A RETROSPECTIVE OF 35 YEARS OF OLD DWELLINGS REFURBISHMENT: WHAT AND WHO BENEFITS?

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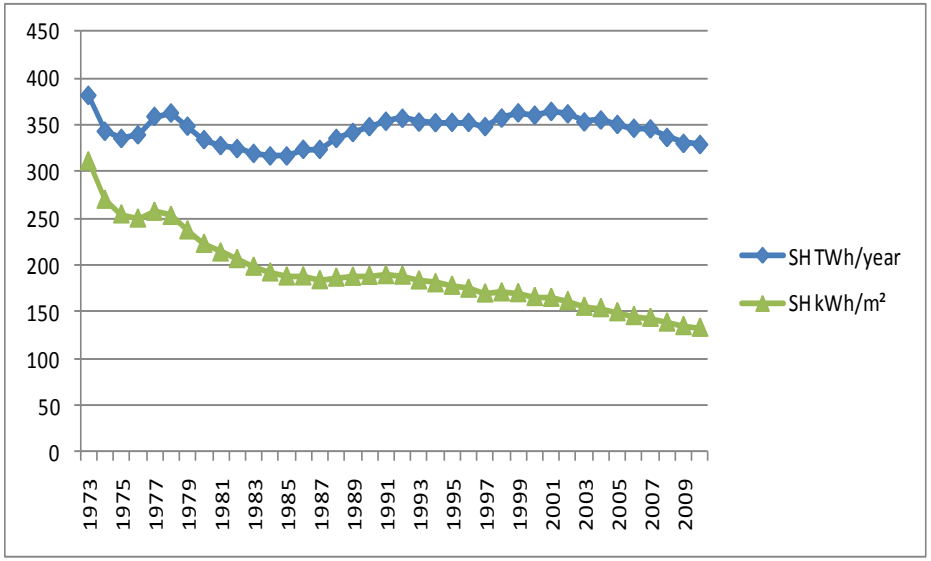
ENERGY EFFICIENCY AND DWELLINGS: THE TURN OF 1975

The 1973 trauma: first oil crisis:

- Beginning of energy consumptions statistics
- Implementation of first rules of energy efficiency for new dwellings construction focused on Space Heating (fossils, 85% of final energy dwelling consumptions)
- Spectacular decrease of unitary Space Heating (/m²) consumptions since 1973

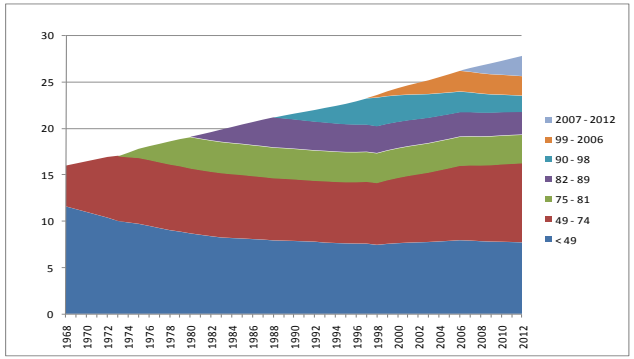
X 0.43 !!!



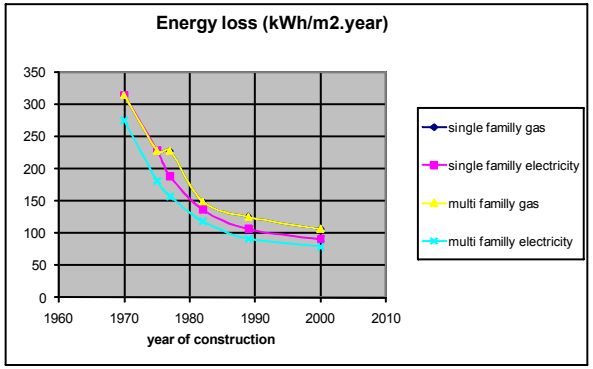
Evolution of total and unitary Space Heating (SH) consumption of Primary Residences stock
(source: CEREN, climate adjusted final energy: TWhfe/year and kWhfe/(m².year))

4 POSSIBLE CAUSES

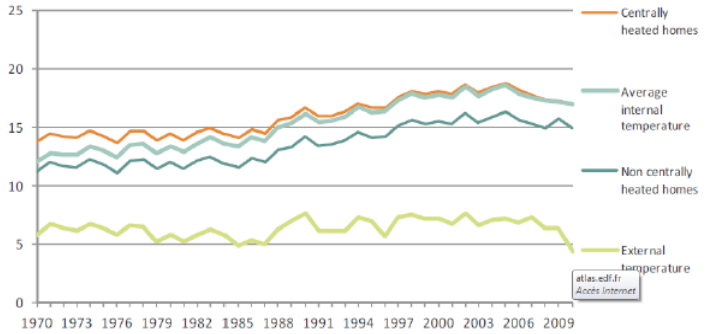
- Output (demolition, reallocation...) of dwellings from the existing stock
- Increase of energy efficiency requirements (thermal regulations) for new dwellings;
- Retrofitting of existing buildings;
- Changes in households' behaviour.



Evolution of French Primary Residences stock depending on the year of construction (million), *source: CEREN*

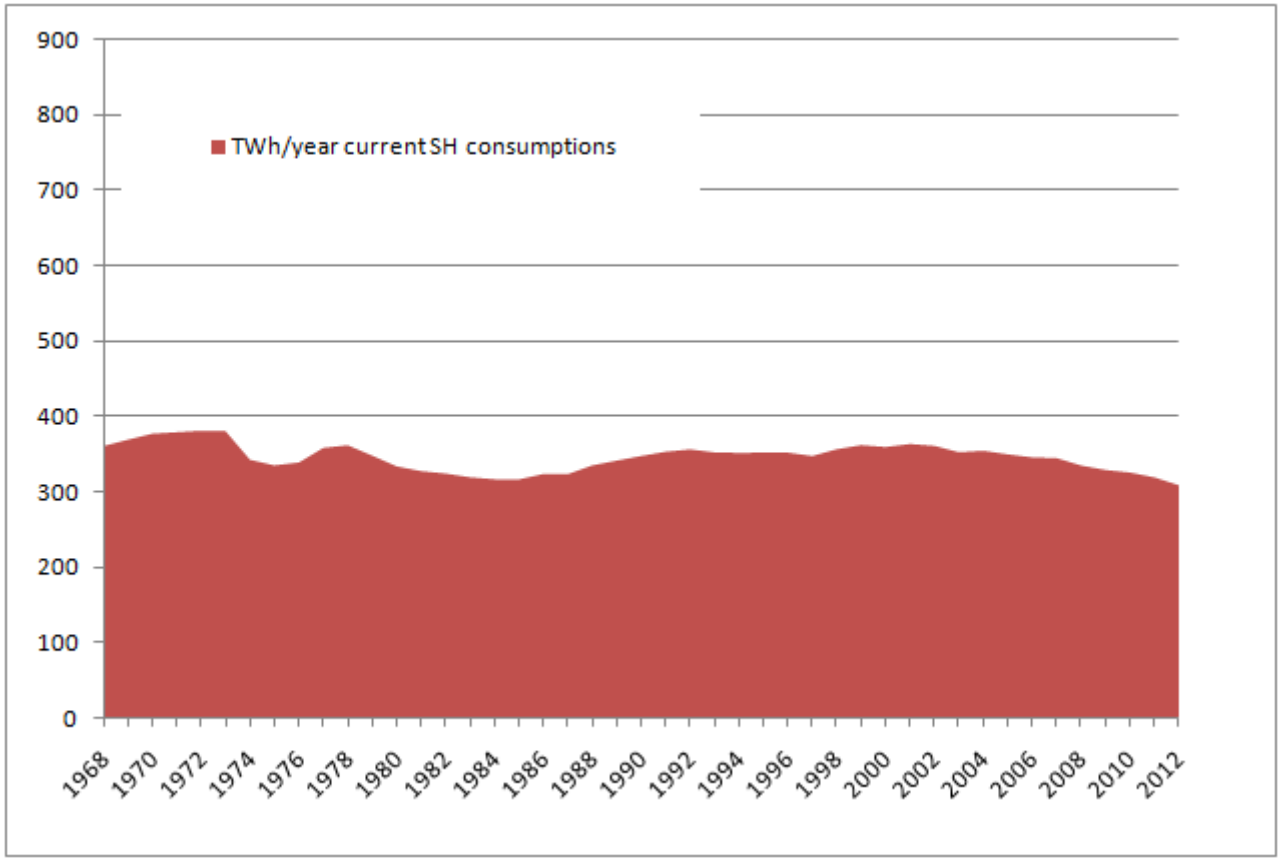


Evolution of building envelope and ventilation energy losses: obligations for French new dwellings 1975-2000 *(Duforestel, 2001)*



Evolution of average winter internal (calculated) and external temperature (°C) in UK homes *(Palmer, J., Cooper, I., 2012)*

EFFICIENCY IN NEW DWELLINGS VS REFURBISHMENT OF EXISTING ONES (SH)



Observed total Space Heating consumptions1973-2012 **(red)** (final energy, SH, France)

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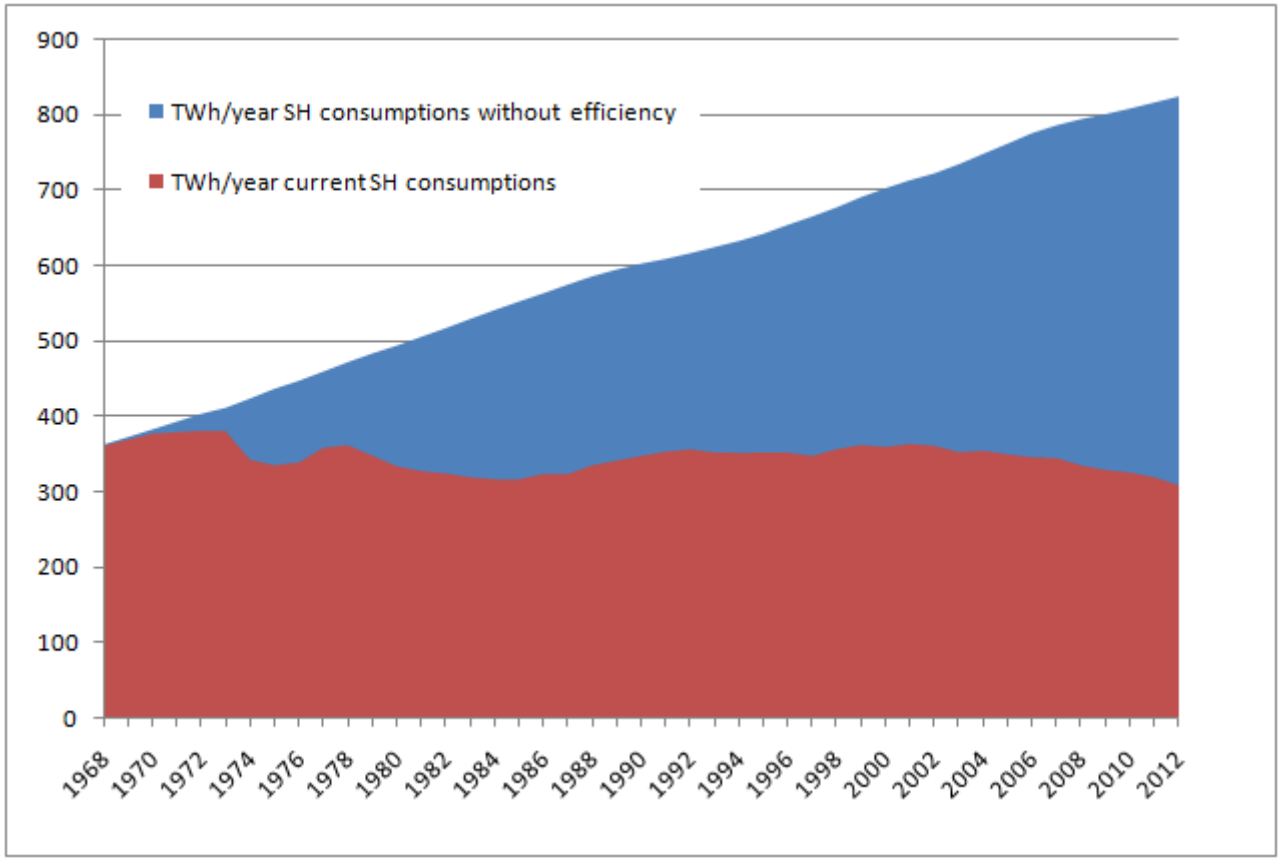

Without any change, total SH consumptions should reach 800 TWhef/year by 2012 **(blue)**

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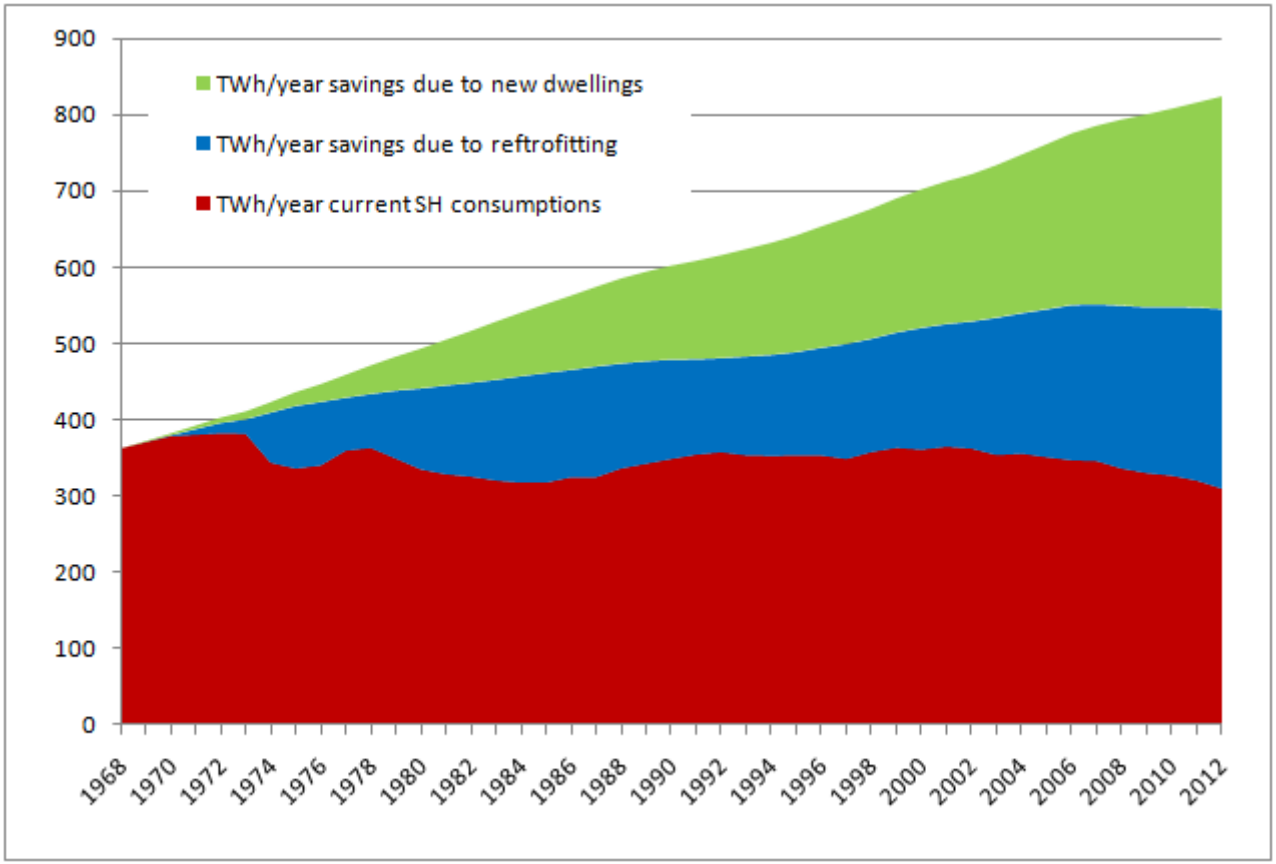
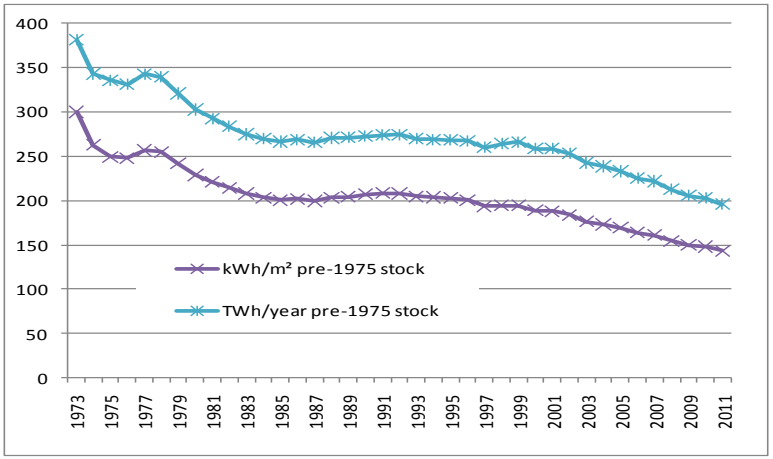


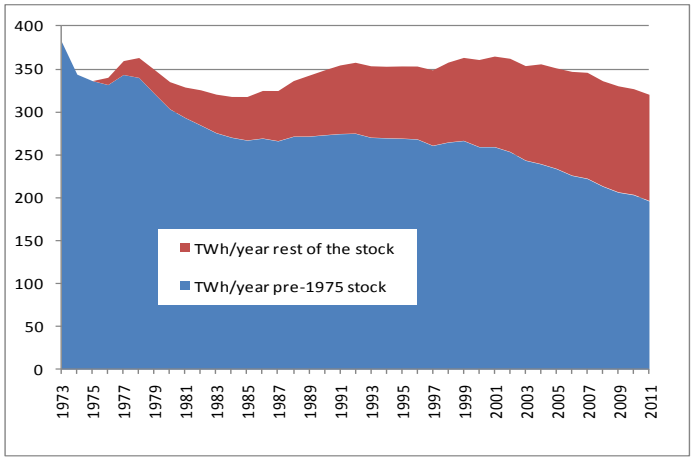
We can estimate real savings due to new buildings: ½ difference between observed and unchanged consumptions

FOCUSING ON PRE-1975 FRENCH DWELLING BUILDING STOCK (NO "NEW" EFFECT): SH

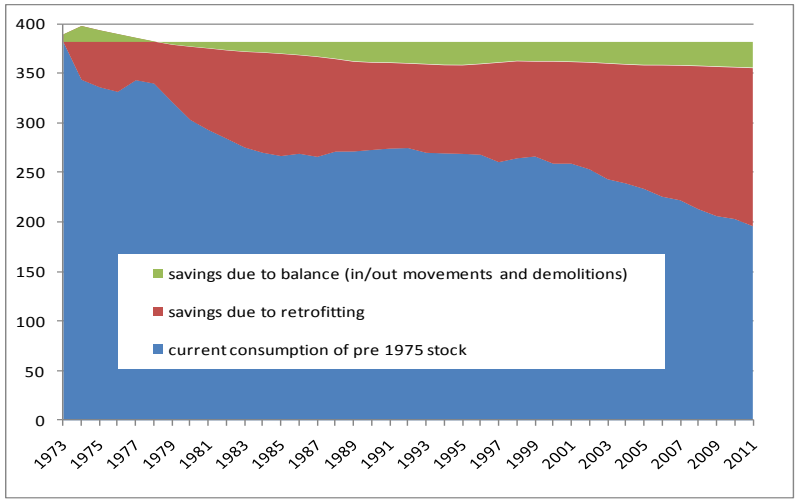


Evolution of unitary and total SH consumptions of pre-1975 dwelling stock *(final energy, source CEREN)*

X 0.58



Responsibility of pre-1975 dwelling stock compared to the whole stock in SH consumptions *(final energy, source CEREN)*

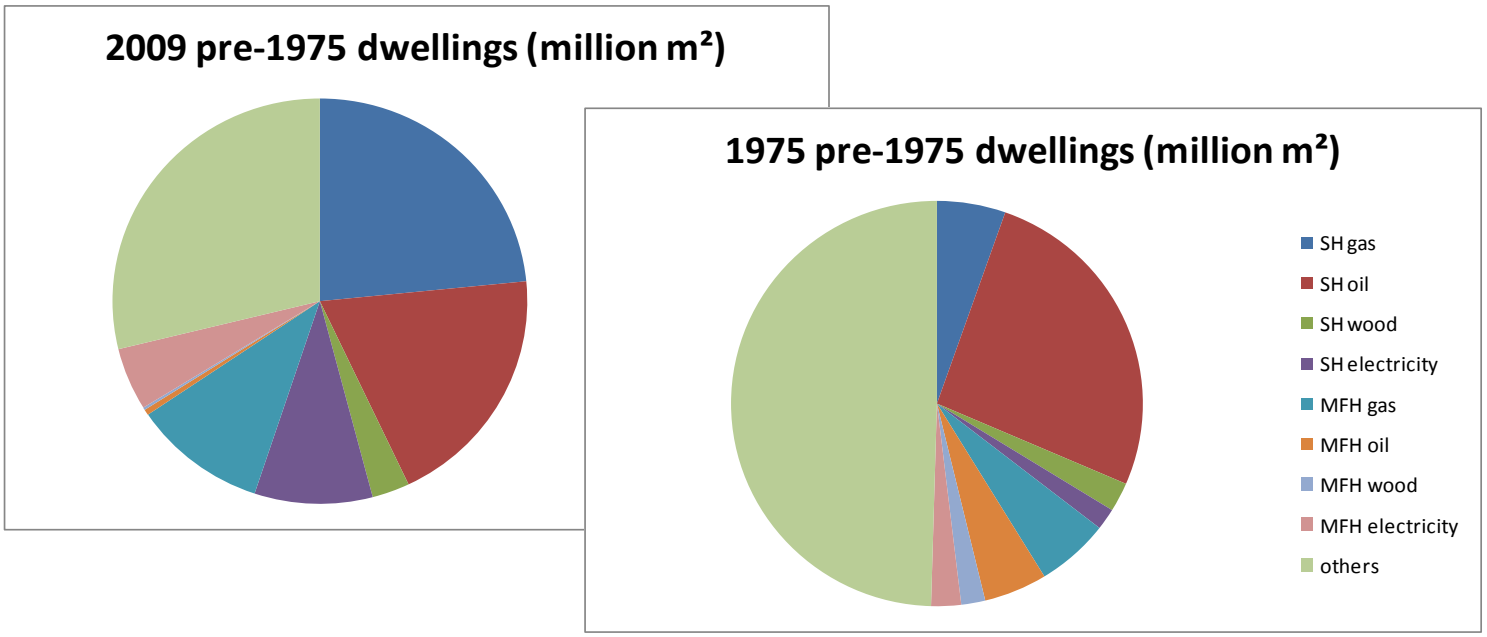


Evolution of pre-1975 dwelling stock SH consumptions: savings due to in/out movements and existing stock retrofitting *(PR, TWh final energy, source: authors calculations and CEREN data for current consumptions)*

EVOLUTION OF ENERGY EFFICIENCY VS COMFORT

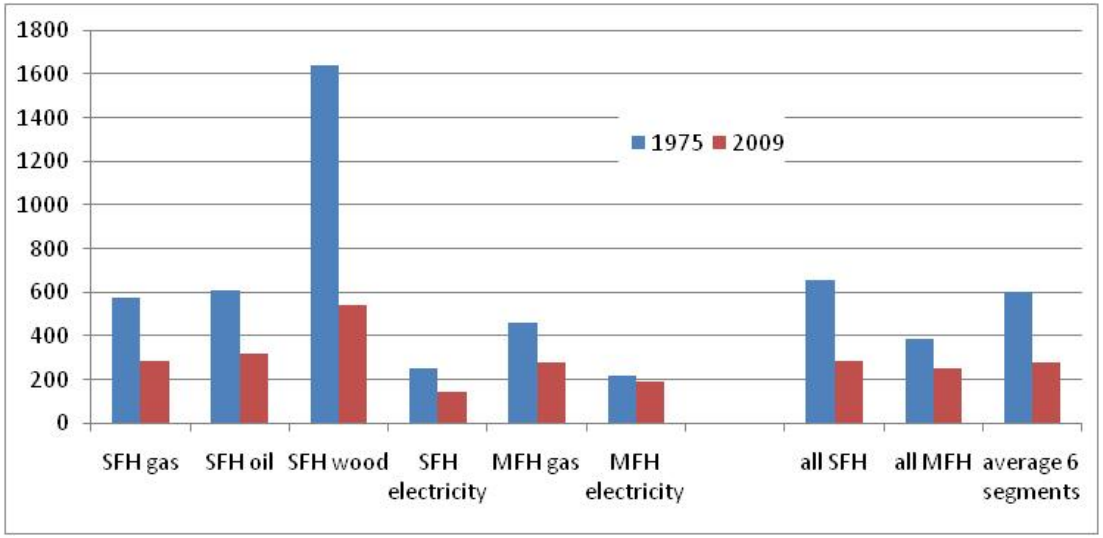
6 segments :

- SFH gas, oil, wood, electricity
- MFH gas, electricity



Evolution of pre-1975 dwelling stock: space heating energies
(source: authors calculations from CEREN data)

EVOLUTION OF ENERGY EFFICIENCY VS COMFORT



Pre-1975 dwelling stock EPC SH consumptions (6 segments) by 1975 and 2009 *(source: authors' calculations)*

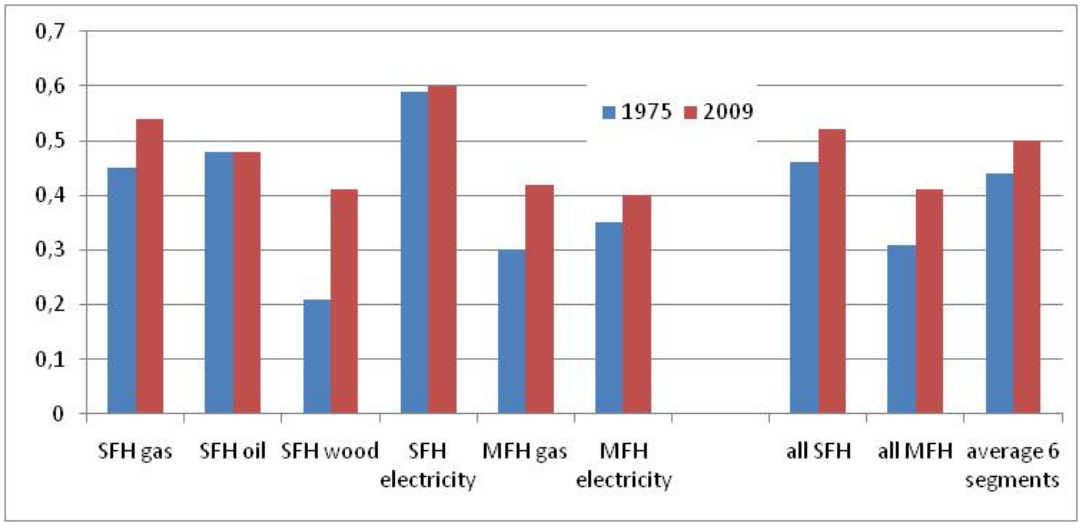
2009 survey:

- 2000 French HH → 900 HH
- pre 1975 PR
- EPC calculated 2009 and 1975 (no thermal insulation, 1975 SH equipment efficiency)
- assumption: no fuel switch between 1975 and 2009

Energy efficiency increase:

- average decrease of unitary theoretical SH consumptions: 64% (EPC)

EVOLUTION OF ENERGY EFFICIENCY VS COMFORT



Pre-1975 dwelling stock SHIF (6 segments) by 1975 and 2009

2009 survey:

- Space Heating Intensity Factor calculated 2009 and 1975 (SHIF: C Th/C real = C EPC/C real)
- assumption: no fuel switch between 1975 and 2009

Comfort increase:

- all segments have been improved, but with limited increase: (14%); 1975 and 2009 SHIF are very low: 0.44 → 0.5
- PR with smaller SH bills (MFH, gas) have experienced the best increase

YESTERDAY AND TOMORROW?

In the past 40 years:

- unitary SH consumptions decrease is spectacular
- renovation and new buildings regulations have the same level of impact
- pre-1975 dwellings SH consumptions:
    - due to retrofitting, energy efficiency have highly increased
    - but progress in comfort is limited

Remaining questions:

- is success of renovation due to building envelope insulation or increase of SH equipment efficiency?
- low SHIF are usually considered are promise of future important rebound effect, but SHIF were low by 1973 and still low by 2009:

→ for future scenarios including deep renovation, shall we consider small increase in comfort and very limited rebound effect?