PROJECT IDEAS IN IMPROVING ENERGY EFFICIENCY OF BUILDINGS

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BEEP, UNDP
Present condition of energy consumption in construction sector

- Heating energy consumption is much higher than electric
- Building energy demand increasing quickly
## Energy sources

### Installed capacity of power plants, MW

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Installed Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid Solar wind PP (11)</td>
<td>0.9</td>
</tr>
<tr>
<td>Solar PP (14)</td>
<td>1.2</td>
</tr>
<tr>
<td>Wind PP (6)</td>
<td>0.5</td>
</tr>
<tr>
<td>Hydro PP (13)</td>
<td>28.2</td>
</tr>
<tr>
<td>Dalanzadgad PP</td>
<td>6</td>
</tr>
<tr>
<td>Dornod PP</td>
<td>36</td>
</tr>
<tr>
<td>Erdenet PP</td>
<td>28.8</td>
</tr>
<tr>
<td>Darkhan PP</td>
<td>48</td>
</tr>
<tr>
<td>Uhaa hudag PP</td>
<td>18</td>
</tr>
<tr>
<td>PP4</td>
<td>136</td>
</tr>
<tr>
<td>PP3</td>
<td>16.1</td>
</tr>
</tbody>
</table>

Total Installed Capacity: 560 MW

96.4%
## Energy production and distribution, 2010

<table>
<thead>
<tr>
<th>No</th>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Produced electricity, mln. kWh</td>
<td>4256.0</td>
</tr>
<tr>
<td>2</td>
<td>Distributed electricity, mln. kWh</td>
<td>3585.1</td>
</tr>
<tr>
<td>3</td>
<td>Distributed heat, mln. kWh</td>
<td>7235.4</td>
</tr>
<tr>
<td>4</td>
<td>Average heat value of coal, kWh/kg</td>
<td>3.8</td>
</tr>
<tr>
<td>5</td>
<td>Coal consumption. Thousand Ton</td>
<td>5063.1</td>
</tr>
</tbody>
</table>
The coldest capital city

- Duration of heating season: 240 days
- HDD: app. 7400 °C-day
- CDD: 490 °C-day
- Heating design temperature: -39°C
- Cooling design temperature: 30.1°C
TYPE OF SETTLED AREA

- Small village and cities /Bag, soum and temple/
- Middle or large cities /Aimag centers, Ulaanbaatar/
- Ger area /part of cities/
- Mining camp
Statistic data of construction sector

• In 2010, construction entities built buildings worth of 600.5 bln. MNT, including residential buildings and commercial centers, showing an increase by 54.4 percent or 211.6 bln. MNT compared with previous year.

• In 2010, total of 630 new buildings and structures were constructed. Out of which, 152 were residential buildings for 9899 households; 63 school and cultural buildings; 55 office buildings; 16 industrial buildings and 9 hotel buildings.
Type of dwelling (UB)
Type of dwellings (in UB)

- 25%
- 40%
- 35%
Ger- Traditional dwelling /Felt insulated wood framed home/

- Specific fuel consumption much higher
- High infiltration
- Less R value
Product

- 30-90m² single or double store houses
Specific energy consumption for heating

<table>
<thead>
<tr>
<th>Bad insulation</th>
<th>Better insulation</th>
<th>Non-insulated</th>
<th>Insulated</th>
<th>Before 1997</th>
<th>After 1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ger</td>
<td>House</td>
<td>Apartments</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Energy cost of heating

<table>
<thead>
<tr>
<th>No</th>
<th>Type of heating system</th>
<th>Cost of energy, MNT/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>District heating (by heat meter)</td>
<td>7.5-(9.2)</td>
</tr>
<tr>
<td>2</td>
<td>Electric heating (90% eff)</td>
<td>103</td>
</tr>
<tr>
<td>3</td>
<td>Electric heating (90% eff) night tariff</td>
<td>81</td>
</tr>
<tr>
<td>3</td>
<td>Coal burning stove (50% eff)</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>LPG heater</td>
<td>200</td>
</tr>
<tr>
<td>5</td>
<td>Low pressure boiler (70%)</td>
<td>42</td>
</tr>
</tbody>
</table>

Baganuur coal 80MNT/kg (4.09kWh/kg), Nalaikh coal 120MNT/kg. (4.07kWh/kg)
BNbD “Thermal performance of building”

• Basic legal document (Building code) of energy consumption of building including below requirements:
  – U-value of building structures /Efficiency/
  – U-value of building structures /Health/
  – Specific heat loss of building
  – Compactness
  – Glass-wall ratio
  – Vapor transfer resistance
  – Energy passport of building / Energy label
Thermal performance test
Project ideas

• Retrofit of existing houses
  – Improve U-value of building structures
  – Reduce infiltration heat loss

• Solar hot water systems for households
- 40% energy efficiency (mostly net profit positive)
- 30% low carbon energy supply
- 30% forestry and agriculture
Retrofit insulation for existing houses
RESULT

<table>
<thead>
<tr>
<th></th>
<th>Annual heating demand, kWh</th>
<th>Electricity cost for heating (normal tariff). MNT</th>
<th>Electricity cost for heating (day-night tariff). MNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before insulation</td>
<td>16,317</td>
<td>1,453,844</td>
<td>1,144,409</td>
</tr>
<tr>
<td>After insulation</td>
<td>5,589</td>
<td>497,979</td>
<td>399,564</td>
</tr>
</tbody>
</table>
Emission factor

- Central energy system: 1.1501 tCO2/MWh* (OM)
- Bituminous Coal: 0.340 tCO2/MWh**
- Brown coal briquettes: 0.351 tCO2/MWh
- LPG: 0.227 tCO2/MWh
- Diesel oil: 0.266 tCO2/MWh
- Solar thermal: 0.000 tCO2/MWh

* - cdm-mongolia.com
** - IPCC Guidelines for National Greenhouse Gas Inventories
Baseline data

- Meteorological data: Meteonorm
Baseline data

• Fuel consumption
  – Not exactly data for dwellings (fuel consumption survey data from different sources)
  – Calculation method (EN832, ISO13789, ISO13790) based on thermal performance of building (U-value, ACH etc)
SOLAR HOT WATER SYSTEM

- 30-70 percent of energy consumption for hot water possible to use solar energy
T*SOL Pro 5.0
Simulation software for solar water heater system design
Solar hot water system for one family

- Annual energy consumption for hot water: 2840kWh.
- Solar energy consumption: 58.7%
- Electric energy consumption: 1172kWh/a
Барилгын эрчим хүч хэмнэлттэй МОН/09/301 төсөлөн танилцуулаа.

Барилгын салбарынгай хөлөгчийн хийн ялгырлыг  сөлөрөл  зорилго бүхий эмхэхүү тесел нь эл өгөхөдөө уялц ахуйн гурав зүрхийто буранддың уламжлалтай.

dэлээрэнэүү үзээх

gэр өрөмгөлдөн айл орх хашаанд а эрчим хүчийн хэмнэлт төсүү гарихад 5 сая төгрөгийн урамшуулал олого байна

Улаанбаатар хотой аагаарын бохирдолгы буруулуул бус ад хамрахад байгаагаар өрөмгөлд эрчим хүчийн хэмнэлттэй хүүхий орон сүүл, баруун өмнөхдөө 5 сая төгрөгийн урамшуулал авах боломжийт. Хэмнэлтэй төсөл байран 2013 оны 5 сарын 1 өгрийг өлзөөн авна.

dэлээрэнэүү үзээх