Methodology of assessing macro economic impacts of energy efficiency: Case study of Tunisia

Dr. Ulrike Lehr
Based on a study commissioned by GIZ, Germany on behalf of the Tunisian National Energy Agency (ANME). Thanks to my colleague in Germany, Anke Mönnig and to my Tunisian colleagues from ALCOR, Rafik Missaoui and Sami Marrouki
Economic impact assessment – why?

Economic assessment of a future or current policy measure helps to

1. Make decisions based on data
2. Compare different possible routes to the future
3. Decide based on economic indicators
4. Compare effects along a time trajectory, thus prevent myopia
Energy efficiency as part of the Tunisian Solar Plan

Targets of the Tunisian Solar Plan:

- The targets for **renewable energy** and **energy efficiency** in the Tunisian Solar Plan (PST) are set for 2016 and 2030.
- For **renewable energy**, the PST sets a target of 1000 MW capacity installed by 2016 and of 4600 MW capacity installed by 2030.
- The conventional capacity development reaches 5100 MW by 2016 and 7000 MW by 2030.
- Therefore, **renewable energy** will reach a share of 16% of total capacity installed by 2016 and the respective share by 2030 will be up to 40%. This translates into a share of 30% electricity produced.
- The Tunisian Solar Plan foresees a **decrease in primary energy use** by 40% until 2030.
What are the employment impacts from increased efficiency in Tunisia?

- How many people currently work in the sector?
- How many jobs will be created in the sector by 2030? (Gross effect)
- Which type of qualification will be needed?
- What are the drivers and barriers of green jobs in Tunisia?

How can we measure this?

- What is the „efficiency sector“?
- How does it fit into our economic framework with I/O tables and the existing 19 sectors?
- Does the method developed for industrial countries work for developing countries?
Analysis in 4 steps

- Future development as a framework for the analysis
- Turning the physical and technological scenario into monetary units and a scenario for future investment into EE in Tunisia.
- Attributing domestic Tunisian shares to the production, installation, and operation of EE technologies.
- Estimation of employment effects from domestic production, installation and operation with Input-Output-Analysis and indicators.
Step 1

- **Framework data:**
  - Tunisian Solar Plan
    - Timeline: 2016 (2020, 2030)
    - (Installation electricity and heat generation from renewable energy and waste)
    - Efficiency investments
  - Development beyond the Solar Plan
    - exports
    - .... Other

Step 2

- **Investment:**
  - Tunisian Solar Plan
    - Investment paths
    - Private / public investments
    - Returns on investment
Step 3

- Domestic shares /imports

Step 4

- Economic analysis of employment from domestic production, operation, maintenance, planning:
  - Input/Output Analysis for energy efficiency technologies
  - Impact analysis for installation

- Results: Possible employment from the Solar Plan and beyond => Analysis of educational and political framework
Gross employment

Demand / Investment

Production

Direct employment

Demand for industrial inputs

Production in input industry

Indirect employment

Gross employment
Thorough analysis = account for ALL effects

Increasing efficiency

Investment, Operation and Maintenance

Prices

Non RES

RES

“Substitution Budget”

International trade

Exports/Imports

Gross effect (positive)

- neg. effect

Net effect

Most efficiency investments pay back at least during their lifetime => economic viable
Evaluation of economic effects: employment

Results Past

<table>
<thead>
<tr>
<th>Program</th>
<th>Pilot /tests</th>
<th>Production</th>
<th>R &amp;D</th>
<th>Installation</th>
<th>O&amp;M</th>
<th>Total 2010</th>
<th>2005-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficiency</td>
<td>30</td>
<td>210</td>
<td>153</td>
<td>409</td>
<td>129</td>
<td>931</td>
<td></td>
</tr>
<tr>
<td>Energy Audits</td>
<td>-</td>
<td>-</td>
<td>153</td>
<td>-</td>
<td>-</td>
<td>153</td>
<td></td>
</tr>
<tr>
<td>Building efficiency</td>
<td>5</td>
<td>210</td>
<td>-</td>
<td>350</td>
<td>-</td>
<td>565</td>
<td></td>
</tr>
</tbody>
</table>
How can we measure future effects?

Adjusted Input-Output approach embedded in a small model of Tunisia.

Combination of:
- Input-Output tables,
- labor-intensities of the respective production,
- country specific statistical data

Depending on
- the shares of imported goods and services and
- domestic production

From the technology specific tables:
- information about the cost structure of 5 RE technologies
- increase in energy efficiency of buildings and in the main industry sectors.

\[
\Delta GDP = 1 + 2 + 3 - 4
\]

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Scenarios for future projections

- The Tunisian Solar Plan (PST), on energy efficiency and renewable energy in electricity and heat
- The Tunisian Solar Plan foresees a decrease in primary energy use by 40% until 2030.
- Climate Change and Energy in the Mediterranean, Plan Bleu, EIB 2008
- Mécanisme Financier pour le développement, de l'Efficacité Énergétique et des Énergies Renouvelables dans les pays sud- et est-Méditerranéens
- Total 0.75 billion € on efficiency
## Scenarios in detail

### Energy Efficiency

<table>
<thead>
<tr>
<th>Year</th>
<th>Building material</th>
<th>Efficient Light bulbs</th>
<th>Efficient household appliances</th>
<th>Efficient equipment (industry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1,410,500</td>
<td>71,000</td>
<td>73,100</td>
<td>500</td>
</tr>
<tr>
<td>2020</td>
<td>1,410,500</td>
<td>71,000</td>
<td>73,100</td>
<td>400</td>
</tr>
<tr>
<td>2030</td>
<td>1,410,500</td>
<td>71,000</td>
<td>73,100</td>
<td>400</td>
</tr>
</tbody>
</table>

### Installed capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>[m²]</th>
<th>[dwellings]</th>
<th>[dwellings]</th>
<th>[GWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1,410,500</td>
<td>71,000</td>
<td>73,100</td>
<td>500</td>
</tr>
<tr>
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<td>1,410,500</td>
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<td>1,410,500</td>
<td>71,000</td>
<td>73,100</td>
<td>400</td>
</tr>
</tbody>
</table>

### Investment

<table>
<thead>
<tr>
<th>Year</th>
<th>[Euro/m²]</th>
<th>[Euro/dwelling]</th>
<th>[Euro/dwelling]</th>
<th>[Euro/MWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>15</td>
<td>16</td>
<td>158</td>
<td>100</td>
</tr>
<tr>
<td>2020</td>
<td>14</td>
<td>14</td>
<td>132</td>
<td>83</td>
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<tr>
<td>2030</td>
<td>12</td>
<td>11</td>
<td>108</td>
<td>68</td>
</tr>
</tbody>
</table>

### Operation & Maintenance

- None

### Imports of whole systems

<table>
<thead>
<tr>
<th>Year</th>
<th>[%]</th>
<th>[%]</th>
<th>[%]</th>
<th>[%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>75</td>
<td>50</td>
<td>50</td>
<td>90</td>
</tr>
<tr>
<td>2020</td>
<td>60</td>
<td>40</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>2030</td>
<td>50</td>
<td>30</td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

### Imports of production inputs: services

- All domestic

### Exports

- None
Results

- Efficiency investment according to Tunisian Solar Plan is less than 10% of total investment.
- Efficiency jobs make for more than 10% of investment.
- Efficiency creates more jobs per 100 million TD (namely 438 persons) than any RE technology.
- Modelling approach helps to compare, rank and prioritize different scenarios.
Thank you for your attention!

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The Tunisian National Agency for Energy Efficiency (ANME) developed a strategic plan, which covers several fields, including:

**Measures**
- Development and execution of the national programs of energy efficiency;
- Development of the legal and lawful framework relating to the energy efficiency;
- The granting of the tax and financial incentives for EE;
- The set-up of training, education courses, and information dissemination;
- The support of the research and the development and realisation of demonstration projects;

**Results**
- Energy intensity fell since 1985 (start of ANME) from 0.42 toe/1000$ PIB) to a level of 0.36 toe/1000$ PIB in 2004 (against 0.58 in Algeria and 0.11 in Germany).
- The residential sector contributed most to final energy consumption (30.6%), followed by the industrial and transport sectors (25.1% and 23.6% respectively).
- The potential for improved energy efficiency in buildings is still large.