KEY ACHIEVEMENTS OF THE UNDP/GEF PROJECT

“Improving Energy Efficiency in the Residential Building Sector of Turkmenistan”

NATIONAL IMPLEMENTING PARTNER: STATE CONCERN “TURKMENGAS”
FOREWORD

Since late 2011, the United Nations Development Programme (UNDP) and several national partners led by the State Concern “Turkmengas” have been conducting a project entitled “Improving Energy Efficiency in the Residential Building Sector of Turkmenistan”. This project is funded by the Global Environment Facility (GEF) with co-financing from the Government of Turkmenistan.

The project seeks to achieve transformation of residential building design and construction in Turkmenistan, thereby saving energy and correspondingly curtailing GHG emissions on a large scale.

The project seeks such results via integrated activity in several areas, including implementation of building energy codes, state investment in renovation of existing building stock, improved design and management practice, training of aspiring and practicing professionals, and demonstration and replication of best practices.

This publication presents numerous important achievements, promising a wide impact in construction and design practice in Turkmenistan. This provides a summary of the project’s accomplishments and effects of their use in the residential building sector of Turkmenistan.
Revised building codes (SNT):
- SNT “Residential Buildings”
- SNT “Roofs and Roofing”
- SNT “Building Climatology”
- SNT “Building Thermal Engineering”

Developed guidance materials:
- Guidance manual to SNT “Residential Buildings”
- Guidance manual to SNT “Roofs and Roofing”
- Guidance manual to SNT “Building Thermal Engineering”
- Software for the building Energy Passport
- Database of Energy Passport data

POTENTIAL EFFECTS FROM TRANSITION TO REVISED BUILDING CODES

**ENERGY SAVINGS without automated heat control (AHC) in buildings**

- Heat energy: 28%
- Electricity: 14%

**ENERGY SAVINGS with automated heat control (AHC) in buildings**

- Heat energy: 47%
- Electricity: 17%
**NATURAL GAS SAVINGS*, mln. m³**

- **TOTAL 2017-2027:**
  - **WITHOUT AHC:** 188.9
  - **WITH AHC:** 260.2

**REDUCTION IN GREENHOUSE GAS EMISSIONS, thsd. ton CO₂e**

- **TOTAL 2017-2027:**
  - **WITHOUT AHC:** 358.8
  - **WITH AHC:** 494.4

---

* Determined in accordance with construction volumes stated in the National Programme for Regional Social Development (2015) and the National Plan for Socioeconomic Development of Turkmenistan for 2011-2030
Developed Compendium of technical solutions for thermal bridges in building envelopes, with calculations of associated heat losses

The compendium enables building designers to accurately determine thermal resistance of building envelopes and to calculate and reduce heat losses through the building envelope. Use of the given techniques also helps designers to properly select and determine the size of heating systems.

POTENTIAL EFFECTS FROM USE OF THE COMPENDIUM IN DESIGN OF RESIDENTIAL BUILDINGS (2017-2027)

143,4 75,5
Reduction in greenhouse gas emissions, thsd. ton CO₂e Natural gas savings*, mln. m³

3,1 5,9 4,6 6,2 7,7 11,7 14,6
2017 2018 2019 2020

* Determined in accordance with construction volumes stated in the National Programme for Regional Social Development (2015) and the National Plan for Socioeconomic Development of Turkmenistan for 2011-2030
IMPLEMENTATION OF ENERGY AUDIT (EA):

Developed documents:

- Methodology for energy audit of residential buildings
- Provisions on rules and process for energy audit in residential buildings of Turkmenistan

Potential effect from implementation of the recommendations from EA in 22 buildings

Reduction of energy consumption per square meter per year:

- 69 kWh/m² for heating and cooling
- 18 kWh/m² for lighting

The methodology for EA was tested in practice in the cities of Ashgabat (Abadan), Turkmenbashy, Balkanabad, Khazar, Mary, Bayramaly, Turkmenabad, Seydi, and Dashoguz.
Design and construction of three new buildings with enhanced energy performance

Overall reduction of greenhouse gas emissions for the three new pilot buildings

1165 TON CO₂e PER YEAR

**ANNUAL REDUCTIONS IN ENERGY CONSUMPTION***

<table>
<thead>
<tr>
<th>Residential Building Type</th>
<th>Heat Energy Savings (kWh)</th>
<th>Heat Energy Savings per Square Meter</th>
<th>Electricity Savings (kWh)</th>
<th>Electricity Savings per Square Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-Story 54-Unit</td>
<td>159933</td>
<td>32,2</td>
<td>67795</td>
<td>13,6</td>
</tr>
<tr>
<td>12-Story 114-Unit</td>
<td>1085225</td>
<td>30,6</td>
<td>749514</td>
<td>21,1</td>
</tr>
<tr>
<td>12-Story 66-Unit</td>
<td>566754</td>
<td>24,3</td>
<td>200609</td>
<td>8,6</td>
</tr>
</tbody>
</table>

*Data from monitoring of energy consumption after construction
National partner

MINISTRY OF COMMUNAL SERVICES OF TURKMENISTAN

Renovation of three residential buildings to enhance energy performance

Overall reduction of greenhouse gas emissions from the three renovated pilot buildings

476 TON CO₂e PER YEAR

ANNUAL REDUCTIONS IN ENERGY CONSUMPTION*

<table>
<thead>
<tr>
<th>Residential Building</th>
<th>Heat Energy Savings</th>
<th>Heat Energy Savings per Square Meter</th>
<th>Electricity Savings</th>
<th>Electricity Savings per Square Meter</th>
<th>Savings of Natural Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-STORY 40-UNIT</td>
<td>91239 kWh</td>
<td>34,2 kWh/m²</td>
<td>72800 kWh</td>
<td>64,9%</td>
<td>4910 m³</td>
</tr>
<tr>
<td></td>
<td>31,3%</td>
<td></td>
<td>27,2 kWh/m²</td>
<td></td>
<td>71,7%</td>
</tr>
<tr>
<td>5-STORY 45-UNIT</td>
<td>134970 kWh</td>
<td>59,2 kWh/m²</td>
<td>91212 kWh</td>
<td>55,7%</td>
<td>10504 m³</td>
</tr>
<tr>
<td></td>
<td>38,7%</td>
<td></td>
<td></td>
<td></td>
<td>76,4%</td>
</tr>
<tr>
<td>9-STORY 54-UNIT</td>
<td>192837 kWh</td>
<td>38,8 kWh/m²</td>
<td>199775 kWh</td>
<td>61,1%</td>
<td>15120 m³</td>
</tr>
<tr>
<td></td>
<td>32,9%</td>
<td></td>
<td></td>
<td></td>
<td>81,5%</td>
</tr>
</tbody>
</table>

*Data from monitoring of energy consumption after reconstruction
Developed 11 designs and Energy Passports of individual low-rise houses (cottages) with enhanced energy performance and solar water heaters.

**ENERGY SAVINGS**

- **57%** for heat and ventilation
- **50%** for cooling and ventilation
- **27%** for domestic hot water supply

**POTENTIAL EFFECT FROM IMPLEMENTATION OF THESE DESIGNS FOR CONSTRUCTION OF LOW-RISE HOUSES (2017-2027)**

- **762,9** reduction in greenhouse gas emissions, thsd. ton CO₂e
- **401,5** natural gas savings*, mln. m³

*Submitted for confirmation

* Determined in accordance with construction volumes stated in the National Programme for Regional Social Development (2015) and the National Plan for Socioeconomic Development of Turkmenistan for 2011-2030
Created Energy management system for collection and transmittal of data for energy consumption, from meters installed in 5 residential buildings and the boiler house in the Koshi residential complex in Ashgabat.

POTENTIAL EFFECT FROM USE OF THIS SYSTEM TOGETHER WITH AUTOMATIC HEAT SUPPLY CONTROLS

16-20% ENERGY SAVINGS FOR HEATING AND COOLING

The purpose of energy management is to reduce energy consumption through implementation of the following measures:

- control energy consumption;

- measure energy consumption;
- collect, archive and transmit the information on operation of heat supply control devices and data taken from meters to interested organizations;
- analyze the information, take decisions, invoice for consumed heat energy.
Automatic heat supply control (AHC) device for residential buildings prepared for domestic assembly

5 prototypes of the automatic heat supply control device assembled, installed and tested in 5 residential buildings in the Koshi residential complex in Ashgabat

18% HEAT ENERGY SAVINGS

Potential effect from use of the automatic heat supply control device

NEEDS TO CONTROL HEAT ENERGY CONSUMPTION

Before implementation of the energy savings measure

After implementation of the energy savings measure
POTENTIAL EFFECT FROM USE OF AHC IN EXISTING BUILDINGS (2018-2027)

Reduction in greenhouse gas emissions, thsd. ton CO₂e

Natural gas savings*, mln. m³

* Determined in accordance with the investment plan developed by the UNDP / GEF project for modernization of the residential building stock of Turkmenistan for increasing energy efficiency
POTENTIAL EFFECT FROM USE OF AHC IN NEW RESIDENTIAL BUILDING STOCK (2017-2020)

Year | CO₂e Emissions, thsd. ton | Natural Gas Savings, mln. m³
--- | --- | ---
2017 | 1,9 | 47,4
2018 | 2,9 | 24,9
2019 | 3,9 |
2020 | 4,8 |

*Denoted in accordance with construction volumes stated in the National Programme for Regional Social Development (2015) and the National Plan for Socioeconomic Development of Turkmenistan for 2011-2030.
National partner
MINISTRY OF COMMUNAL SERVICES OF TURKMENISTAN

- Assessment of potential energy savings in the residential building stock of Turkmenistan
- Financial analysis and investment plan for modernization of the residential building stock of Turkmenistan for enhanced energy performance

Potential effect of modernization of the residential building stock for enhanced energy performance (2018–2027):

191 MLN. M³ PER YEAR
Reduction of domestic consumption of natural gas

362 THSD. TON CO₂e PER YEAR
Reduction of greenhouse gas emissions

US $250 MLN.
Investment distributed over 5 years

7 YEARS
Return on investment from export of saved gas

1619,9
Reduction in greenhouse gas emissions, thsd. ton CO₂e

3077,8
Natural gas savings*, mln. m³

362,7

<table>
<thead>
<tr>
<th>Year</th>
<th>Reduction in greenhouse gas emissions</th>
<th>Natural gas savings</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>67,6</td>
<td>128,5</td>
<td>67,6</td>
</tr>
<tr>
<td>2019</td>
<td>97,1</td>
<td>184,5</td>
<td>97,1</td>
</tr>
<tr>
<td>2020</td>
<td>142,0</td>
<td>269,8</td>
<td>142,0</td>
</tr>
<tr>
<td>2021</td>
<td>167,7</td>
<td>318,7</td>
<td>167,7</td>
</tr>
<tr>
<td>2022</td>
<td>190,9</td>
<td>362,7</td>
<td>190,9</td>
</tr>
</tbody>
</table>

* Determined in accordance with the researches of the UNDP/GEF project
Developed National Action Plan for Rational Use of Energy in the residential building sector

The goal of the plan is the reduction of annual consumption of energy resources by no less than 0.5 percent in the residential sector of Turkmenistan.

POTENTIAL EFFECT FROM IMPLEMENTATION OF THE NATIONAL ACTION PLAN (2017-2027)

3572,2

Reduction in greenhouse gas emissions, thsd. ton CO$_2$e

1880,1

Natural gas savings*, mln. m$^3$

<table>
<thead>
<tr>
<th>Year</th>
<th>Reduction in CO$_2$e</th>
<th>Natural Gas Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>10,6</td>
<td>20,2</td>
</tr>
<tr>
<td>2018</td>
<td>83,6</td>
<td>158,8</td>
</tr>
<tr>
<td>2019</td>
<td>118,3</td>
<td>224,9</td>
</tr>
<tr>
<td>2020</td>
<td>168,6</td>
<td>320,3</td>
</tr>
<tr>
<td>2021</td>
<td>194,3</td>
<td>369,2</td>
</tr>
<tr>
<td>2022</td>
<td>217,5</td>
<td>413,2</td>
</tr>
</tbody>
</table>

* Determined in accordance with the researches of the UNDP/GEF project
- Curricular program revised for students at TSIAC
- Materials developed for instructors and students at TSIAC

Confirmed

- A section entitled "Energy Conservation" has been included in the curricular program for students in four specialties of the architectural-construction faculty of TSIAC
- Lecture material, practical guidance manuals for the section "Energy Conservation"
- Laboratory guidance manuals for the section "Energy Conservation"
- An energy conservation laboratory established at TSIAC
- Contest on energy-efficient residential building design held among TSIAC students
- Supervision provided for two diploma theses of TSIAC students
National partners

STATE CONCERN “TURKMENGAS”

MINISTRY OF CONSTRUCTION AND ARCHITECTURE OF TURKMENISTAN

MINISTRY OF COMMUNAL SERVICES OF TURKMENISTAN

STATE CONCERN “TURKMEN OIL AND GAS CONSTRUCTION”

TRAININGS, SEMINARS AND PUBLICATIONS

8 TRAINING SESSIONS FOR 120 SPECIALISTS
on design of energy-efficient residential buildings

1 NATIONAL SEMINAR
on implementation of energy management of residential buildings

5 TRAINING SESSIONS FOR 100 SPECIALISTS
on energy audit of residential buildings across all five velayats

5 TRAINING SESSIONS FOR 100 SPECIALISTS
on organization and implementation of energy management of residential buildings across all five velayats

1 NATIONAL SEMINAR
on implementation of energy audit of residential buildings

8 ROUNDTABLE MEETINGS
5 WORKING-GROUP MEETINGS
4 NATIONAL CONFERENCES

4 PRESENTATIONS DELIVERED FOR ANNUAL INTERNATIONAL CONSTRUCTION CONFERENCES

4 STUDY TOURS

PUBLICATIONS IN THE LOCAL MASS MEDIA to Germany-Denmark, Croatia, Belarus, and Russia

GUIDANCE MANUALS

- Guidance manual developed on energy efficiency of residential buildings
- Guidance manual developed on planning and implementation of energy management for existing residential buildings of Turkmenistan