Mongolia’s First Cooperative Transformation Attempt on Built Environment through Greening Kindergarten Building

D. NERGUI
Mongolia Green Building Council

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• Design and Technology Option Analysis
• Capacity Building and Cost-Benefit Analysis
• Financing Mechanism Assessment
• Design Specifics and Procurement
• Conclusion
Design and Technology Option Analysis

Principles:

• Resource efficiency and technology availability locally
• Technology friendliness from both education users and environment perspectives
• Cost effectiveness
• Overall green building principles, including energy efficiency, indoor air quality, comfort ability, use of renewable energy, safety and requirements for outdoor environment
• Encourage local innovation
Stakeholder consultation
Building technology options – Example: Insulation
Capacity Building and Cost-Benefits Analysis

Capacity Building
- Kindergarten users and customers
- Government
- Building industries

Purpose:
Discuss approaches and methodologies of undertaking costs and benefits of analysis with the focus of technology options relate to building structures, heating options, insulation, building exterior and interior which can allow the government working group to make a final decision on technology selection

Cost-Benefit Analysis
Approach and methodology:
The use of quantitative and qualitative indicators
Comparison
The use of financial and non-financial indicators

CBA main Indicators:
- Initial investment
- Operational and maintenance cost
- Heating
- Electricity
- Fresh water supply and waste water treatment
- Health, social and environmental impact
- Automatic control
CBA Results:

- Initial investment is 26% higher than that of similar size ordinary kindergarten building.
- Cost saving includes 50% in heating expenses, 95% in electricity and 16.6% in fresh water supply and 99.5% cost reduction associated wastewater treatment that ensure the prevention of burning at least 68-89 tons of coal annually. In other words, it can reduce the direct CO2 emission by 91.8-120.15 tons a year.
- It can also eventually reduce burden and pressure on state and/or local budgets.
- Operational and maintenance cost of a green kindergarten can be twice less costly than ordinary/brown kindergarten. Annual cost saving from the heating provision of 1m² space is for example 1’449’680 MNT (724SD).
- According to the public health impact analysis of a green kindergarten, annual cost saving per 1 child is 398’571 MNT (199 USD).
- The Net Social Benefits of green kindergarten project is 1.192.2 million MNT as a result of operational and maintenance cost savings, public health and environmental benefits of a green kindergarten building (596000 USD).
Financing Mechanism Assessment

• Situation analysis

• Identification of potential financing sources
  – State budget
  – Local budget
  – Grant assistance
  – Concessional loans
  – Mixed funding
  – PPPs
  – Private sector funding
  – Special purpose bond

• Assessment of potential financing sources
FMA: Mongolia’s economic growth

MONGOLIA GDP ANNUAL GROWTH RATE

SOURCE: www.tradingeconomics.com | NATIONAL STATISTICAL OFFICE OF MONGOLIA
FMA: Potential funding sources

- **Public funds**
  - State budget
  - Capital city and local Budget

- **Multilateral development assistance**
  - Asian Development Bank and World bank
  - Green Climate Fund
  - Global Partnership for Education

- **Bilateral development assistance**
  - Japan International Cooperation Assistance
  - Korea International Cooperation Assistance
  - German Federal Enterprise for International Cooperation

- **Private Sector**
  - Public-Private partnership
  - Domestic and International private sector investment

- **Innovative financing mechanism**
  - Special Purpose Bond
### Assessment of Potential Financing Sources

<table>
<thead>
<tr>
<th>Potential Financing Sources</th>
<th>Possibility</th>
<th>Expected lead time to prepare and execute a project</th>
<th>Transaction cost</th>
<th>Risk</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  State Budget</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2  Local Budget</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3  Grants from International agencies</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>4  Concessional Loan</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5  Mix of Grants and Concessional Loans from International agencies</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6  PPPs-Concession</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>7  Private Sector Funding</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>8  Special Purpose Bond</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
Design Specifics – Final view
Design Specifics – Final view
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Design Specifics – Final view
The total savings from green energy use is estimated to be 94.3 million MNT (47000USD).
it can ensure 9.1 million MNT (4500USD) savings annually starting from 5th year thereafter.
It can ensure 11.1 million MNT (5500 USD) savings annually starting from the second year and thereafter.
Social, Public Health and Environmental impacts

Main environmental impact:
- Less air pollution
- Less soil pollution
- Less underground water pollution

<table>
<thead>
<tr>
<th>Health conditions</th>
<th>Annually/ MNT</th>
<th>Per child/ MNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal cost of medicine for treatment of respiratory diseases</td>
<td>11'250'000 (5625 USD)</td>
<td>10'000 (5 USD)</td>
</tr>
<tr>
<td>Salaries of parents in 9 months, 125 children</td>
<td>Minimum labour salary</td>
<td>Per month/ hour</td>
</tr>
<tr>
<td>Productivity</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Employee satisfaction</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air pollutant</th>
<th>Measuring unit</th>
<th>Air quality</th>
<th>Permitted level</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM-10</td>
<td>ug/m3</td>
<td>157</td>
<td>Minimum pollution /101-250/</td>
</tr>
<tr>
<td>PM-2.5</td>
<td>ug/m3</td>
<td>34</td>
<td>Normal /51-100/</td>
</tr>
<tr>
<td>PM-1</td>
<td>ug/m3</td>
<td>10</td>
<td>Clean /0-50/</td>
</tr>
<tr>
<td>CO</td>
<td>ug/m3</td>
<td>239</td>
<td>Minimum pollution /101-250/</td>
</tr>
<tr>
<td>SO 2</td>
<td>ug/m3</td>
<td>11</td>
<td>Normal /51-100/</td>
</tr>
<tr>
<td>NO 2</td>
<td>ug/m3</td>
<td>15</td>
<td>Clean /0-50/</td>
</tr>
<tr>
<td>NO</td>
<td>ug/m3</td>
<td>3</td>
<td>Clean /0-50/</td>
</tr>
<tr>
<td>O 3</td>
<td>ug/m3</td>
<td>76</td>
<td>Normal /51-100/</td>
</tr>
<tr>
<td>CO 2</td>
<td>Ton</td>
<td>91.8-120.15</td>
<td>1 ton is valued around $20 and local valuation is 3.6-4.2 million MNT</td>
</tr>
</tbody>
</table>

1 ton is valued around $20 and local valuation is 3.6-4.2 million MNT

Air pollutant PM-10 measured in ug/m3 with an air quality of 157, indicating Minimum pollution. Air pollutant PM-2.5 measured in ug/m3 with an air quality of 34, indicating Normal. Air pollutant NO measured in ug/m3 with an air quality of 15, indicating Clean.
Possible reuse materials in Green kindergarten building

<table>
<thead>
<tr>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro block</td>
</tr>
<tr>
<td>Sheep wool insulation</td>
</tr>
<tr>
<td>Gypsum panel</td>
</tr>
<tr>
<td>Façade panel</td>
</tr>
<tr>
<td>PVC, steel pipes</td>
</tr>
<tr>
<td>Rubber studs in playground</td>
</tr>
<tr>
<td>Power and communication cables</td>
</tr>
<tr>
<td>All kinds of casting</td>
</tr>
</tbody>
</table>
Green engineering design, technology guidelines

The main criteria for green building:
1. Resources efficiency
2. Electricity, heat and water savings
3. Less waste and pollution
4. Use of human and environmentally friendly technology
5. Less operational and maintenance costs
6. Must have innovation elements
7. Eco-friendly environmental planning
8. Using these principles in all phases of planning and construction
Green public procurement

- There is a legal basis for procurement of green kindergarten in Mongolia.
- Bidding documents for green kindergarten was developed based on sample bidding documents of works.
- Technical specification was developed as a part of this Bidding documents.
- This can be used for other similar public procurement as an example.
Conclusion

• This assessment and design identified the importance of closer cooperation of relevant stakeholders to successfully run a project and also smooth start of a green building project.

• The CBA done from net social benefits perspectives suggested that the green kindergarten project is cost effective and has positive net social benefits with twice reduced operational and maintenance costs and is resource and energy efficient.

• The state budget, concessional loans and a mixed funding of grants and concessional loans from international agencies are most preferred funding sources for construction of green kindergarten building.
Conclusion

• The final design of green kindergarten building meets all required standards and building code of Mongolia and the building is designed to be child and environmentally friendly.

• Any public procurement shall be organized in line with public procurement procedures and regulation. The technical specification is an important part of the bidding document of the procurement. Therefore, the project team developed the model technical specification for green kindergarten based on the selected technologies and building materials which can be used as it is or can be slightly modified depending on specific local conditions and requirements.
THANK YOU!