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RESÚMENES / *ABSTRACTS*

Energy demand and energy efficiency

Energy intensity in Spain

Managing energy demand is a key element of energy policies by allowing countries to advance towards the goals of reducing the cost of energy supply, minimizing environmental impact and increasing energy security. Energy intensity, an indicator that reflects the relationship between energy consumption and the volume of economic activity, is often used to measure the energy efficiency of the economies.

Spanish energy intensity has experienced a peculiar and undesirable path in recent years. While the rest of the countries in our geographical and economic environment presented a decreasing trend, Spanish energy intensities grew steadily between 1995 and 2005, when it began to decrease. In 2008 Spanish energy intensity was 19% higher than the EU-15.

An assessment of the drivers for this divergent behavior is made using the decomposition methodology. The analysis includes energy consumption of households and all productive sectors, covering also the power plants and transportation of passengers and goods. A methodology to analyze the direct and indirect energy consumption is presented to help identify key sectors in the Spanish energy intensity evolution.

Fuel prices and fuel consumption

A critical issue in gauging the effectiveness of efficiency gains concerns how consumers adjust to altered unit costs. While, for example, higher fuel prices raise the cost of driving, improved efficiency of automobiles reduces them, thereby stimulating the demand for car travel. Such demand increases are referred to as the rebound effect, as it offsets the reduction in energy demand that results from an increase in efficiency.

After introducing the various definitions and the scope of the rebound found in the scientific literature on automotive travel, a recent study by Frondel, Ritter and Vance (2010) using both panel estimation and quantile-regression methods on household travel diary data collected in Germany between 1997 and 2009 is presented in detail. This study investigates the heterogeneity of the rebound effect in private transport. With the average rebound effect being in the range of 57% to 62%, which is in line with a recent German study by Frondel, Peters, and Vance (2008), it is substantially larger than those obtained from other studies. Furthermore, the quantile-regression results indicate that the magnitude of estimated fuel price elasticities -- from which rebound effects can be derived, depends inversely on the household's driving intensity: Households with low vehicle mileage exhibit fuel price elasticities, and hence rebound effects, that are significantly larger than those for households with high vehicle mileage.

Energy security

Energy security indices in Europe

The term energy security is common currency in the energy field. However, a degree of conceptual heterogeneity has led to something of a lack of consensus on its definition. At the same time, a variety of studies have aimed to analyse, classify and measure energy security and risk. However, this has not led to a convergence on a shared understanding: different authors have produced a set of assorted indicators, responding to different factors. Therefore, a distinction can be drawn between simple (or disaggregated) and composite (or aggregated) indicators. In this regard, the *Socioeconomic Energy Risk Index* has been developed by the Research Group on International Political Economy and Energy (UNED) for the project *Risk of Energy Availability: Common Corridors for European Security of Supply* (REACCESS). This project, financed by the 7th Framework Programme of the European Commission, has been carried out with the participation of 14 partners.

Thus, in this session, we will approach to the qualitative and quantitative analysis of risk of energy security of supply, providing some examples of attempts to measure this concept. Moreover we will emphasize on the elaboration and results of the *Socioeconomic Energy Risk Index*, as well as, on the evolution and outcomes of the REACCESS project up to now.

Innovation in energy

Potential impacts of Smart Grid on building energy use and demand

Building energy impacts are an important part of the determination as to whether Smart Grid investment is cost-effective for utilities and society. Smart Grid network architecture choices made today, which are strongly guided by the policies of state and federal regulatory authorities, will influence the future impacts of the Smart Grid on energy use in buildings. What is the ideal combination of meter, network communication and customer-side technologies? MIT's analysis of the implications of different architectures, looking 5 to 10 years ahead, seeks to inform policymakers on questions such as:

- Demand Response: How much potential exists to save energy as well as demand through control strategies?
- Dynamic Pricing: How does time-differentiated pricing impact consumer energy behavior? What characteristics of technology and analytic support to will encourage consumers to further respond?

- Granular Data: What is the potential of short interval energy data to support diagnostics that impact behavior and help identify malfunctioning controls and equipment? How may collective information feedback (community/GIS) add to individual motivation?

Government policies for innovation in energy

Most researchers and analysts agree that if the world is to meet the interlinked environmental, security, and economic challenges associated with our current energy system, we will need to accelerate *innovation* in energy technologies. The innovation process includes research, development, demonstration, market formation, and widespread diffusion. These stages depend on and feed into each other. Innovation involves various types of institutions, ranging from national and local governments, to private firms, trade associations, and universities. According to an innovation systems perspective, government policies affect all stages and all actors.

The Energy Technology Innovation Policy (ETIP) research group at Harvard is using this innovation systems perspective to learn about effective, efficient, and socially and culturally appropriate policies to accelerate energy innovation. This presentation will discuss some of ETIP's research, including:

- Government investment portfolios.
- Private sector investment in energy RD&D and the role of policy.
- Government RD&D institutions.
- Policies stimulating technology adoption and diffusion.

The economics of climate mitigation: what integrated assessment models teach us?

Integrated assesment models (IAM) are important tools for assessing the feasibility and the strategies needed to achieve a low carbon economy, as for example can be seen by their role in the IPCC reports. this talk will provide an insider view of the status of international modeling and of the main insights and limitations that can be drawn from their analysis.

Energy and climate policies

Carbon pricing for low-carbon investment

The European Directive on Emission Trading provides a legal framework for the European Carbon market that is lasting beyond 2020. However, the UN conference in Cancun and the discussions on international carbon credits (CDM) illustrated the shift of international climate cooperation, from carbon markets to nationally defined mitigation policies and a set of public finance and technical cooperation mechanisms to provide international support.

With less emphasis on international carbon markets, the primary focus of the European Emission Trading scheme is to support low-carbon development in Europe. CPI and CS explored, whether the EU ETS is an effective policy instrument to capture the attention of firms, provide clear guidance for strategy and investment choices and support the implementation of low-carbon choices:

- The EU ETS is a visible policy instrument that can demonstrate that governments are serious in translating emission reduction targets into action. It captures the attention of decision makers in organizations, which is the first step to prioritize climate against many competing interests. International Financial Reporting Standards need to make carbon costs and opportunities fully visible to investors.

- The EU ETS is an effective mechanism to translate an emission trajectory into a carbon price. This allows the integration of climate policy in strategic decision making processes. Its implementation needs to be further simplified so that business can assess the new opportunities and challenges the EU ETS creates when making operational, investment and strategic decisions.

- The EU ETS delivers a carbon price today, and established a robust mechanism for future carbon price formation. The carbon price enhances profitability of low-carbon processes and products and is thus essential for shifting corporate and finance choices. The response to EU ETS remains however limited in sectors where the stringency and carbon price is not high enough to warrant action.

Auctions for renewable energy support

The large increase in renewable energy deployment in many countries is making much more salient the economic support required for this deployment, and therefore

increasing the pressure for reducing it. On the other hand, the coordination required in many regions between higher-level economic support and lower-level licensing also asks for mechanisms able to incorporate naturally this coordination.

In this presentation we revisit an often maligned instrument for the promotion of renewable energy, auctions, which however is theoretically superior in many respects to the current feed-in-tariffs or green certificate systems, particularly regarding coordination between different administrations, and also regarding the achievement of lower support levels. After many negative experiences, auctions have been readopted in some countries, Brazil being probably the most relevant example.

Based on these experiences, we propose a new design for renewable energy auctions, which tries to address some of its shortcomings and may become an interesting tool for pushing forward renewable energy deployment globally.

Long-term energy prospective

The future of US natural gas production, use and trade

The overarching conclusions of the MIT Future of Natural Gas Interim Study, released in June, 2010, is that there are significant global supplies of conventional and unconventional natural gas and that gas natural gas will play a leading role in reducing greenhouse-gas emissions over the next several decades, largely by replacing older, inefficient coal plants with highly efficient combined-cycle gas generation. The focus of the study is on North American gas markets but also reviews key aspects of the global gas marketplace.

Kenderdine's discussion will focus on the study's set of findings and proposals for legislative and regulatory policies, as well as recommendations for industry actions that maximize the impacts of gas consumption on mitigating greenhouse gas emissions. Some of the study's key findings include:

- The US has a significant natural gas resource base, about 92 years' worth at present consumption rates. Much of this is from unconventional sources, including gas shales. Globally, baseline estimates show that recoverable gas resources probably amount to 16,200 trillion cubic feet (Tcf), a total that does not include unconventional gas resources other than those in the US and Canada;
- Environmental issues associated with producing unconventional gas resources are manageable but challenging;
- In a carbon constrained environment, natural-gas consumption will increase dramatically and will largely displace coal in the power generation sector by

2050;

- There will be a smaller role for natural gas in the transportation sector, largely in the form of compressed natural gas vehicles, with some opportunities for methanol
- The introduction of large intermittent power generation from wind and solar will have specific proximate and long term effects on the mix of generation technologies; and
- A global "liquid" market in natural gas with diverse supplies, and transparent prices set by supply and demand is desirable for consumers.

Energy scenarios towards Decarbonisation in the European Union by 2050

Using the energy model PRIMES, E3MLab is quantifying energy system scenarios for the European Union member-states which aim at reducing greenhouse gas emissions by 80% in 2050 compared to 1990 and by 40% in 2030. The scenarios simulate considerable changes in fuel and technology mix in all demand and supply sectors, assuming a combination of bottom-up policy measures (such as technology or consumption standards) and price signals (such as carbon pricing). Decarbonisation in power generation allows electricity to substitute for fossil fuels in demand sectors, including in transportation. The power sector evolves by deploying a balanced mix of low carbon options with great emphasis on renewables complemented with CCS development and nuclear energy in some member-states. Energy efficiency progress is shown as a cornerstone of the decarbonisation scenarios, enabled by considerable savings in buildings and the wide use of eco-design appliances and equipment. Electricity saved in houses and buildings is replaced by new demand for electricity arising in transport. A series of sensitivity analysis scenarios explore the impact of possible failures in the deployment of key decarbonisation options. The model-based analysis provides insights about the impacts on costs, prices and investment. The results show that an ambitious decarbonisation roadmap to 2050 is feasible but requires a steady and well regulated investment effort to be undertaken by both demanders and suppliers of energy. Stable long-term policies and anticipations with reduced uncertainty are crucial for limiting cost and price impacts.

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