UNDA project, on “Up-scaling Energy Efficiency in the residential and services sectors in the Arab Region”

National Seminar on: “Launching of the baseline mapping study of the energy use situation in the buildings sector in Jordan”,
5 March 2019 – Amman - Jordan
Content

1. Main objectives of the study of the baseline situation for residential sector
2. Data collection and analysis methodology for the residential sector
3. Questions and topics to discuss
Mains objectives of the baseline mapping study of the energy use situation in the buildings sector

- Estimation of the built stock in number and surface area
  - by type of housing
  - by geographical and climatic zones
  - by thermal quality (if possible)

- Estimation of final energy consumption
  - by energy source
  - by use
  - By climate zone

- Estimation of the equipment rate
  - By use
  - by type of housing
  - by climate zone
Mains objectives of the baseline mapping study of the energy use situation in the buildings sector

- **Zoom on some specific uses**
  - Evolution of the equipment rate
  - Evolution of energy performance
  - Evolution of energy consumption linked to use

- **Development of EE Indicators**
  - By total final energy consumption
  - By energy source
  - By use
  - By type of housing
  - By climate zone

- To allow the development of residential building stock evolution scenarios and the estimation of EE potential for this park
Data collection and analysis methodology for the residential sector

- 4 types of possible sources of information
  - Sources of public institutions
  - Surveys
  - Measurements campaigns
  - Modeling

- It is often necessary to combine certain sources to form complete sets of indicators

<table>
<thead>
<tr>
<th>Statistical data of the park</th>
<th>Data for GIS</th>
<th>Energy consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Energy</td>
<td>JNBC</td>
<td>Ministry of Energy</td>
</tr>
<tr>
<td>Department of Statistics</td>
<td>DoS, MoMA,</td>
<td>NERC</td>
</tr>
<tr>
<td>JNBC, MoPWH, MoMA</td>
<td>Google Map…..</td>
<td>RSS, JorGBC…....</td>
</tr>
</tbody>
</table>

Typology & Quantities of Equipment / Buildings
Breakdown by climate zone
Characterization physical / energetic
### Data collection and analysis methodology for the residential sector

#### Available sources from public institutions

<table>
<thead>
<tr>
<th></th>
<th>National level</th>
<th>Regional level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available data</td>
<td>- Final energy consumption in residential energy</td>
<td>- Final energy consumption in residential energy</td>
</tr>
<tr>
<td></td>
<td>- Final energy consumption by use</td>
<td>- Final energy consumption by use</td>
</tr>
<tr>
<td>Sources</td>
<td>✅ Surveys</td>
<td>✅ Surveys</td>
</tr>
<tr>
<td></td>
<td>✅ Statistic Department</td>
<td>✅ Data gathering from gas and electricity distributors</td>
</tr>
<tr>
<td></td>
<td>✅ Energy Audits</td>
<td></td>
</tr>
<tr>
<td>Strengths</td>
<td>Reliable sources</td>
<td>Surveys</td>
</tr>
<tr>
<td>weaknesses</td>
<td>✅ Limited sources on building and equipment features</td>
<td>✅ Small number of indicators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✅ No aggregation possible at the levels above</td>
</tr>
<tr>
<td>Timeliness</td>
<td>Access to data processed by the Ministry of Energy, Electricity's utilities and statistic department but no access to the raw database</td>
<td></td>
</tr>
</tbody>
</table>
Data collection and analysis methodology for the residential sector

- **Main energy services / uses**
  - Lighting
  - Heating
  - Air conditioner
  - Hot water
  - Refrigerators
  - Washing machines (dresses / dishes)
  - Iron
  - Other

- **Other distribution keys according to**
  - Type and size of housing
  - Urban / rural
  - Owners / Tenants
  - Heating systems installed
  - Installed air conditioning systems
  - Thermal quality
Data collection and analysis methodology for the residential sector

- Evolution of the park and equipment rate
  - Evolution of the size of the park / thermal quality
  - Evolution of equipment rate and energy performance
  - Evolution of housing types and sizes
  - Focus on specific energy services / uses
Data collection and analysis methodology for the residential sector

<table>
<thead>
<tr>
<th>المحافظة</th>
<th>عمان</th>
<th>الزرقاء</th>
<th>السلط</th>
<th>مأرب</th>
<th>أبين</th>
<th>المفرق</th>
<th>جرش</th>
<th>عجلون</th>
<th>الكرك</th>
<th>الطفيلة</th>
<th>معان</th>
<th>العقبة</th>
<th>المجموع</th>
</tr>
</thead>
<tbody>
<tr>
<td>المجموع</td>
<td>378165</td>
<td>141849</td>
<td>60697</td>
<td>22353</td>
<td>164849</td>
<td>38286</td>
<td>25722</td>
<td>20431</td>
<td>35051</td>
<td>13016</td>
<td>15061</td>
<td>17617</td>
<td>933097</td>
</tr>
<tr>
<td>فيلا</td>
<td>5482</td>
<td>149</td>
<td>337</td>
<td>55</td>
<td>570</td>
<td>84</td>
<td>54</td>
<td>6</td>
<td>85</td>
<td>15</td>
<td>36</td>
<td>61</td>
<td>6934</td>
</tr>
<tr>
<td>دار</td>
<td>333030</td>
<td>115700</td>
<td>36973</td>
<td>13239</td>
<td>106614</td>
<td>11635</td>
<td>13784</td>
<td>12350</td>
<td>16308</td>
<td>6744</td>
<td>6468</td>
<td>11096</td>
<td>683941</td>
</tr>
<tr>
<td>تفة</td>
<td>39653</td>
<td>26000</td>
<td>23387</td>
<td>9059</td>
<td>57665</td>
<td>26567</td>
<td>11884</td>
<td>8075</td>
<td>18658</td>
<td>6257</td>
<td>8557</td>
<td>6460</td>
<td>242222</td>
</tr>
<tr>
<td>ريف</td>
<td>26615</td>
<td>6572</td>
<td>20320</td>
<td>8772</td>
<td>38301</td>
<td>25310</td>
<td>12203</td>
<td>6491</td>
<td>22587</td>
<td>4439</td>
<td>7856</td>
<td>1961</td>
<td>181427</td>
</tr>
<tr>
<td>حضر</td>
<td>11245</td>
<td>7</td>
<td>10041</td>
<td>12</td>
<td>18111</td>
<td>32</td>
<td>5872</td>
<td>1</td>
<td>8905</td>
<td>2100</td>
<td>2100</td>
<td>1737</td>
<td>0</td>
</tr>
<tr>
<td>دار</td>
<td>15082</td>
<td>2498</td>
<td>10194</td>
<td>2791</td>
<td>20127</td>
<td>4328</td>
<td>6319</td>
<td>3085</td>
<td>13650</td>
<td>2333</td>
<td>6114</td>
<td>1841</td>
<td>70833</td>
</tr>
<tr>
<td>تفة</td>
<td>351550</td>
<td>135277</td>
<td>40377</td>
<td>13581</td>
<td>126548</td>
<td>12976</td>
<td>13519</td>
<td>13940</td>
<td>12464</td>
<td>8577</td>
<td>7205</td>
<td>15656</td>
<td>751670</td>
</tr>
<tr>
<td>ريف</td>
<td>5194</td>
<td>142</td>
<td>252</td>
<td>43</td>
<td>507</td>
<td>52</td>
<td>42</td>
<td>5</td>
<td>53</td>
<td>9</td>
<td>31</td>
<td>61</td>
<td>6391</td>
</tr>
<tr>
<td>حضر</td>
<td>321785</td>
<td>113202</td>
<td>26932</td>
<td>10448</td>
<td>88503</td>
<td>7307</td>
<td>7912</td>
<td>9265</td>
<td>7403</td>
<td>4644</td>
<td>4731</td>
<td>10976</td>
<td>613108</td>
</tr>
<tr>
<td>دار</td>
<td>24571</td>
<td>21933</td>
<td>13193</td>
<td>3090</td>
<td>37538</td>
<td>5617</td>
<td>5565</td>
<td>4670</td>
<td>5008</td>
<td>3924</td>
<td>2443</td>
<td>4619</td>
<td>132171</td>
</tr>
</tbody>
</table>

Survey – Ministry of Energy, 2014
Data collection and analysis methodology for the residential sector

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data collection and analysis methodology for the residential sector</td>
<td></td>
</tr>
</tbody>
</table>
Data collection and analysis methodology for the residential sector

Electrical Energy Distribution (2016)

Distribution of energy consumption by source

Distributions to be examined according to other distribution keys ....
Data collection and analysis methodology for the residential sector

- Park distribution by climate zone

- Other distribution keys by climate zone according to:
  - Type and size of housing
  - Urban / rural
  - Owners / Tenants
  - Heating systems installed
  - Installed air conditioning systems
  - Thermal quality

Data collection and analysis methodology for the residential sector

- Example of approach used in France

![Flowchart showing the methodology]

- Selection of useful data for the study
- Access: Crossing query tables
- Calculation of the hypotheses
- Export of Excel file for exploitation on MapInfo
Data collection and analysis methodology for the residential sector

- **Key EE indicators in the Residential**
  - Per capita energy consumption
  - Energy consumption per household
  - Energy consumption by income / consumption
  - Energy consumption per floor area (heated)
  - Equipment by housing
  - Energy consumption by use and household
  - Energy consumption for heating by heated surfaces
  - Energy consumption for conditioning by conditioned surfaces

- **Aspects to consider:**
  - The effect of weather conditions
  - The effect of tariffs and prices of different energy sources
Data collection and analysis methodology for the residential sector

- Example of disaggregation and monitoring of the evolution of the indicators

Index: 1990=1. Data for IEA18 (Australia, Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, UK, USA). Source: IEA energy efficiency indicators database. TC: Temperature Corrected.
Data collection and analysis methodology for the residential sector

(left) Total energy consumption for residential apartments in Amman and Zarqa (Al-Sallami 2015)
(right) Energy consumption comparison of the base case and the two design scenarios in Amman

Source: S. Attia - 2016 - Life Cycle Costing for a Near Zero energy Building in Jordan
Data collection and analysis methodology for the residential sector

- Methodological aspects to take into account
  - Approach taken by all stakeholders to adherence to results
  - Assessment of information contained in available sources (Ministry of Energy, DoS, Research papers, etc.) and determination of additional information requirements
  - Methods for estimating additional data (combination of bottom-up and top-down approaches)
    - Ascending: use of micro data (Energy consumption of a representative sample of dwellings by type and climatic zone) to reduce uncertainty
    - Descendant: Macro Data (Country or region) according to distribution of: dwellings, population, etc..
  - Confrontation of results from modeling with metered data (Consumption of electricity / gas by a representative housing stock)
  - Seeking coherence with national and regional level statistics
Questions and topics to discuss

- What are the energy uses on which to zoom?
- How can we estimate the penetration rate of high-performance equipment and its evolution?
- How can one estimate the rate of buildings with a good level of thermal quality and the evolution of this rate?
- What sources are available for additional information other than those provided by usual sources (Ministry of Energy surveys, Department of statistics, energy audits by NERC, Research papers...)?
- How to strengthen the efforts of existing data producers: Ministry of Energy, Statistic services, etc.?
- How to set up a residential energy monitoring tool to measure the impact of energy efficiency policies in the country?
- Other points to discuss ....
THANK YOU FOR YOUR ATTENTION

Adel Mourtada (adel.mourtada@yahoo.fr)

Consultant CESAO/ESCWA