Implementing Eco-District and Green Building In Ulaanbaatar

Promoting Bilateral Mechanisms in Asia and the Pacific Workshop on the Joint Crediting Mechanism
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There is a problem…

… we know the solutions

Pollution
- Coal based heating and electricity supply
- Sub standard living conditions in ger areas
- Available housing stock not affordable while demand is important

How to implement them…

Extend access to urban services and integrated redevelopment
- Affordable housing using innovative building methods
- Green Building using renewable energy
Integrated planning and development process, and complete solution at the neighborhood level to build up citywide sustainability and green development.

- **Combination** of public policy, catalytic investments from local government and utilities, private sector and communities participation.

- **Bridge the gap** between green policy objectives and practical investments.

- **Appropriate scale** for step by step implementation and to enhance neighborhood urban and environmental solutions.
Mix land uses and functions (residential, commercial and recreation functions; ample public and green space; education, cultural and health facilities)

Social mix (urban areas that mixed different category of population having different income level) and vibrant/engaged communities

Green building and planning using implementable renewable energy and energy efficient

Attractive for communities: Quality of life, social integration, and Affordable

Attractive for real estate developers: Reasonable Net Profit Value

In line with City master and local plans, and urban regulation
<table>
<thead>
<tr>
<th>Country</th>
<th>District</th>
<th>Program</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Berlin - Kreuzberg</td>
<td>13 buildings</td>
<td>Urban renewal</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Amsterdam GWL Terrein</td>
<td>6ha - 591 housing units</td>
<td>New urban area and urban renewal</td>
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<tr>
<td></td>
<td>Culemborg: Eva Lanxmeer</td>
<td>24 ha - 244 housing units</td>
<td>New urban area</td>
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<tr>
<td>Sweden</td>
<td>Malmö: Bo01</td>
<td>30ha - 1,100 housing units</td>
<td>New urban area</td>
</tr>
<tr>
<td></td>
<td>Malmö: Augustenborg</td>
<td>1,800 housing units</td>
<td>Urban renewal</td>
</tr>
<tr>
<td>France</td>
<td>Dunkerque: Courghain</td>
<td>104 housing units</td>
<td>Urban renewal</td>
</tr>
<tr>
<td></td>
<td>Nantes: Ile de Nantes Malakoff</td>
<td>350 ha - 8,200 housing units</td>
<td>Urban renewal and new urban area</td>
</tr>
<tr>
<td></td>
<td>Grenoble: ZAC de Bonne</td>
<td>8.5 ha - 850 housing units</td>
<td>New urban area</td>
</tr>
</tbody>
</table>
Townhouses

Land footprint: around 7 plots/Khaasha
28 and 56 Housing units

70% affordable and social housing
Green space and public amenities

Mix Townhouses and low-sized buildings

Land footprint: around 9 plots/Khaasha
66 to 84 Housing units
Higher room for shops and offices

IRR: 12% - 16%
Construction Cost $325 - $350
Selling Price: AH: $550
MP: $850
## Construction methods

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>Construction Timeline</th>
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</thead>
<tbody>
<tr>
<td>Metal Framing</td>
<td>45 days</td>
</tr>
<tr>
<td>Modular Homes</td>
<td>60 days</td>
</tr>
<tr>
<td>Community Built</td>
<td>Dependent on Scale</td>
</tr>
<tr>
<td>Pre Cast Concrete</td>
<td>2 months</td>
</tr>
<tr>
<td>Multipoint foundation</td>
<td>2 months</td>
</tr>
</tbody>
</table>

Construction Cost between $300/m² and $400/m²

Some construction methods allow construction during the 4 seasons.
Step by Step Implementation
Green Components

Renewable Energy
- Passive Solar Design
- PV (Photo Voltaic) Panels
- Ground-Source Heat Pumps
- Solar Hot Water System

Energy Efficiency
Modern energy efficiency technology based on Mongolian Norm and Regulation BnDB 23-02-09 “Thermal Performance of Buildings”

Efficient land use planning
- Compact design
- Shape and building orientation

Energy Performance Monitoring (green and smart)
Solar PV
Planned 6kW array per townhouse, generates average 1kW over 24 hours. Covers all electricity needs and contributes to heat and hot water. Selling excess power increase benefits and eliminates the need for storage. But
Regulations and administrative procedures for household systems are not in place. Mongolia has good conditions for PV, but pollution and dust will reduce performance.

Solar Hot Water
Indirect active systems are required for Mongolia. Solar Hot Water is more efficient than PV in converting solar energy to heat (60%). But Technically more complex; Some electricity is needed.

Ground Source Heat Pumps
Heat Pumps have lower efficiency in cold climates like Mongolia. Heat pumps require electricity to work (20-40% of output) in UB. Vertical open loop is most suitable, about 0.45 l/s for 7.5 kW output Feasibility depends on suitable ground conditions, studies underway to determine feasibility.
Passive Solar Design
A set of design principles that can be used to reduce heating and cooling requirements in conjunction with energy efficient construction (5-25% for modest systems / 40% for "highly optimized" systems / Up to 75% for "very intense" systems).

But
Requires careful design, computer calculations;
More challenging for multifamily housing;
Increased materials cost must be balanced with affordability.

Energy-Efficient Building Technology
Already part of Mongolian regulations (BnDB 23-02-09);
Target reduce heating load to less than 50% of present 30-40 W / (m² • °C • day);
Not just increased insulation, but consideration for ventilation and moisture, with attention to materials and design details;

But
Requires improved design and regulatory technical capacity;
Requires realistic energy tariffs based on metering to provide incentives.

Energy Performance Monitoring
Data collection is no longer costly;
Operations can be optimized to reduce cost;
Verifies designs and detects maintenance requirements.
How Each Technology Saves Energy

**Demand Side**

All reduce energy inputs and increase occupant comfort.

**Supply Side**
Solar PV / Solar HW / Ground Source Heat Pumps

All reduce dependence on coal combustion. Individually or in combination, will be able to fully supply all energy needs for the housing density planned.

Supply and Demand investments must be balanced, with realistic tariffs and subsidies to incentivize policy objectives.
Energy Efficiency and renewable energy

Performance Monitoring And Smart Cities

LAYOUT
Land Use Regulation (AHURP - Master Plan)

Depending on
- Climatic constraints
- Zoning
- Road network
- Land occupation

Resulting in
Optimal orientation Shape of the buildings (implementation / height)

CONSTRUCTIVE PARAMETERS
Additional specifications (Land regulation / Construction law)

Reduce air pollution
Reinforced insulation - Drastic reduction of heat losses

GEOTHERMAL ENERGY
Ground Source Heat Pump
- Geophysical surveys
- Seasonal potential
- Capacity over time
- Heating October – April
- Hot tap water if adequate

SOLAR ENERGY
PV Solar Panels
- Around 7sqm/flat
- No storage
- Fed back to the public grid
- Renewable Energy Law
- Support to geothermal h.

Solar Water Boilers
- Applications
- If geothermal energy inadequate
- Replacing electric boiler

3-R Cycle – waste collection / greywater recycling in Lrb
(Depending on the cost effectiveness)

Additional costs (specific Fund) – not part of the basic construction costs
Funds arrangements – Subsidies

HOUSEHOLDS (Low and Very Low Income) → Rent → Social Housing

Municipal infrastructure
Public space and facilities

Commercial areas
Market rate housing

Affordable Housing

Green Building Technology

CLIMATE FUNDS

Compensate

HOUSEHOLDS (Moderate Income)

Buy/Rent

ECO-DISTRICT

Contractors

Procure

M U B

Select

PUBLIC FUND

Finance

Contractors

DEVELOPERS

Finance

DEVELOPMENT FUND

Japan Fund for Poverty Reduction
Project Preparation / Implementation Arrangements

1. Identification
- Cluster of households willing to swap
- Choice of the size and type of the URU
- Agreement between Communities and MUB

2. Design/Approval
- Agreement on land swap/sell and resettlement plan
- Preliminary design of the URU
- Contract between communities and MUB/project management unit

3. Financing commitment/Detailed design
- Public fund commitment
- Private sector selection
- Detailed plan and design

4. Construction
- Procurement
- Construction and supervision
- Completion of infrastructure / housing units

5. Development
- Affordable/Social housing
- Market rate housing commercial areas
- Development coordination

6. Operation
- Sustainable O&M
- Operation and maintenance for urban services
- Maintenance of public space, building and public facilities
Financing Solutions

- Climate Change Mitigation and Resilience Funds
  Green Climate Fund…

- Grant Funds to support energy efficiency and renewable energy solutions
  Japanese Fund for Joint Crediting Mechanism…

- Local Commercial Bank
  (Xac Bank, TDB, Arig Bank, Ni Bank, Golomt Bank, Khan Bank…)

- Guaranties

- Private sector department of Development Banks
  (ADB-PSOD, EIB, EBRD, PROPARCO, IFC)

- Private Sector
  PPP, Energy Efficiency Performance Contract, International Infrastructure Support System (IISS)
Demonstration project and leverage private sector investment to deliver affordable and green housing stock, and establish policies, mechanisms, and standards for sustainable affordable housing (AH) and green urban development.

- Physical component will deliver 10,000 to 15,000 housing units (55% affordable, 15% social, and 30% market rate units) and redevelop 100-130 hectares of ger areas into ecodistricts that will be:
  
  (i) mixed-use with ample public space and public facilities,
  (ii) mixed-income with at least 60% of combined affordable and social housing units,
  And
  (iii) resource efficient and maximizing the use of renewable energy.

- Institutional and capacity component will:
  
  (i) Establish mechanisms for delivery of affordable housing units stock;
  (ii) Improved urban redevelopment process and standards; and
  (iii) Strengthened project management, and institutions for urban redevelopment and AH.
Synergies

MUB
Support the implementation of the City Master Plan Implementation,
Support NOSK activities
Ger Areas Housing Project
GADA...

ADB
Ulaanbaatar Urban Services and Ger Areas Development Investment program
Urban Transport Development Investment Program
Improving Access to Health Services to Disadvantaged Group Project

International organizations
JICA, UNHabitat, UNDP, Asia foundation, GIZ,
World Bank, IFC, EBRD...

Private sector investments
Ulaanbaatar Urban Services and Ger Areas Development Investment Program

- **Infrastructure** - Road, Water Supply, Sewerage, Heating(Plant, Pipe)

- **Socio-economic Facilities** - Kindergarten, Business Incubator & Vocational Training Center

- **Technical Support** – Implementation, Detailed Design, Sub-Center Development, Community Engagement