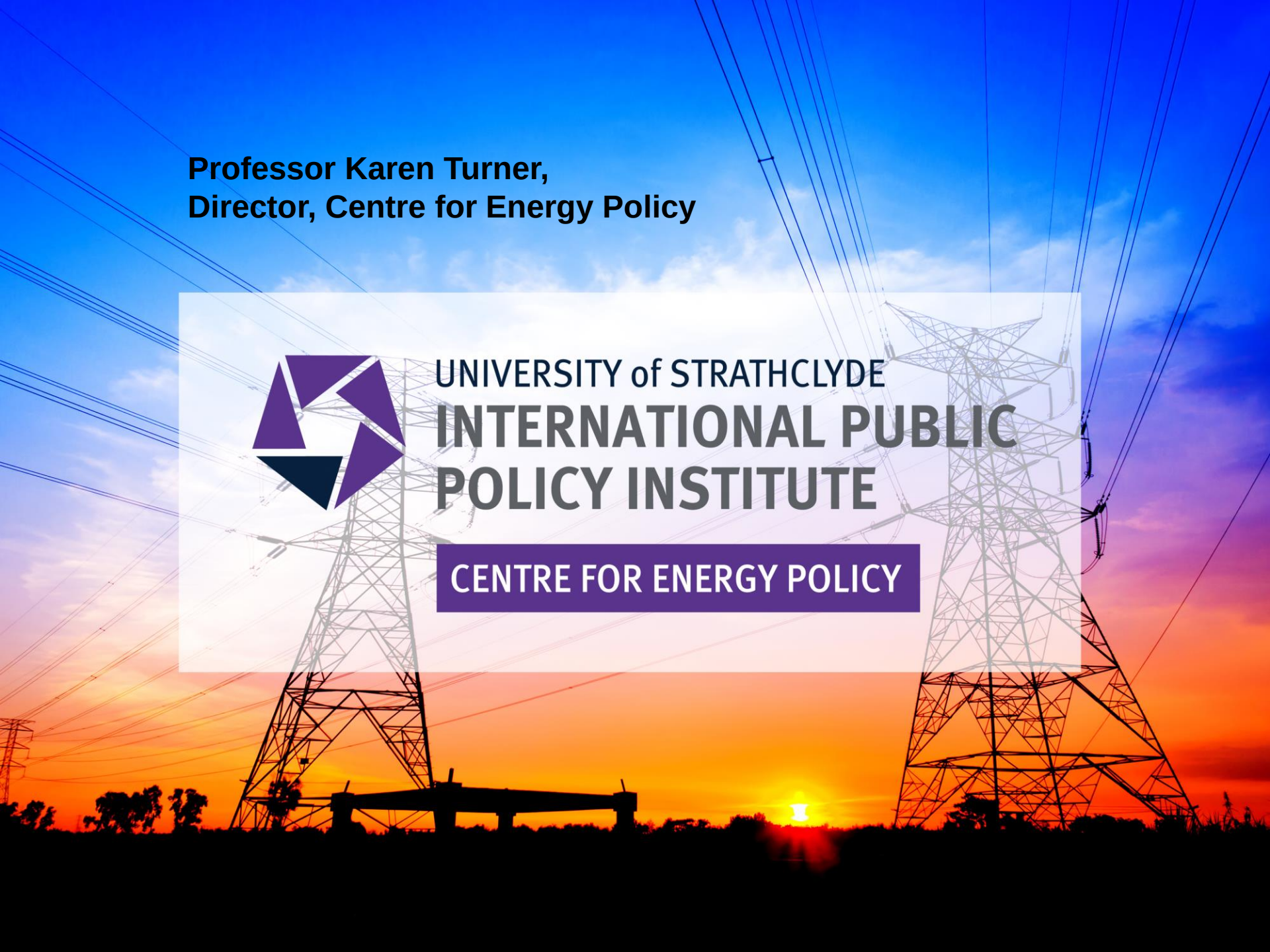
Professor Karen Turner,
Director, Centre for Energy Policy



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The third of the EU 20-20-20 targets:

A 20% improvement in the EU's energy efficiency

ECONOMIC BENEFITS OF ENERGY EFFICIENCY AND REBOUND EFFECTS?

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The best solution?

- IPCC and WEC conclusion: By 2030 energy efficiency gains will provide a substantial part of the remedy for climate change
- Reducing global energy consumption by app. 30% below where it would otherwise be, almost offsetting projected economic growth-driven energy consumption increase
- Stern report states that the “technical potential for efficiency improvements to reduce emissions and costs is substantial”
- Cites IEA finding that the “energy efficiency has the potential to be the biggest source of emissions savings in the energy sector”
- UK Energy White Paper (2003) described energy efficiency as “the cheapest, cleanest and safest way of addressing our energy policy objectives”

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A problem of 'rebound?'

- Implementation of energy saving technological improvements triggers economic processes that may cause some degree of 'take back' or 'rebound' in expected energy savings
- If changing technology allows us to extract the same level of energy service (e.g. heating our buildings or running vehicles, machinery etc.) using less physical input of energy
- Means we have a *reduction in implicit/effective price of energy*, or **price/cost of the energy service** in question
- In the household sector, may lead us to use more of the service (e.g. turn up the heating)
- And/or to allocate the **savings/increased real income** to use of something else (luxuries and/or necessities) that has energy embedded in its supply chain
- In industry/production, reduced input costs may permit lowering of prices and/or lead to **improved competitiveness** and more production, and energy use, up- and down-stream

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How much of a problem?

- Rebound is triggered by the initial change in the price of an energy service
- Ripple effects as incomes and other prices change – response builds from direct to 'indirect' and economy-wide' rebound in a wider set of energy uses
- One suggestion to 'counter' rebound – offset the initial energy service price trigger through, for example, a tax on energy use
- ***But are we sure we want to counter/stifle the rebound trigger?***
- Rebound *will* cause us to lose some of the energy savings that may be expected (from an engineering perspective) when we introduce energy saving technologies
- But energy saving is just one (albeit very important) dimension in a wider range of potential benefits from improved energy efficiency
- Key point: the rebound trigger is also a trigger for economic growth processes

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Rebound research

- International research field, with early focus on ‘direct rebound’ (energy use directly targeted by efficiency improvement) and concern over potential ‘backfire’
- Increasing attention on ‘indirect rebound’ in household context (how do households spend what they save?) - using economy-wide multi-sector input-output models
- And on ‘economy-wide rebound’ as a result of growth processes as prices and incomes start to change – using multi-sector computable general equilibrium (CGE) models
- Common dominant focus on impacts on energy use and/or carbon emissions
- Rather than accompanying economic benefits
  - E.g. rebound *is* likely to be greater the more energy-intensive the activity where efficiency improves, but what of the income benefits if this is the activity of a low income household?
- Premise/hypothesis that magnitude of rebound will increase as we consider a wider set of energy uses and/or expand boundaries of the economy
  - E.g. rebound *is* likely to be greater in a domestic context if competitiveness improves in exporting sectors, but does presence of trade necessarily mean that rebound will be a problem at a global level?

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Our rebound research

- Modelling team at the Fraser of Allander Institute, University of Strathclyde involved in UKERC study on rebound in 2007 following questions raised in a House of Lords report in 2005
- Led to ESRC-funded project at Strathclyde (Fraser of Allander Institute):
  - *An empirical general equilibrium analysis of the factors that govern the extent of energy rebound effects in the UK economy'*
- Focus on economy-wide impacts of energy efficiency improvements in one part/sector of the economy - UK and Scottish case studies
  - Including input to Scottish Government funded FAI study: *The impact on the Scottish economy of reducing greenhouse gas emissions in Scotland*
- Collaboration with ZEW Centre for European Economic Research in Mannheim Germany
  - IPPI occasional paper: *International spillover and rebound effects from increased energy efficiency in Germany*
- Advisory role on IEA 'Multiple Benefits of Energy Efficiency' project
- New EPSRC funded project in collaboration with CIED, University of Sussex
  - *Energy Saving Innovations and Economy-Wide Rebound Effects*

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Our key findings to date:

1. The nature and magnitude of rebound is an empirical problem – depends on (a) nature of efficiency improvement and (b) structure of the economy and economic conditions

2. Nature of economic response differs depending on whether efficiency improves in household or industrial sectors – demand-driven vs. productivity led growth

   – In household case, impact on competitiveness and ultimate macro-level outcome depends crucially on how/if cost of living implications of energy efficiency improvements are reflected in wage demands

3. Rebound from industrial energy efficiency will be accompanied by net economic benefits: improved competitiveness, increased GDP, total employment and investment

   – Same processes as improved efficiency in any input
   – However, in the case of energy, there are two issues:
   ➢ Generally a less important/smaller scale input to production than capital or labour
   ➢ A ‘produced’ input – need to consider impact on/response of energy producers

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Key findings (cont..)

4. ‘Negative’ indirect rebound pressure where supply chains impacted by reduced energy demand are more energy intensive than those for goods and services savings/increased incomes may be (re-)directed

5. Response of energy suppliers to changing demand, prices and revenues is crucial
   - Impact on investment, capacity and pricing decisions over different time frames
   - We found that ‘disinvestment’ effect dampens rebound over time

6. In an global economy context, energy efficiency improvements in one country *will* impact energy demand (and supply) in others
   - But this may not mean increased rebound
   - While other policy approaches that take direct action to reduce energy use may inadvertently cause energy use to reallocate to other countries (e.g. ‘pollution haven’ hypotheses involving ‘carbon leakage’ to countries with more relaxed energy/environmental policies)
   - As a result of changes in comparative advantage, **policy actions to support cost effective implementation of more energy efficient technologies may have ‘negative leakage’ effects, drawing energy use to more energy efficient locations**

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Current/future research

Our new EPSRC project furthers our energy efficiency research, focussing particularly on:

- Responses of energy suppliers in terms of capacity, investment and price decisions – including consideration of regulatory context
- How household energy efficiency decisions are linked to use of durable goods (e.g. boilers, cars) and industrial energy efficiency decisions to use (and productivity) of capital and labour
- Identifying and tailoring model and scenario design for key industrial case studies

We are also keen to extend research to consider related issues such as:

- *Carbon* efficiency in cases of heavy energy users and energy suppliers – including modelling introduction of carbon capture and storage/re-use
- Interaction of different energy/climate policies

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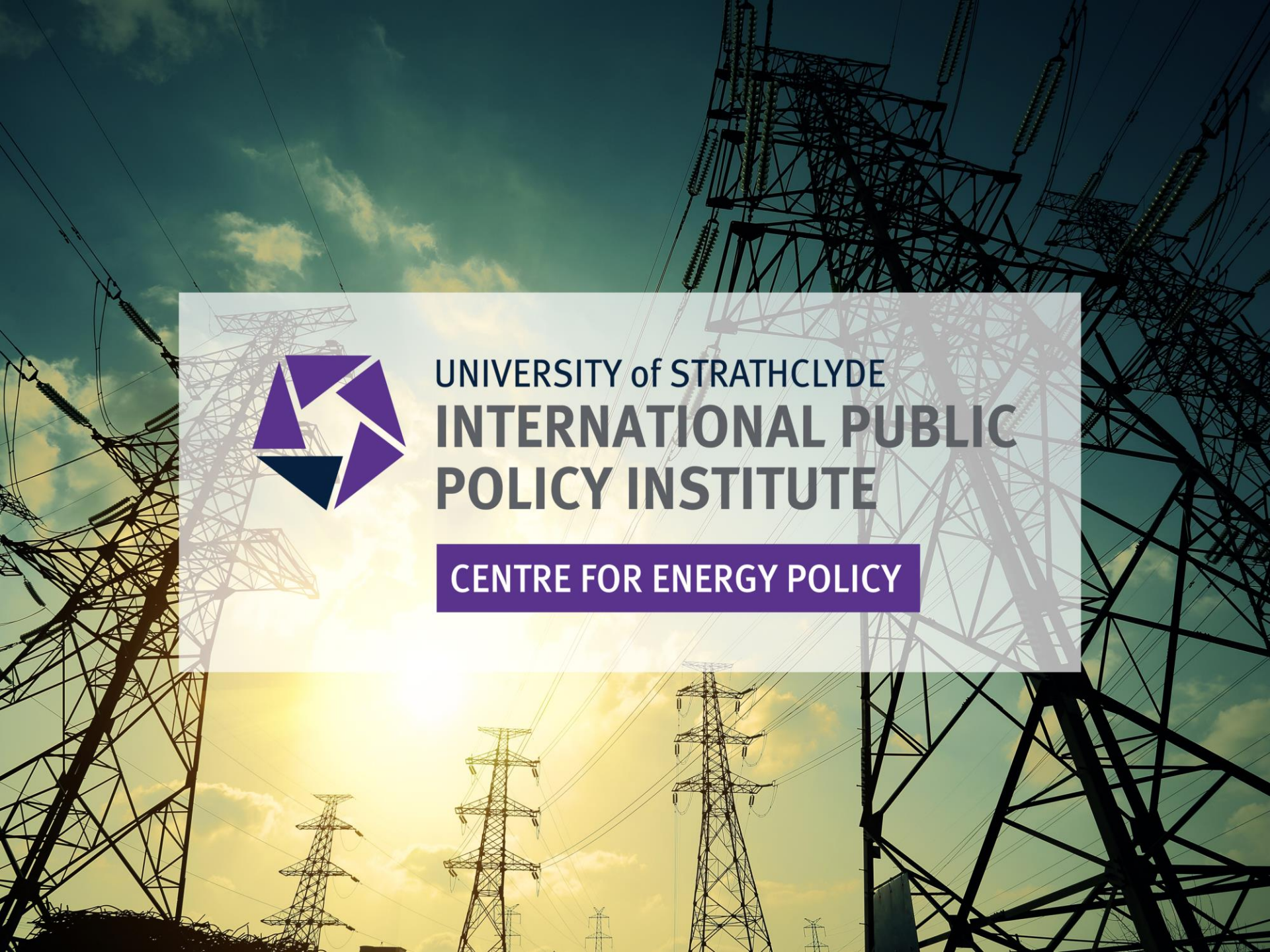
Stakeholder engagement

- EPSRC project Stakeholder Advisory Group and case study collaborations, outputs and events – please get in touch with me at karen.turner@strath.ac.uk

- Planned CEP events:
  - Workshop in collaboration with ClimateXChange to be hosted by the Scottish Government at Atlantic Quay in Glasgow on 23rd June: *How can Scotland make the most of its energy efficiency policy?* - Register to attend by emailing cep-ippi@strath.ac.uk
  - Currently planning two or more events on **'The one big thing'** that Scotland could do to address issues of climate change mitigation and climate justice in the run up to the Paris UNFCCC COP meeting – thoughts and ideas welcome!
  - In pipeline, the role of CCS and/or CCU in reducing Scottish territorial emissions – building on collaborative activity with the Scottish Carbon Capture and Storage (SCCS) research network
  - Potential role of transfer of technologies developed in Scotland to Sub-Saharan African and other low income countries (e.g. Strathclyde Malawi MREAP project)

- CEP launch on 5th May (Strathclyde Engage week) and activity at the All-Energy conference at the SECC on 6th and 7th May



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