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

Preliminary Report – Executive Summary

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Center for Climate Change and Sustainable Energy Policy
Central European University

Prepared for the European Climate Foundation by
The Center for Climate Change and Sustainable Energy Policy (3CSEP)
Central European University
Budapest, Hungary

Principal Investigator: Diana Ürge-Vorsatz
Further Authors: Daniele Arena, Sergio Tirado Herrero , Andrew Butcher, Éva Kőpataki
Lead experts: Álmos Telegdy, Sándor Fegyverneky
Contributing Author: Tamás Csoknyai*

* Budapest University of Technology and Economics (BME)

1 Executive summary

1.1 Background, aims and scope

In Hungary buildings are key to the climate challenge: they contribute approximately half of energy-related CO2 emissions(Novikova, 2008). This is partially caused by the extreme inefficiency of the Hungarian building stock. For instance, Hungary ranks among the top-ten EU27 countries in terms of specific dwelling energy consumption scaled to EU average climate (247 kWh m^{-2} $year^{-1}$ for the Hungarian average residential unit vs. 220 m^{-2} $year^{-1}$ of the EU average in period 2000-2007). This sector has been shown to have the highest cost-effective climate change mitigation potentials in Hungary (Eichhammer et al., 2009).

If the energy efficiency of the Hungarian building stock is improved, not only can this reduce greenhouse gas emissions significantly, but it can also advance several other important social, political and economic policy agendas, including the improvement of energy security, social welfare, reduction of fuel poverty, new business opportunities, as well as improved air and life quality and health. This has particular significance as Hungary is closer than most EU Member States to the fulfilment of its emission targets set under the European Union's burden sharing agreement, but it faces important challenges in energy security (Hungary has one of the highest gas dependences of IEA member countries) and energy poverty (15% of Hungarian citizens cannot afford to keep their homes adequately warm).

An especially important co-benefit of a programme aiming at a large-scale and deep renovation of the Hungarian building stock is the potential net employment growth, particularly as Hungary is the Member State with the second worst employment rate in the EU. Little more than half of Hungary's working-age population has a declared job, and 4 out of 10 Hungarians aged 15-64 are out of the labour market (i.e. they do not have a job and are not looking for a job). In such circumstances, the increase of the employment rate is a fundamental political priority, especially in the more disadvantaged population segments and regions.

The goal of the present research is to gauge the net employment impacts of a large-scale deep building energy-efficiency renovation programme in Hungary. The deep renovation of a massive amount of Hungarian buildings, beyond its other significant benefits such as reducing or eliminating fuel poverty, improving social welfare, and improving energy security – is expected to have a consistent impact on employment:

- Directly, by the creation of many new jobs in the construction industry;
- Indirectly, on all the sectors that supply materials and services to the construction industry itself;

- In addition, the savings caused by the reduction in energy consumption, plus the additional consumption fuelled by the wages of the additional jobs created, will increase the disposable income of the families; income that, when spent, will generate additional induced benefits to employment.

These impacts are expected to be larger than the jobs lost in the energy supply sector as a result of reduced energy consumption. **Fig. 1-1** shows the chain of effects on employment of the proposed programme.

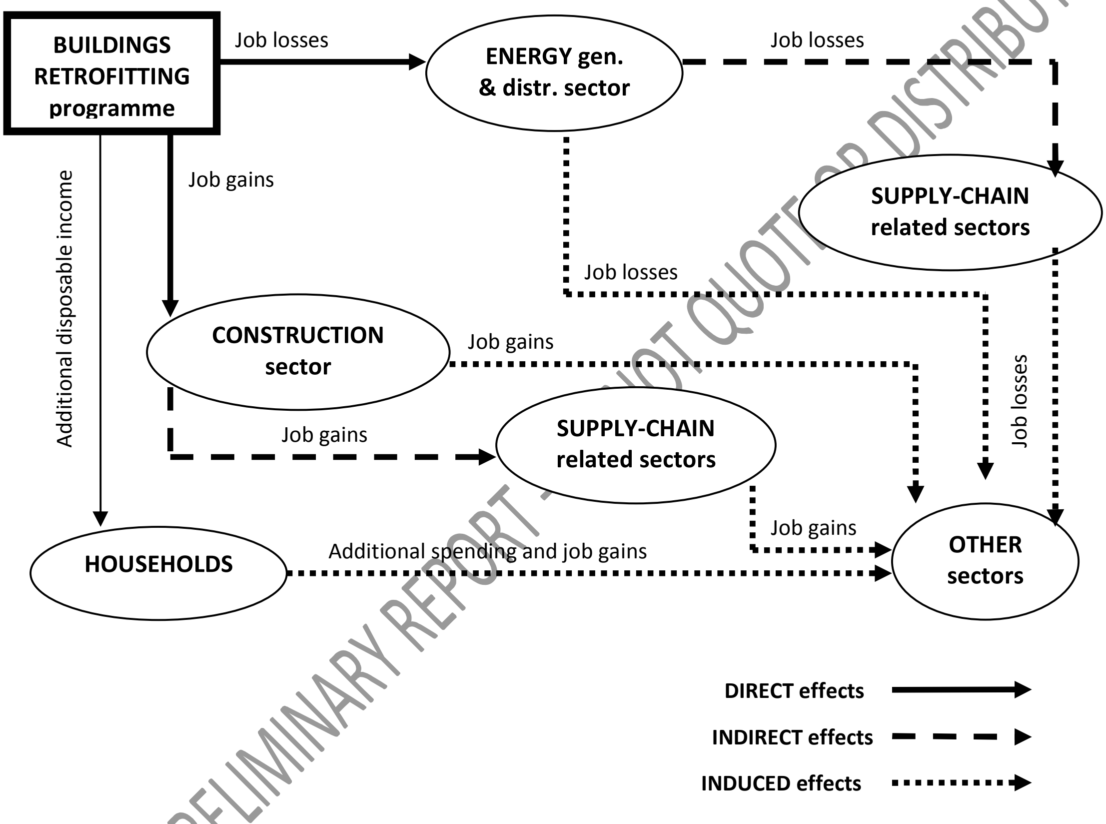

Fig. 1-1: Chain of effects on employment of the proposed intervention

This report is being produced in the framework of the European Climate Foundation (ECF) Energy Efficiency programme, in particular the “energy efficiency in buildings” strategic initiative pursued by the ECF.

1.2 Scenarios

Since the employment impacts (short- and long-term) are determined by the scale and schedule of the renovation programme, the study investigates the impact of specific scenarios. The scenarios depend mainly on the type or depth of retrofits included in the programme and the dynamic of renovation assumed. **Table 1-1** summarises the scenarios covered in this report.

Name	Scenario	Description
S-BASE	Baseline scenario	No intervention, business-as-usual retrofitting rates and intensities
S-DEEP1	Deep retrofit with faster retrofitting rate	Deep retrofits, average renovation rate of around 20 million sqm (the equivalent of 250,000 dwellings) per year
S-DEEP2	Deep retrofit with slower retrofitting rate	Deep retrofits, average renovation rate of around 12 million sqm (the equivalent of 150,000 dwellings) per year
S-SUB	Suboptimal retrofit with slower retrofitting rate	Suboptimal retrofits, average renovation rate of around 12 million sqm (the equivalent of 150,000 dwellings) per year

Table 1-1: Summary of the scenarios covered by the research

The study focuses mainly on existing residential and public sector buildings, as those are the two sectors where most policy intervention/public support is warranted and where the highest social and political benefits can be found. The research focuses on scenarios that support "deep" retrofits, which bring the buildings as close to passive house standards (i.e. a consumption of 15 $kWh/m^2/y$ for heating) as realistically and economically feasible, but examines other scenarios, too. This is due to the very substantial potential lock-in effect resulting from suboptimal renovations, ranging up to 30% of national present emissions by 2050 and severely jeopardising the meeting of Hungary's ability to attain ambitious GHG emission reduction targets by that time. Therefore it is important to channel intellectual and financial resources in catalysing a renovation scenario that keeps long-term climate (and social) interests in the foreground rather than cherry-picks in a short-term economic optimisation framework. However, the adoption of a suboptimal renovation plan, which involves lower gains in energy efficiency, cannot be ruled out; it is included in the study together with the deep retrofit programme as a reference, to show the differences between the effects of the two types of programmes.

1.3 Methodology

There are several methodological approaches to analyse the impact of climate interventions on the labour market: the most frequently used ones being direct estimates based on scaling up case studies, Input-Output analysis, computable general equilibrium model (CGEM) analysis and transfer of results from previous studies.

Among these, Input-Output analysis is the most widely utilised and probably most robust methodology employed for forecasting the direct, indirect and induced employment impacts of changes in the economy, including energy efficiency interventions. Input-output tables allow the analysis of changes in the economic activity of all sectors generated by an intervention. Provided the labour intensity of each sector, estimates of the net employment effects (the balance of jobs created and destroyed) can be derived.

The first version of this study uses Input-Output analysis to estimate the employment impacts of the retrofit programme scenarios. A scaling-up of case studies was attempted, but resulted unfeasible in the first phase of the research due to the scarcity of available case studies on deep retrofits, especially in Hungary.

The programme is assumed to start in 2011, and impacts are evaluated for the year 2020. The Input-Output method requires the calculation of the total investments in renovations for the year 2020 (to estimate the positive effects of the increased demand in the construction sector), and the computation of the total energy cost savings obtained in the same year (to estimate the negative effects of the fall in demand in the energy sector).

In order to estimate the total investments in retrofits and the energy cost savings, all buildings of the Hungarian stock are divided into classes. For each class and each scenario, the specific retrofit costs and the energy savings are derived from case studies and literature. These are used to calculate the total renovation investments and cost savings in energy.

The increase in construction demand and the decrease in energy demand are then entered into the input-output tables, which give as a result the changes in output for every sector of the economy. By multiplying these changes in output by the labour intensity in each sector (i.e. the number of Full-Time Equivalent, or FTE, workers employed per unit of output in each industry), the employment effects for all sectors are calculated.

The induced effects (i.e. the employment effects generated by the increased disposable income available to families as a consequence of the energy savings and the new direct and indirect jobs) can also be calculated through input-output table operations. Indeed, induced effects can have a significant weight in the final evaluation of the programmes, especially as the cost savings generated by the improvement in energy efficiency are radically different for all scenarios. However, due to the short timeframe available to produce preliminary results, the results of the induced effects will be presented in the final version of the report.

1.4 Main findings

1.4.1 Energy and CO2 savings, investments, cost savings

Undoubtedly, the renovating scenarios will generate substantial energy savings, in particular the scenarios that involve deep retrofits. **Fig. 1-2** shows the evolution of the final energy use for the whole building stock in each scenario.

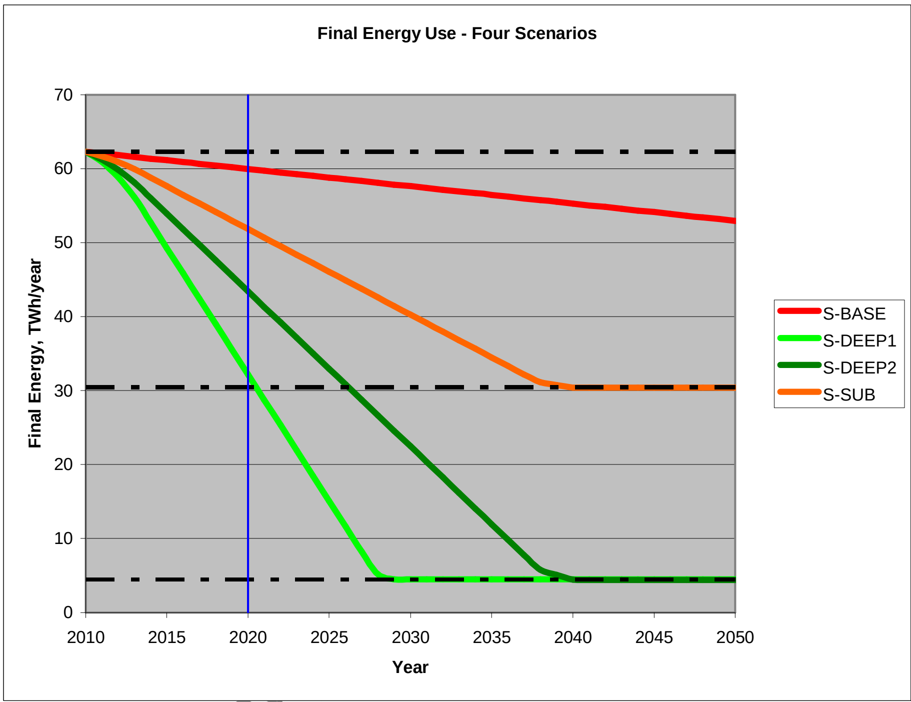

Fig. 1-2: Evolution of the final energy use for all scenarios

It can be also interesting to see the evolution of energy use for the total duration of the programme for all types of building. **Fig. 1-3** to **Fig. 1-6** show the evolution of energy use by all categories of buildings in the Hungarian building stock until 2050, for all scenarios. It is easy to see that the three categories that use most of the energy are the traditional multi-family, panel multi-family, and traditional single-family residential buildings.

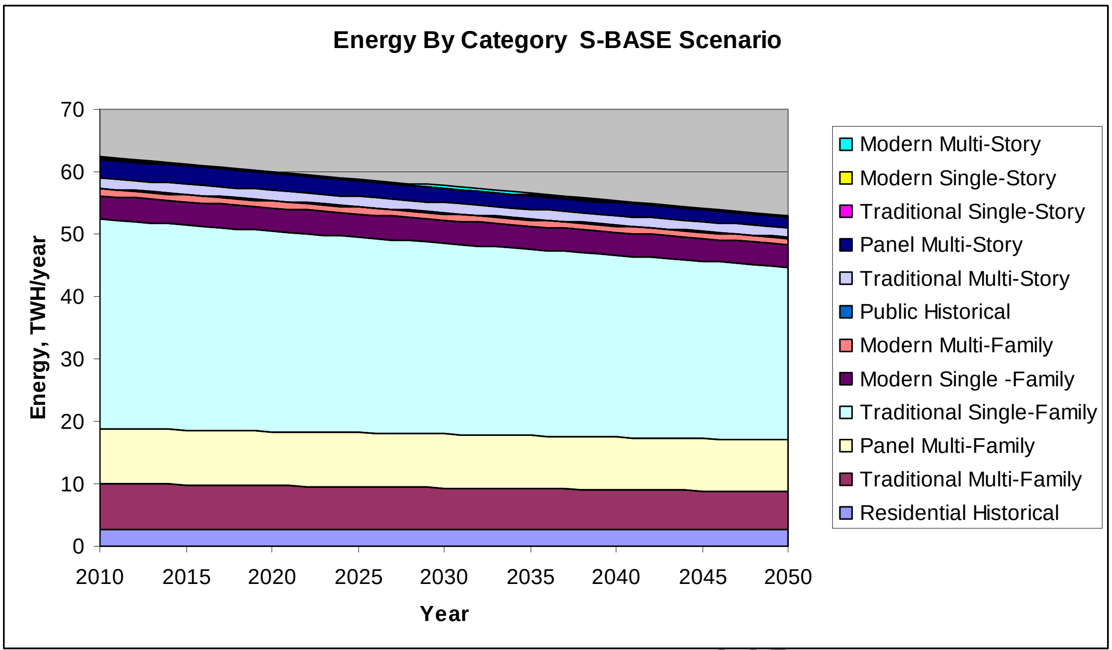

Fig. 1-3: Energy use for all categories of buildings - S-BASE scenario

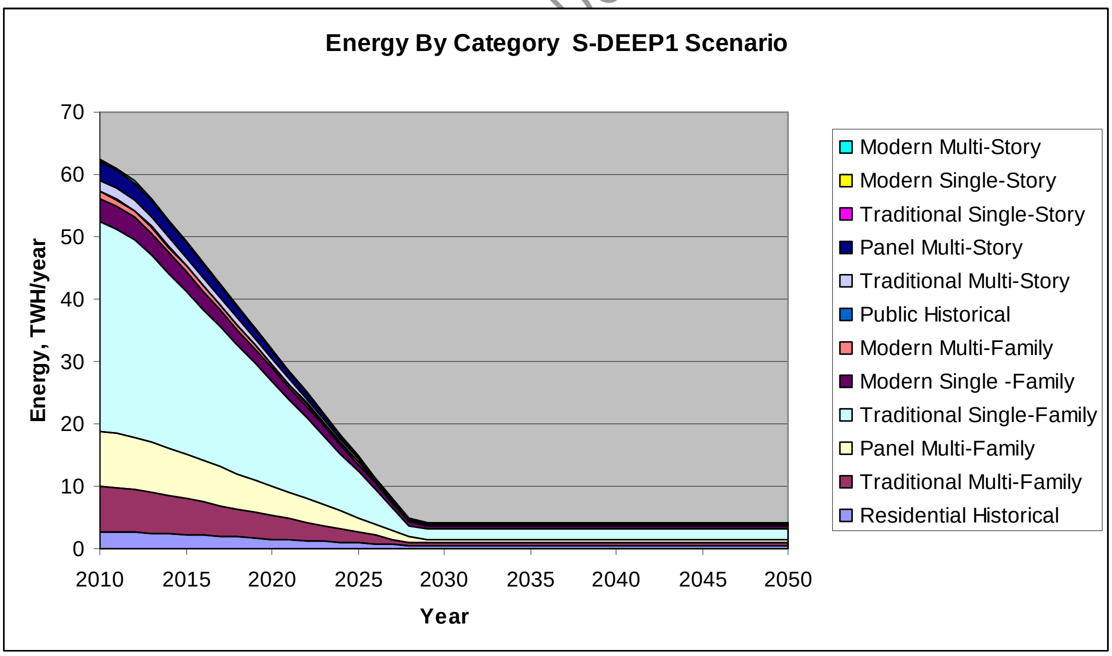

Fig. 1-4: Energy use for all categories of buildings - S-DEEP1 scenario

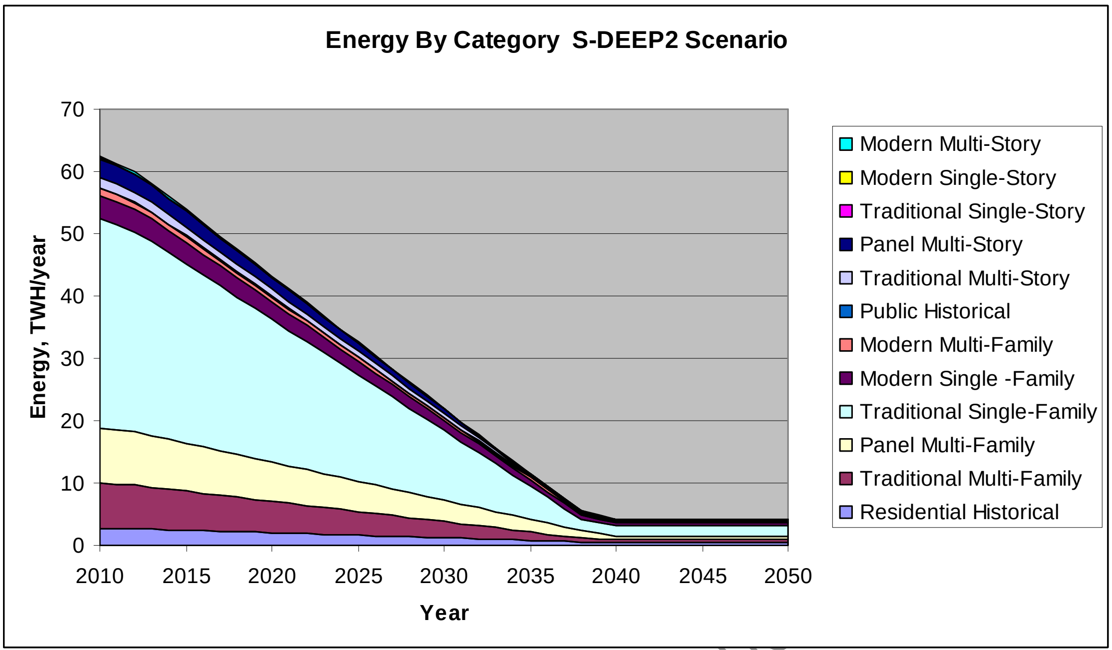

Fig. 1-5: Energy use for all categories of buildings - S-DEEP2 scenario

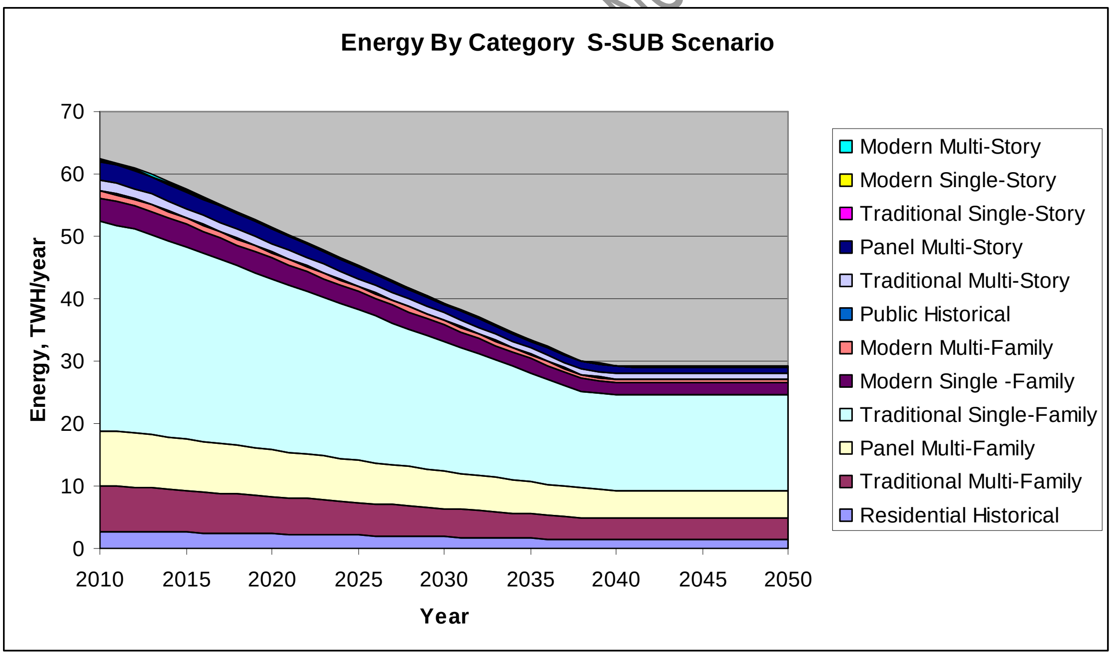

Fig. 1-6: Energy use for all categories of buildings - S-SUB scenario

CO2 emissions will also be significantly reduced with respect to a business-as-usual evolution, as can be seen in **Fig. 1-7**. The deep renovation scenarios can save up to 150 billion tonnes of CO2 by the year 2030.

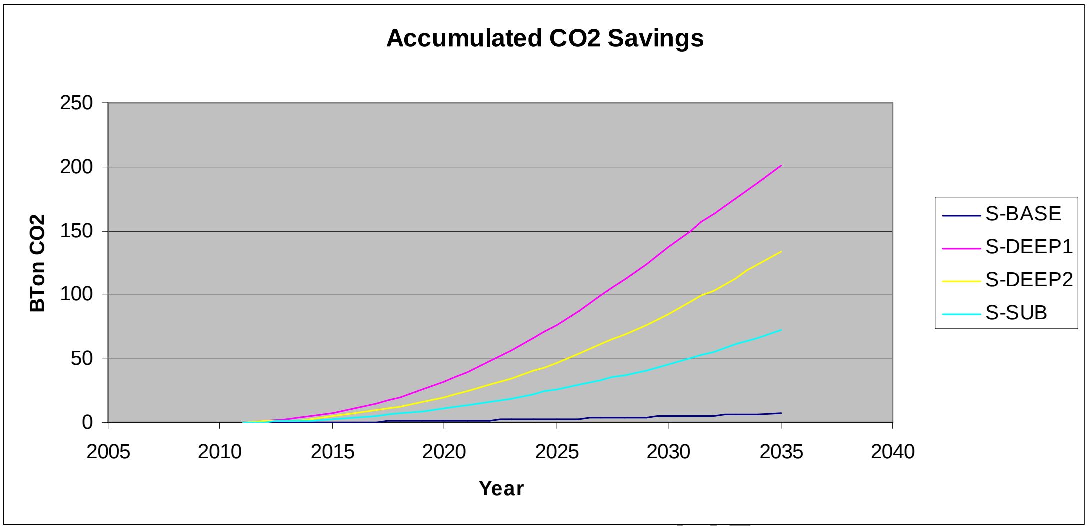

Fig. 1-7: Accumulated CO2 emission reductions for each scenario

The first estimates obtained show that the retrofit programmes considered will involve a considerable amount of investments, but will also generate a consistent amount of cost savings due to the improved energy efficiency. **Table 1-2** shows the investments and the energy cost savings in 2020 for all scenarios, while **Fig. 1-8** visualises the annual amount of investments for each scenario until the end of the programme. The values take into account a ramp-up period of three years, which the research assumes will be required by the construction industry to respond to the additional demand.

Scenario	S-DEEP1	S-DEEP2	S-SUB
Million Euros invested in 2020	6,464	3,879	1,619
Energy cost savings in 2020 (million Euros)	1,518	928	499
Accumulated energy savings from the start to 2020 (million Euros)	7,369	4,580	2,462

Table 1-2: Investments and energy cost savings by 2020

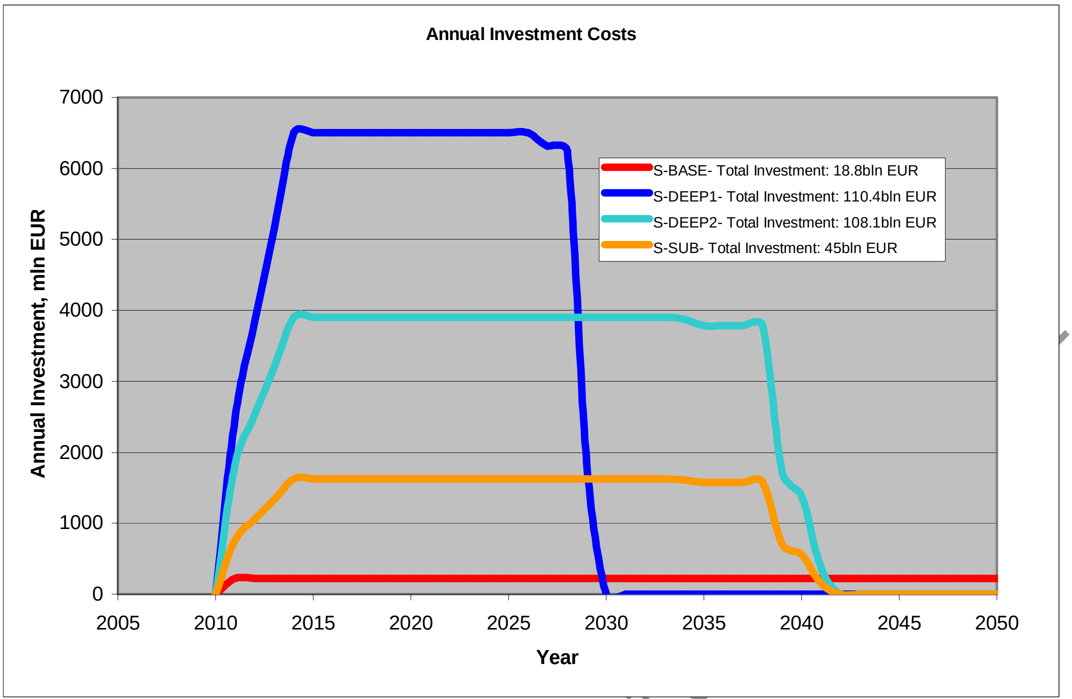

Fig. 1-8: Annual investments for the renovation scenarios until the end of the programme

The accumulated energy expenditure savings for all scenarios until year 2035 can be seen in **Fig. 1-9**: clearly, cost savings are highest for the most intensive scenario, S-DEEP1. They are much more modest for the other scenarios, and practically inexistent for the baseline scenario.

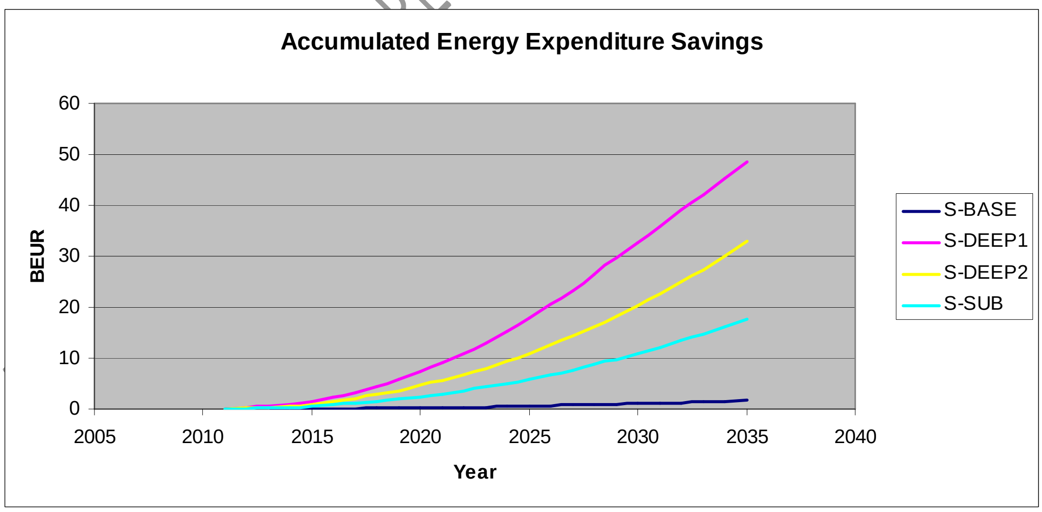

Fig. 1-9: Cumulative energy cost savings for all scenarios

1.4.2 Employment impacts

All the scenarios will engender remarkable net employment benefits in virtually all sectors of the economy.

Table 1-3 summarizes the direct and indirect employment impacts in Hungary of all scenarios in 2020, compared with the *S-BASE* scenario. The results of the total (direct and indirect) impacts can also be seen graphically in **Fig. 1-10**. The amount of FTE jobs created per million Euros invested, a measure used in most employment impact studies, is higher for the most intensive scenario (*S-DEEP1*). For all scenarios, the measure of job creation per million Euros invested is higher than in the vast majority of studies reviewed for this research: a typical value for other measures is around 10 to 20 FTE jobs created per million Euros, compared to the values of 33 to 40 obtained with the present scenarios.

Scenario	S-DEEP1	S-DEEP2	S-SUB
Direct impacts on employment in construction (thousand FTE units)	160.31	96.19	40.16
Direct impacts on employment in energy (thousand FTE units)	-13.59	-8.31	-4.46
Direct + indirect impacts generated by investments in construction	298.22	174.72	66.81
Direct + indirect impacts generated by energy savings	-41.50	-24.83	-12.71
Direct + indirect impacts in all sectors (thousand FTE units)	256.72	149.88	54.09
FTE Jobs / million Euro invested	**39.71**	**38.64**	**33.40**

Table 1-3: Summary of employment impacts for all scenarios

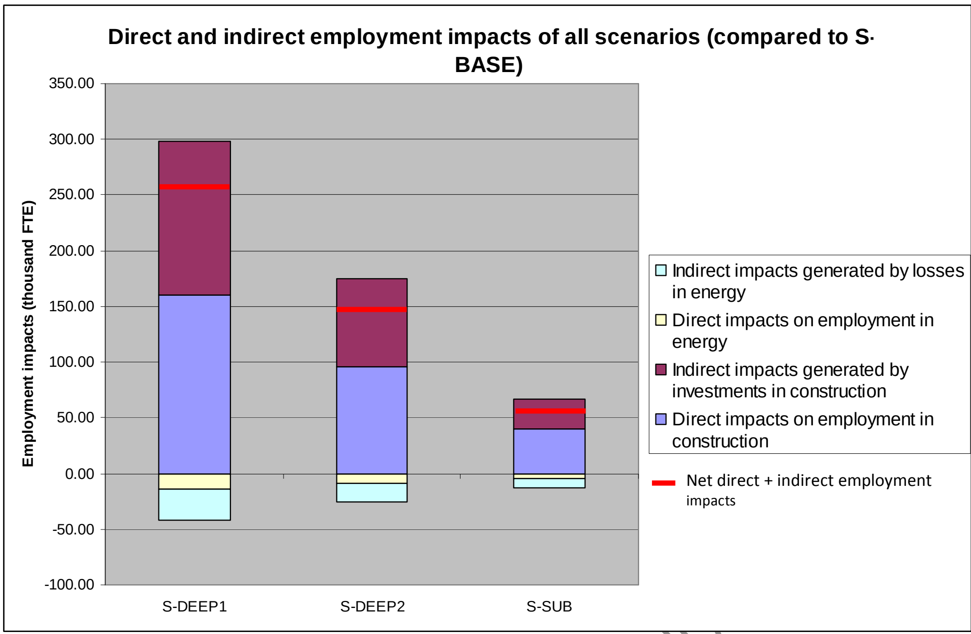

Fig. 1-10: Direct and indirect employment impacts of all scenarios

Table 1-4 shows the net direct and indirect employment impacts of the retrofit scenarios in all sectors of the Hungarian economy. The only sector where the impact is negative is – unsurprisingly – the energy sector (here called "electricity, gas and water supply"), while the major net benefits (apart from construction) can be seen in manufacturing: this sector will obviously make a big contribution for the supply of materials for the renovations to the construction industry.

Sectors	Net employment impacts in S-BASE (thousand FTE jobs)	Net employment impacts (thousand FTE) in the other scenarios (difference with S-BASE)		
		S-DEEP1	S-DEEP2	S-SUB
Agriculture, hunting, forestry and fishing	0.06	1.62	0.94	0.32
Mining and quarrying	0.12	3.15	1.79	0.35
Manufacturing	1.94	54.33	31.74	11.58
Electricity, gas and water supply	-0.38	-11.83	-7.12	-3.90
Construction	5.68	160.64	94.10	35.87
Wholesale and retail trade, restaurants and hotels	0.71	19.80	11.55	4.08
Transport, storage and communications	0.41	11.36	6.62	2.33
Finance, insurance, real estate and business services	0.40	11.18	6.50	2.19
Community, social and personal services	0.23	6.46	3.76	1.27
Total	**9.16**	**256.72**	**149.88**	**54.09**

Table 1-4: Net direct and indirect employment impacts on all sectors of the economy

Qualitatively, a few observations have to be made concerning the employment impacts in the Hungarian labour market for all retrofit scenarios.

Geographic distribution of employment effects. A programme focusing on the improvement of energy efficiency in the building sector is more likely to have direct employment benefits in the construction industry distributed throughout the country, as the buildings to renovate are not concentrated in any geographical region. House renovations are usually conducted by local small and medium size enterprises (SMEs) which have a deeper knowledge of the local market than large companies, so they will be the major direct beneficiaries of a large-scale building retrofit programme. Therefore it is expected that a large share of these jobs, at least the direct employment created, will be local and decentralised rather than centralised, and unlikely to be "exported" outside of the Hungarian borders.

Temporal durability of employment effects. The magnitude of the programme considered in this study is such that the direct and indirect employment effects will proceed throughout several decades, and the decrease of jobs in the energy sector will certainly be countervailed by the employment and income effects of the retrofit program.

Supply of labour and skill level implications. The results show that in the intensive refurbishment period the construction industry will need a vast amount of new workers. The question might then arise if there is a sufficient supply, in the required location and skill level, of workers in Hungary to satisfy this demand. The model used in this research assumes a ramp-up period, during which the construction industry will adapt to the new demand and respond to a possible shortage of supply in workers or skill.

The demand for workers will be spread across all skill levels: from construction entrepreneurs, to college-trained professionals, skilled and unskilled workers. While the supply of entrepreneurs and professionals is perhaps easier, issues may arise for the supply of skilled and unskilled workers. In principle, unskilled workers can be supplied by the unemployed and inactive Hungarian labour force; in practice, the skills of the unemployed and inactive may differ from those needed in the programme, and these workers may have high reservation wages.

Effects on costs of wage changes and workers' productivity. Wages will respond to the increase in the demand for workers, and they will increase as firms compete for the scarce skills. This may increase the costs of retrofit projects and slow down the rate of renovations and the output of upstream industries. In addition, such a general wage increase can have adverse effects on the whole labour market, as the production costs increase in many industries. On the other hand, the costs of renovation may decrease and the productivity of workers grow as a consequence of economies of scale and the learning factor. In balance, these phenomena may suggest that a more gradual renovation programmehas lower overall social cost from these perspectives.

Inflow of foreign workers. Should the Hungarian workforce fail to fill the job vacancies needed for the retrofit projects, foreign workers may need to fill in these vacancies. While new immigration could revitalize the Hungarian society and give a boost to its stagnant demography, there could also be negative impacts reflected in a growth of illegal immigration, or an increase in grey labour.

Considerations on the energy sector. The energy sector has a low labour-capital ratio and a high number of employees per company. Job losses in that sector are likely to be lumpy, and mostly take place in the case of plant closures. Furthermore, the negative impacts in the energy sector might be attenuated by the so-called *rebound effect* (where an increase in energy demand is caused by the reduction of the per-unit price of energy services and the increased disposable income available to consumers generated by energy-efficiency measures); i.e. that a portion of the saved energy costs will in fact be spent on other services requiring energy input (such as larger homes, refrigerators, etc), thus lowering the negative impact on the energy industry. Part of the energy not needed in the domestic market may also be exported, if the sector if efficient enough to compete on the world market.

Financing of the programmes. While this study does not deal with financing aspects, it is an issue that must be taken into consideration before applying the programme. The vast majority of Hungarian households may not dispose of sufficient up-front capital to invest in a deep retrofit of their house; therefore, a financing formula has to be devised in order to make such a programme viable. In fact, the employment effects also depend on the types of financing for the programme. An “internal” financing (by the households or by the State) will cause a change in the composition of the aggregate demand, which will in turn have consequences on the labour market. If however the large-scale retrofit can be financed through external resources (such as specific EU financing), the aggregate demand is expected to grow and thus mostly generate employment benefits.