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CENTRE FOR ENERGY POLICY

Making the case for supporting broad energy efficiency programmes: impacts on household incomes and other economic benefits

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Multiple benefits from household's energy efficiency

Residential energy services such as heating and lighting spaces are provided using physical energy inputs such as gas and electricity.

ENERGY POLICY – trade-offs between private and social returns

Individuals: benefit from comfort of energy services.

Society: preserve natural resources and limit carbon emissions, and make energy accessible to everybody.

BUT BOTH HAVE ALSO OTHER INTERESTS:

Individuals: consume non-energy goods and services.

Society: ensure economic development and overall welfare.



Multiple benefits from household's energy efficiency

CAN ENERGY EFFICIENCY HELP?

Energy efficiency improvements increase the output of energy services per unit of physical energy.

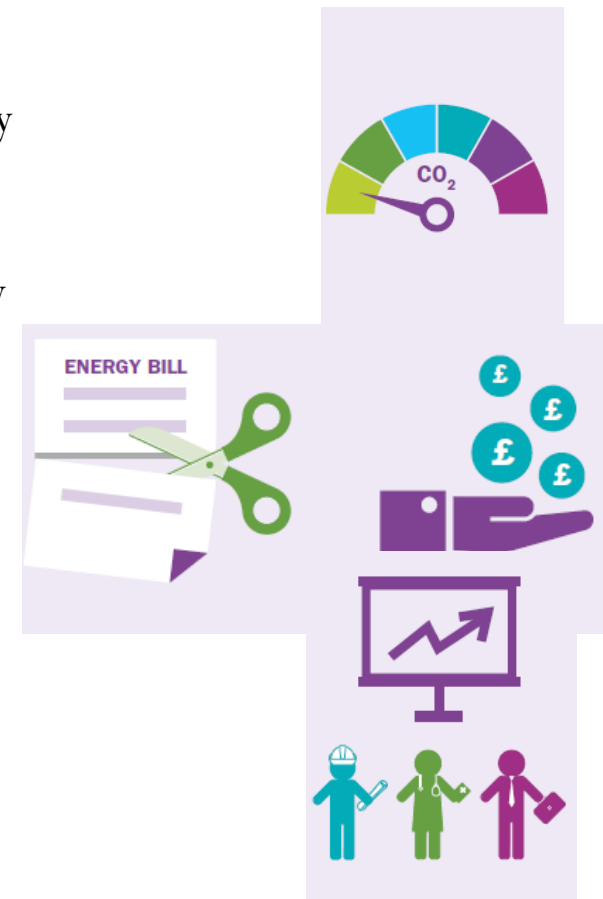
Individuals: they can achieve the same level of comfort from energy services using less input of physical energy (but there is a cost)

Society: more efficient use of energy means less use of natural resources and potentially reduced emissions.

BUT BOTH ALSO REALISE OTHER BENEFITS:

Individuals: have more disposable income to spend on other goods.

Society: higher demand for goods and services stimulates the economic system.



Multiple benefits and public support?

Consider multiple benefits (IEA, 2014) in context of a **general equilibrium** argument.

Economic expansion will potentially deliver more in terms of individual household economic well-being than the initial improvement in energy efficiency

When economy expands (through increased investment, employment and output) as a result of increased and reallocated real household spending, increased incomes from employment of labour and capital services will further boost household incomes

Potentially delivering a level of pay back that would **justify public support** required to allow the efficiency improvement to occur?

May be argued that macroeconomic expansion can be delivered through other policies - where energy efficiency policy requires the support of the public purse, focus on helping those households who are currently unable to heat their homes sufficiently.

Focus of modelling analysis

We consider a **government funding argument** for UK – context of a government that requires to maintain a fixed public sector deficit so that any support for energy efficiency programmes must be of a balanced-budget nature

Funding programmes must come either from a reallocation of existing public spending or a change in tax revenues, at least in the short-term (until the costs of introducing the efficiency improvement have been recovered)

Is the **resulting expansion still large enough** to compensate for the impacts of falling government expenditure (in the areas where spending is reduced) or the distortions triggered by increasing tax rates in part(s) of the economy?

Likely to depend on extent of the efficiency improvement and what type and level of spending activity stimulated – low income household have (a) less spending power; (b) benefit less from boosted wage and capital incomes

UK-ENVI computable general equilibrium (CGE) model

- Multi-sector economy-wide CGE model of the UK national economy
- 2010 social accounting matrix
- 30 production sectors producing 30 outputs
- KLEM production functions – energy a distinct type of input
- Government budget can be constrained or not, expenditure/tax exogenous or endogenous
- Competitive goods markets
- Two exogenous regions – rest of the Europe (REU) and rest of world (ROW)
- UK and REU/ROW products imperfect substitutes (Armington assumption) and export demand responds to changes in prices

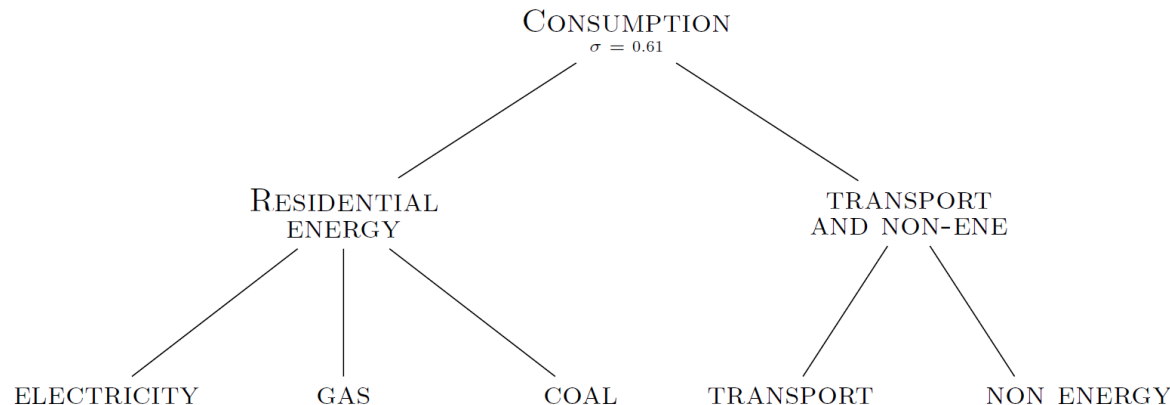
UK households divided into five income quintiles

Myopic decision-makers (firms' investment decisions forward looking)

Household consumption and government budget balance

$$C_{h,t} = YNG_{h,t} - SAV_{h,t} - HTAX_{h,t} - CTAX_{h,t} \quad (1)$$

$$C_{h,t} = \left[\delta_h^E (\gamma EC_{h,t})^{\frac{\varepsilon_h - 1}{\varepsilon_h}} + (1 - \delta_h^E) TNEC_{h,t}^{\frac{\varepsilon_h - 1}{\varepsilon_h}} \right]^{-\frac{\varepsilon_h}{\varepsilon_h - 1}} \quad (2)$$



$$\overline{GOVBAL_T} = GY_t - GEXP_T$$

where

$$GY_t = d_g KY_t + IBT_t + \bar{\tau}_t \cdot LY_t + \overline{FE}_t$$

(5)

Simulations

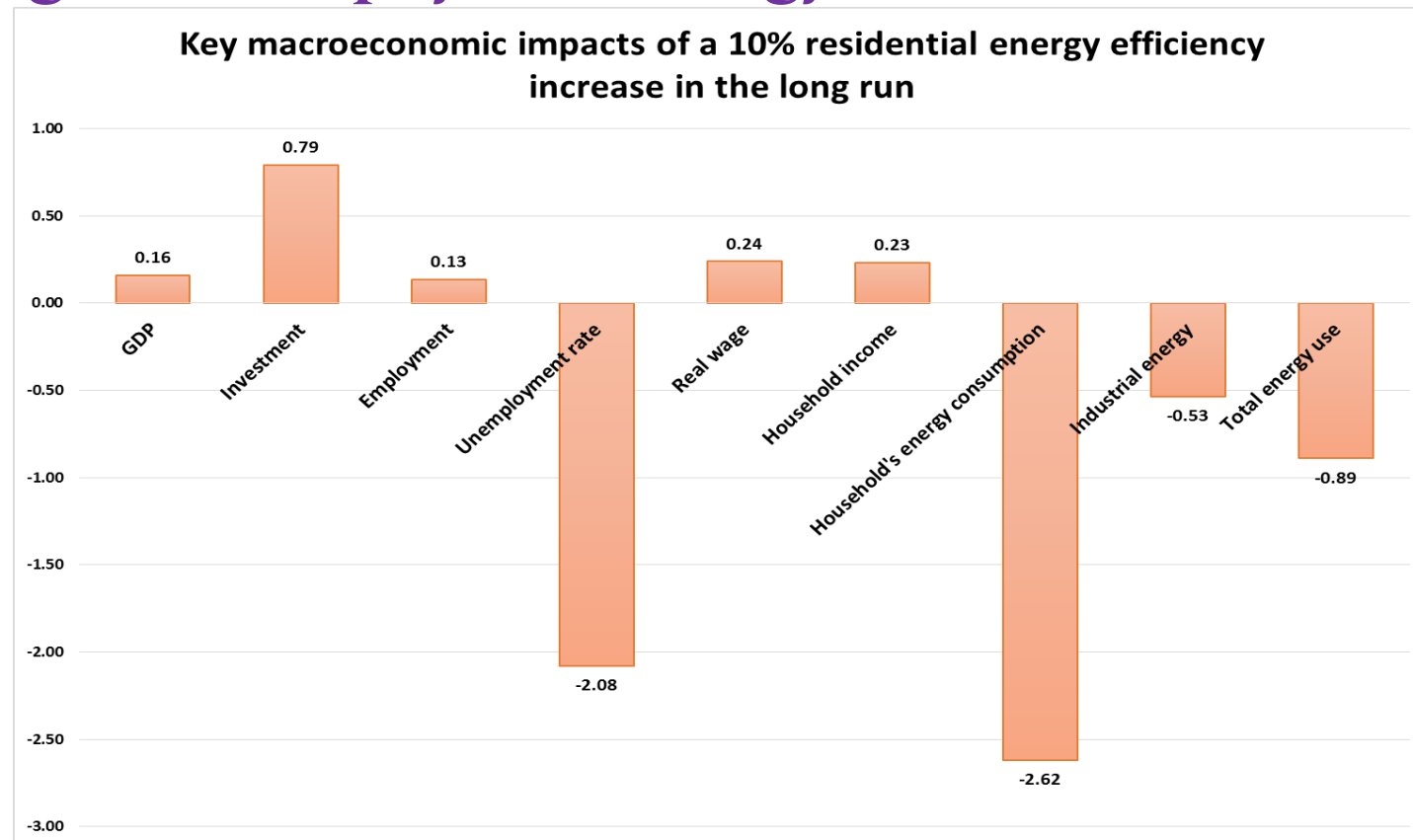
10% increase in efficiency in residential energy use – maintain same consumption using 10% less physical energy

All households or just lowest income band

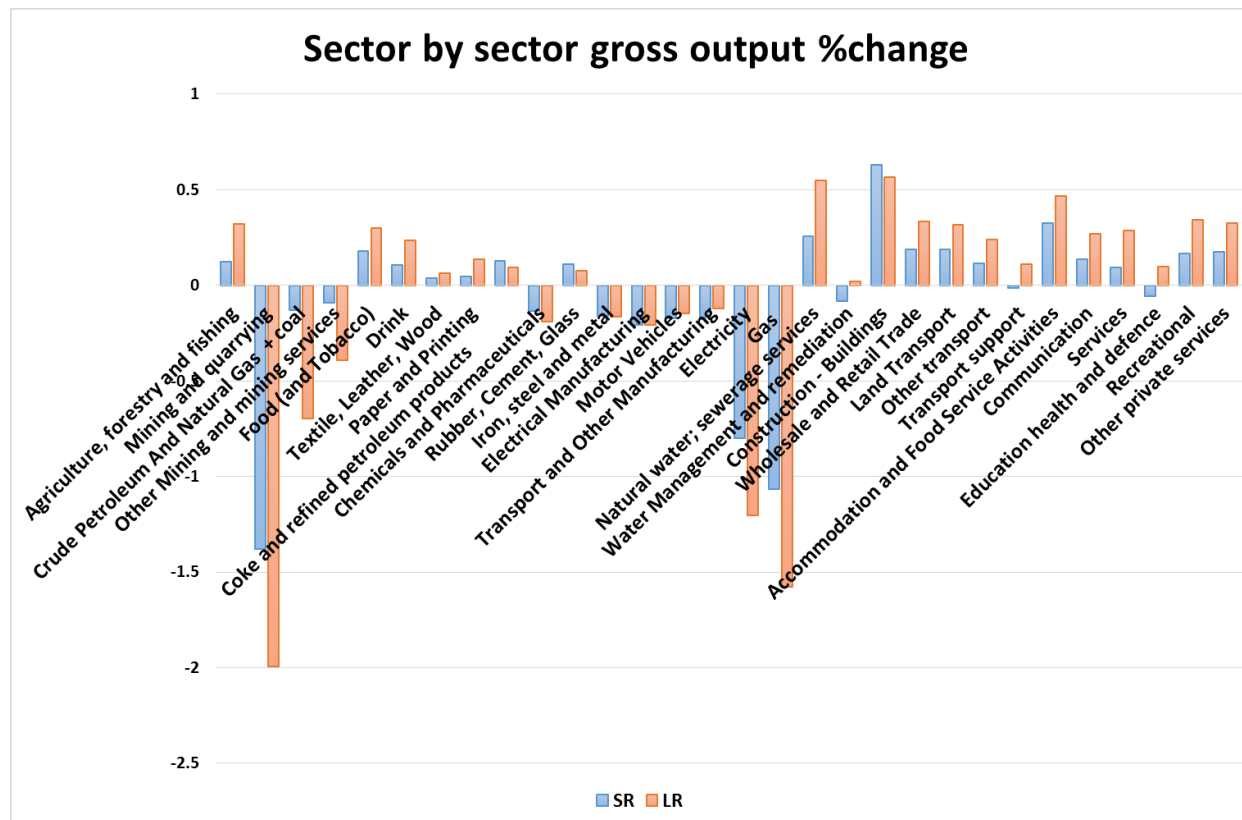
Costless vs. government funded – with no information on cost, simplifying assumption that govt. compensates for the difference in household energy expenditure before and after the efficiency increase, for a limited time period (5 years)

$$\overline{GOVBAL_T} = GY_t - GEXP_T + \Delta EC_t \quad (6)$$

What if all UK households could heat their homes using 10% less physical energy?



Crowding out – which industries win and lose?



That is great, but who is going to pay for it?

Ideally a Government would be able and willing to pay if:

Social returns are higher than **social costs**. This happens when:

- a) the energy efficiency programme deliver in terms of reducing energy use without sacrificing comfort;
- b) the energy efficiency programme triggers a net economic stimulus.

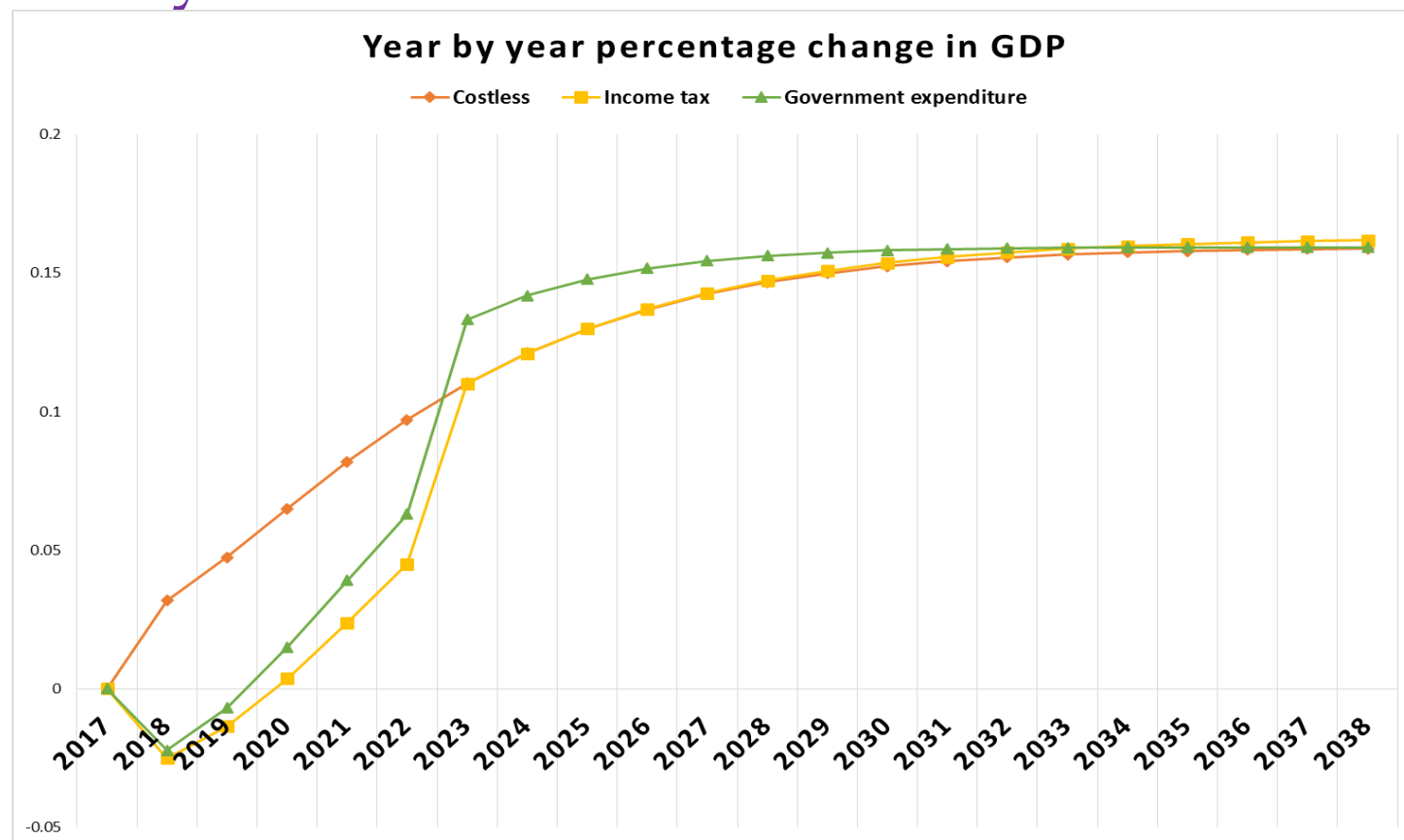
How would the Government pay (i.e. where does the money come from?):

Government spending re-allocation: the Government reduces expenditure on other items to fund households' energy efficiency improvements.

Taxation: The Government rises taxes on income to fund the energy efficiency improvement intervention.

Both this solutions are **temporary** until the intervention is payed (our analysis: after 5 years).

Impact on GDP of an energy efficiency improvement funded by the Government.



Is this worth doing?

Both solutions deliver in terms of energy reduction.... however:

There is a **trade-off across different time periods** in terms of economic expansion.

GDP expansion and all other impacts will come after 3 years but the Government (and public) may want to see results faster than this.

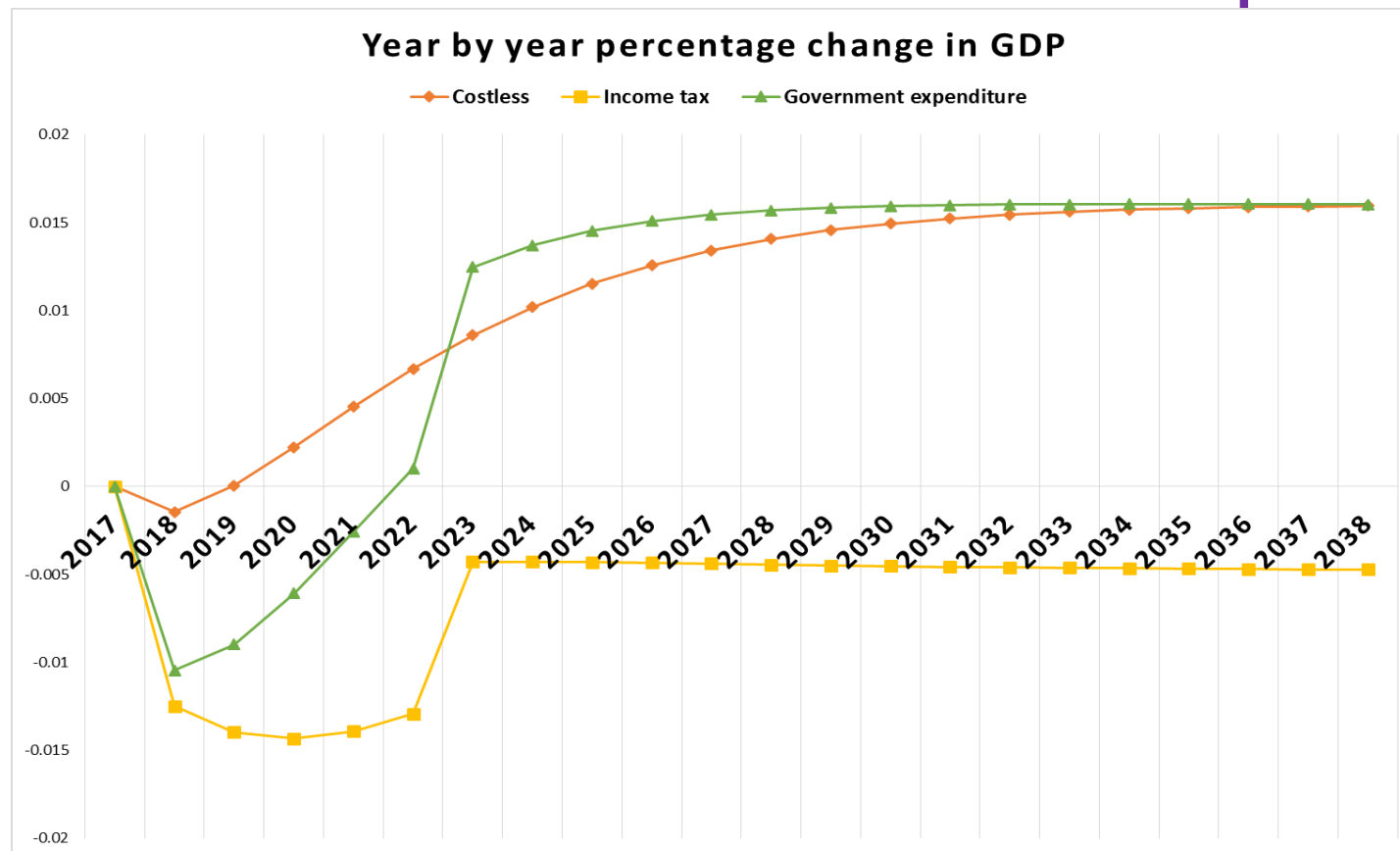
So the Government may think that it can get a better expansionary effect and the reduction in energy use from other policies.

The different roles of energy efficiency policy

1. A climate policy tool
2. (From above) an economic/infrastructure policy tool
3. Social policy

Due to budget constraints and/or political climate, Government may decide to focus funding of energy efficiency improvements where homes are inadequately heated and/or households are considered **fuel poor**.

Impact on GDP of a targeted energy efficiency improvement in lowest household income quintile



Is this worth doing?

Government spending temporary reallocation:

GDP starts rising in 2022, last year of payment.

In the longer term GDP expansion is **1/10** of the case where all households benefits of the energy efficiency improvement.

However the targeted group retains 80% of the disposable income boost they get when all households are more efficient (more limited income boost from economic expansion).

Income tax increase:

GDP decreases until 2023 when the income tax returns to its original level.

In the longer term GDP remains (even if marginally) below the baseline.

However again the targeted group retains 80% of the disposable income boost.

Conclusions and general lessons

1. Energy efficiency improvements in residential energy use **can deliver** both energy reduction and GDP expansionary effects.
2. Government funded interventions **will have a positive returns** (short to medium term) in terms of overall stimulus to the economy (interpret as **infrastructure investment?**)
3. The **larger** the base for the intervention, the **bigger** the stimulus.
4. Priority target limited to fuel poor and/or low income households?

The gains in terms of **impact on incomes** and **reduction in energy spending** as a share of this can still largely be achieved in these households.

However, the **economic expansion is much smaller**. This is because of the lower spending power of these households.



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Thank you for your attention – questions?

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