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

CENTER FOR CLIMATE CHANGE AND SUSTAINABLE ENERGY POLICY

CENTRAL EUROPEAN UNIVERSITY

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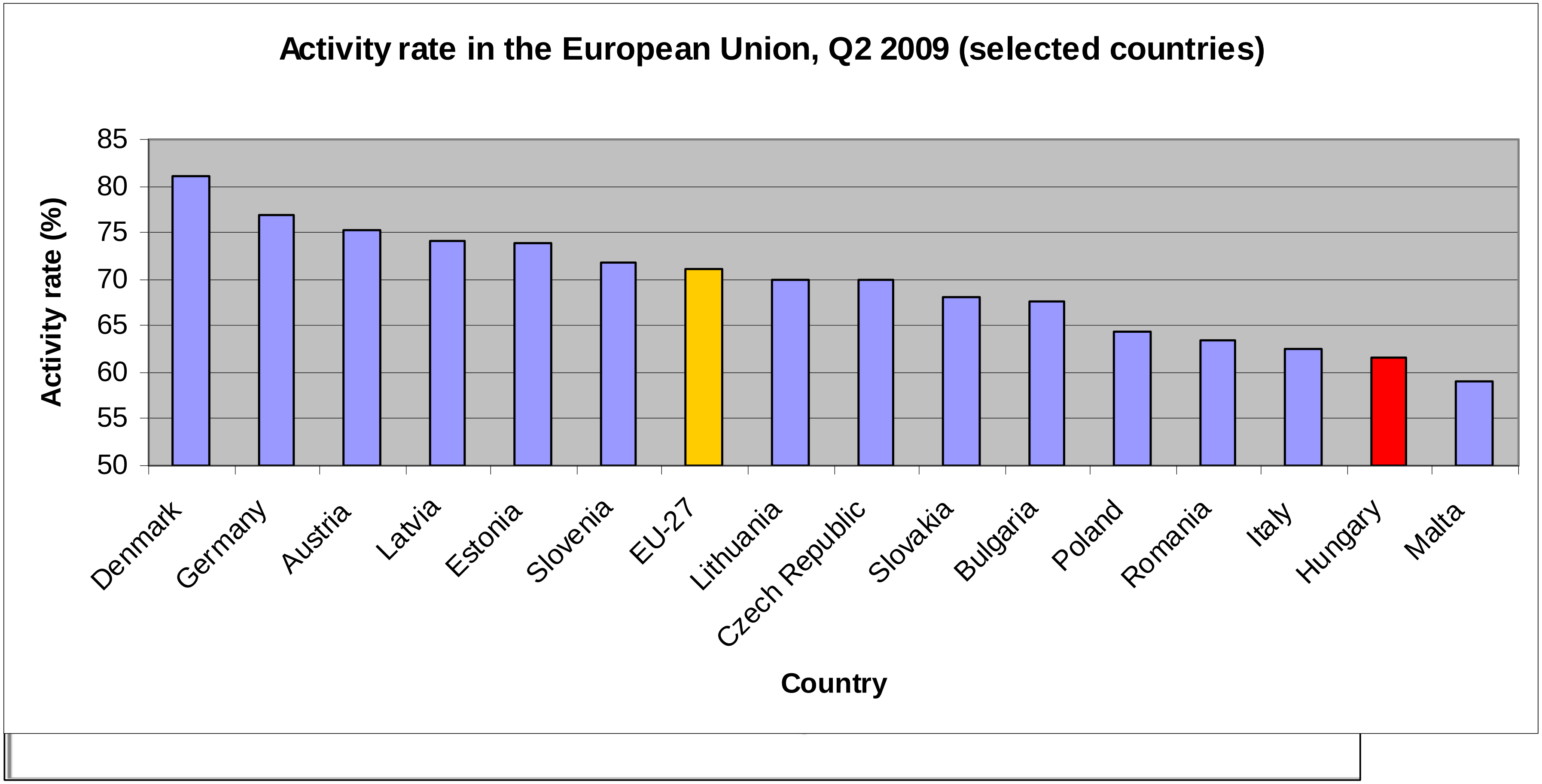
# Background




**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

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# 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 $CO_2$ emissions, energy cost savings
  - Net impacts on Hungarian labour market
- **Two phases**:
  - Preliminary results: 22 March 2010
  - Final report: June 8 2010 (revised results)

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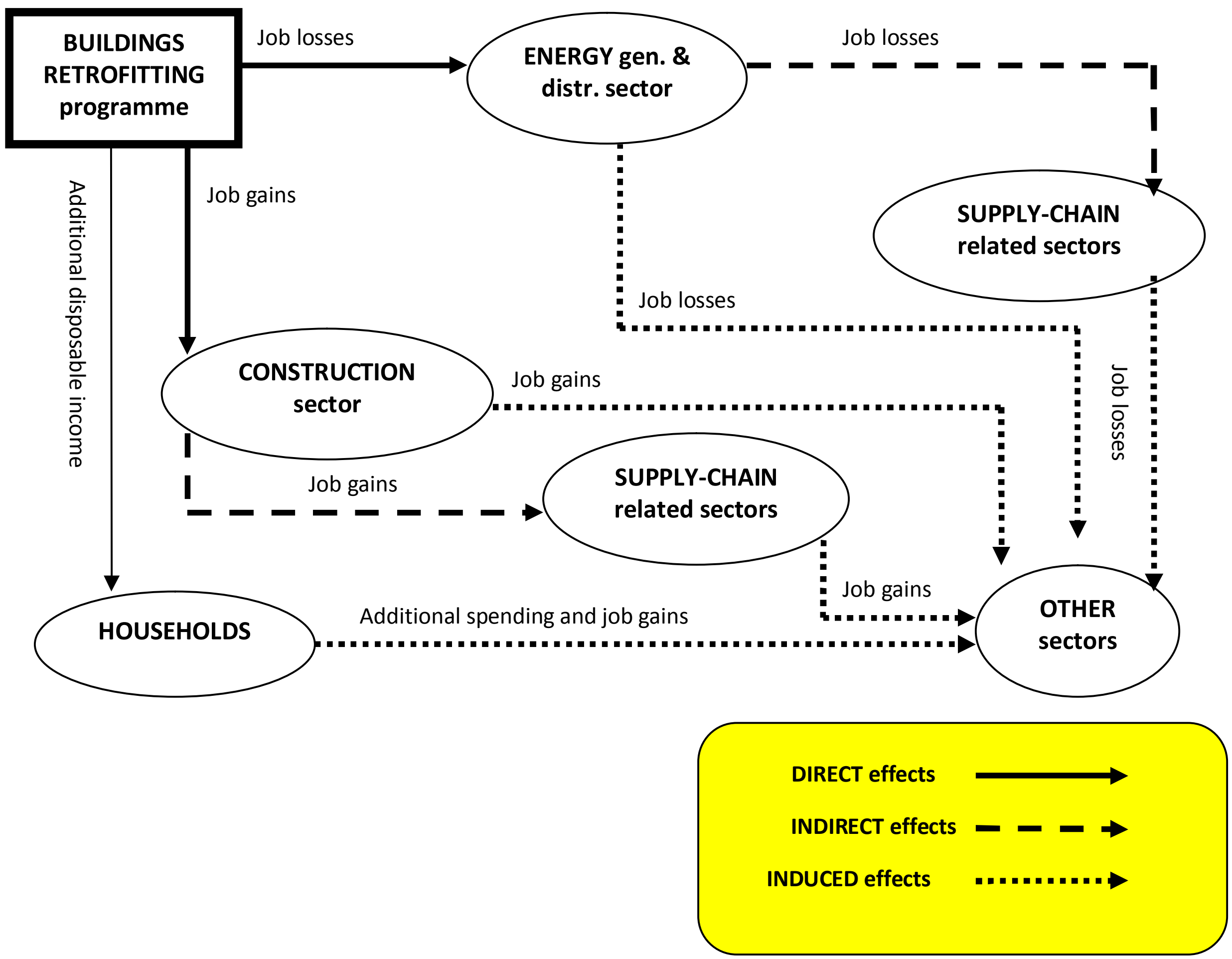
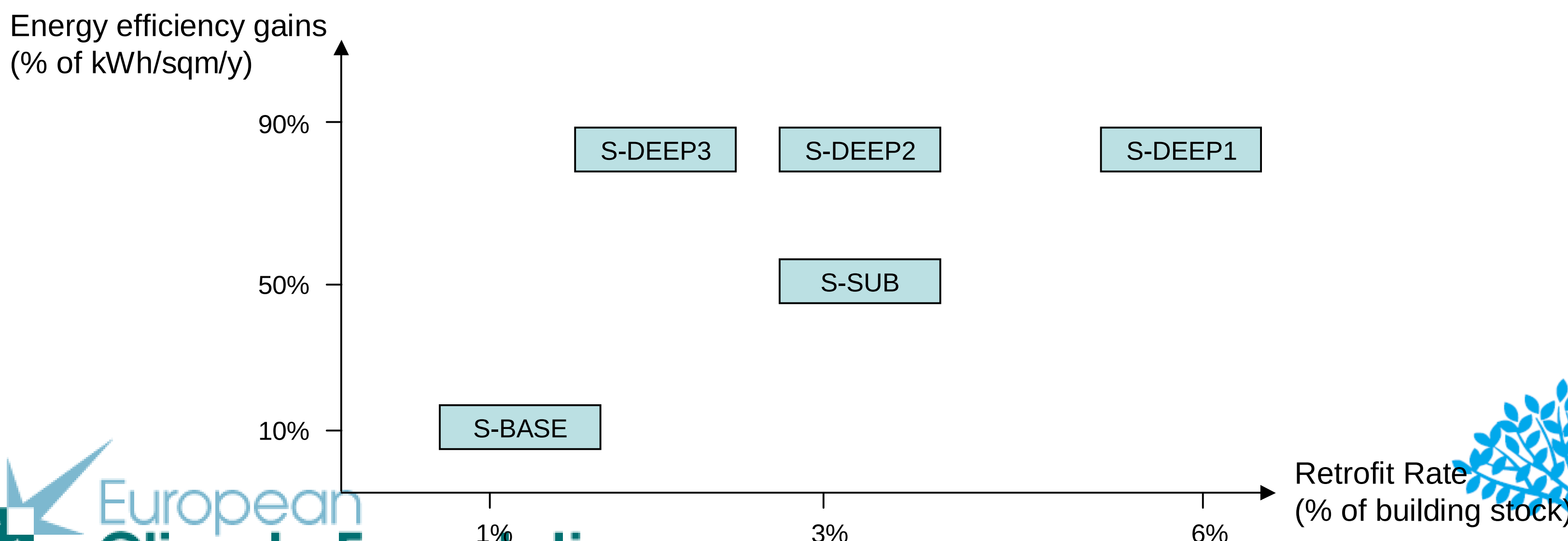
# Employment Effects: Overview



# Scenarios considered

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

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# 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.

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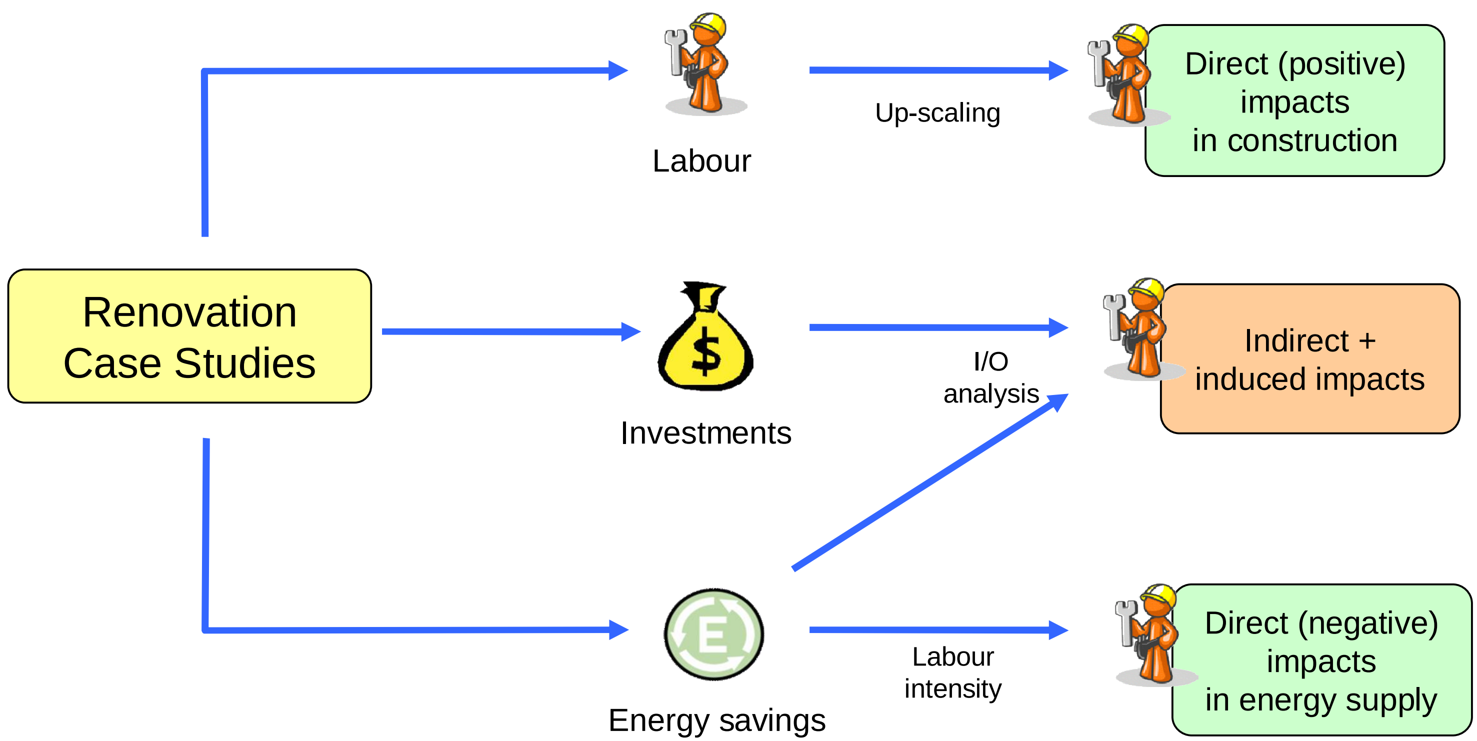
# Methodology: employment impacts

- Mixed: Up-scaling + Input-Output analysis

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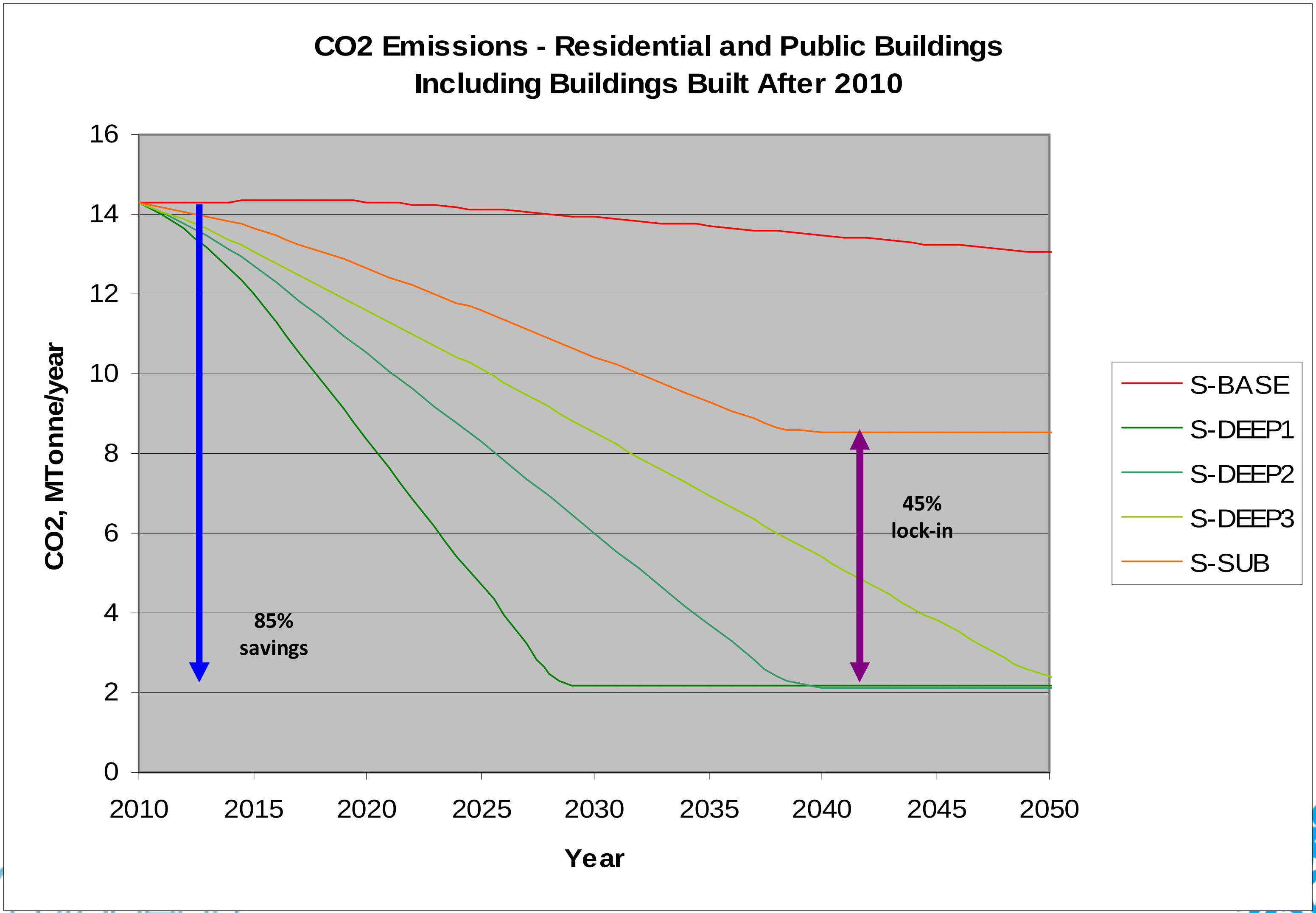
# Scenario results: CO2 emission reductions until 2050: 45% locked in by S-SUB scenario

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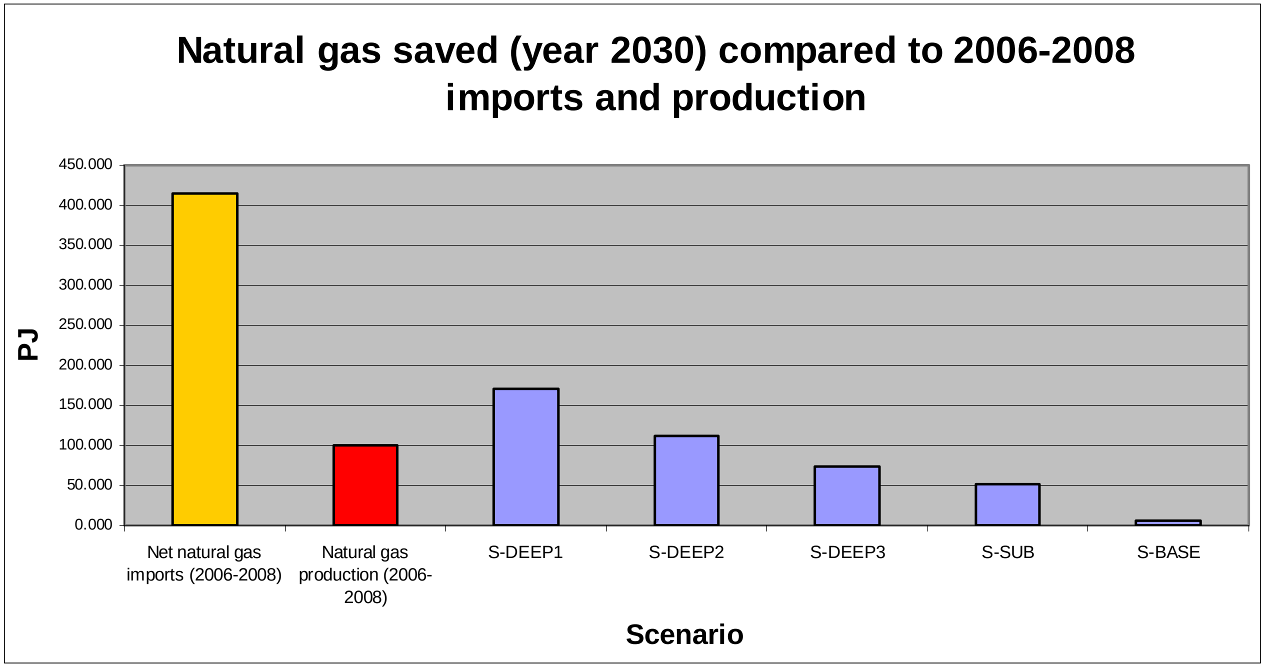
# Energy security benefits

- 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**)**

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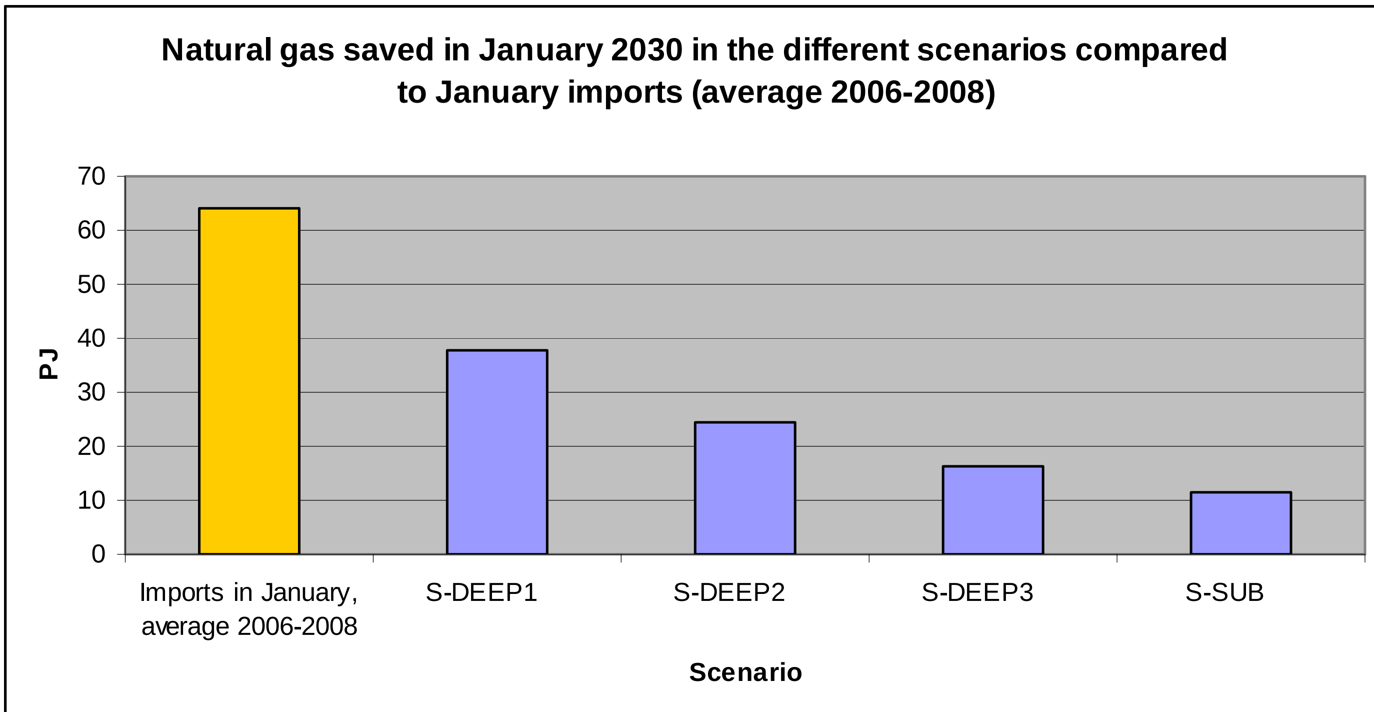
# Energy security benefits (2)

- 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

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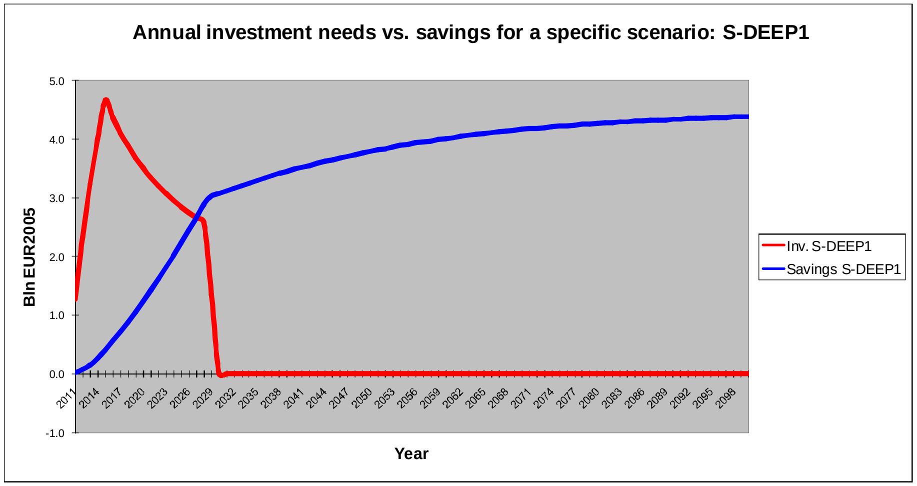
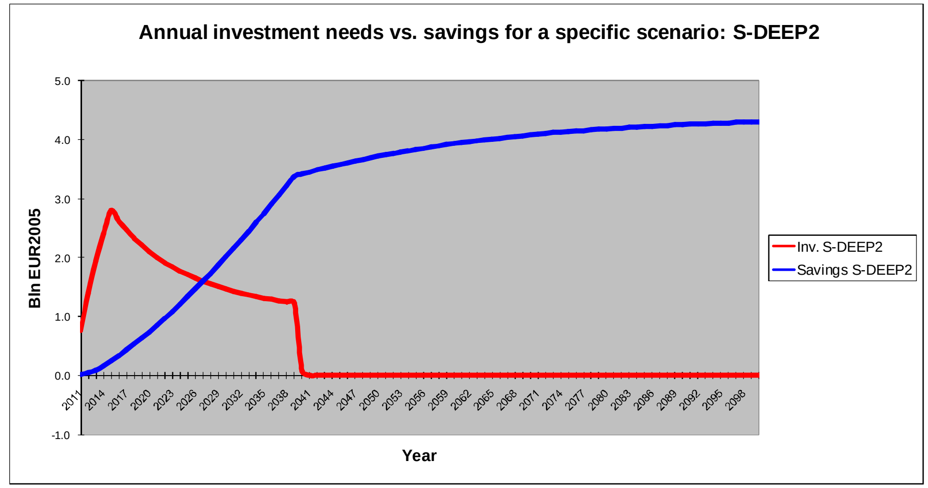
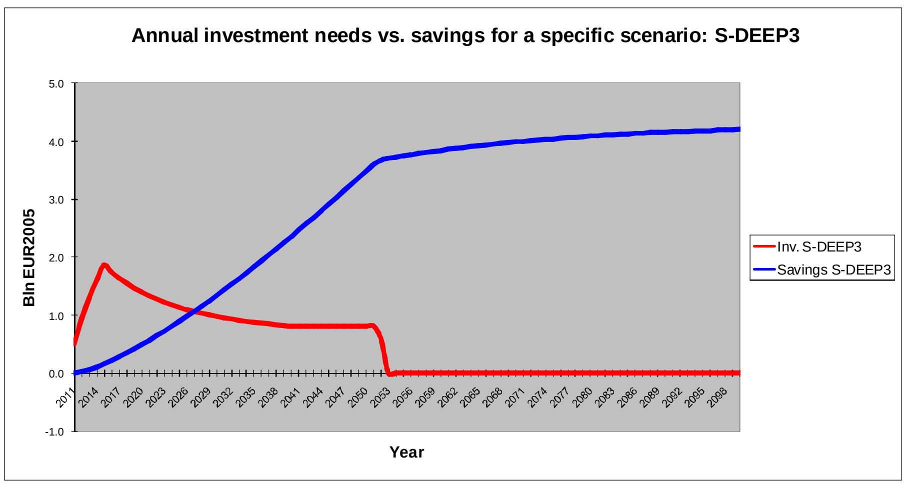
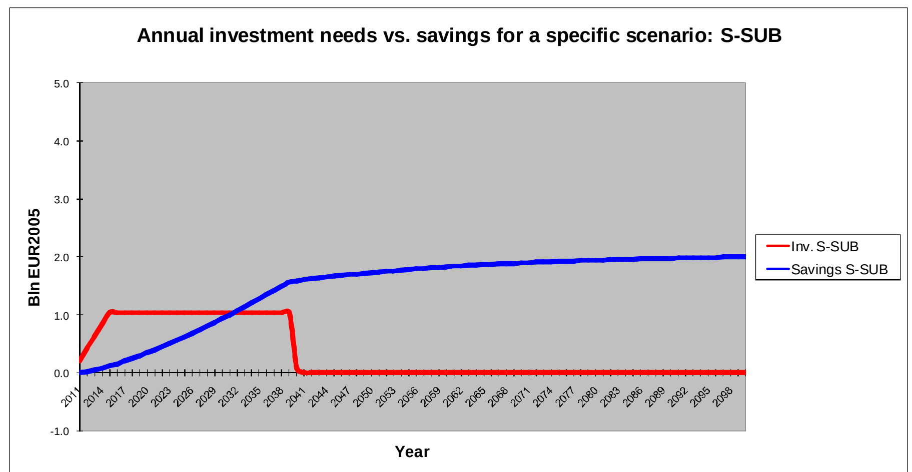
# Scenario results: annual investment needs vs. energy cost savings




- Annual savings become higher than the investment needs in 20 years

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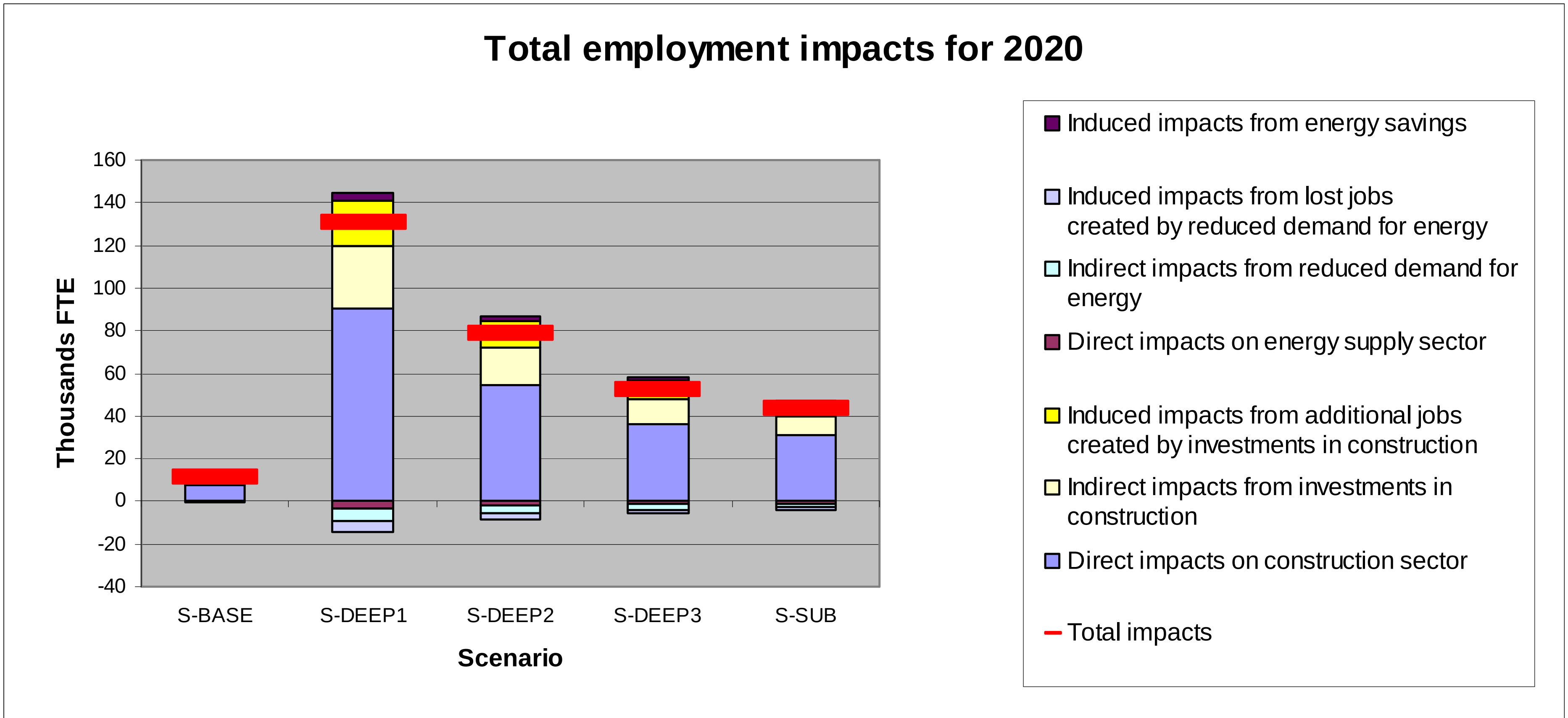
# Total net employment impacts: snapshot in 2020

- 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

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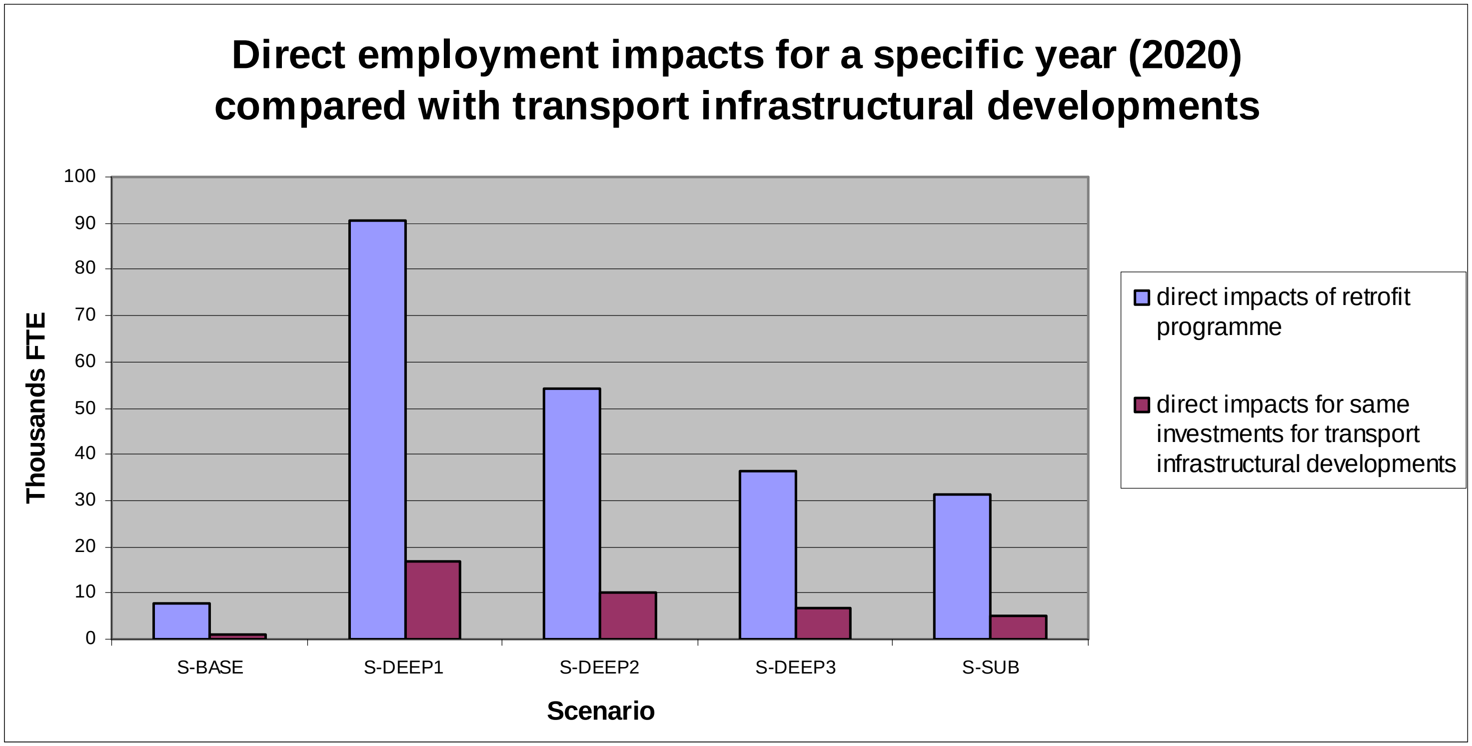
# Direct employment impacts: comparison with other investments




- 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

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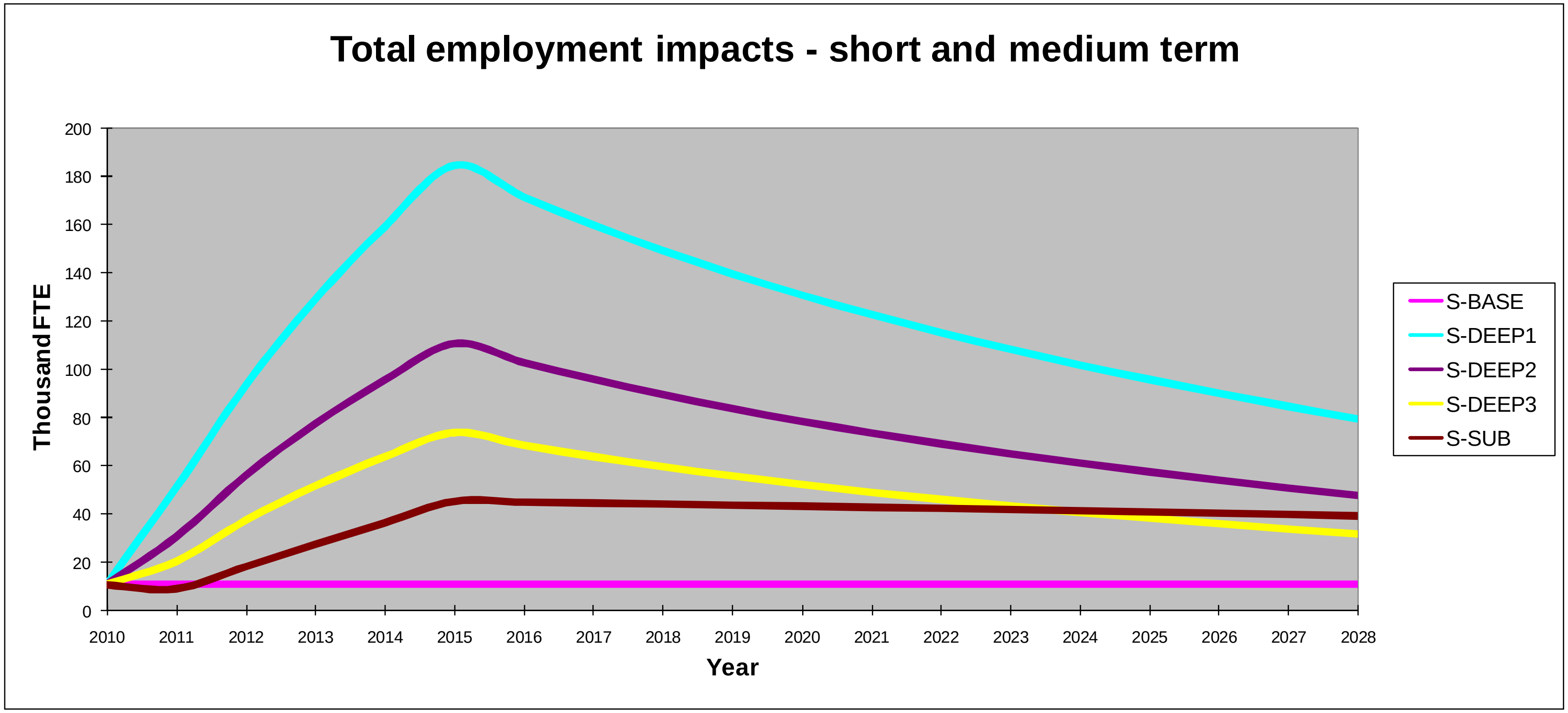
# Net employment impacts in construction: medium-term view




- 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

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# 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€$_{2005}$ (13% of 2009 HU budget)
    - S-DEEP2 – 2.1 B€$_{2005}$ (8% of 2009 HU budget)
    - S-DEEP3 – 1.4 B€$_{2005}$ (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

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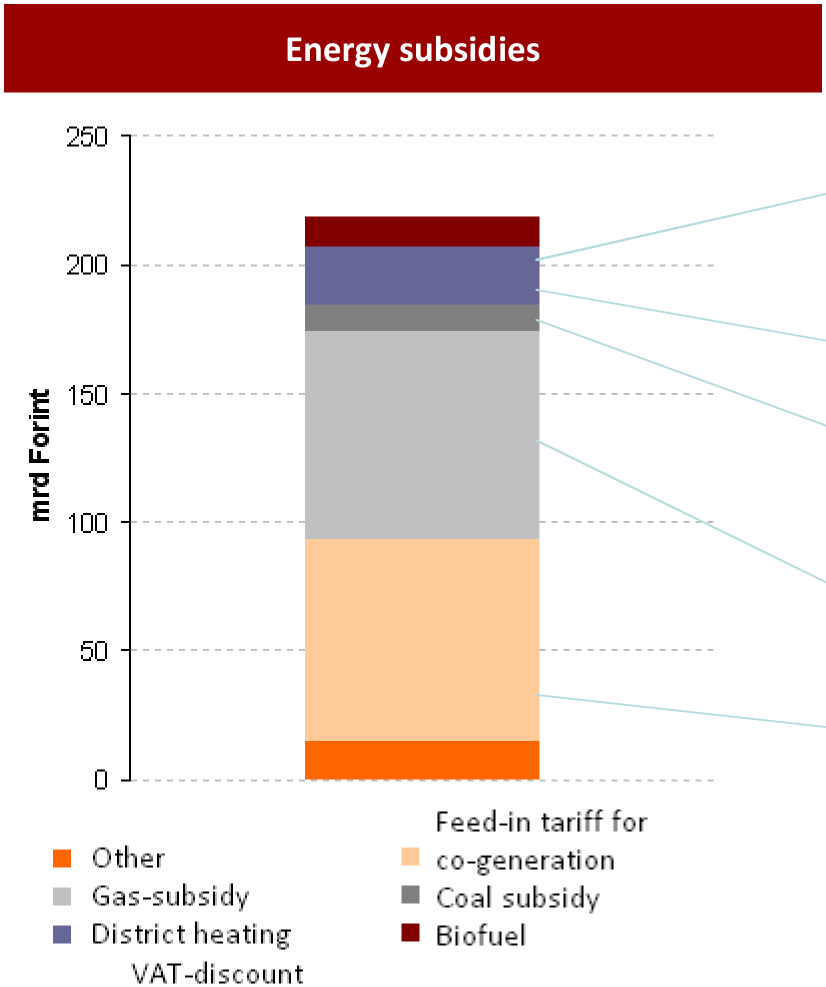
# Energy subsidies in Hungary

Source: slides from Mr. Laszlo Varro, Strategy Director at MOL




**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, decresaes 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

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# 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

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# 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 progam 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

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# From research to policy-making…

- **Timeframe** of the project
  - March-June 2010 (comissioned by ECF Feb. 2010)
  - General elections in Hungary: April 11-25, 2010
  - New government formed on May 29, 2010.
  - Presentation of results: June 8, 2010
- **Policy impact**
  - Late June 2010: the new Hungarian governmnent 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

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

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# Thank you for your attention

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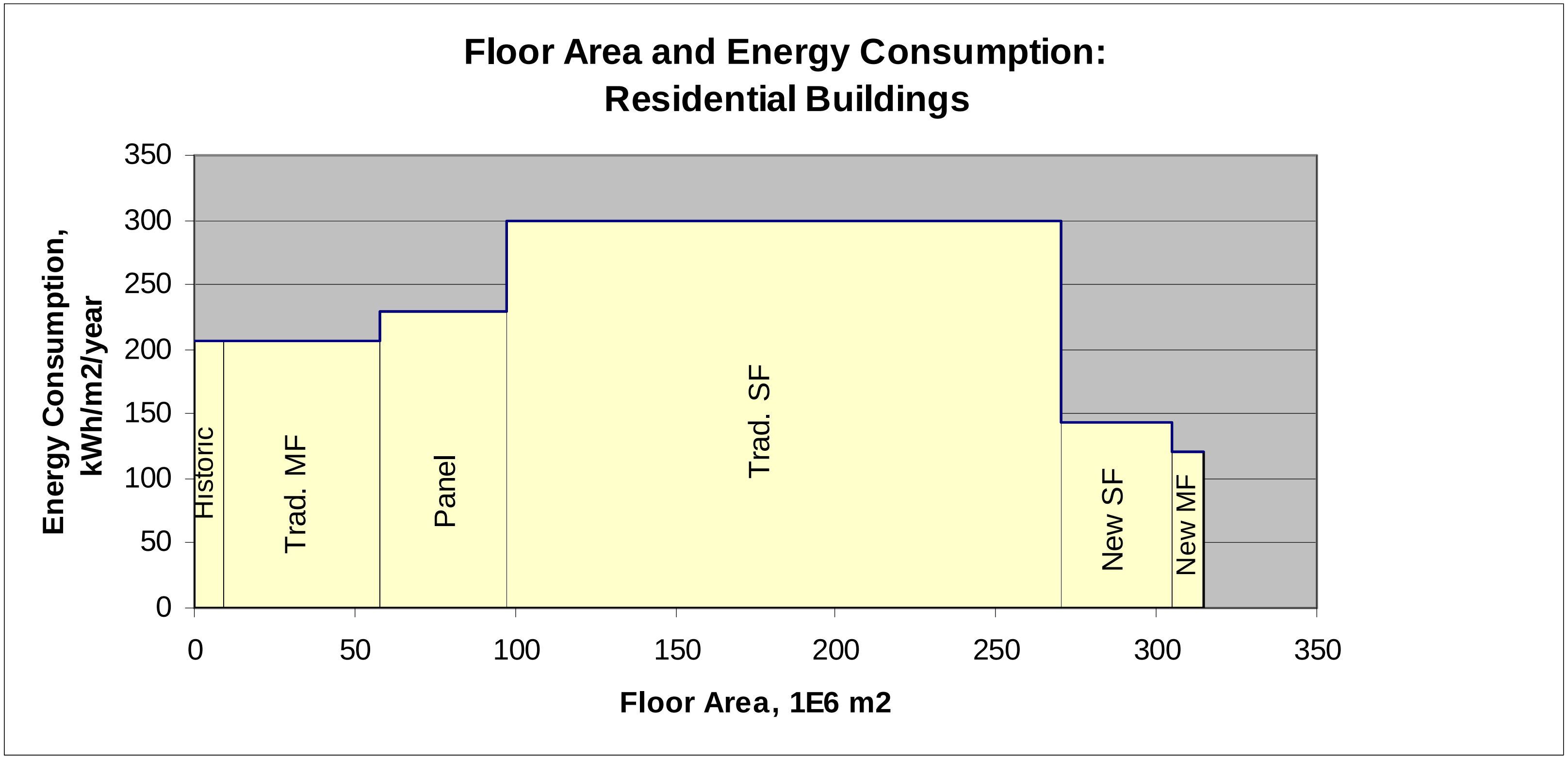
# Residential Building Stock Current Characteristics




Total Energy Consumption: 58 TWh/year

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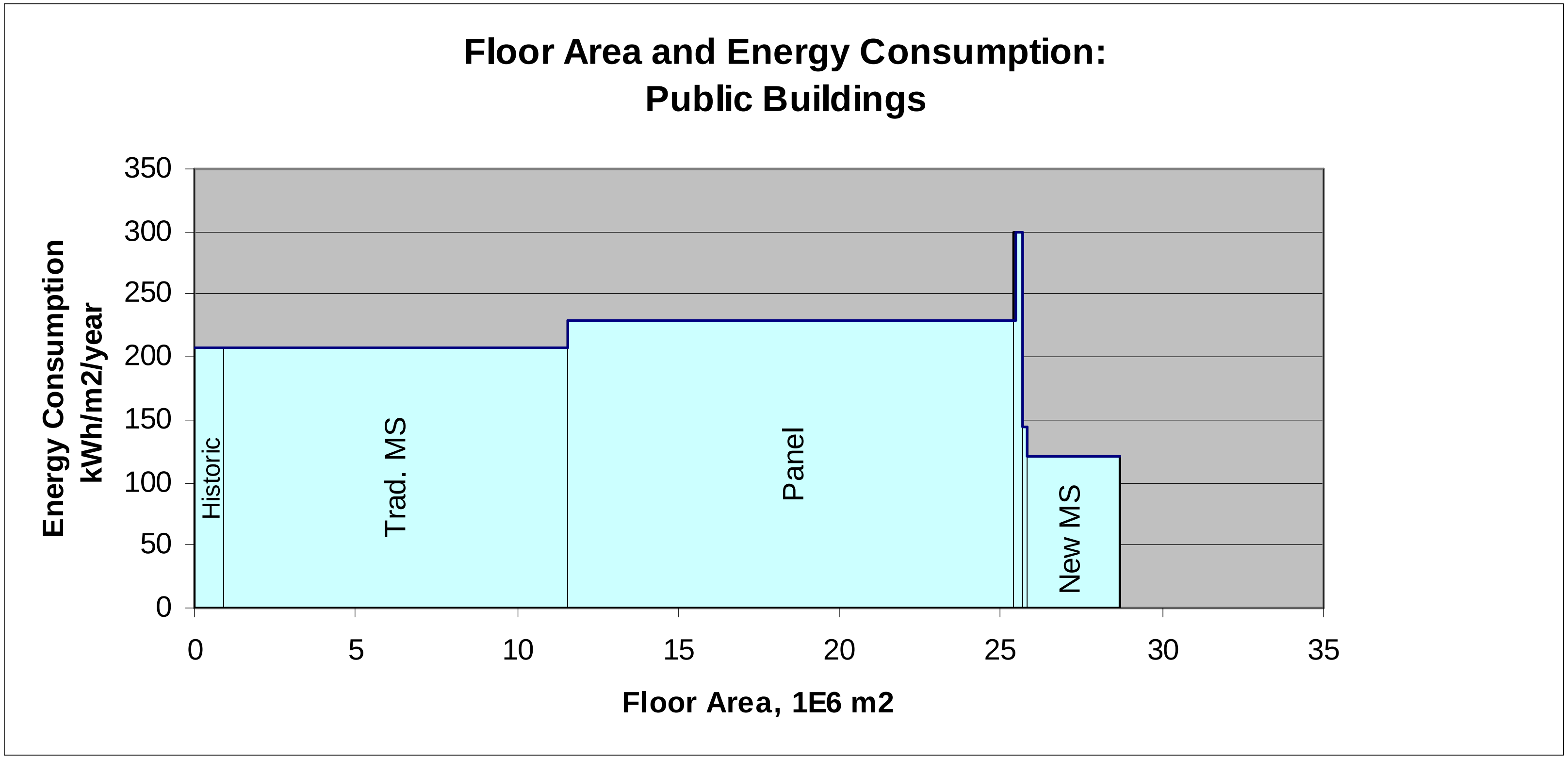
# Public Building Stock
# Current Characteristics




Total Energy Consumption: 5 TWh/year

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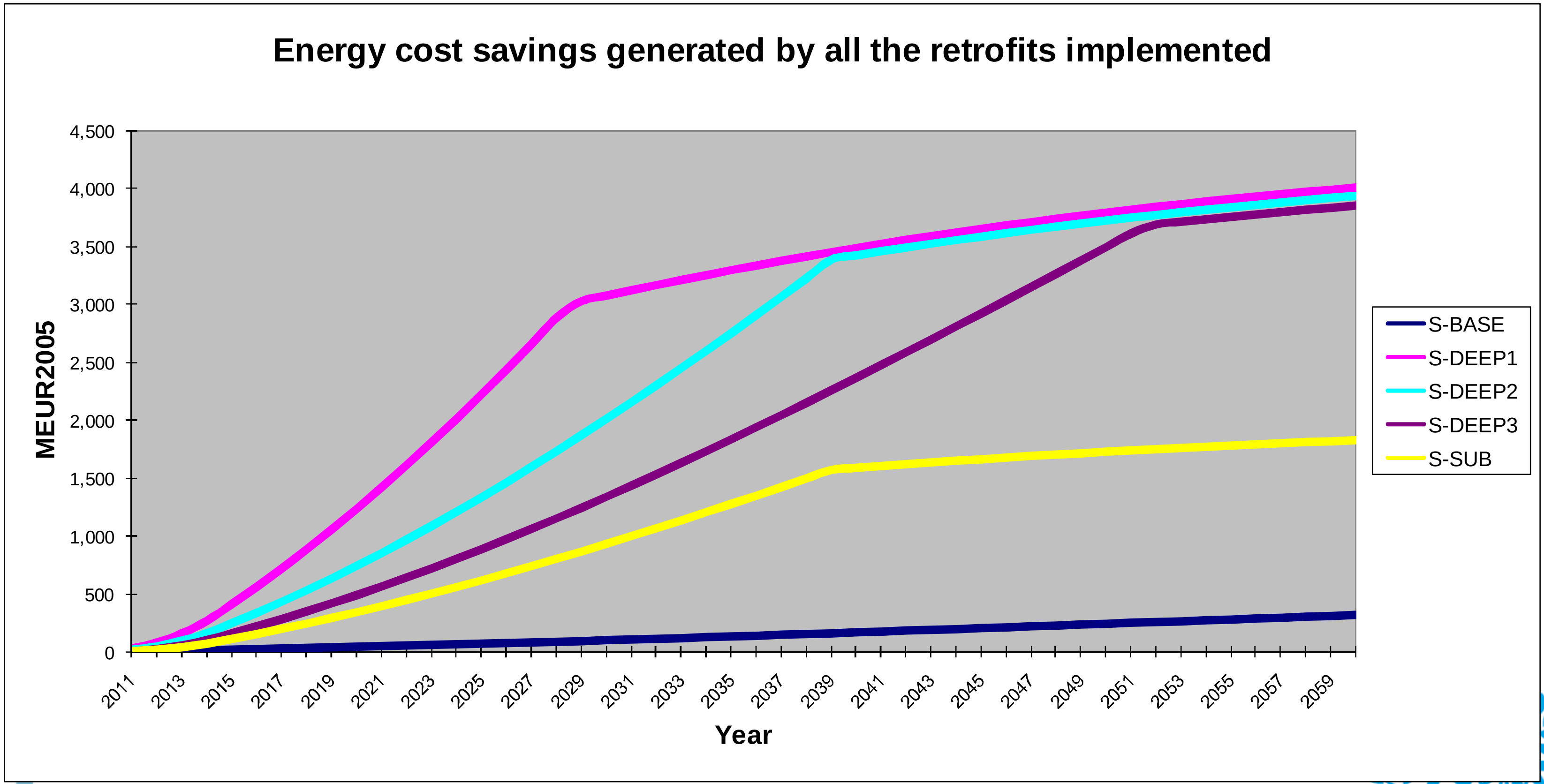
# Scenario results: energy cost savings

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

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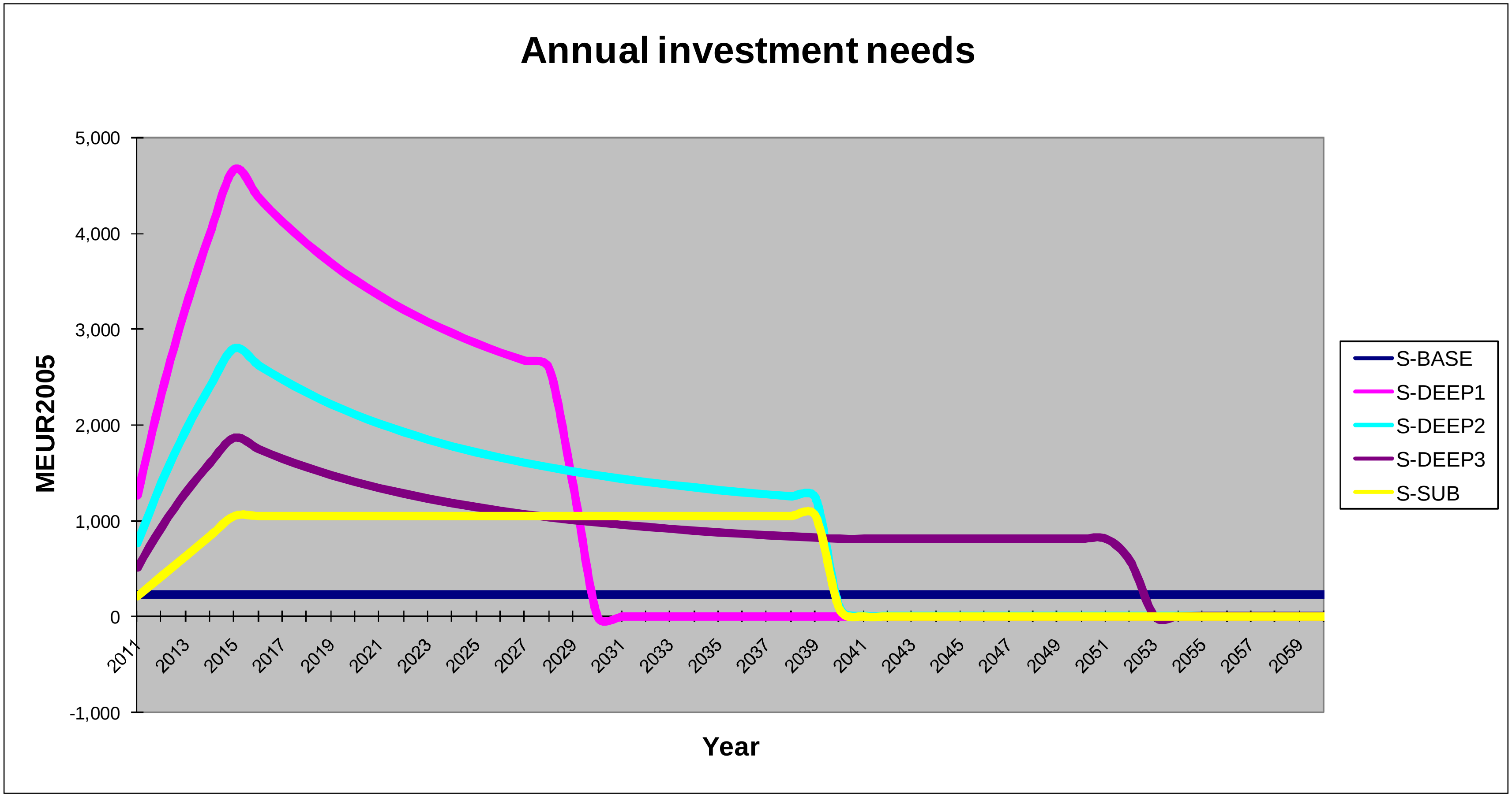
# Scenario results: Investments for the programme




- Initial 5-year ramp-up period
- Subsequent decrease thanks to learning factor

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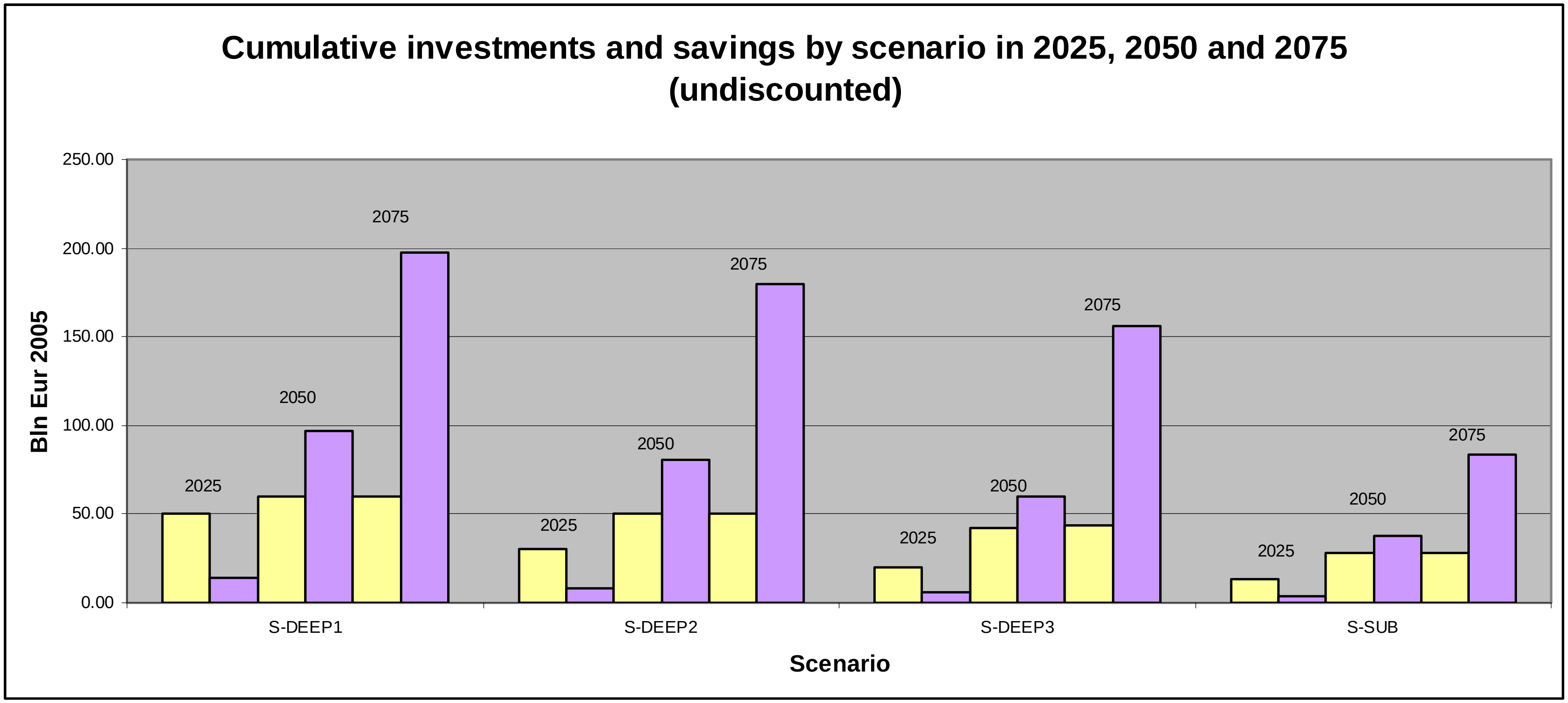
# Cumulative investments and savings (undiscounted)

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# 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

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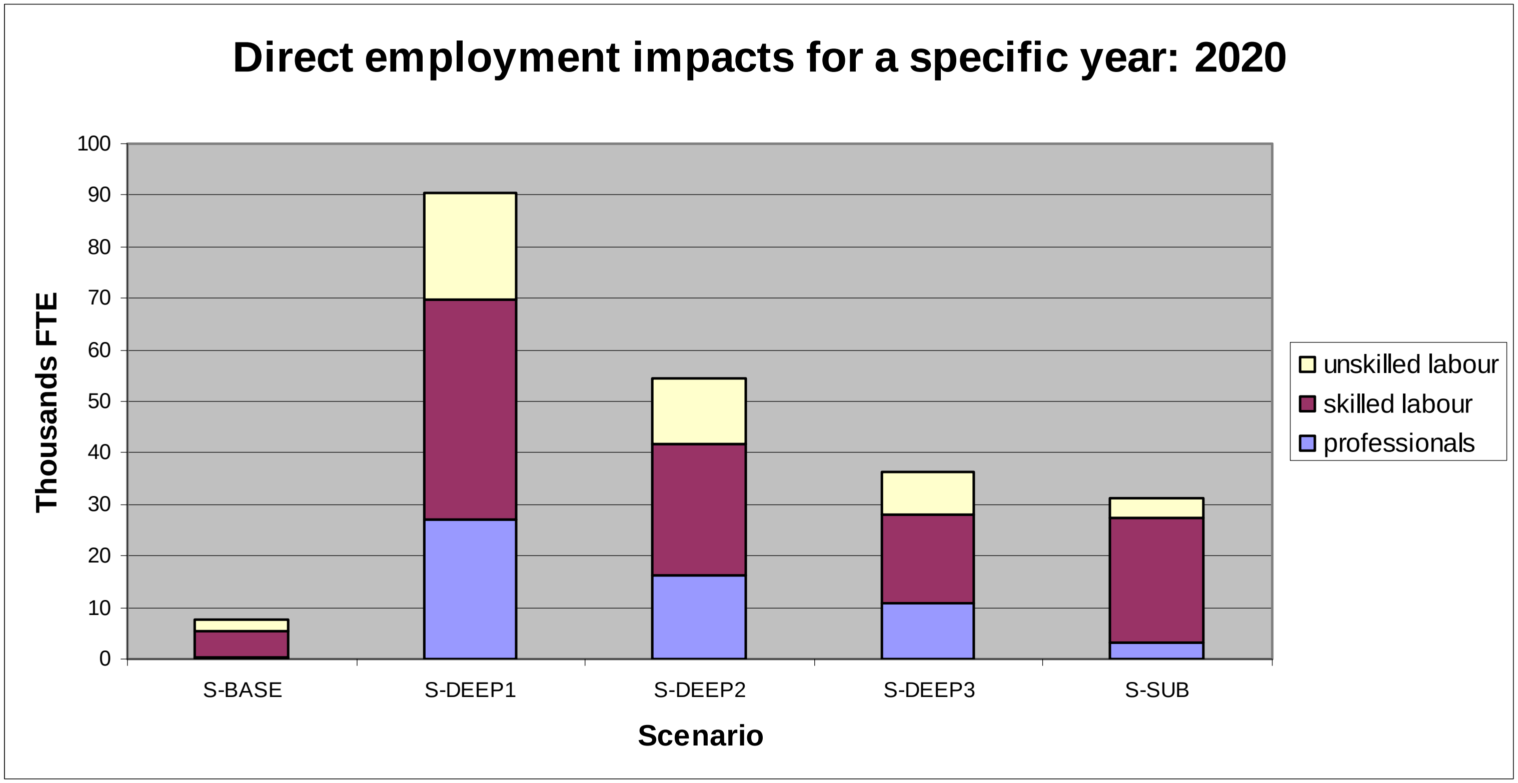
# Direct employment impacts in construction per skill: snapshot in 2020




- The effects on professional labour are highest in the deep renovation scenarios

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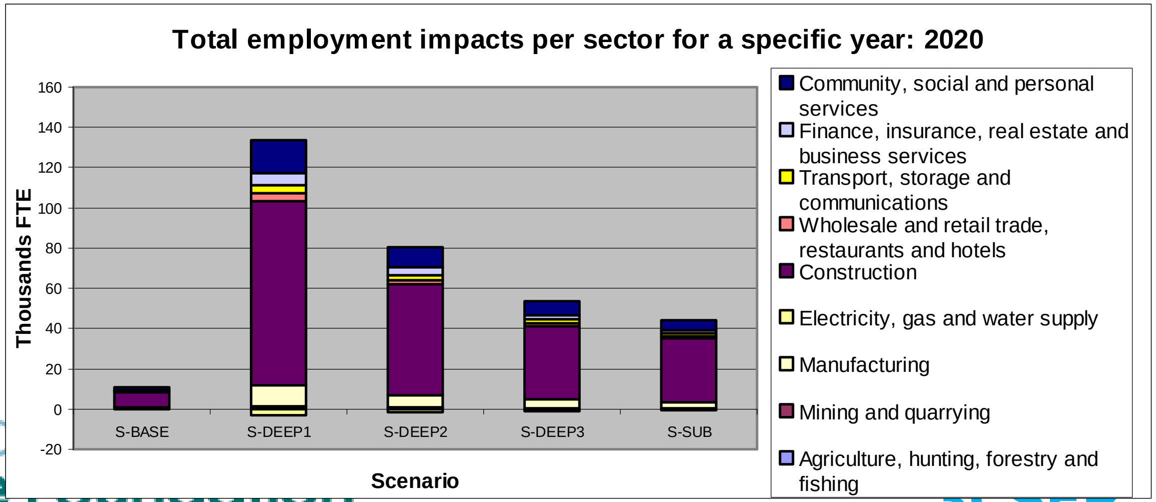
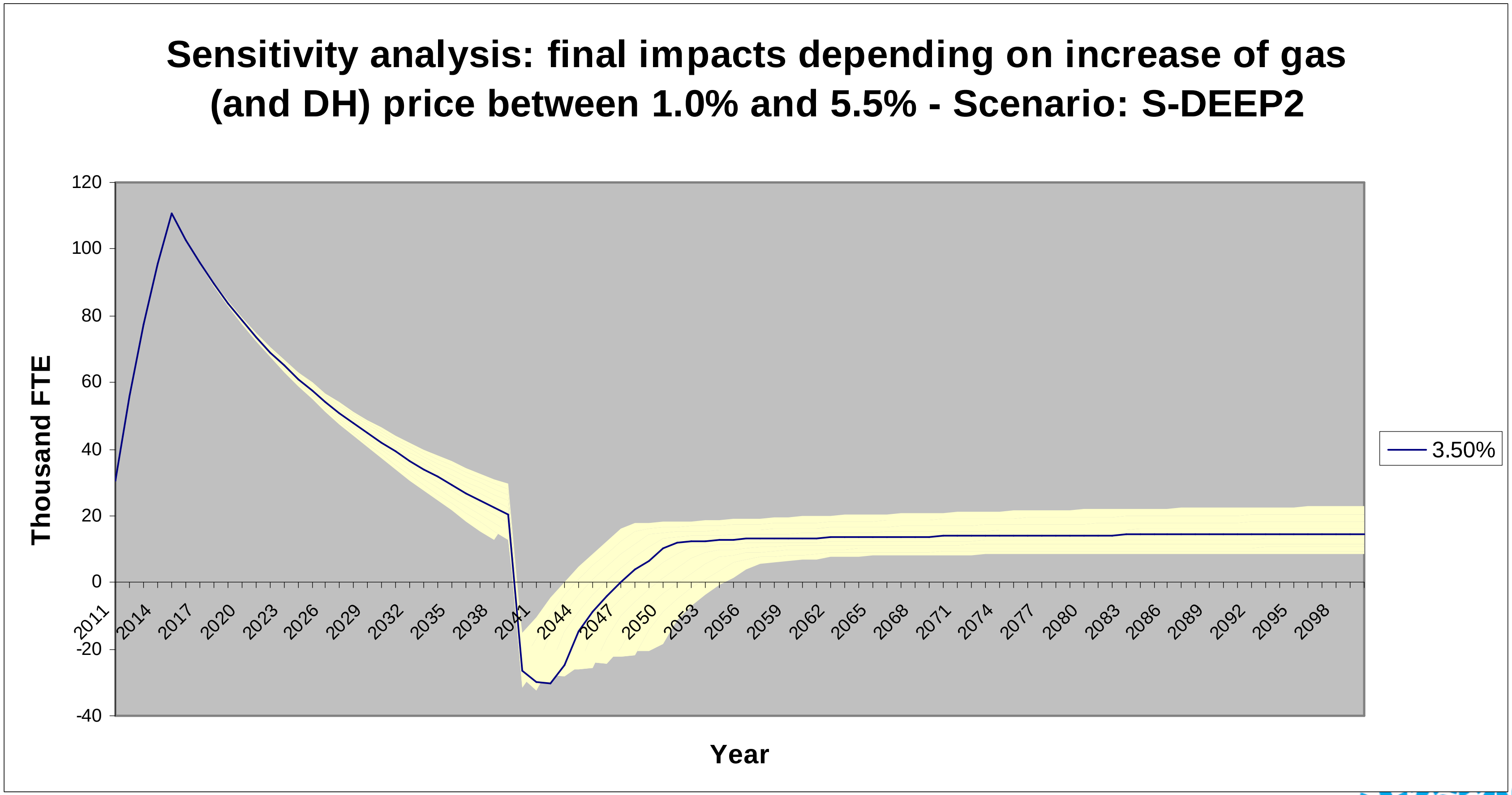
# Total net employment impacts divided by sector: snapshot in 2020

| Thousands FTE | S-BASE | S-DEEP1 | S-DEEP2 | S-DEEP3 | S-SUB |
|---|---|---|---|---|---|
| Agriculture, hunting, forestry and fishing | 0.1 | 0.5 | 0.3 | 0.2 | 0.2 |
| Mining and quarrying | 0.0 | 0.7 | 0.4 | 0.3 | 0.2 |
| Manufacturing | 0.7 | 10.5 | 6.3 | 4.2 | 3.2 |
| Electricity, gas and water supply | -0.1 | -3.1 | -1.8 | -1.2 | -0.8 |
| Construction | 7.7 | 91.8 | 55.1 | 36.7 | 31.7 |
| Wholesale and retail trade, restaurants and hotels | 0.3 | 3.6 | 2.2 | 1.4 | 1.1 |
| Transport, storage and communications | 0.3 | 4.2 | 2.5 | 1.7 | 1.3 |
| Finance, insurance, real estate and business services | 0.5 | 5.8 | 3.5 | 2.3 | 1.8 |
| Community, social and personal services | 1.5 | 16.7 | 10.0 | 6.7 | 5.0 |
| **Total** | 11.0 | 130.7 | 78.4 | 52.3 | 43.4 |



# Sensitivity analysis: variation of increase of energy prices

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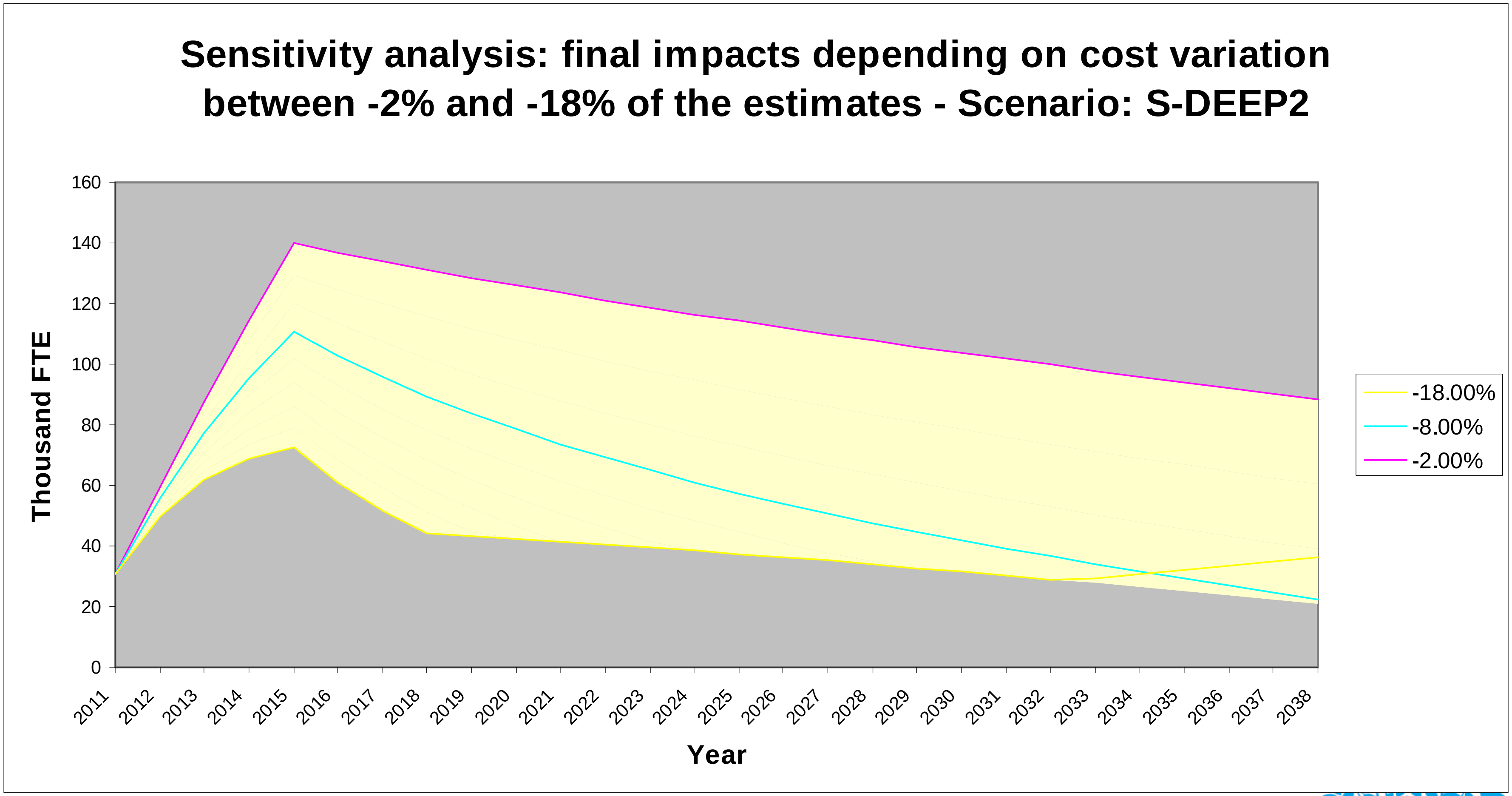
# Sensitivity analysis: variation of learning factor

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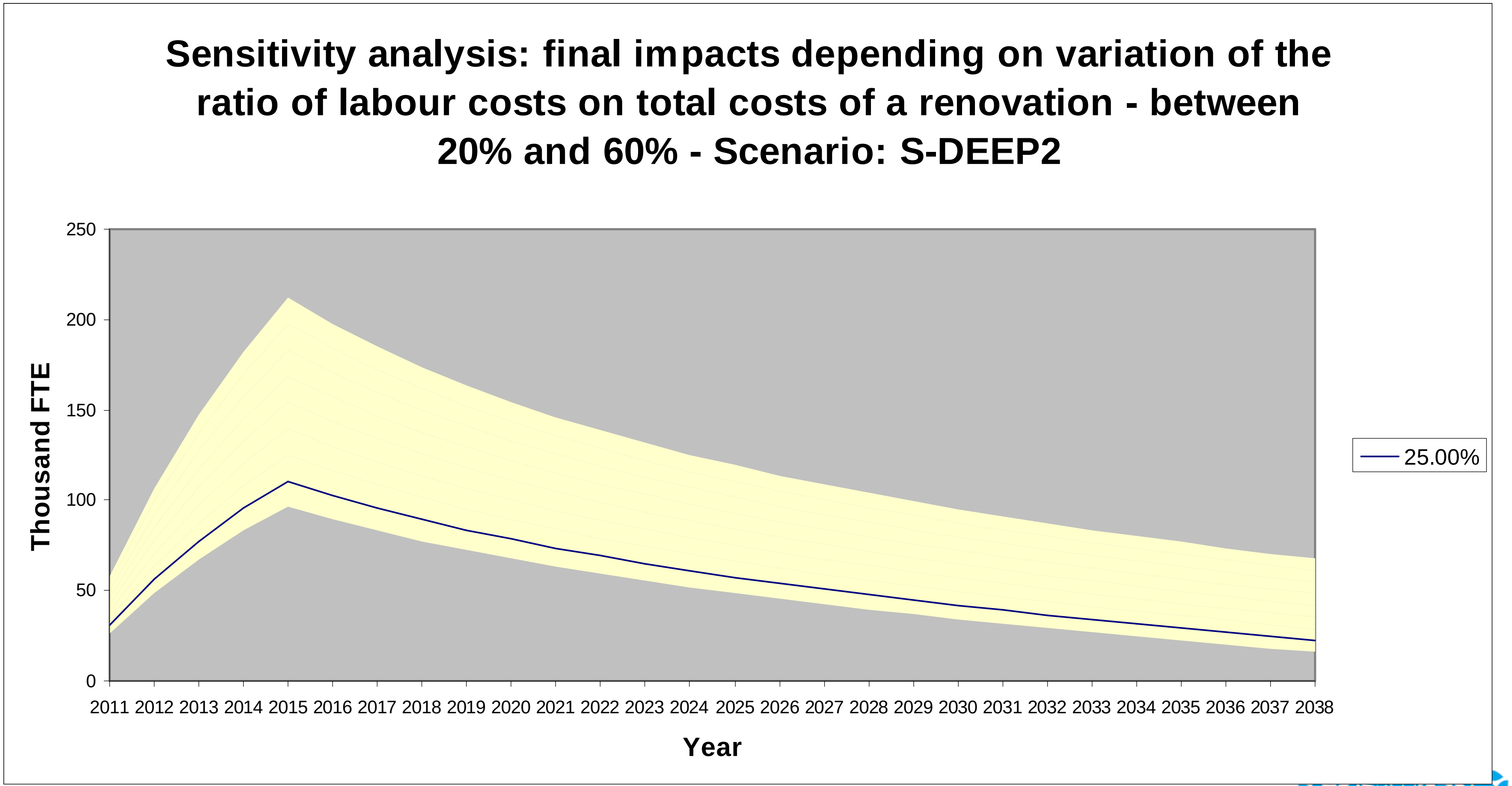
# Sensitivity analysis: variation of ratio labour costs / total costs

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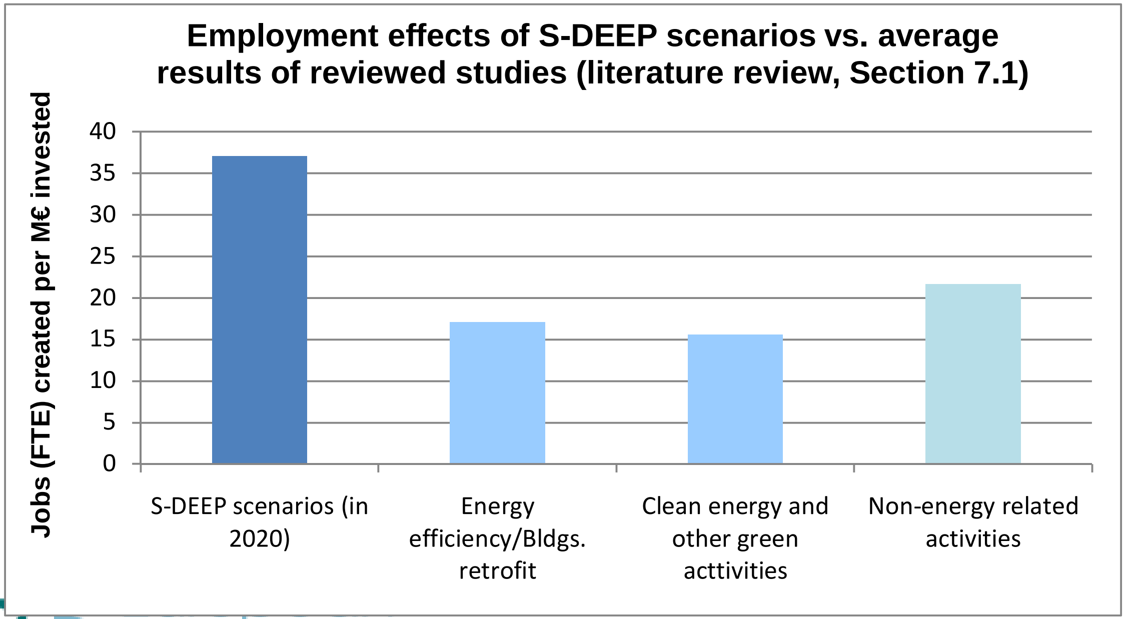
# Results compared with other investment initiatives

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

| Deep renovation scenarios | FTE generated (direct + indirect + induced) per M€ invested in 2020 |
|---|---|
| S-DEEP | 37.3 |
| Studies reviewed | |
| Energy effciency/Bldgs. retrofit | 17.07 |
| Other mitigation | 15.56 |
| Non-energy related activities | 21.64 |

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