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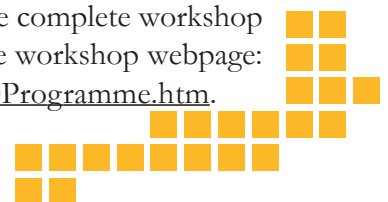
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## Current Empirical Research in Energy Economics

This summer, the third annual International Workshop on Empirical Methods in Energy Economics (EMEE2010) was held at the University of Surrey in Guildford, U.K. Along with the Surrey Energy Economics Centre (SEEC) in the UK and the Centre for Energy Policy and Economics (CEPE) in Switzerland, CBEEDAC is a co-organizer of this workshop which offers participants an opportunity to address the most recent developments in the field of quantitative research in energy economics. The workshop format, which involves no concurrent sessions, an extended time for speaker presentations, as well as assigned discussants for each paper, facilitates stimulating discussions on a wide variety of energy-related topics. During the two-day workshop, participants engaged in wide-ranging discussions of methods designed to help quantify, understand, explain, and forecast various aspects of energy economics. Of course, not all of these pertain to the buildings sector, although in some cases methodological approaches developed for other sectors appear to have potential for use in analysis in the buildings sector.

In this issue of the newsletter, CBEEDAC Executive Director Lucie Maruejols, who attended the workshop, provides brief summaries of five of the papers that were presented. Three of these papers concern the question of reducing energy use, focusing either on price elasticities of energy demand or energy-capital substitutability. The other two papers that are reviewed here are related to the provision of electricity to households, focusing on household preferences concerning the energy mix used to produce electricity as well as the value consumers place on avoiding power supply interruptions.

Full texts of all the papers presented at the workshop, including the articles summarized in this newsletter, along with the complete workshop program, are available for public download from the workshop webpage: <http://www.seec.surrey.ac.uk/Events/EMEE2010Programme.htm>.



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# Summaries of Empirical Energy Economics Papers from the 3rd EMEE International Workshop

## *Issues concerning price and substitution elasticities*

Focusing on household energy use, the paper presented by **Meier** and **Jamasb** examines **the relationship between income and energy spending** in the UK. The authors argue that energy poverty is a critical notion when considering policy measures that affect the purchasing power of households for energy goods. In an economy where living standards are increasing, the definition of energy poverty changes over time as the share of expenditures allocated to energy fluctuates. Since the amounts spent on energy vary according to household income levels, all households may not respond in the same way to policy measures that affect energy prices. The authors' empirical analysis examines the portion of expenditure that is devoted to purchasing energy for a number of British households over several years. The authors observe that as the income increases, energy expenditure increases as well, up to a certain level. At this point, called the inflexion point, additional income does not necessarily result in an increased expenditure for energy goods. This observation suggests that at the inflexion point, the households' basic need for energy is satisfied, so that any extra income is spent on other goods and services.

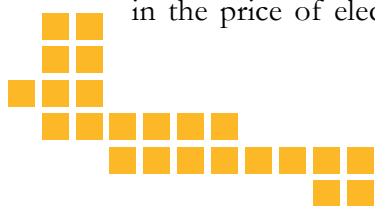
Using survey data, respondents are classified into income groups, and price and income elasticities of energy demand are examined for each group. The study also considers the effect of a diverse set of factors on energy expenditure, such as access to natural gas, living in an owned dwelling, and household composition. The authors find that households with relatively high incomes, between 30,000 and 45,000 British pounds, exhibit the highest elasticity with respect to the electricity price. At this level of income, energy needs are apparently met, so that the response to a change in the price of electricity is larger in magnitude

than for lower income households where the scope to increase or decrease energy consumption is smaller. Conversely, a change in the price of natural gas leads to larger adjustments in energy consumption among low-income families than others. The paper presents a number of other results showing that the direction of the response to a price change is the same for all income categories, but that the magnitude of the adjustments differs according to income level. Policy measures that affect the price of energy may therefore impact some households differently than others, and lead to mixed results.

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Continuing on the topic of elasticities, the paper by **Dilaver, Hunt** and **Huntington** examines three **different approaches to the estimation of US gasoline demand**, each of which has different implications for the elasticities that are calculated. Since the magnitudes of elasticities are important when considering the implementation of policy measures that increase energy prices, such as a carbon tax, the variety of results concerning demand responses to changes in prices obtained using different models is troublesome. This study investigates the effect of particular methodological choices in the calculation of elasticities, and shows the effect of these choices on the results obtained. Price and income elasticities are calculated for the period 1949-2005 using each of the three approaches and the results are compared across specifications.

The three approaches differentiate between *constant* and *time varying* elasticities, and between a *deterministic* and a *stochastic* trend. Trends are commonly incorporated in the analysis of gasoline demand to account for technological progress. Since the demand for energy is a derived demand that is





based essentially on the demand for the goods and services that are produced using energy, it is necessarily tied to the technology level at each point in time. A deterministic trend is a standard time trend, which has a constant effect in each period, while a stochastic trend incorporates a random factor that allows for more flexibility. With constant elasticities, changes in demand due to a given variation in price are the same at all times, while time varying elasticities allow changes over time in demand responses to price changes. In their empirical application, the authors distinguish between short-run and long-run elasticities and take into account the possibility of asymmetric price responses, allowing consumers' reactions to differ when facing a price increase rather than a price decrease. The three different models, estimated using the same time series, yield different results which, the authors' argue, is likely due to the difference in the structure of the trend component rather than the varying nature of the elasticities.

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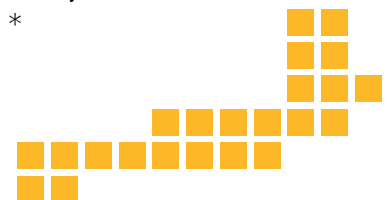
Policy measures that are often considered involve using increases in the price of energy as a lever to reduce energy consumption. With this in mind, **Tovar Reanos** and **Iglesias** examine the **relationship between capital and energy** and the effect of an energy price increase on the accumulation of capital. The nature of the relationship between energy demand and the stock of capital is important, as a strong dependence between the two would imply a strong effect of energy policies on capital. The elasticity of substitution between capital and energy in the industrial sector is used to determine the direction and extent of the relationship. The authors provide an extensive review of previous research and estimate their own elasticities using three models that address several technical issues arising in the calculation of the elasticity of substitution. Preliminary results show that energy and capital are more often complements than substitutes, and that a policy that is designed to reduce energy use would potentially harm capital.

### *Household preferences concerning the provision of electricity*

A study by **Grösche** and **Schröder** examines **public support for greening the energy mix in Germany**. In 2008, the electricity supply in Germany was composed of 15% renewable energy and 23% nuclear power, with the remainder derived from fossil fuels. The government promised to double the share of renewable energies in the electricity mix by 2020, and is financing this move by imposing a levy of 1.1 Euro cents per kWh sold to every customer. The purpose of the study is to measure how much consumers (voters) are actually willing to pay to switch to a greener electricity supply, and whether they support the current levy.

In an extensive survey, participants were asked how much they would pay for hypothetical electricity mixes made up of particular shares of fossil fuels, nuclear power and renewable energy, compared to an electricity mix benchmark made up entirely of fossil fuels. On average, participants were found to put a higher price on mixes that contain higher shares of renewable energy, and a lower price on mixes that contain a higher share of nuclear power. These observations mean that the overall willingness to pay rises with the share of renewable energy and decreases with the share of nuclear power. However, there is a strong heterogeneity in the results, revealing that the preferences vary considerably among customers. The analysis shows that a portion of the respondents exhibit preferences that are opposite to the average preferences of the group. Specifically, 8% of the participants are willing to pay a smaller price tag when the share of renewable energy in the mix rises, and 9.5% of the respondents are willing to pay a higher price when nuclear power is more predominant in the electricity mix they receive. These results are compared to the actual mix offered to German customers in 2008. The study finds that fewer than a majority of customers are actually ready to pay the 1.1 cents levy per kWh of electricity to have a 15% share of renewable energy in their electricity mix.

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## Household preferences concerning the provision of electricity (Cont'd)

Finally, the paper by **Pepermans** also considers an issue pertaining to the provision of electricity to the residential sector. Specifically, the author investigates the **value of continuous power supply** for Flemish consumers. The study focuses on the reaction of consumers to a hypothetical situation where the electricity supply system would not perform as well as it does now, and where power outages would be more substantial, possibly because of low maintenance provided by the now-privatized utilities. Data are collected through a choice experiment in order to reveal the preferences of consumers regarding power outages that are described by their annual frequency, duration,

invoice impact, peak or off peak characteristics, announced or unannounced characteristics, as well as the season in which they occur. The results might be of interest to utility companies as the results suggest that Flemish consumers would be ready to endorse a lower quality of power supply if they were to be compensated with smaller utility bills. Of course, the accuracy of the responses coming from consumers that have virtually no experience of power outages and their practical effects is questionable. The stated preferences obtained through the choice experiment might be different if participants had actually experienced longer and more frequent interruptions of service.

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Dilaver, Z., L.C. Hunt, and H. Huntington,

“A Comparison of Different Time Series Econometric Models of US Gasoline Demand”.

Grösche, P. and C. Schröder,

“Eliciting Public Support for Greening the Electricity Mix Using Random Parameter Techniques”.

Jamasb, T. and H. Meier,

“Household Energy Expenditure and Income Groups: Evidence from Great Britain”.

Pepermans, G., “The Value of Continuous Power Supply for Flemish Households”.

Tovar Reanos, M.A. and E.M.A. Iglesias,

“Capital-Energy Relationships: An Analysis of Three Panel Data Estimation Methods”.

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## PEOPLE

This summer, CBEEDAC benefited from ongoing research support provided by **Noha Abdel Razak**. In addition, an extensive data project has been carried out with the help of **Laura Adkins-Hackett**. Laura, who is entering her final year of undergraduate studies before undertaking an MA in Economics, has been assembling, organizing,

checking, and analyzing detailed data on energy prices from the 1960's to recent years for each Canadian province or region. **Maxine Cunningham** has been working on improving and expanding the content of our on-line searchable meta-database of energy use surveys and articles.

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## BUILDING SERVICES

CBEEDAC has the expertise to provide services to the building sector in the area of data storage and analysis. For more information regarding these services, on becoming a sponsor of CBEEDAC, or about the services provided by other Data and Analysis Centres, contact CBEEDAC or see our website at our new web address: [www.cbeedac.com](http://www.cbeedac.com).

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