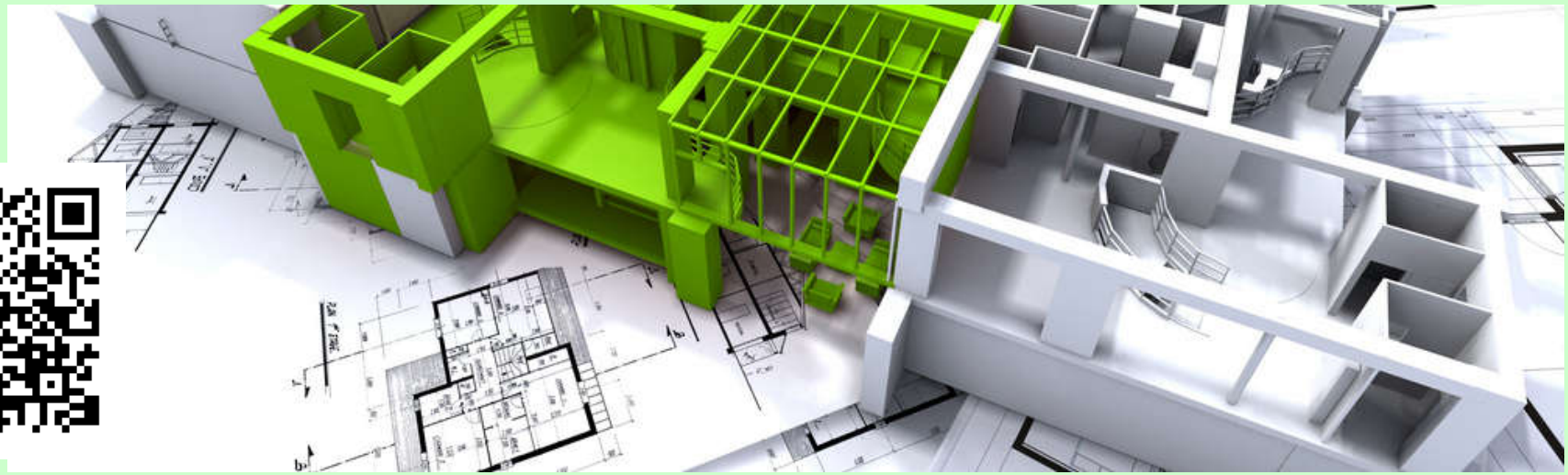
The 15th Asia Pacific Conference on the Built Environment: 5R Technology for Building Environment (Recycle, Reduce, Renewable, Resource, Retrofit)
18–19 October 2019 (Fri-Sat), Kaohsiung, Taiwan



New opportunities of using building information modelling (BIM) for green buildings

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http://ibse.hk/cmhui/191018_APCBE_KaoHsiung_BIM_SH.pdf

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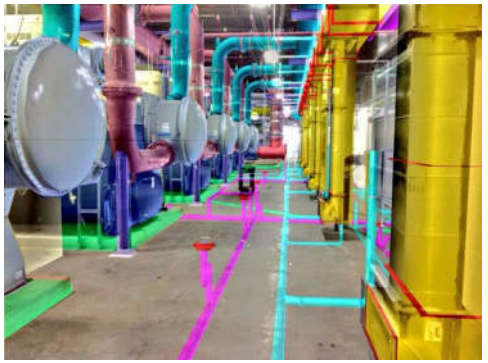
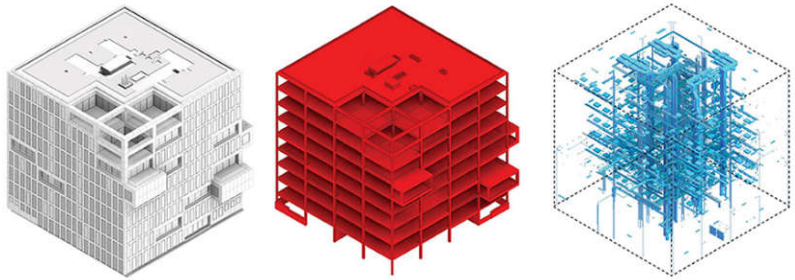


Green BIM

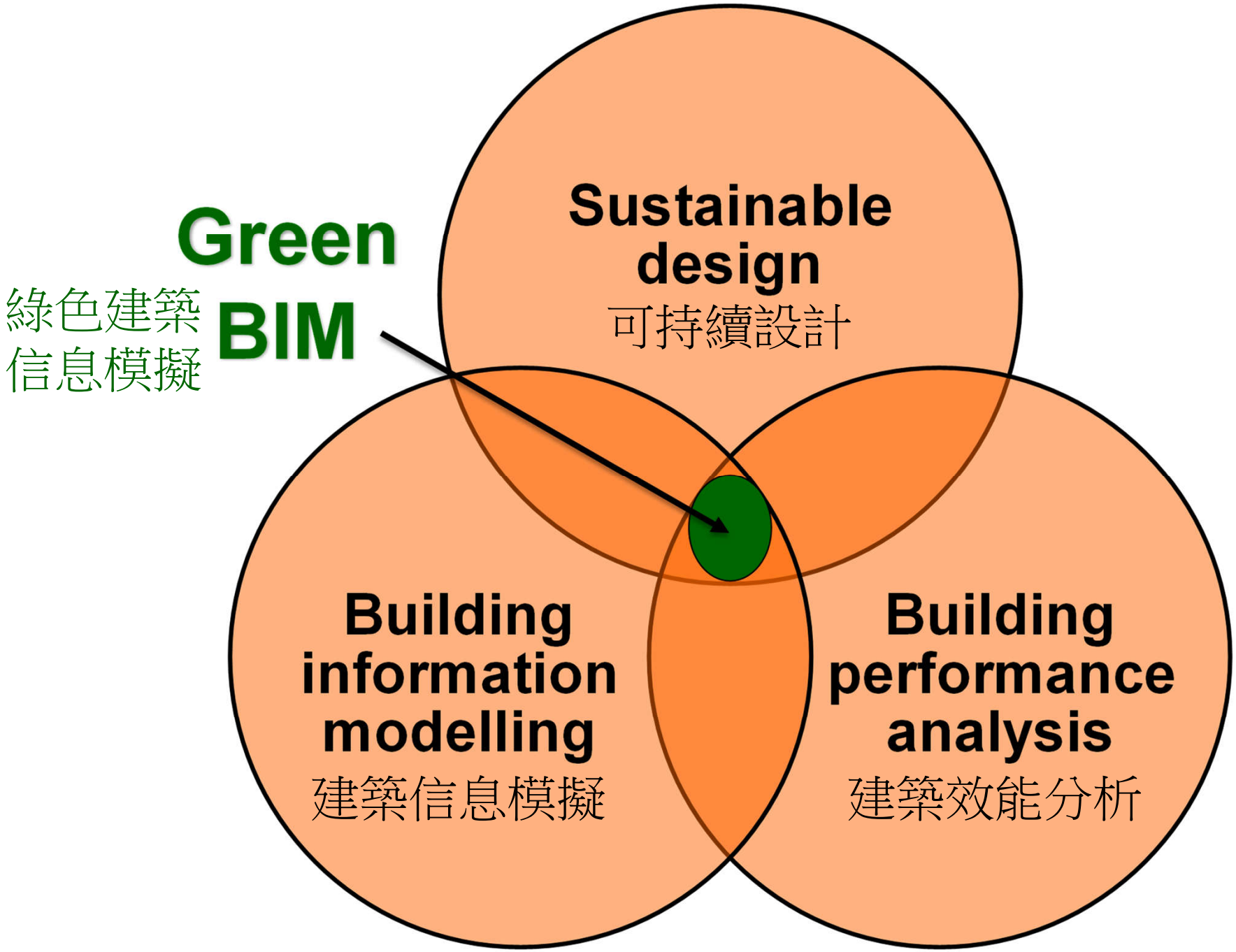
Introduction

- **Building Information Modelling (BIM)**
  - A collaborative working process
  - 3D design + Information



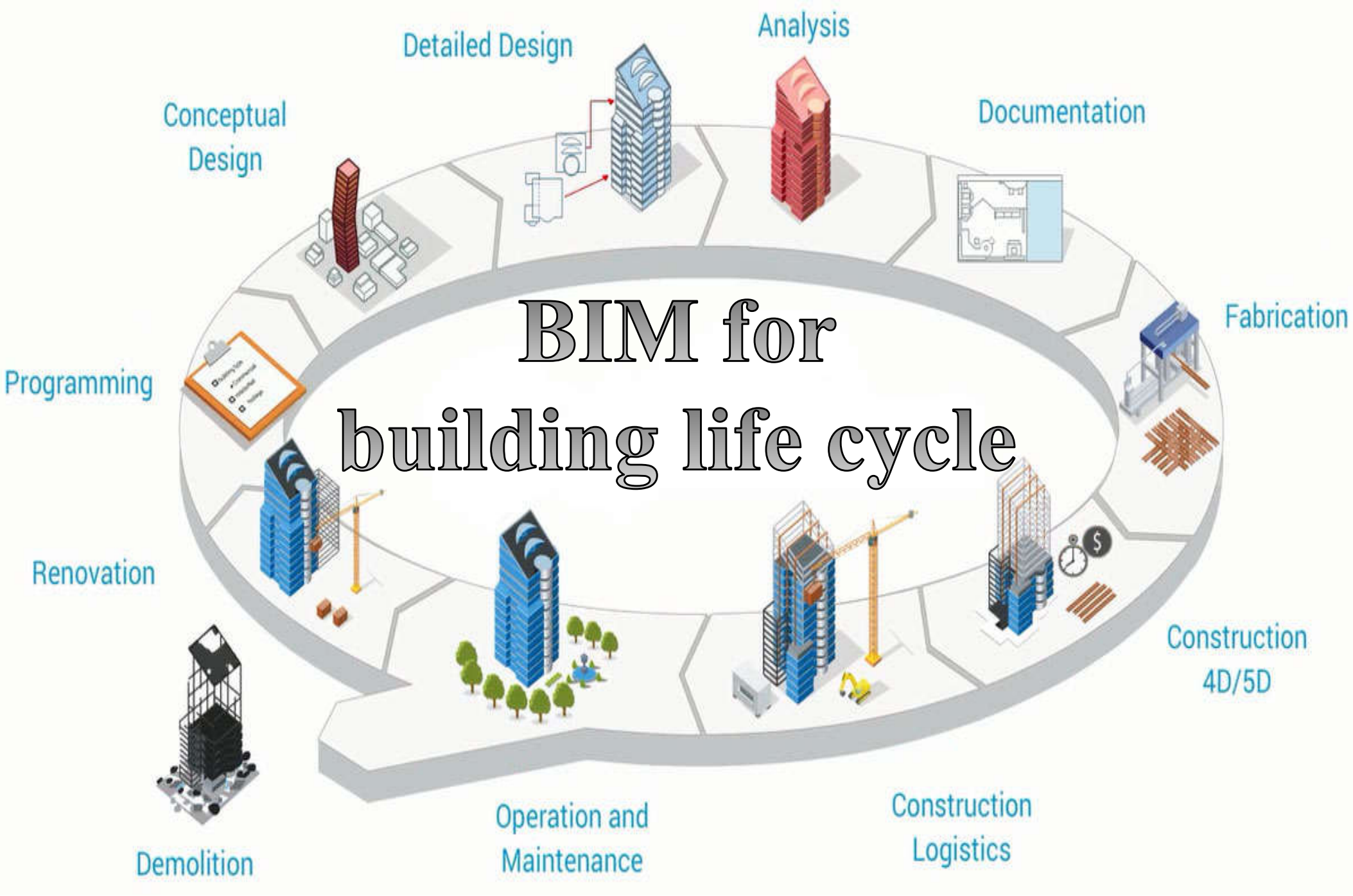
- BIM definitions:
  - Process of creating & using digital models for design, construction, and/or operations of projects
  - Simulate the construction project in a virtual environment, to identify any potential design, construction, or operational issues

Basic concepts of Green BIM



(Adapted from: ABRI (2015))

BIM at different stages of the project life cycle

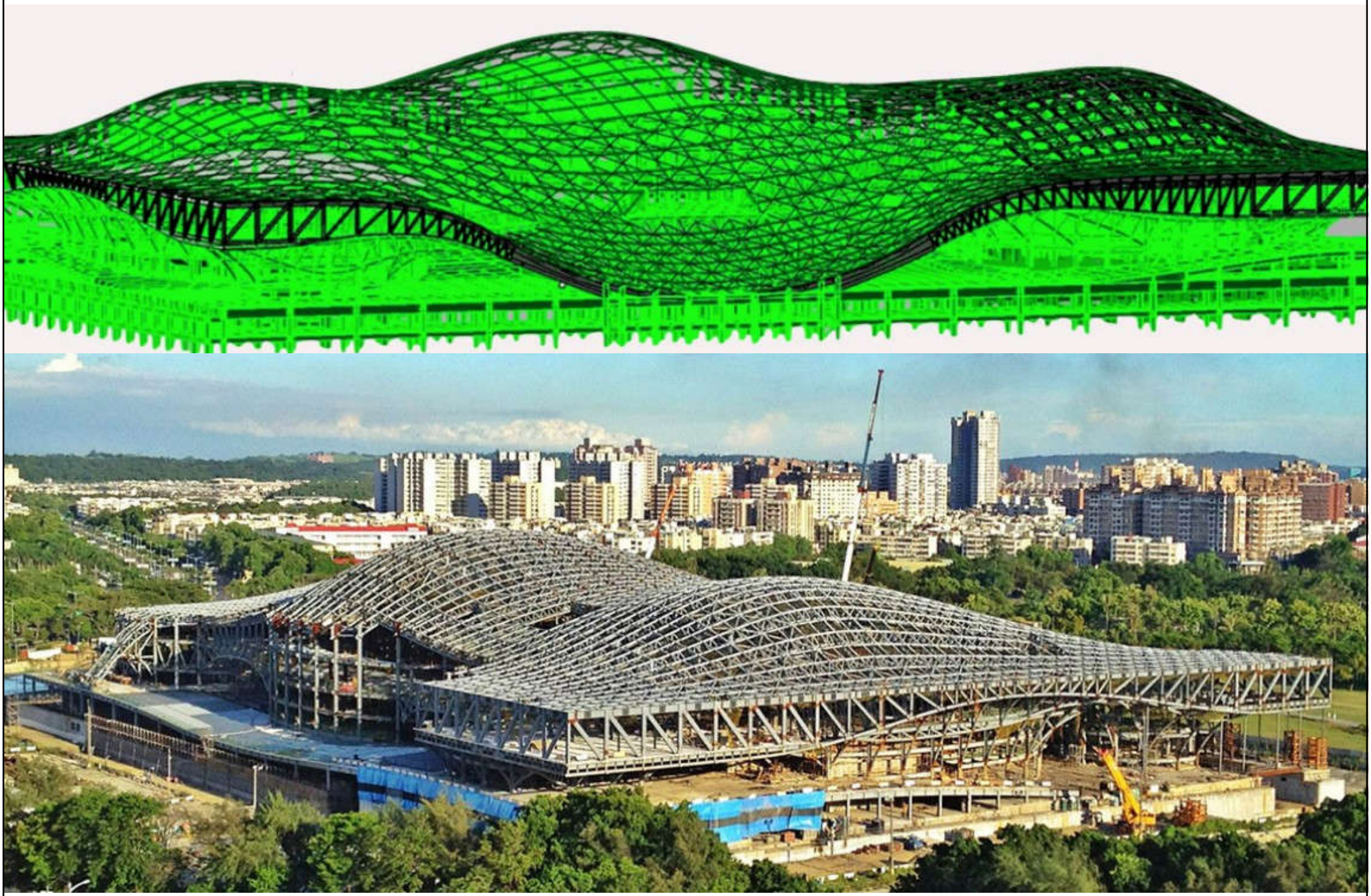


(Source: http://blog.drawbotics.com/2018/11/07/the-bim-revolution-in-building-management/)

Key characteristics of BIM

- BIM as an enabling platform
  - Digital transformation, common data environment
- Collaboration
  - Improve coordination of multiple disciplines
- Visualization
  - Inform decisions & enhance communication
- Analysis
  - Decision support analysis e.g. energy modelling

BIM model and real structure of Weiwuying (衛武營藝術文化中心)

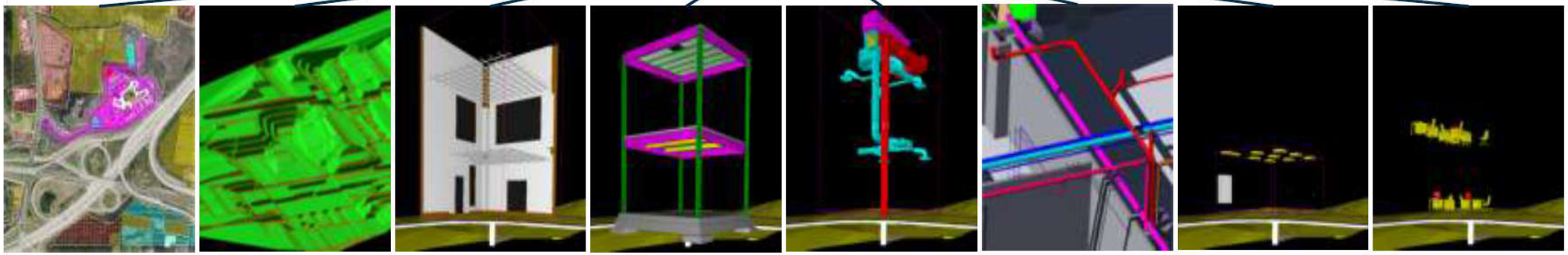


(Image source: http://www.ckgroup.com.tw)

BIM for building, construction and infrastructure

Design meeting

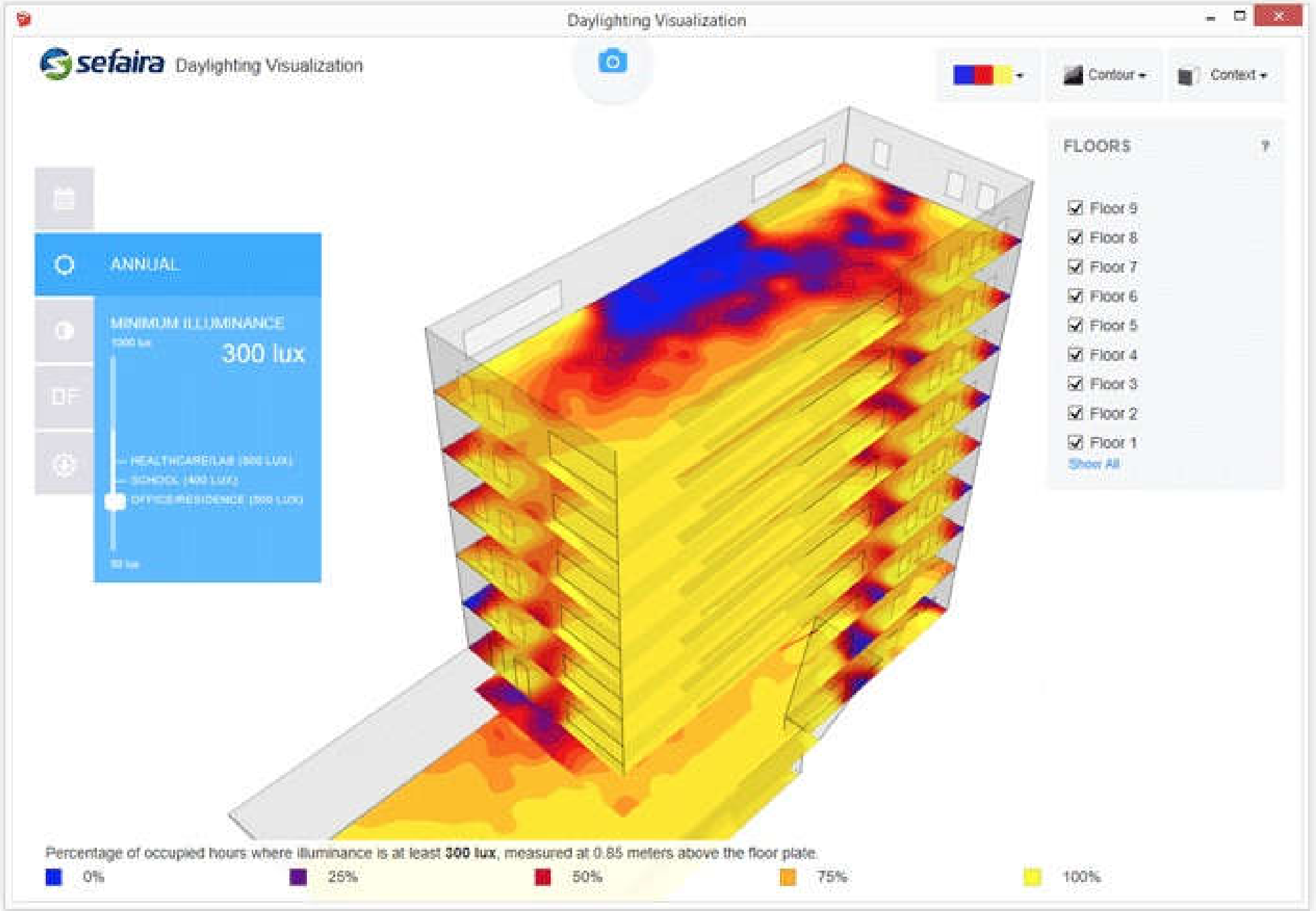
Construction meeting



BIM is changing the way we build, collaborate and operate (Avatars in the virtual BIM environment)

(Image source: https://new.siemens.com/global/en/products/buildings/digitalization/bim.html; https://www.kensetsunews.com/web-kan/73531)

BIM-supported daylight visualization and analysis

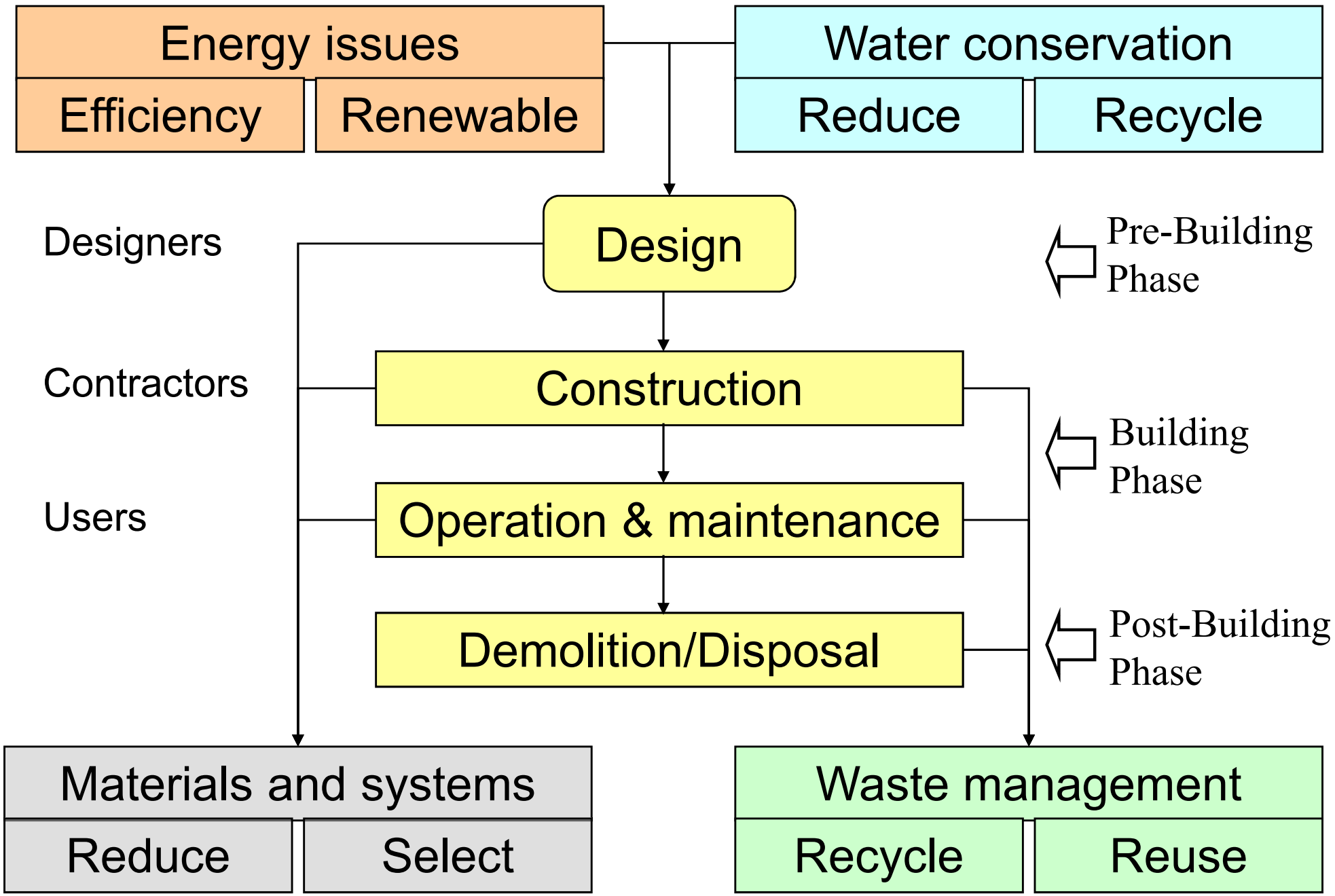


(Source: https://architosh.com/2015/10/energy-modeling-what-you-need-to-know-about-green-building-design-and-leed/)

Green building issues

- Green building assessment
  - Rating systems e.g. LEED, BEAM Plus, EEWH
- Building performance analysis
  - Daylighting, energy efficiency, IEQ
- Sustainable building design process
  - Evaluation & optimization (costs, life cycle impact)
- Environmental impacts & low carbon building
  - Sustainability & carbon emission management

Building life cycle and sustainable construction



Green BIM potentials throughout the lifecycles of green projects

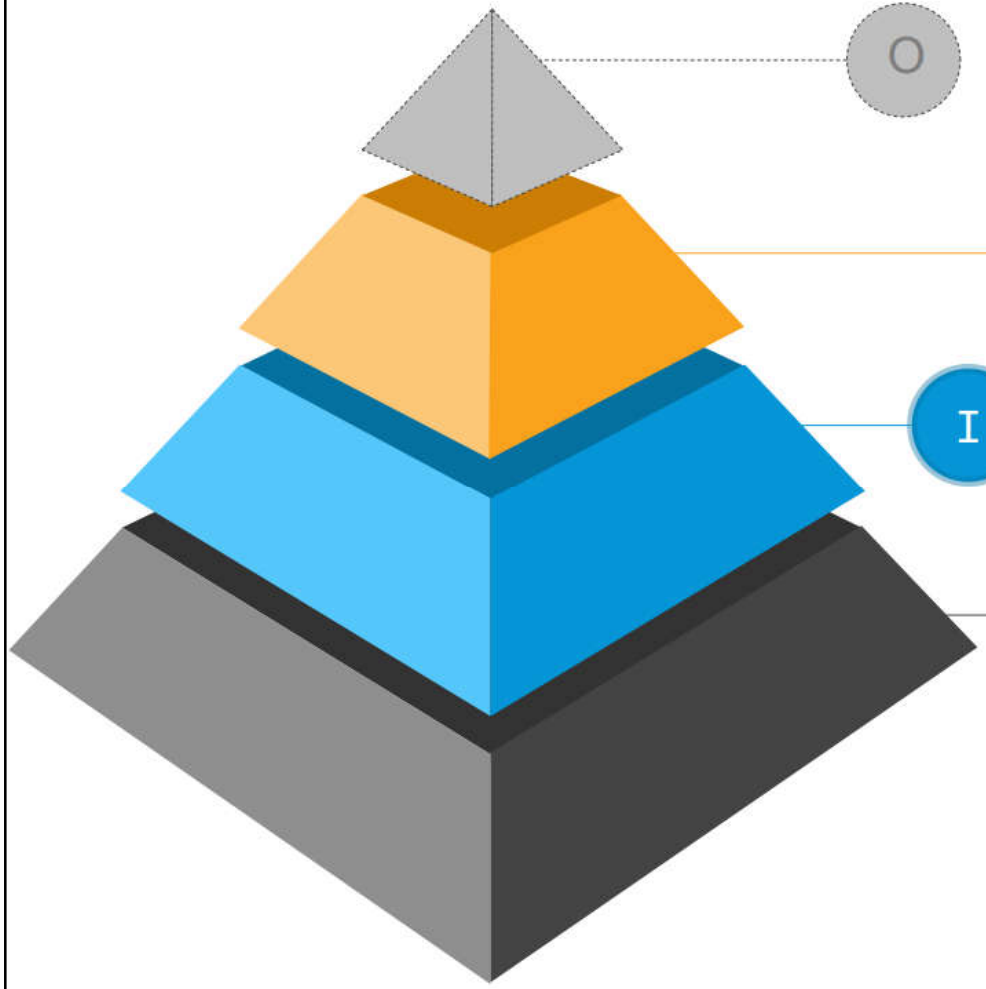
1. **Design Phase**: Facilitate data exchange and integration, provide visualized building performance analysis and simulations, assess design alternatives.
2. **Construction Phase**: Analyze various environmental impacts of construction process, contribute to waste reduction, improve construction productivity and performance.
3. **Operation Phase**: Help to monitor the sustainability performance of buildings.
4. **Renovations and retrofit**: Support the retrieving of energy and capital investments, benefit energy and waste management.

(Adapted from Lu, et al.(2017))

Green BIM potentials

- Automation of green building assessment
  - Full integration & automation
- Building design optimization
  - Life cycle design & environmental management
  - Integrate with building maintenance & retrofits
- BIM and LCA integration
  - BIM-supported life cycle assessment (LCA)
  - Incorporate sustainability information & simplify the LCA application

BIM future map:
BIM Model >> Integration >> Automation >> Optimization



Optimization
Getting the best possible solution
(Cost/resources efficiency)

Automation
Automate repetitive tasks and
embed analysis

integration
Through external software,
programmed calculation
sheets.

BIM Model
Model containing main design
data

Automation & Optimization are critical to MEP and O&M which can use the BIM data/information to enhance efficiency/effectiveness

(Image source: https://www.autodesk.com/autodesk-university/class/Next-Level-BIM-Electrical-Embedded-Analysis-Using-Revit-API-2018)

Green BIM potentials

- For Green BIM to be mature (short-term plan): Integrated Analyses
  - Integrated infrastructure planning
  - Integrate with geographical info. system (GIS)
  - Life cycle analysis
  - Passive system analysis
  - Green building certification, energy code compliance

Green BIM potentials

- For Green BIM to be mature (long-term plan): Automation & Optimization
  - Automatic MEP system balancing & sizing
  - Building automation & monitoring systems
  - BIM-enabled off-site fabrication
  - Smart building/smart metering/smart sensing
  - Multi-disciplinary design optimzation
- The exchange of information between BIM and other tools is a critical factor

Discussions & Conclusion

- Main challenges & research gaps:
  - (a) Interoperability problems between BIM tools & sustainability tools
  - (b) Limited capability of BIM for the construction and operation phases
  - (c) Lack of clear industry standards or codes for Green BIM applications
  - (d) Lack of appropriate project delivery methods
  - (e) Lack of incentives & low industrial acceptance for the adoption of Green BIM

Discussions & Conclusion

- To fully integrate BIM & green building, the information requirements must be considered carefully, especially during the construction, operation & renovation phases
- The Green BIM potentials can be enhanced if useful information & data are collected and provided to facilities managers & end-users

THANK YOU 謝謝 !!

5R (Recycle, Reduce, Renewable, Resource, Retrofit)

Green BIM

綠色建築信息模擬