Employment Impacts of a Large-Scale Deep Building Energy Retrofit Programme in Hungary

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Background

**Climate and energy challenges in Hungary**

- GHG emissions are below Kyoto targets, but very high energy dependency, especially from Russian gas.
- The average Hungarian household is in fuel poverty according to the UK definition.
- Thermal inefficiency of Hungarian buildings is the largest energy saving potential among end-use sectors.
- Contribute 50% of energy-related emissions in Hungary.
- Hungary has the second lowest employment rates of the EU and the OECD.

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**Households' specific energy consumption (kWh/m2a) scaled to EU average climate. Hungary vs. CEE Member States. Average 2000-2007**

Source: own elaboration based on data retrieved from the ODYSSEE database.
The project in a nutshell

- **Objective:** to gauge the net employment impacts of a large-scale deep building energy-efficiency renovation programme in Hungary

- **Scope of the research:**
  - Type of buildings: residential and public buildings (no industrial or commercial)
  - Type of renovation: reduce demand for heating (no appliances)
  - Employment effects: direct, indirect and induced

- **Expected results:**
  - Non-employment results: investments involved, reduction in energy consumption and CO2 emissions, energy cost savings
  - Net impacts on Hungarian labour market

- **Two phases:**
  - Preliminary results: 22 March 2010
  - Final report: June 8 2010 (revised results)
Employment Effects: Overview

- **BUILDINGS RETROFITTING programme**
  - Job gains
  - Additional disposable income

- **CONSTRUCTION sector**
  - Job gains

- **ENERGY gen. & distr. sector**
  - Job losses
  - Job losses

- **SUPPLY-CHAIN related sectors**
  - Job gains

- **HOUSEHOLDS**
  - Additional spending and job gains

- **OTHER sectors**
  - Job losses

**Effects**
- DIRECT effects
- INDIRECT effects
- INDUCED effects
### Scenarios considered

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
<th>Retrofit rate</th>
<th>Type of retrofits</th>
<th>Forecasted completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-BASE</td>
<td>Baseline scenario: no intervention</td>
<td>1.3% of the total building stock (around 4.5 million square metres a year, equivalent to 55,000 dwellings)</td>
<td>“Business as usual” retrofits</td>
<td>N/A</td>
</tr>
<tr>
<td>S-DEEP1</td>
<td>Deep retrofit with fast implementation rate</td>
<td>Around 20 million square meter (equivalent to 250,000 dwellings) per year</td>
<td>Deep retrofits</td>
<td>18 years</td>
</tr>
<tr>
<td>S-DEEP2</td>
<td>Deep retrofit with medium implementation rate</td>
<td>Around 12 million square meter (equivalent to 150,000 dwellings) per year</td>
<td>Deep retrofits</td>
<td>28 years</td>
</tr>
<tr>
<td>S-DEEP3</td>
<td>Deep retrofit with slow implementation rate</td>
<td>Around 8 million square meter (equivalent to 100,000 dwellings) per year</td>
<td>Deep retrofits</td>
<td>41 years</td>
</tr>
<tr>
<td>S-SUB</td>
<td>Suboptimal retrofit with medium implementation rate</td>
<td>Around 12 million square meter (equivalent to 150,000 dwellings) per year</td>
<td>Suboptimal retrofits</td>
<td>28 years</td>
</tr>
</tbody>
</table>

### Energy efficiency gains (% of kWh/sqm/y)

- **S-BASE**: 1%
- **S-DEEP1**: 3%
- **S-DEEP2**: 6%
- **S-DEEP3**: 1%
- **S-SUB**: 3%

### Retrofit Rate (% of building stock)

- **S-BASE**: 1%
- **S-DEEP1**: 5%
- **S-DEEP2**: 10%
- **S-DEEP3**: 15%
- **S-SUB**: 12%
Methodology: building stock model

- Data on the building stock
  - # units, size, specific energy consump. for heating
  - Novikova (2008), Korytarova (forthcoming)
  - Ramp-up period: progressive implementation rates

- Costs of suboptimal and deep renovations
  - Lit. review, case studies
  - Best-case approach for deep (e.g., SOLANOVA)
  - Decreasing cost for deep renovations: learning factors

- Energy prices
  - Increase in real energy prices estimated from KSH and IEA.
Methodology: employment impacts

- Mixed: Up-scaling + Input-Output analysis

- Labour
  - Up-scaling
  - Renovation Case Studies
  - Investments
  - Energy savings
  - Labour intensity
  - Direct (positive) impacts in construction
  - Indirect + induced impacts
  - Direct (negative) impacts in energy supply
Scenario results: CO2 emission reductions until 2050: 45% locked in by S-SUB scenario.
Energy security benefits

- Reduced import of natural gas (NG)
  - At the end of their implementation, the deep renovation scenarios can save up to 39% of the NG imports in Hungary (2006-2008 levels).
  - The natural gas saved in 2030 is the same order of magnitude as Hungary’s NG production (2006-2008 levels)
Energy security benefits (2)

- In January - peak month for imports - the energy savings achieved by 2030 would be equivalent to between 59% (S-DEEP1 scenario), 26% (S-DEEP3 scenario) and 18% (S-SUB scenario) of the natural gas imports recorded for that month.

![Graph showing natural gas saved in January 2030 in different scenarios compared to January imports (average 2006-2008).]
Scenario results: annual investment needs vs. energy cost savings

- Annual savings become higher than the investment needs in 20 years
Total net employment impacts: snapshot in 2020

- Direct effects
  - Calculated with bottom-up method
- Indirect + induced effects
  - Application of I/O tables
  - Indirect + induced impacts have the same order of magnitude as the direct impacts

### Total employment impacts for 2020

**Scenario**
- S-BASE
- S-DEEP1
- S-DEEP2
- S-DEEP3
- S-SUB

**Y-axis (Thousands FTE)**
- 160
- 140
- 120
- 100
- 80
- 60
- 40
- 20
- 0
- -20
- -40

**Legend**
- Induced impacts from energy savings
- Induced impacts from lost jobs created by reduced demand for energy
- Indirect impacts from reduced demand for energy
- Direct impacts on energy supply sector
- Induced impacts from additional jobs created by investments in construction
- Indirect impacts from investments in construction
- Direct impacts on construction sector
- Total impacts
Direct employment impacts: comparison with other investments

- Labour intensity in renovations is higher than labour intensity in many other sectors
- E.g., many more jobs would be created with these programmes than if the money was spent in building highways or similar infrastructures
Net employment impacts in construction: medium-term view

- The initial increase shows the ramp-up period
- The subsequent decrease is due to the learning factor
  - Productivity increases
  - Therefore costs and labour intensities decrease
  - There is practically no learning factor in S-BASE and S-SUB: the technologies are mature
Further issues

- **Distributed geographic effects**
  - The buildings are renovated throughout the country
  - Work is mainly done by SMEs
  - Induced consumption is also distributed

- **Durability of effects**
  - Such a programme lasts **20-30 years**, effectively a worker’s lifetime

- **Employment effects** in the energy sector
  - Large fixed costs in the energy sector: Job losses are probably in “lumps” – e.g. power stations still need people to maintain them, even if the demand is lowered
  - Some increase in energy demand is expected from other sectors (e.g. commercial, manufacturing) which will compensate the losses from residential sector: **rebound effect**
Further issues (2)

- **Supply of labour**
  - There is availability of labour in Hungary for all skill levels
    - Entrepreneurs, professionals
    - Skilled, unskilled – among unemployed and inactive
  - However, these workers need to be attracted to the construction industry
    - Training
    - “Promotion” of the sector
    - Possibly higher wages (at least in the beginning)
  - Population aging
  - What if there is no sufficient labour supply?
    - Guest workers might be brought in
  - Such a **large-scale program** is likely to raise the **wage level** in the country
    - Increases the costs of the project
    - Increases the costs of other investments (because opportunity costs are higher)
    - But also increases consumption (hence more induced effects)

- **Supply of materials**
  - Manufacturing must keep up with the increased demand from construction sector
Further issues (3)

- **Grey labour**
  - Opportunity for the State to increase the control on grey labour in construction

- **Fuel poverty**
  - Such a programme has the potential of eradicating fuel poverty
  - Great attention has to be put in financing, especially for the lower income households

- **Real estate markets**
  - The value of buildings increases
  - The lifetime of buildings is extended
Financing

- Such programme will need a vast amount of **financing**
  - E.g. in 2020:
    - S-DEEP1 – 3.5 B€\textsubscript{2005} (13% of 2009 HU budget)
    - S-DEEP2 – 2.1 B€\textsubscript{2005} (8% of 2009 HU budget)
    - S-DEEP3 – 1.4 B€\textsubscript{2005} (5% of 2009 HU budget)
- The **energy savings** are **higher** than the **investments**, but they **accrue later**
- However, at least part of the initial funds can come from:
  - **EU funds** (up to 400M€ per year)
  - Redirecting the **current energy subsidies** (about 800M€ per year)
  - An **ESCO-type scheme of financing** in which part of the savings go into repaying the investment costs
Energy subsidies in Hungary

- **Biofuel**: relatively little CO2 emission mitigation at a high cost
- **District heating VAT discount**: further decreases energy efficiency
- **Coal subsidy**: artificially increases the competitiveness of high carbon intensity energy
- **Gas subsidy**: decreases energy efficiency and competitiveness of renewable heat
- **Feed-in tariff for co-generation**: predominantly subsidy of gas based co-generation, decreases competitiveness of renewable heat

- 300 Bn HUF state investment to a new lignite plant.
- 1 Mt additional CO2 emission compared to a BAT gas turbine

Source: slides from Mr. Laszlo Varro, Strategy Director at MOL
Summary of results: conclusions

- **Deep renovation** scenarios deliver **higher climate and energy benefits** as compared to suboptimal renovation scenarios
  - Deep retrofit scenarios can save 85% of energy use and relative carbon emissions
  - A suboptimal scenario locks in 45% of 2010 heating-related emissions
  - Deep retrofit scenarios can reduce up to 39% of annual natural gas needs in 2030, 59% in the critical month of January (compared to average 2006-2008 values)
  - A suboptimal scenario will reduce imports of 10% only (18% in January)
  - The construction sector has the opportunity of learning new techniques which will inevitably be state-of-the-art in a few years

- **Employment impacts** are **highly positive in the short to medium term**, especially for **deep renovation** scenarios
  - 131,000 jobs created in S-DEEP1, 78,000 in S-DEEP2, 52,000 in S-DEEP3, 43,000 in S-SUB
  - Around 38% are indirect and induced effects in other sectors
  - Labour intensity in deep retrofit is higher than if the money was invested in other initiatives (e.g., 5 times higher than road construction)

- The major issue is **financing**
  - The renovation programmes would have a high impact on the state’s budget (up to 13% for S-DEEP1, 8% for S-DEEP2, 5% for S-DEEP3)
  - However, a large amount of money (up to 1 billion Euros) can come from the EU or from redirecting current energy subsidies (e.g. to gas and district heating)
  - Part of the initial investment costs can be financed by a pay-as-you-save financing scheme
Summary of results: recommendations

- To promote a **deep renovation** program with a **less ambitious rate of renovation**
  - e.g. *S-DEEP3*—(2.3% of the floor area, 100,000 dwellings-equivalent)
  - 52,000 jobs created by 2020
  - Less than 2 Billion Euros of peak annual investment, 1 bln in later program phases

- The **employment impacts** are **slightly lower** but **sustained**: no shock in the economy and in the industry
  - The slower rate of renovation allows for a “smooth” transition period
  - Time is allowed for the firms to learn, train employees and increase production of materials
  - The learning factor ensures that the costs become lower throughout the years
    - The investment shock is reduced
    - Less money is “locked in” on renovations which could have been less expensive in following years
  - Labour supply issues and wage effects are reduced

- The **public administration** should be **involved** in **planning** and **financing**
  - To assure that deep renovations and thus savings are achieved
  - To reduce potential supply bottlenecks
From research to policy-making…

**Timeframe** of the project
- March-June 2010 (commissioned by ECF Feb. 2010)
- General elections in Hungary: April 11-25, 2010
- Presentation of results: June 8, 2010

**Policy impact**
- Late June 2010: the new Hungarian government announces a new, more ambitious renovation programme for the residential sector:
  - 100,000 units per year, increasing up to 150-200,000 units per year
  - *Complex* renovations: 70-80% target energy savings (previously up to 50%)
  - Hungary taking leadership in advanced EE solutions for the buildings sector
Employment Impacts of a Large-Scale Deep Building Energy Retrofit Programme in Hungary

Thank you for your attention

http://3csep.ceu.hu/
3csep@ceu.hu
Residential Building Stock
Current Characteristics

Total Energy Consumption: 58 TWh/year
Public Building Stock
Current Characteristics

Total Energy Consumption: 5 TWh/year
Scenario results: energy cost savings

- Energy savings generated each year by all retrofits implemented until that year

![Graph showing energy cost savings over years for different scenarios](image)

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[Logo]

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3CSEP
Scenario results: Investments for the programme

- Initial 5-year ramp-up period
- Subsequent decrease thanks to learning factor
Cumulative investments and savings (undiscounted)

Cumulative investments and savings by scenario in 2025, 2050 and 2075 (undiscounted)
Employment effects: available methodologies

- **Scaling-up of case studies**
  - *Bottom-up method*
  - Based on case-study data

- **Input-Output analysis**
  - *Top-down method*
  - Based on input-output tables

- **CGEM**
  - (Computable general equilibrium models)
  - More complex
  - Adds dynamics to I/O method
  - Can model international exchanges

- **Results transfer**
  - Useful if data is lacking (e.g. developing countries)
  - Subject to uncertainties
Direct employment impacts in construction per skill: snapshot in 2020

The effects on professional labour are highest in the deep renovation scenarios
Total net employment impacts divided by sector: snapshot in 2020

<table>
<thead>
<tr>
<th>Sector</th>
<th>Thousands FTE</th>
<th>S-BASE</th>
<th>S-DEEP1</th>
<th>S-DEEP2</th>
<th>S-DEEP3</th>
<th>S-SUB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, hunting, forestry and fishing</td>
<td>0.1</td>
<td>0.5</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>0.0</td>
<td>0.7</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.7</td>
<td>10.5</td>
<td>6.3</td>
<td>4.2</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Electricity, gas and water supply</td>
<td>-0.1</td>
<td>-3.1</td>
<td>-1.8</td>
<td>-1.2</td>
<td>-0.8</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>7.7</td>
<td>91.8</td>
<td>55.1</td>
<td>36.7</td>
<td>31.7</td>
<td></td>
</tr>
<tr>
<td>Wholesale and retail trade, restaurants and hotels</td>
<td>0.3</td>
<td>3.6</td>
<td>2.2</td>
<td>1.4</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Transport, storage and communications</td>
<td>0.3</td>
<td>4.2</td>
<td>2.5</td>
<td>1.7</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Finance, insurance, real estate and business services</td>
<td>0.5</td>
<td>5.8</td>
<td>3.5</td>
<td>2.3</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Community, social and personal services</td>
<td>1.5</td>
<td>16.7</td>
<td>10.0</td>
<td>6.7</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11.0</strong></td>
<td><strong>130.7</strong></td>
<td><strong>78.4</strong></td>
<td><strong>52.3</strong></td>
<td><strong>43.4</strong></td>
<td></td>
</tr>
</tbody>
</table>
Sensitivity analysis: variation of increase of energy prices

Sensitivity analysis: final impacts depending on increase of gas (and DH) price between 1.0% and 5.5% - Scenario: S-DEEP2

Year
Thousand FTE

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Sensitivity analysis: variation of learning factor

Sensitivity analysis: final impacts depending on cost variation between -2% and -18% of the estimates - Scenario: S-DEEP2

Year


Thousand FTE

-18.00%
-8.00%
-2.00%
Sensitivity analysis: variation of ratio labour costs / total costs

Sensitivity analysis: final impacts depending on variation of the ratio of labour costs on total costs of a renovation - between 20% and 60% - Scenario: S-DEEP2
Results compared with other investment initiatives

- The scenarios have an average FTE generated (direct + indirect + induced) per Million Euro invested much higher than the studies reviewed.

<table>
<thead>
<tr>
<th></th>
<th>FTE generated (direct + indirect + induced) per M€ invested in 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep renovation scenarios</td>
<td>37.3</td>
</tr>
<tr>
<td>S-DEEP</td>
<td>37.3</td>
</tr>
<tr>
<td>Studies reviewed</td>
<td></td>
</tr>
<tr>
<td>Energy efficiency/Bldgs. retrofit</td>
<td>17.07</td>
</tr>
<tr>
<td>Other mitigation</td>
<td>15.56</td>
</tr>
<tr>
<td>Non-energy related activities</td>
<td>21.64</td>
</tr>
</tbody>
</table>