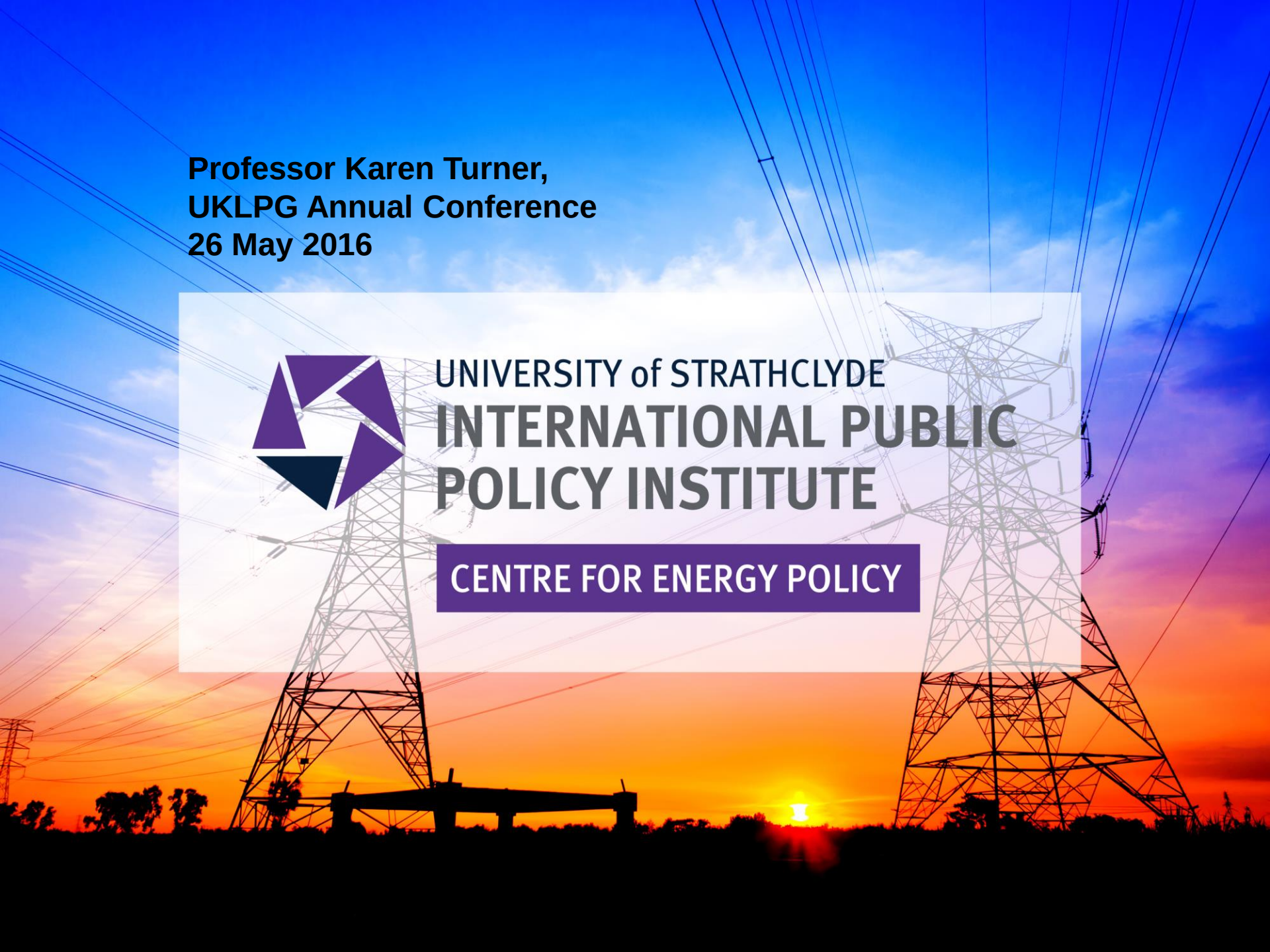


Professor Karen Turner,
UKLPG Annual Conference
26 May 2016

UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE

CENTRE FOR ENERGY POLICY

Role of low-carbon energy services in decoupling rebound and economic benefits of energy efficiency

KAREN TURNER

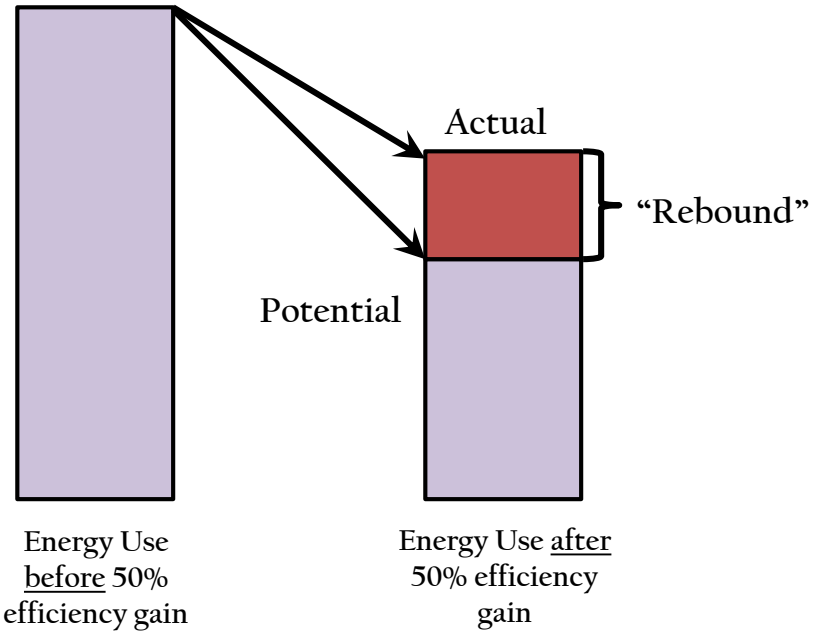
UKLPG ANNUAL CONFERENCE, 26 MAY 2016

PROJECT TITLE: 'ENERGY SAVING INNOVATIONS AND ECONOMY-WIDE REBOUND EFFECTS'

PROJECT WEB-SITE:
HTTP://CIED.AC.UK/RESEARCH/IMPACTS/ENERGYSAVINGINNOVATIONS

EPSRC GRANT REF. EP/M00760X/1

What is rebound?



UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE
CENTRE FOR ENERGY POLICY

What is rebound?

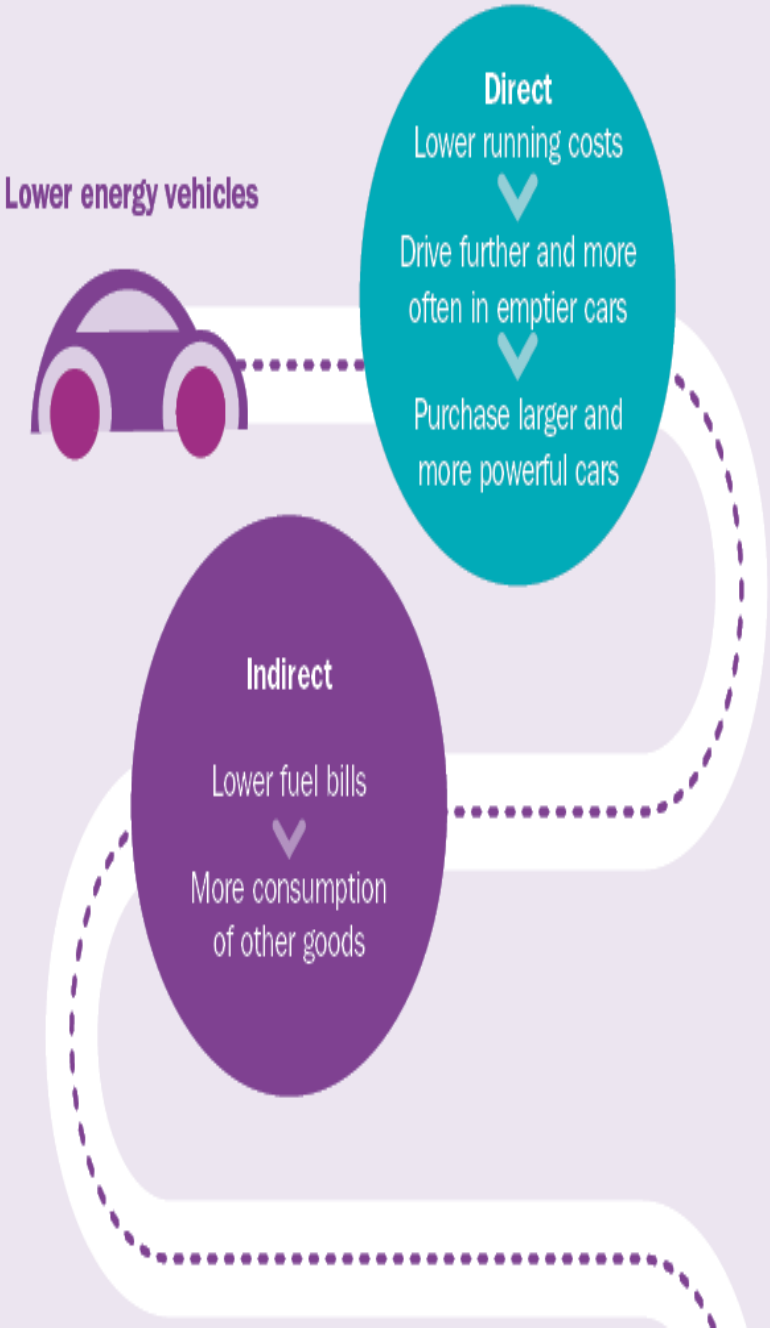
- Rebound triggered by fact that reduced physical energy requirement reduces price of delivering energy service
- Most obvious is ‘direct rebound’ – e.g. costs £X less to run heating at 20 degrees for 1 hour, we may heat the house for longer and/or higher temperature
- But will trigger series of economic responses
- Zero rebound would imply no economic response whatsoever

Direct

Cost-effective efficiency improvements make energy services cheaper, thereby encouraging increased consumption of those services.

Indirect

Cost savings from energy efficiency improvements may be spent on other goods and services whose provision involves energy use and emissions at different stages of their international supply chains. For example, savings on gasoline bills may be used to purchase laptops made in Asia and shipped to the UK.

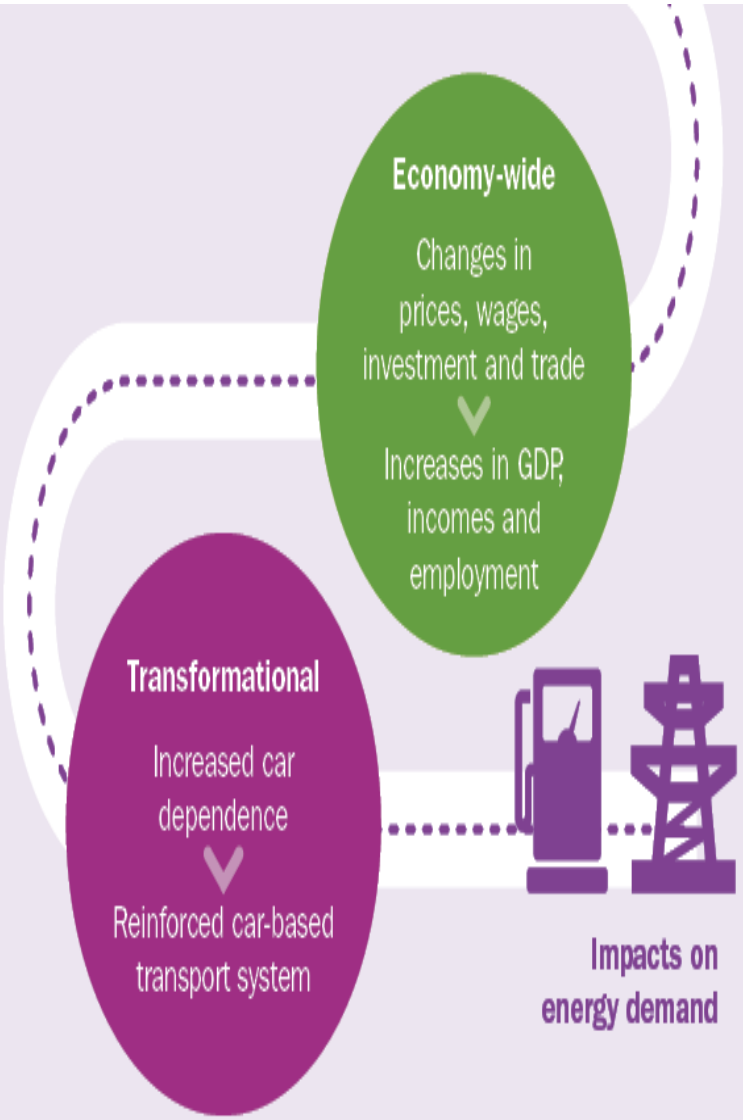


Economy-wide

Shifts in consumption patterns may trigger multiple changes in prices, investments and incomes in both domestic and international markets. Energy efficiency improvements by firms may lower output prices, boost productivity and competiveness, encourage economic expansion and thereby increase energy consumption.

Transformational

In some cases, efficiency improvements may help open up markets for new technologies and systems, triggering entirely new energy-using applications, products and industries.



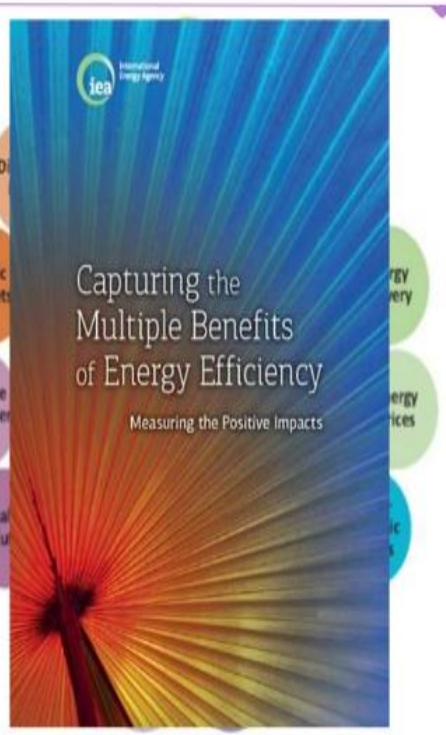
Impacts of low-energy innovations are uncertain and often unexpected.

UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE

CENTRE FOR ENERGY POLICY

EE has multiple benefits

DATABUILD



IEA (2014), *Capturing the Multiple Benefits of Energy Efficiency*, OECD/IEA, Paris.

UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE
CENTRE FOR ENERGY POLICY

Multiple benefits

- Primary aim – cost effective energy efficiency improvements to deliver energy savings/reduced energy use at sectoral and economy-wide levels

- Issue of 'rebound' effects triggered by decrease in price of energy service
  - E.g. more efficiency boiler example
  - May not be a 'bad thing' if homes under-heated
  - Real income boost, reduced spend on energy - fuel poverty implications

- Trigger for a stimulus to the wider economy

- Where efficiency increases in energy use on production side of economy – productivity-led expansion
- Where efficiency increase in household energy use – demand-led expansion

- Change in ***what*** is consumed
- And ***level*** of consumption – incomes boosted by falling energy costs and increased economic activity

European Commission

Science for Environment Policy

SfEP Logo.jpg

Household energy efficiency could help boost the economy

Improving the energy efficiency of homes could have positive economy-wide impacts, recent UK research suggests. It would allow householders to spend the money they save on energy on other products and services. Although this additional demand and the associated production in non-energy sectors would partly offset the energy saved in the home, this 'rebound effect' does not completely outweigh the household energy savings.

June 2015
Thematic Issue 49

Exploring the Links between Energy Efficiency and Resource Efficiency

This study explored the links between increased energy efficiency of UK households and the wider UK economy using 'general equilibrium' modelling. In particular, researchers investigated a potential 5% improvement in energy efficiency, which they assumed would occur as a result of technological improvements (e.g. more efficient appliances) that allow a household to continue operating at the same capacity, but using less energy.

Financial savings from this lower energy use will probably mean that householders use their appliances more than before, creating 'direct rebound effects'. This study also considered 'indirect rebound effects'. These occur because the cost savings allow householders to spend more money on goods and services other than energy. The energy used by other sectors that provide these goods and services can reduce the overall benefits of the initial improvement in household efficiency. To understand these rebound effects, the researchers assessed the energy usage of 21 economic sectors. These included four energy sectors (1. coal; 2. refined oil (and also nuclear fuel that goes to the electricity generation sector - analysed together with oil, as these two sectors were integrated in the study's source of data); 3. gas; 4. electricity) and 17 other sectors, including food, textiles/clothing and finance.

The model's results suggest that the 5% improvement would have positive effects on the national economy, because increased real income and spending on non-energy sectors has a

Source: Lecca, P., McGregor, P. G., Swales, J. K., & Turner, K. (2014). The added value from a general equilibrium analysis of increased efficiency in household energy use. *Ecological Economics*. 100, 51–62. Doi:10.1016/j.ecolecon.2014.01.008.

UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE
CENTRE FOR ENERGY POLICY

Our research question

- Working with multi-sector economy CGE model
- Similar to HMRC model used by DECC, AMOS model used by Scottish Government

- **Can we decouple economy-wide rebound and economic expansion?**

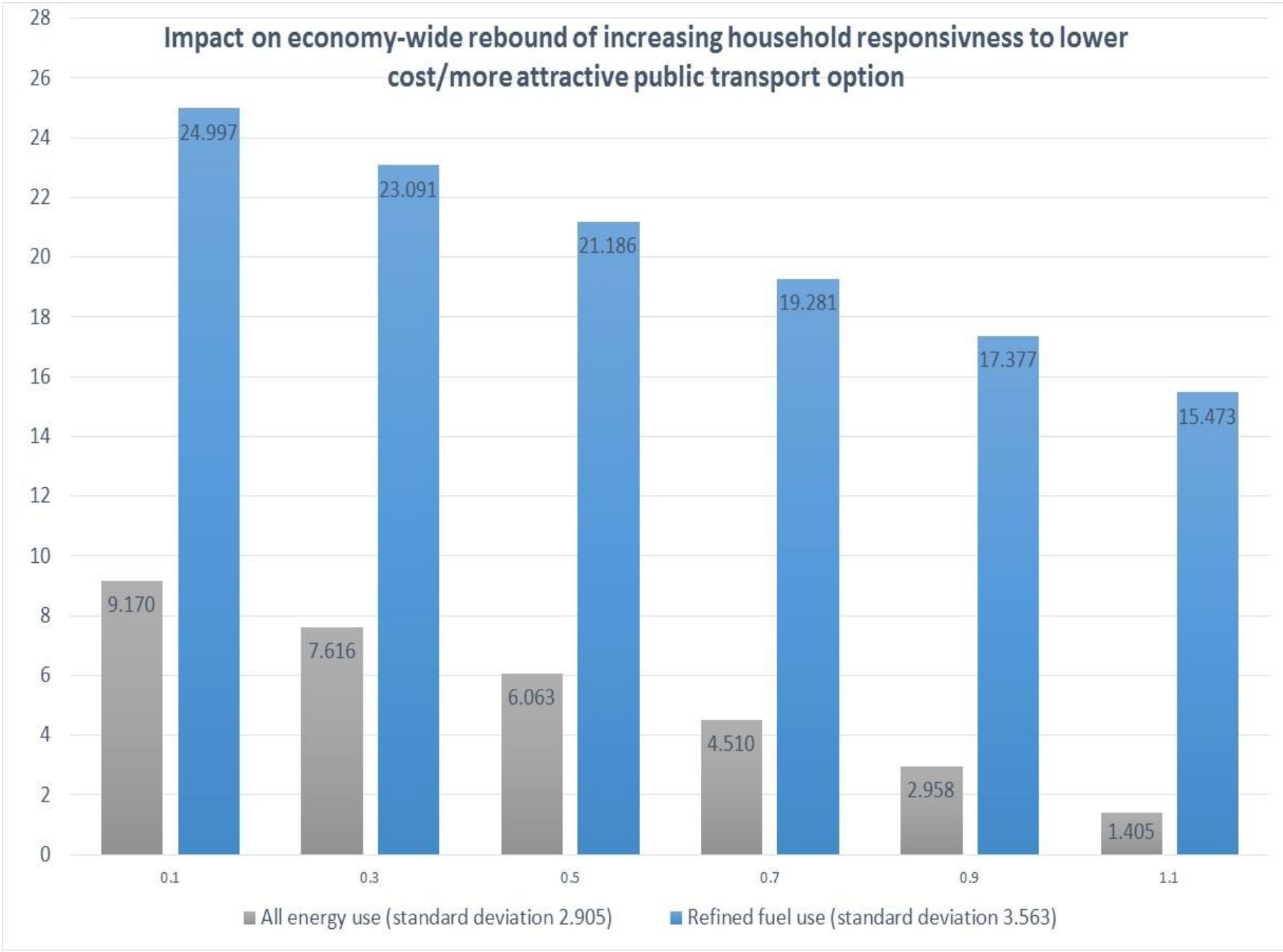
- Economy-wide rebound driven by same processes as economic expansion
- Does this make rebound a necessary ‘evil’?
- **Can we reduce rebound without sacrificing macroeconomic benefits of increased energy efficiency?**
- Focus of energy efficiency often simply on the most energy intensive activities
- **What if we increase energy efficiency in something that is a competitor for a relatively energy-intensive activity?**

UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE
CENTRE FOR ENERGY POLICY

Public vs. private transport

- Experiment with UK CGE model: increase energy efficiency in UK ‘Road and Rail’ public (and freight) transport sector
- Delivers expected benefits of a productivity led expansion – positive impact on GDP, aggregate investment, employment, exports, household income and consumption
- However, expansion accompanied by rebound in energy use across economy

- Focus in model on household choice between public vs. private options in delivering transport service
- The more households respond to change in relative price of public over private options that may result from energy cost savings
- Or cost savings could be used to improve attractiveness of public option in another way


Impact on economy-wide rebound of increasing household responsivness to lower cost/more attractive public transport option
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
24.997
23.091
21.186
19.281
17.377
15.473
9.170
7.616
6.063
4.510
2.958
1.405
0.1
0.3
0.5
0.7
0.9
1.1
All energy use (standard deviation 2.905)
Refined fuel use (standard deviation 3.563)

UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE
CENTRE FOR ENERGY POLICY

Key result

- As we make households more willing to substitute in favour of public option
- Economy-wide rebound reduced while retaining macroeconomic benefits

- Key – ***composition*** of household transport activity
- Dematerialisation agenda – focus on efficiency of delivery (and use) of energy (using) ***service*** options to deliver low carbon expansion

- Could the same argument apply to delivery of heating services?
- Gas vs. low carbon electricity?
- **Off-grid: oil vs. LPG?**

UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE
CENTRE FOR ENERGY POLICY

More general conclusion

- Further exploration of hypothesis need not be limited to *energy* efficiency?
- A broader efficiency and competitiveness argument
- Broader social benefits/externalities of making low carbon technologies more competitive
- Counter argument to 'limits to growth'
- Sustainable/low carbon economic development problem about the composition rather than level of economic activity
- Focus on *demand for service* rather than demand for fuel itself
- Technologies with low energy/carbon properties *relative to other means of delivering service*….
- …can deliver wider social benefits through economic expansion with *lower and less damaging rebound effects*

Research Councils UK Energy For a Low Carbon Future

UNIVERSITY of STRATHCLYDE
INTERNATIONAL PUBLIC POLICY INSTITUTE
CENTRE FOR ENERGY POLICY

Thank you for listening!

karen.turner@strath.ac.uk

http://cied.ac.uk/research/impacts/energysavinginnovations

University of Strathclyde Business School
FRASER OF ALLANDER INSTITUTE

Centre on Innovation and Energy Demand