energy Buildings (NZEBs)

- The **Energy Performance of Building Directive (EPBD)**
  - new public buildings after December 31, 2018
  - all new buildings after December 31, 2020.
- A NZEB is a building that ***"has a very high energy performance with the nearly zero or very low amount of energy required covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby***".
- Implemented through **Building Regulations.**

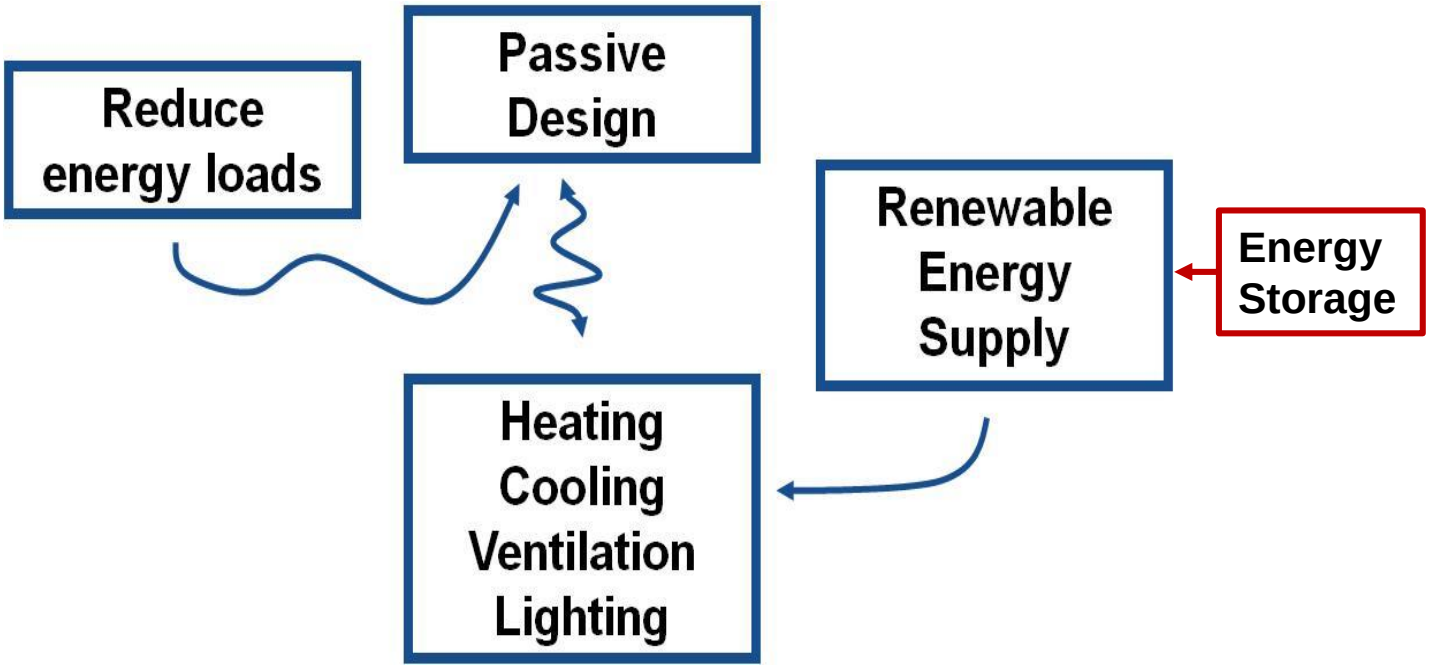
(D'Agostino et al., Synthesis Report on the National Plans for NZEBs; EUR 27804 EN; doi 10.2790/659611)|

INCREMENTAL

ELEMENTAL



HOLISTIC APPROACH



TECHNOLOGY AND DESIGN TOOLS

We have the **technologies**,

and the **modelling** capabilities,

*to design and construct buildings and cities by simulating **energy and environmental** performance.*

Renewable Energy

Energy Generating Building Envelopes

Solar P

Cardiff University researchers completed energy-harvesting façade and roof retrofit in Tibet as part of its HABITAT Global Challenge Research project.

Trans

SE COST

Before retrofit

After retrofit

RETROFIT

AIR COLLECTOR

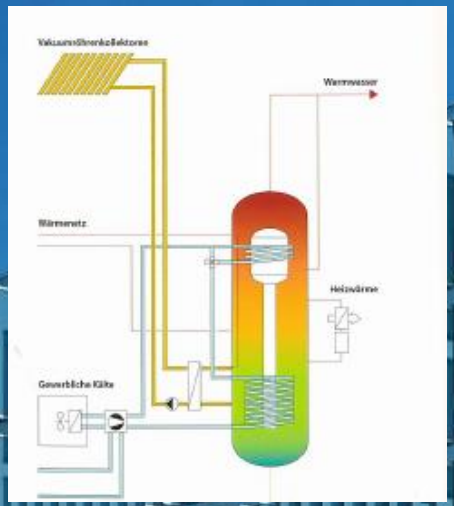
HEATING SYSTEM

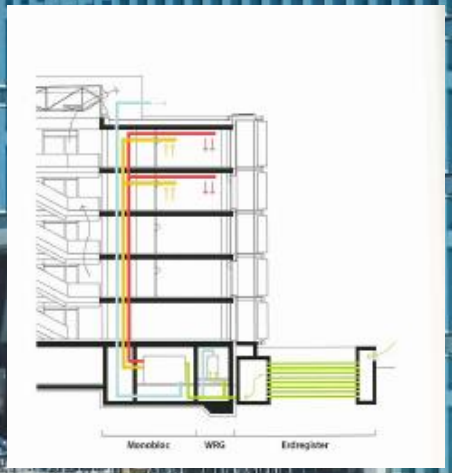
LCRI LOW CARBON RESEARCH INSTITUTE

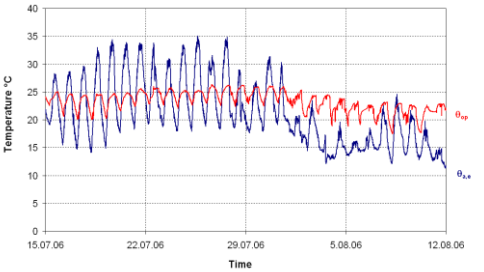
PRIFYSGOL CAERDYDD

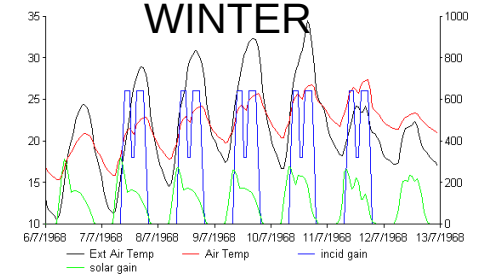
EMPA near-zero carbon office, Zurich

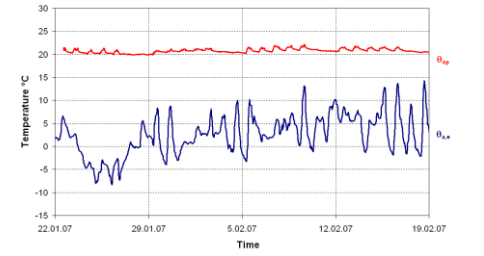
TECHNOLOGIES + TOOLS

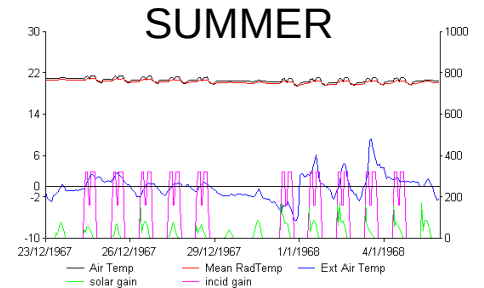




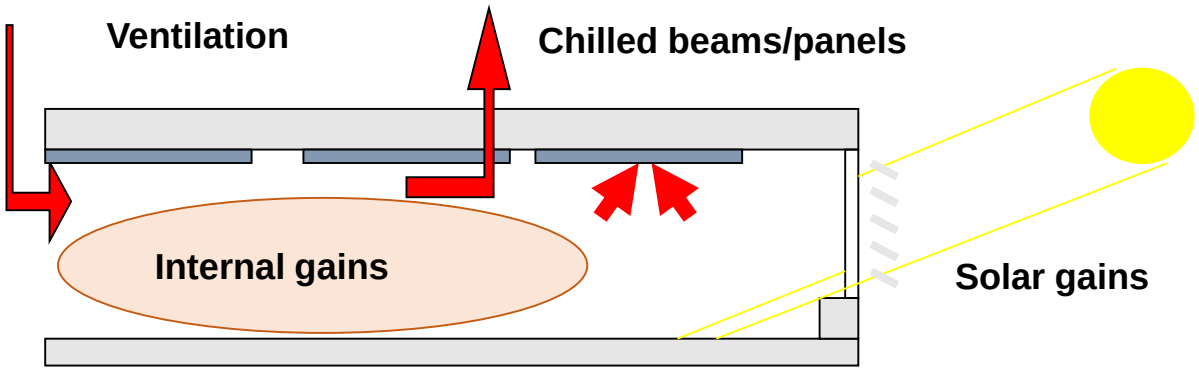


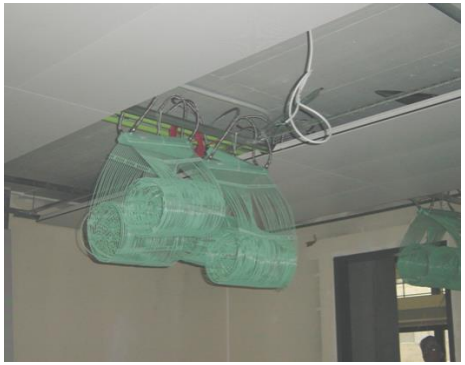


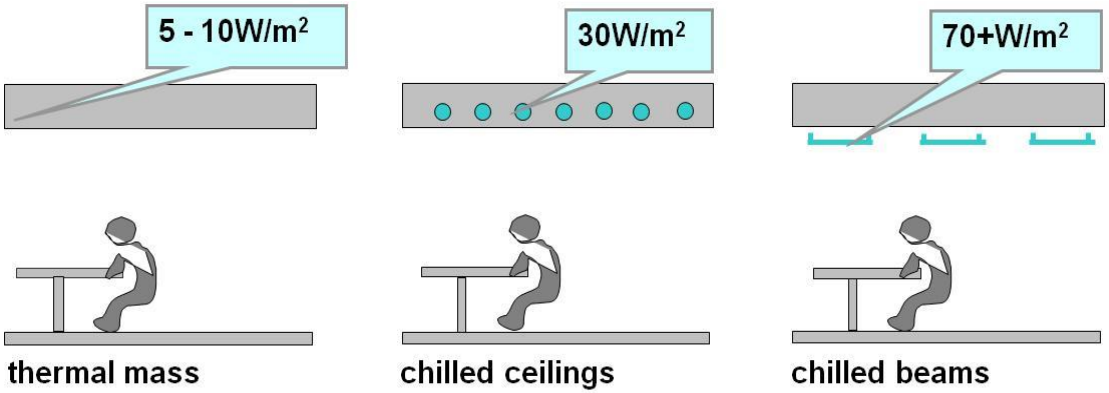




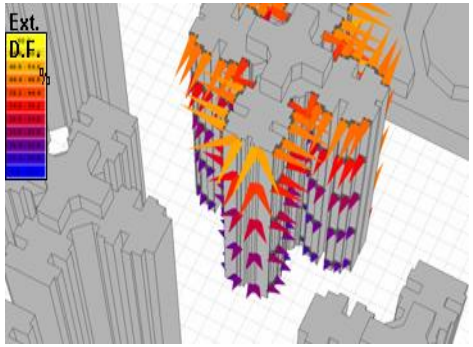
COMFORT IN GREEN BUILDING ?
Surface heating and cooling

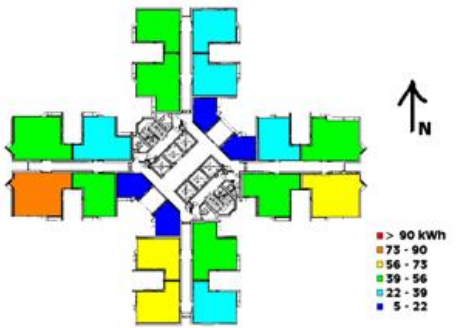


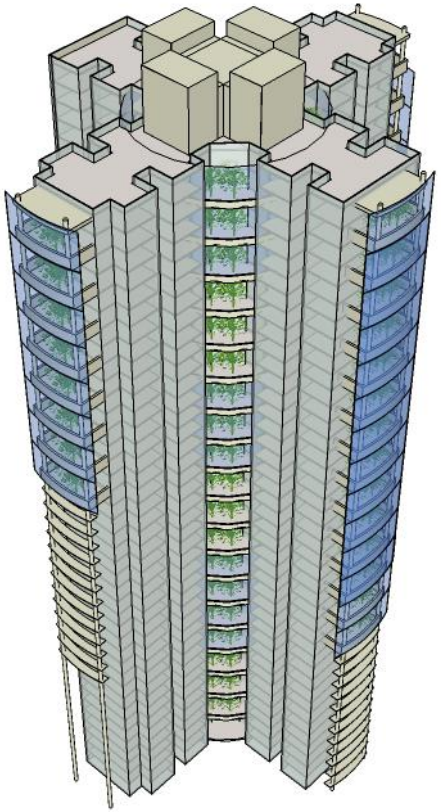


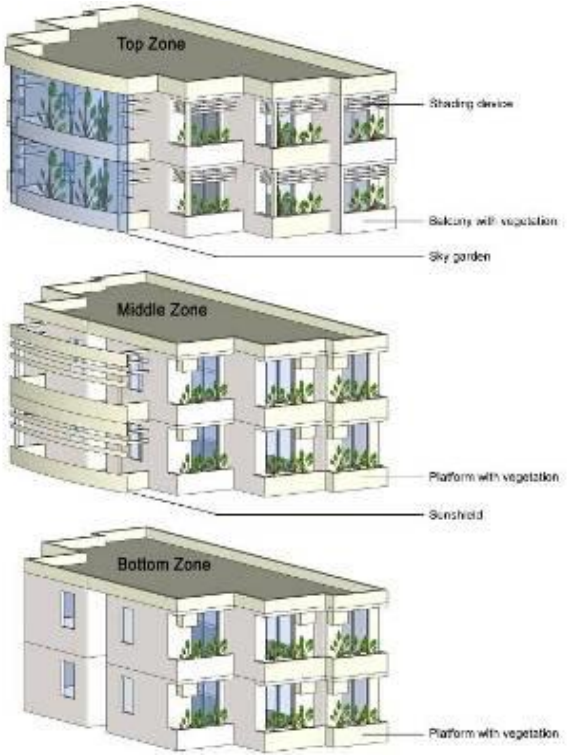


Façade design



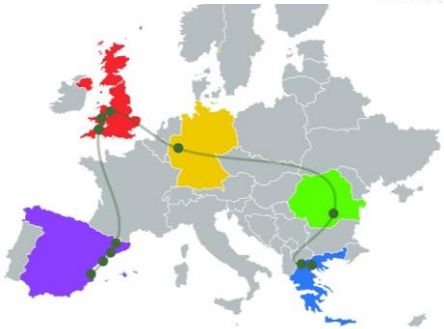


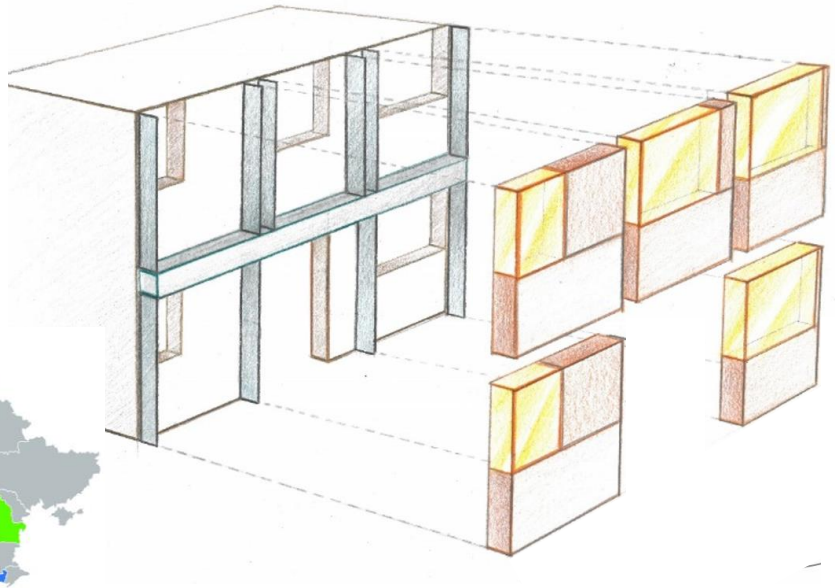




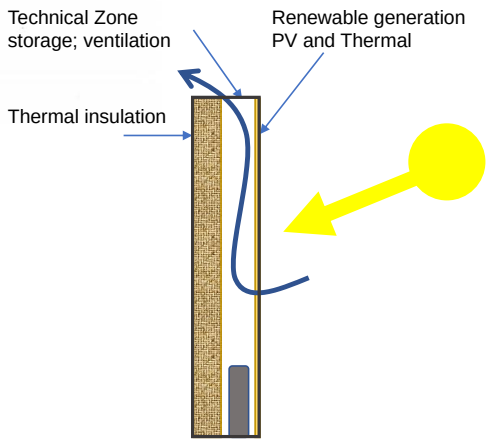
Plug-n-Harvest

H2020 EeB-07-2017
EU contribution €6m
2017-2021



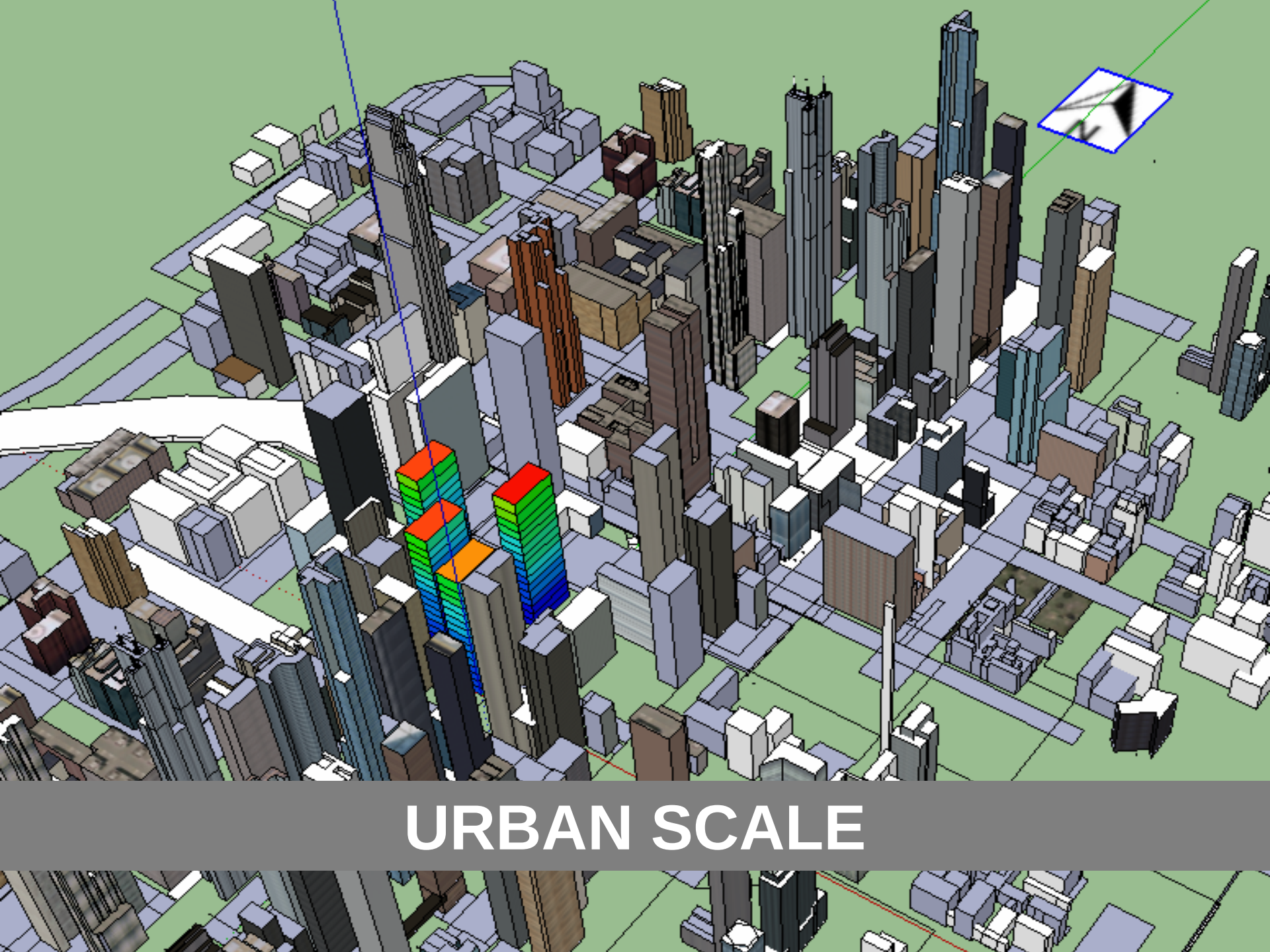


Plug-n-Harvest Concept



OPTIONS:

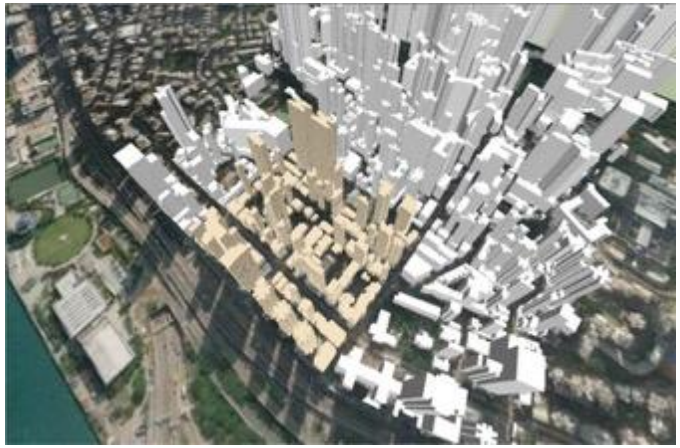
Thermal insulation; PV generation; battery storage; solar thermal air heating; mechanical ventilation;


URBAN SCALE

URBAN SCALE TOOLS

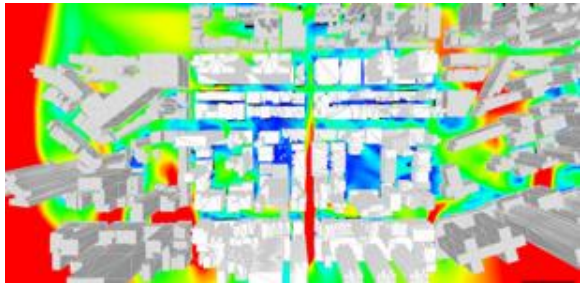
Sustainable High Density Cities Lab

THE UNIVERSITY OF HONG KONG faculty of architecture HKURBAN lab



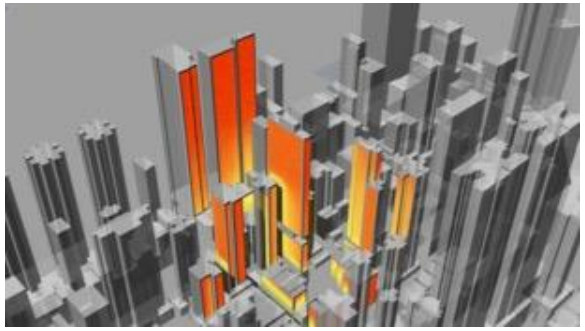
Air Ventilation Analysis:

AKL FlowDesigner



Daylighting Analysis:

DIVA FOR RHINO



Existing condition

Option1

Option2

Option3

Building Energy:

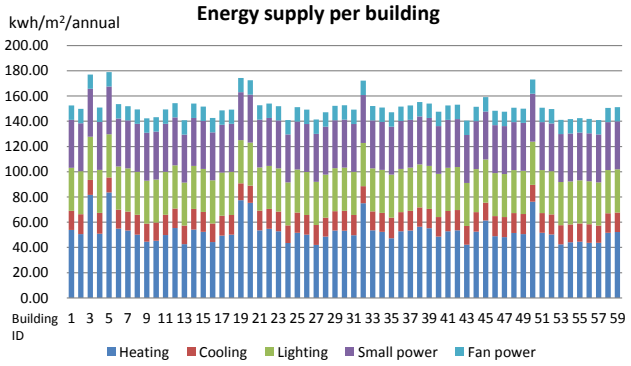
HTB2

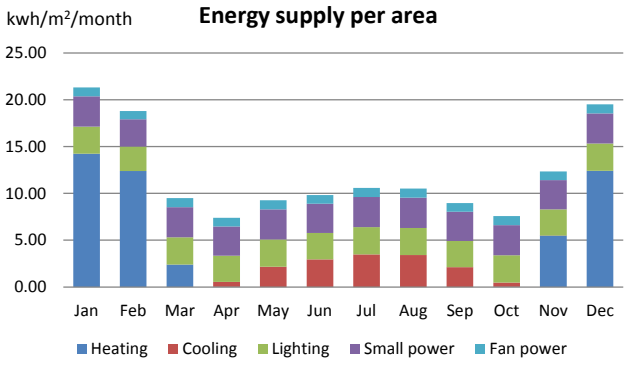
Thermal comfort:

CityComfort+

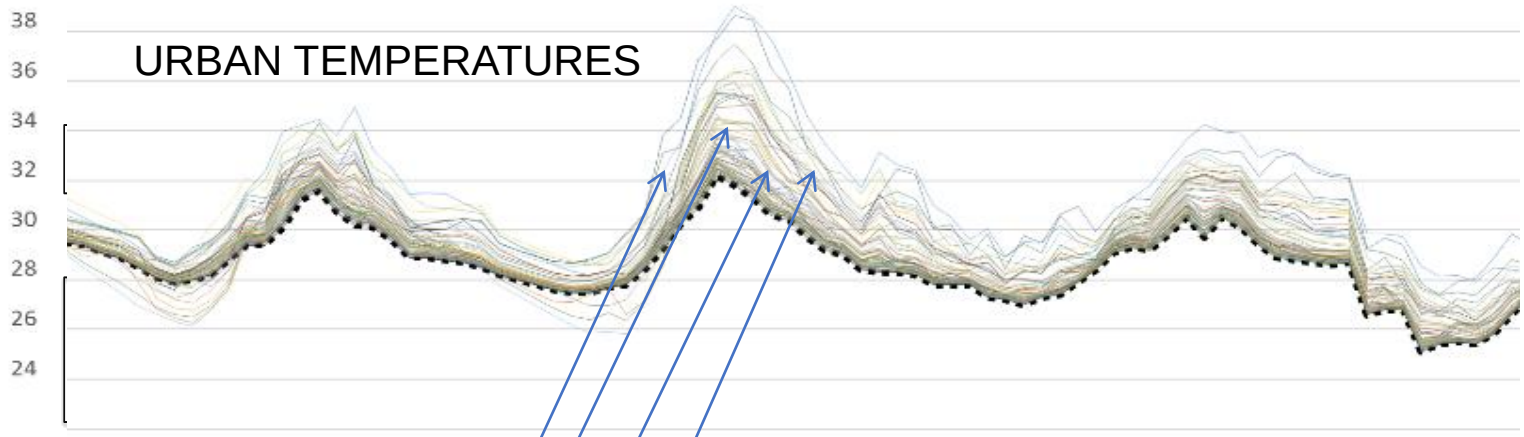
Large Scale low carbon Urban Developments

50% Building Integrated Renewables



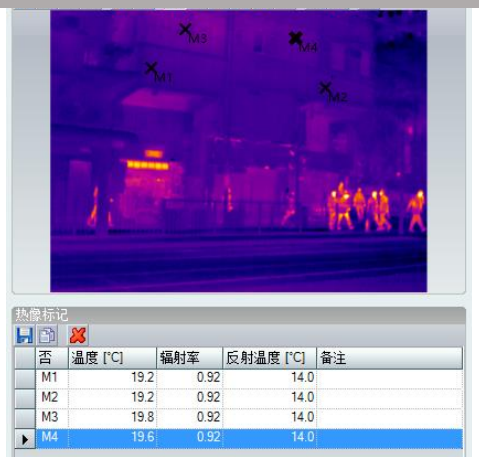


Integrated Model:
Urban Microclimate (UMM) + Energy (HTB2)

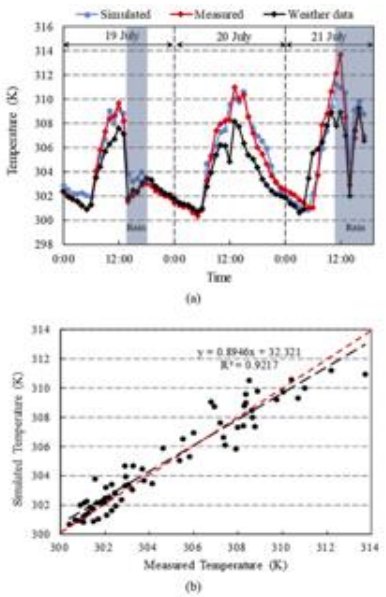


Improve external comfort

Reduce building energy demand



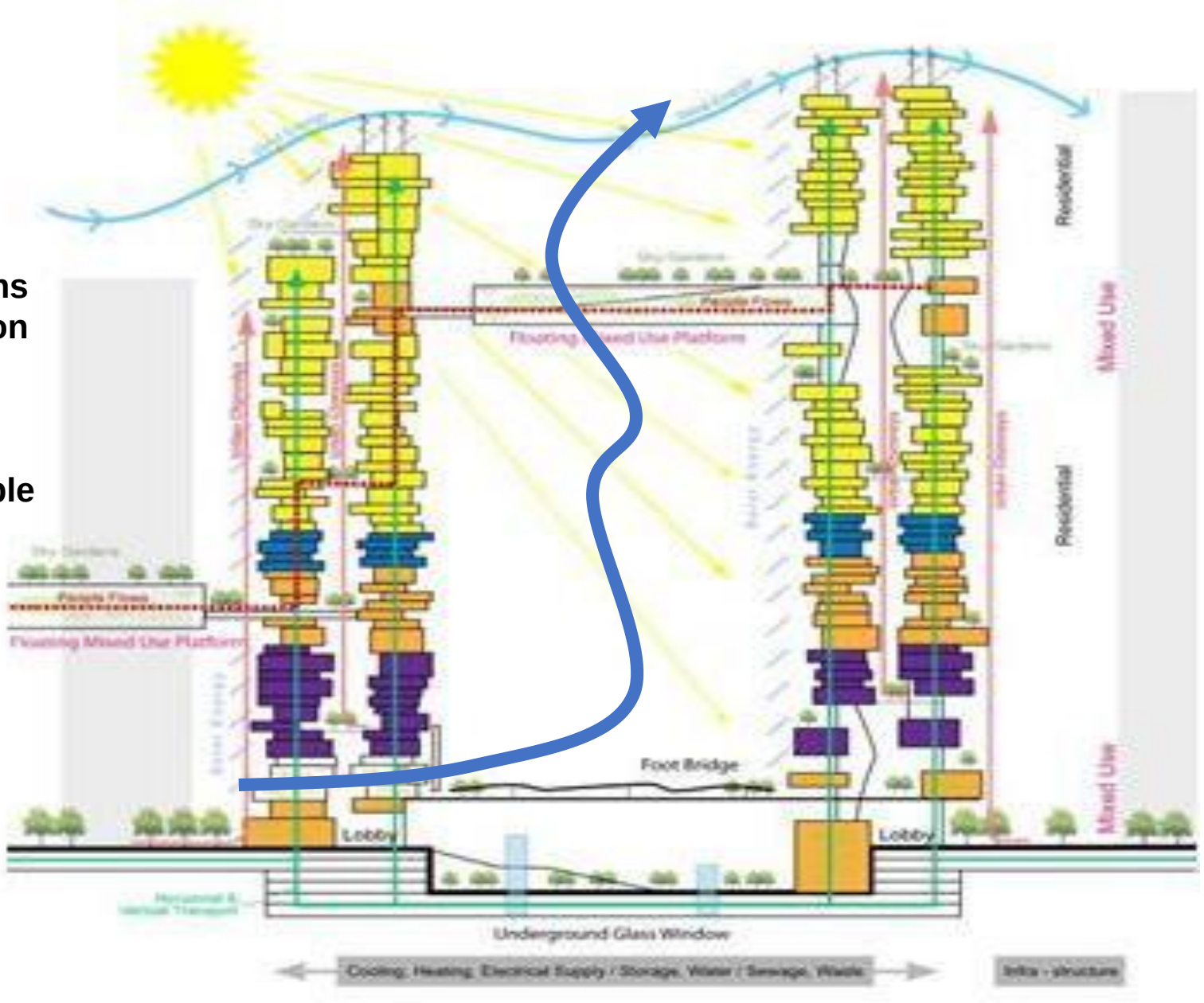
Model Testing on a Scale Concrete City (Guangzhou)



A zonal model for assessing street canyon air temperature of high-density cities, Weihui Liang, Jianxiang Huang, Phil Jones, Qun Wang, Jian Hang, Building and Environment Vol 132, 15 March 2018, Pages 160-169

CITY AS A BUILDING

Heat gains
Ventilation
Cooling
Daylight
Noise
Renewable energy



BUILT ENVIRONMENT

NEW BUILD

RETROFIT

URBAN SCALE

Low Carbon

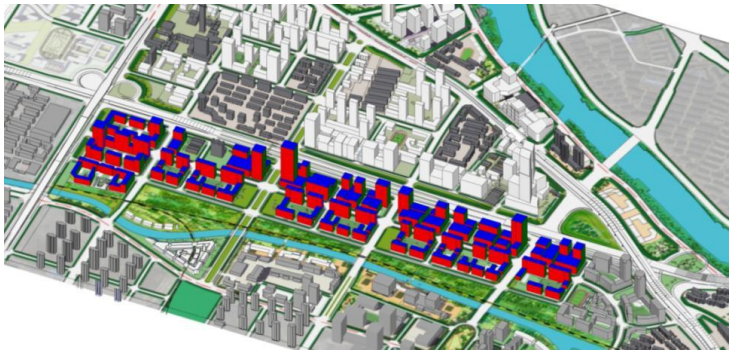
Near-Zero Carbon

Zero Carbon

Energy Positive

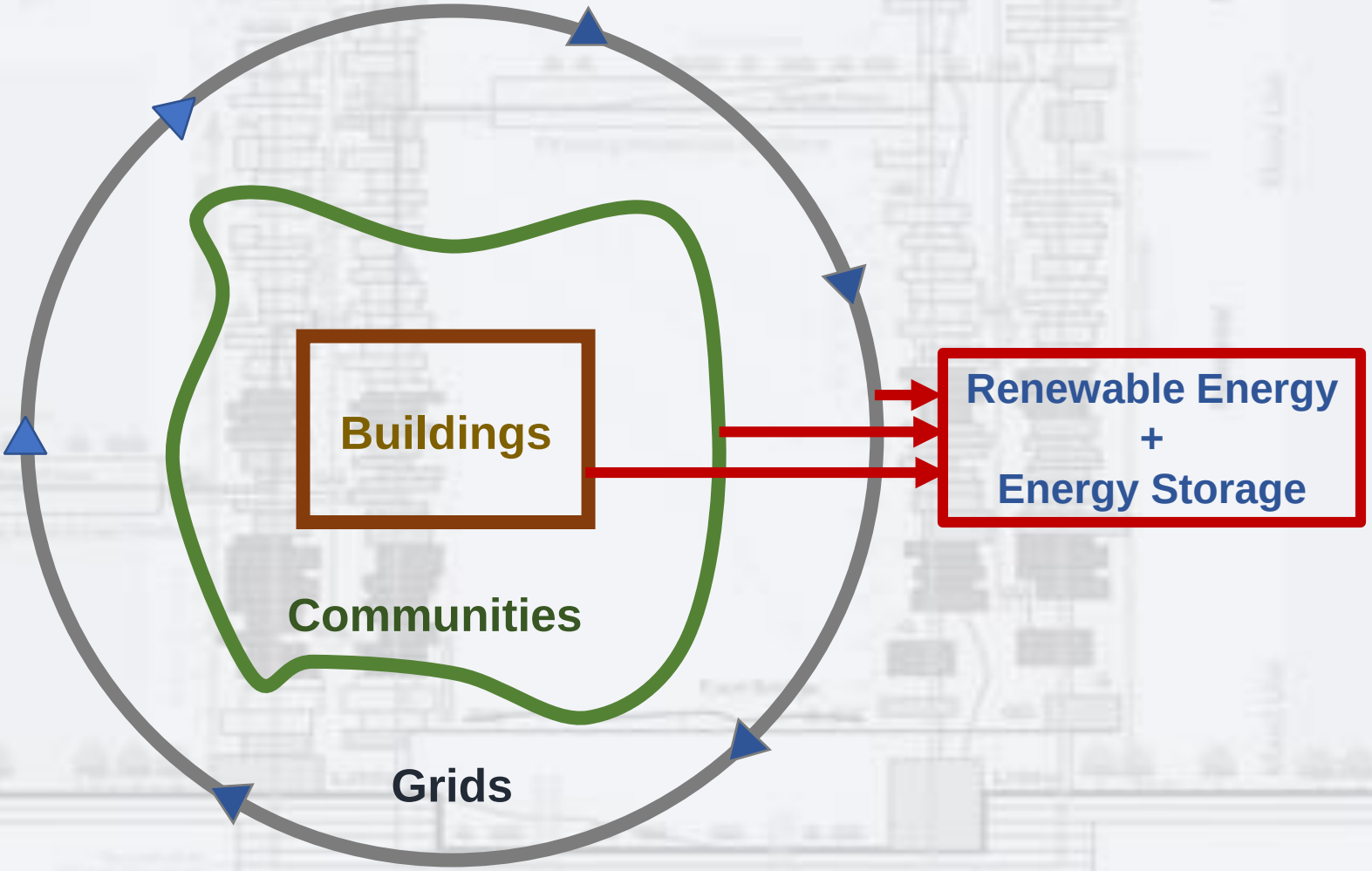
Before retrofit

After retrofit



ENERGY SUPPLY

Future Energy Systems
and
The Built Environment



BARRIERS AND BENEFITS

WHY SO LONG?

- Lack awareness
- Industry resists change
- Government does not push
- Procurement lock-in
- Uncertainties: costs / performance
- Who owns it - architect, engineer, building physicist?

BENEFITS (MULTIPLE)

Building / Community

- Energy cost savings
- Comfort, health and well-being
- Productivity increase
- Increase asset and rental value
- Less pollution

National / Global

- Carbon emissions reduction.
- Reduced use of resources.
- Security of energy supply.
- Reduced environmental damage
- Public health savings

Thank You

Chinese Vice Premier Liu Yandong visits the SOLCER House