Improving residential sector in TIMES-Kazakhstan

Aiymgul Kerimray, Rocco De Miglio, Aidyn Bakdolotov
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HOUSEHOLDS ACCESS TO ENERGY SERVICES

<table>
<thead>
<tr>
<th>Service</th>
<th>Urban 2011</th>
<th>Rural 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>100%</td>
<td>77%</td>
</tr>
<tr>
<td>District heating</td>
<td>67%</td>
<td>3%</td>
</tr>
<tr>
<td>District heating</td>
<td>0.60%</td>
<td>22.10%</td>
</tr>
<tr>
<td>Pipeline gas</td>
<td>54.40%</td>
<td></td>
</tr>
</tbody>
</table>

Committee of statistics (2014)
AVAILABILITY OF ENERGY CONSUMING DEVICES, %

Committee of statistics (2014)
RESIDENTIAL ENERGY CONSUMPTION, ktoe

- 28% of Total Final Consumption
- Average annual increase by 5%
- Coal, district heating and gas dominate (67%)
Residential energy consumption by fuel type, by regions, TJ

Construction of gas pipelines to the North, East and Central Kazakhstan is still under the discussion
**HEATING DEGREE DAYS, °C-days**

- Heating is a basic need for survival in Kazakhstan
- There were no studies to identify how many of households were unable to keep sufficiently warm their home in Kazakhstan

NASA (2008)
AVERAGE ANNUAL INCOME OF HOUSEHOLD, USD, CURRENT PRICES

Committee of statistics (2014)
MAIN PROBLEMS IN THE HEATING SECTOR

- Losses of heat in buildings reach 30%
- Losses of heat in lines - 17.5%
- 32% of housing stock require refurbishment
- **Average heat consumption in residential buildings – 270 kWh/m²**
  - Average in Europe – 100-120 kWh/m²
- Absence of metering devices

Program of modernization of housing maintenance and utilities (2015)

**Losses of heat in buildings**

- Draught and ventilation: 56%
- Walls: 22%
- Windows: 14%
- Floors and ceilings: 8%

UNDP Kazakhstan (2012)

**REASONS**

- Low energy prices
- Low interest of homeowners to pay for refurbishment
- Low effectiveness of mechanisms for maintenance and refurbishment of buildings
HEAT PRICES FOR RESIDENTIAL USERS

- Tariffs do not reflect true cost of heat supply
- Low price of coal

OECD (2012)
Kazakhstan is the third country in the world with the highest coal consumption per capita in the residential sector.

Coal consumption in the residential sector per capita

**REASONS**
- Cheap fuel
- Absence of alternative supply
- Capital intensive stoves

IEA (2012)

Solid fuel fired stove in Kazakhstan (Taraz)
FIRST RESULTS OF HOUSEHOLDS SURVEY

Primary data of the three households surveys were obtained:

- Main interview (including housing conditions and other)
- Income and expenditures
- Checklist of households composition

Total number of surveyed households: 11808
FIRST RESULTS OF HOUSEHOLDS SURVEY

Number of households by tenure status

- Blank: 47%
- Tenant: 44%
- Owner occupied: 9%
- Other: 0%
- Akimat: 0%

Urban: 12%
Rural: 0%

Number of households by type of dwelling

- Apartment: 47%
- Detached house: 44%
- Part of house: 9%
- Room in apartment: 0%

Number of households by living space

- 10-30m²: 24%
- 31-50m²: 45%
- 51-80m²: 23%
- 24%

Number of households by the year of construction of dwelling

- 1910-1950: 18%
- 1951-1970: 28%
- 1971-1990: 51%
- 1991-2010: 1%

Further results on energy expenditure will be available soon

Using the year of construction of dwelling and the fuels used by dwelling the building types can be disaggregated in the model.
TIMES-KAZAKHSTAN MODEL

- Developed over the period of 2011-2013 within the project funded by Ministry of education and science of the Republic of Kazakhstan

- **Is now being updated within the ongoing Project (2015-2016) “Development of Policy Options for Mid- and Long-term Emissions Pathways and Role of Carbon Pricing” funded by PMR**

- Base year was changed from 2009 to 2011

- Updated energy balances as a sum of 16 regional energy balances were represented

- New technologies database was updated

- Demand projections were updated, GDP growth is expected at 2% (previous assumption 6%)
TIMES 16 REGIONS KAZAKHSTAN
MODEL

- Was started in 2014 under the project funded by Ministry of education and Science of the Republic of Kazakhstan.

At the final stage, expected to be finished by the end of 2015, trade matrices, user constraints to be fine-tuned, demand projections to be elaborated, calibration to be improved.
ASSUMPTIONS ON ENERGY END-USE AND DEMAND DRIVERS AND ELASTICITIES

<table>
<thead>
<tr>
<th>Demand</th>
<th>Driver</th>
<th>Elasticity to the DRIVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling</td>
<td>GDP</td>
<td>1</td>
</tr>
<tr>
<td>Clothes drying</td>
<td>GDP per capita</td>
<td>0.2</td>
</tr>
<tr>
<td>Clothes washing</td>
<td>GDP per capita</td>
<td>0.2</td>
</tr>
<tr>
<td>Dish washing</td>
<td>GDP per capita</td>
<td>1</td>
</tr>
<tr>
<td>Other electric appliances</td>
<td>GDP per capita</td>
<td>1.59</td>
</tr>
<tr>
<td>Heating</td>
<td>Population</td>
<td>1</td>
</tr>
<tr>
<td>Hot water</td>
<td>GDP per capita</td>
<td>0.8</td>
</tr>
<tr>
<td>Cooking</td>
<td>Population</td>
<td>1</td>
</tr>
<tr>
<td>Lighting</td>
<td>GDP per capita</td>
<td>0.2</td>
</tr>
<tr>
<td>Residential other</td>
<td>GDP per capita</td>
<td>1</td>
</tr>
<tr>
<td>Refrigeration</td>
<td>GDP per capita</td>
<td>0.34</td>
</tr>
</tbody>
</table>
RES OF FUEL SUPPLY FOR THE RESIDENTIAL SECTOR

Natural gas and district heating distribution systems were split to
• dense
• medium
• sparse locations
with corresponding investment costs and efficiencies

Installation of automatic controllers and heat metering devices was included in the model
RES OF RESIDENTIAL SECTOR TECHNOLOGIES

Three additional “virtual” processes:
- “Unmet” demand
- Savings from new buildings
- Refurbishment of buildings

“Unmet demand” process was added to monitor the gap between theoretical thermal requirement and actual consumption and test different policies aiming at reducing the unmet demand.
Natural gas rises strongly in the BAU
Refurbishment measures are not in the solution. Without any incentive, and in spite of the high thermal needs, costs are higher than other options to come to the solution
Even with investment costs defined for constructing additional heat lines district heating is a preferred option. Improved, dense locations distribution system was chosen.
Gas and district heating prevail in the solution for water heating
Gasification plan of the Government is still under question
CHALLENGES, OPEN ISSUES

- **Low quality and insufficient data on energy**
  - different sources show different data
  - need to transform fuel-energy balances to IEA format, time consuming
- Residential energy consumption survey has not been conducted, data on energy split by end-use is not collected
- Few studies on energy demand projections in Kazakhstan
- Theoretical thermal requirement is difficult to estimate due to the absence of data by building types, and corresponding U-values
- No studies on indoor air pollution and health effects from solid fuels combustion in Kazakhstan
- Few studies on fuel poverty in Kazakhstan
FUTURE WORK

• Conduct **scenario analysis** with TIMES-KZK and TIMES 16RKZ model, compare results

• **Obtain drivers and elasticities** from CGE model for Kazakhstan developed by DIW Econ

• **Get energy audit reports** of buildings and disaggregate buildings by type of building/age in the TIMES-Kazakhstan model

• **Estimate fuel poverty** in Kazakhstan with data from households survey
  • “energy expenditure greater than 10% of disposable income”
  • “households with energy expenditures higher than median level and whose income after energy expenditures would be below official poverty line” Hills (2012)

• Conduct a **study on indoor air pollution** and health effects from solid fuel combustion

• **Internalize external costs** of health effects from solid fuel combustion in TIMES-KZK model
THANK YOU FOR YOUR ATTENTION!

Aiymgul Kerimray
aiymgul.kerimray@nu.edu.kz