SUSTAINABLE HOUSING
CHOICES AND CONSIDERATIONS
What Is the Principle of Sustainable Housing?

Тогтвортої орон сууцны зарчим юу вэ?

Environmental sustainability

Social sustainability

Economic sustainability

Cultural sustainability
Environmental sustainability

- Energy Efficiency
- Internal Environmental Quality
- Site Planning & Management
- Building Materials
- Water Efficiencies
- Waste Management
- Innovation

Source: Sustainable housing principle in Affordable House (sani et al., Malaysia)

What are the most important environmental issues to sustainable housing in Mongolia?
Energy efficiency

• Reduced Carbon footprint of buildings throughout their lifecycle:
  o Planning stage (land use, design, landscape etc.)
  o Building stage (machine, materials, waste management)
  o Operations and Management
  o Upgrading and Urban Regeneration
Energy efficiency

- Energy performance of buildings
- Energy audit
- Energy efficiency plan / implementation measures
- Cost benefit analysis / Financial resources
- Investment / Procurement Improvement
- Monitoring and evaluation

Typology of buildings

- Public buildings
- Commercial buildings
- Residential buildings
- High rise - low rise buildings
Energy efficiency

- Energy efficiency in retrofit buildings
- Green spaces and Green infrastructure
Environmental Sustainability

**Planning stage**
- Environmental impact
- Access to city
- Mixed-use
- Density
- Transport
- Climate/Env Hazards
- Possibility of upgrading

**Operation**
- Energy performance: cooling, heating, appliances/utilities
- Water usage & management
- Resilience
- Waste management
- Green solutions

**Building design**
- Considering energy and resource utilization
- Energy and water efficiency design
- IDH and micro generation
- SWM
- Green roof

**Refurbishment**
- Choice of refurbishment materials
- Energy efficient solutions
- Waste management
- Displacement

**Construction**
- Safety
- Local affordable materials
- Minimized impacts

**End of life**
- Demolishing or reusing
- Recycling of building component/building waste

Source: UN-Habitat 2012
Social Sustainability

- Availability of housing options
- Universal design principles (H4A)
- Housing solutions for disaster affected people
- Justice, public participation, knowledge and governance
- Gender equality
- Migration, displaced people
- Youth, children, elderly, disabled people
Social sustainability

Source: UN-Habitat 2012
Social sustainability

- Affordability, dignity and resilience
- Social and spatial justice
- Empowerment, participation and inclusion
- Adaptable housing for current and future needs
- Integrated housing into sustainable community infrastructure
Economic sustainability

- Affordability of housing supply
- Balanced housing market and the choice of affordable tenure
- Building as source of employment
- Recognize home-based enterprise
- Mobilize saving and domestic finance
Economic sustainability

- Secure and neutral tenure
- Land registration info & services
- Mortgage rules
- Investment (PPP and others)
- Building codes and standards
- Labour & local materials → jobs
- Appropriate technologies
- Infrastructure & Service for low income & informal settlements
- Encourage dwellers of informal construction to regularize and upgrade their constructions
- Spatial planning policies – equality, distribution, reduced urban sprawl tec.
Cultural adequacy

- landscape; historical & cultural heritage
- public spaces
- background and culture of inhabitants
What the Characteristics of Sustainable Housing?

Sustainable houses are those that are designed, built and managed as:

- Healthy, durable, safe and secure,
- Affordable for the whole spectrum of incomes,
- Using ecological low-energy and affordable building materials and technology,
- Resilient to sustain potential natural disasters and climatic impacts,
- Connected to decent, safe and affordable energy, water, sanitation and recycling facilities,
- Using energy and water most efficiently and equipped with certain on-site renewable energy generation and water recycling capabilities,
- Not polluting the environment and protected from external pollutions,
- Well connected to jobs, shops, health- and child-care, education and other services,
- Properly integrated into, and enhancing, the social, cultural and economic fabric of the local neighbourhood and the wider urban areas,
- Properly run and maintained, timely renovated and retrofitted.

Source: UN-Habitat 2012
A UN-Habitat tool to assess sustainable housing
GREEN INFRASTRUCTURE
Green Infrastructure (GI)

- Nature based solutions in addressing climate change mitigation and adaptation measures within urban environments

- GI =
  - Protecting, enhancing nature
  - natural processes are consciously integrated into spatial planning and territorial development

(EC, 2013)

- Examples: urban forest, coastal habitat restoration, green roofs
Green Infrastructure (GI): Interventions and nature-based solutions

- Tree Pits/ Retention Cells
- Bioswales
- Green Roofs
- Roof Top Planters
- Green Facades and Green walls
Tree Pits/ Retention Cells

- Single pit vs Stormwater Tree Trench System
- High degree of water take up
- Increase the capacity of water capture
- Improve the resilience of the trees
- Location: pavements or parking lots
- Systems require maintenance every 5-10 years

Source: Wilson, 2017
Bioswales

- Stable rainfall events
- Catches a significant amount of pollutants
- Systems require regular maintenance
- Don’t look beautiful during periods of drought
- System require replace periodically

Source: Wilson, 2017
Green Roofs

- Benefits of heating and cooling requirements of building
- Reducing usage of air conditioners
- Do not require additional space
- Urbanizing cities, and locations with high land values
- Water availability
- Weight $\rightarrow$ need reinforcement

Source: Wilson, 2017
Green Roofs

1) Chongqing Taoyuanju Community Center, Chongqing, China © Sergio Grazia

2) Meydan Shopping Centre. World Architects. Photo © Cristóbal Palma

3) © Michael Moran/OTTO for Andrew Berman Architect
Roof Top Planters

- Planter boxes, contained gardens
- Suitable for flat roof houses
- Improved air quality, reducing energy demand
- Less costly
- Rental buildings
- Self-produced food and promote biodiversity
- Need reinforcement

Source: Wilson, 2017
Green Facades and Green walls

- Office, commercial and apartment buildings
- Aesthetic values
- Solar radiation absorbed by construction materials
- Cooling costs
- Require readily available water
- Public awareness and contact with nature

Source: Wilson, 2017
Green Facades and Green walls
‘Daylighting‘ Rivers

✓ The process of removing obstructions (such as concrete or pavement) which are covering a river, creek, or drainage way and restoring them to their previous condition.

✓ Increasing storage capacity/flood management

✓ Reduce downstream/localized flooding

✓ Require space, financial/labor intensive

✓ Co-benefits (property value, pollution control, landscape, wildlife)

✓ Require high maintenance

Source: Naturally Resilience Community, 2017
Vegetation Buffer Zones

- Reduced impacts from dust storms, flash flooding
- Increased biodiversity
- Slowing down water movement, wind barrier
- Creating habitat, improving cooling and air quality
- Selection of species is crucial
Vegetation Buffer Zones
Mangrove – wetland restoration

• Significant factor in adapting to climate change, through mitigating the effects of storm surges, sea level rises and salt water intrusion
• Strong relationships between coverage & density and reduction in property damage (Barbier et al 2013)
• High carbon storage ecosystem
• Biodiversity and livelihoods support
• Recreational purpose
• Etc.
Urban Forest - Urban Farming

- Biodiversity
- Carbon sink
- Recreational area
- Climate regulation
- Spatial planning
- Air quality
- Healthy community
- Choice of species
- City resilience

UN-Habitat
For a Better Urban Future
Riparian Buffer Zones, Ecological Parks and Green Park Connectivity
CITY AS A SYSTEM
Cities’ ecological footprint

Ecological Footprint and Human Development Index for selected countries and cities
The urban system

- Cities are sources of problems but, at the same time, they also have a huge potential for resource efficiency
- Need to uncouple social well-being and economic growth from their use of resources
- Better manage resource flows
- It relies on cross-scale interactions among the natural system, the trans-boundary engineered infrastructure (roads, railways, water supply, power supply, etc.) and the different actors

The Urban System

- Urban metabolism needs to be optimized on all scales (building, block, neighbourhood, city)
Cities as a living organism

- Flows and Stocks
- Material flows analysis
  - Mass of input flows = Mass of output flows + stocks
  - Life cycle analysis or life cycle assessment (additional tools)
  - Economic input–output life cycle assessment

The linear urban metabolism

Source: Adapted from Kennedy and Hoornweg, 2012 — modified by the EEA.
The circular approach

• Cities need to close the loop of urban cycles
• Recycling and reusing is a way of optimizing the production process by reducing waste, costs and inputs of raw materials
• Ecosystem efficiency
• Urban metabolism can be changed both through policies — urban design and urban planning

Source: Adapted from EC, 2014
Reducing resource consumption

- Strategies for reducing resource consumption
  - reducing the demand for resources
  - minimising inputs and outputs
  - harvesting (using local and renewable sources such as rainwater, solar and wind energy, urban agriculture)

The waste management hierarchy

Source: Adapted from EU, 2008.
Cities as a source of resources

- Bio-waste, composting
- Food waste
- Household appliances/e-waste
- Plastic waste
- Waste water
- Concrete, aggregates, bricks, tiles and asphalt
The challenges

- Data
- City’s boundary
- People’s awareness
- Behavioral changes
- Financial resources
- Technologies and know-how
- Integrated planning