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4th International Symposium on Energy and Finance Issues (ISEFI-2016)

24-25 March 2016

IPAG Business School, Paris, France

184 Boulevard Saint-Germain, 75006 Paris

in partnership with

4th International Symposium on Energy and Finance Issues (ISEFI-2016)

co-organized by IPAG Energy Economics Center, IPAG Business School and CGEMP, University of Paris Dauphine

March 24-25, 2016

IPAG Business School

184, Boulevard Saint-Germain, 75006 Paris

Conference Overview

The 4th **International Symposium on Energy and Finance Issues** (ISEFI-2016), jointly organized by the IPAG Energy Economics Center (IPAG Business School) and the Centre of Geopolitics of Energy and Raw Materials (Paris Dauphine University) with the support of the International Association for Energy Economics (IAEE), will take place on 24-25 March 2016 in Paris, France. It aims to provide academics, policymakers, and practitioners with a valuable forum for discussion and critical analysis of the major issues and challenges that interrelate energy and financial markets.

The conference organizers invite the submission of both theoretical and empirical papers relating to all aspects of energy markets and their interactions with financial markets. The Symposium focuses on the following, but not limited to, topics:

- Corporate finance analysis for energy companies
- Econometrics of energy markets
- Energy and climate models
- Energy and environment
- Energy derivatives: pricing and hedging
- Energy and financial market interactions
- Energy issues in developing and emerging markets
- Energy policy for transportation
- Energy prices: modeling and forecasting
- Energy risks: assessment and modeling
- Financial and economic analysis of energy markets
- Financial regulation of energy and environmental markets
- Finance and investment in renewable energy
- Geopolitics of energy
- Oil and shale gas
- Renewable and alternative technology policy
- Security of energy supply (electricity, oil, gas)
- Speculation and energy prices
- State regulation and energy governance

Keynote Speakers

Prof. Lutz Kilian, *University of Michigan, United States*

Lutz Kilian, Professor of Economics, received his Ph.D. in Economics from the University of Pennsylvania in 1996 and his M.A. in Development Banking from The American University in 1988. He joined the faculty at Michigan in 1996. Prior to his Ph.D., he worked for the research department of the Inter-American Development Bank in Washington, DC. During 2001-03 he served as an adviser to the European Central Bank in Frankfurt/M., Germany. Professor Kilian has been a research visitor at the Federal Reserve Board, the European Central Bank, and the International Monetary Fund. He has also been a consultant for the International Monetary Fund, the Inter-American Development Bank, the World Trade Organization, the European Central Bank,

the Bank of Canada, and the European Parliament, among others. Professor Kilian has published over 70 articles. Professor Kilian has been an Associate Editor of the *Journal of Business and Economic Statistics*, the *Journal of Development Economics*, and the *Journal of Economic Dynamics and Control*, among other journals. He is a research fellow of the Centre for Economic Policy Analysis, the Center for Financial Studies, and the Euro Area Business Cycle Network.

Prof. Adonis Yatchew, *University of Toronto, Canada*

Adonis Yatchew is a Professor of Economics at the University of Toronto, Canada. He received his Ph.D. in Economics from Harvard University in 1980, and has held visiting appointments at Trinity College (Cambridge) and the University of Chicago. Dr. Yatchew has conducted major studies in electrical utilities and oil pipelines as well as in the airline, natural gas, minerals, banking, and entertainment industries. Dr. Yatchew has published widely on econometric estimation techniques, with specific attention to nonparametric procedures, in prestigious journals such as *Econometrica*, *Journal of Economic Literature*, *Journal of Econometrics*, and *Review of Economics and Statistics*. Of particular note is his book entitled "Semiparametric Regression for the Applied Econometrician", published by Cambridge University Press. Dr. Yatchew has also written extensively on regulatory schemes in the area of electricity, and is the Editor-in-Chief of the *Energy Journal*. In addition to this, he has assisted in a variety of litigation procedures and has testified on numerous regulatory matters.

Conference Co-chairs & Organizers

Marie Bessec, *University of Paris Dauphine*
Anna Creti (Co-chair), *University of Paris Dauphine & Ecole Polytechnique*
Khaled Guesmi (Co-Chair), *IPAG Business School*
Yannick Le Pen, *University of Paris Dauphine*
Duc Khuong Nguyen (Co-Chair), *IPAG Business School & Indiana University*
Nadia Sghaier, *IPAG Business School*

Scientific Committee

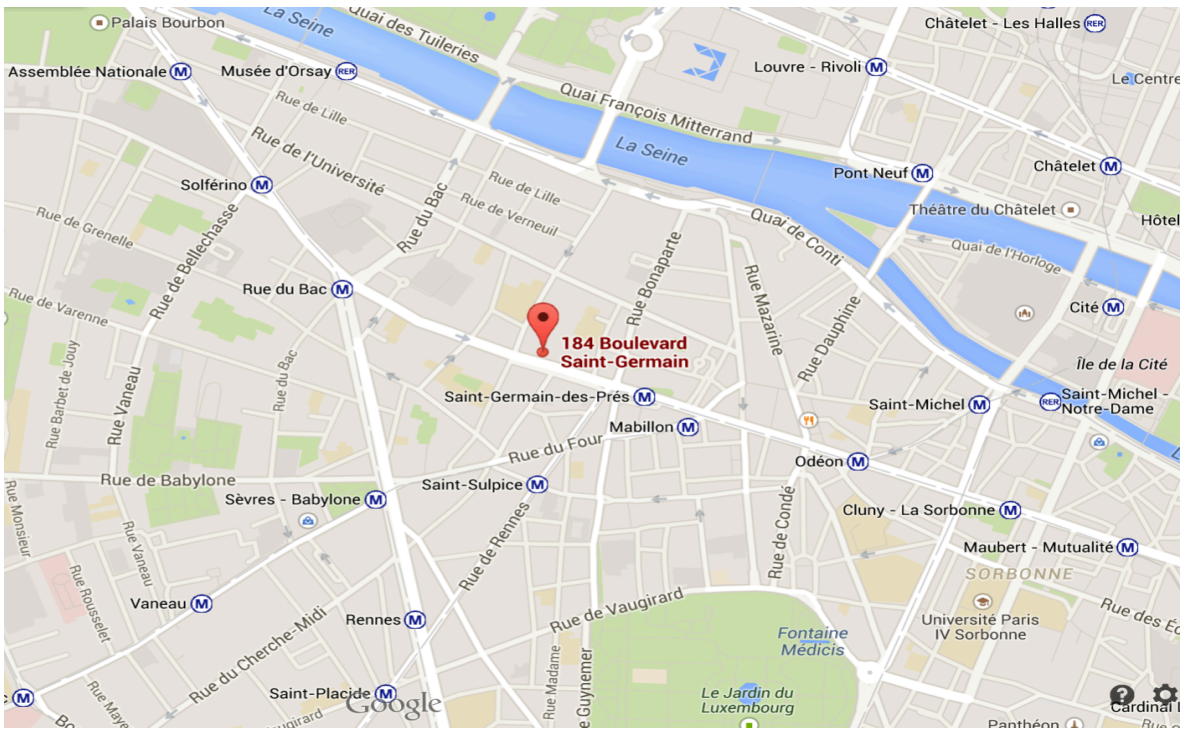
René Aid, *FIME-University of Paris Dauphine & EDF*
Derek Bunn, *London Business School*
Julien Chevallier, *University of Paris 8 & IPAG Business School*
Anna Creti, *University of Paris Dauphine and Ecole Polytechnique*
Shawkat Hammoudeh, *Drexel University*
Fatih Karanfil, *University of Paris West Nanterre la Défense*
Matteo Manera, *University of Milano-Bicocca*
Duc Khuong Nguyen, *IPAG Business School & Indiana University*
Michel Robe, *American University*
Luca Taschini, *London School of Economics*
Perry Sadorsky, *York University*
Benoît Sévi, *Grenoble University*
Stefan Trueck, *Macquarie University, Australia*
Jian Yang, *University of Colorado Denver*

Peng Zhou, *UCLA Institute of the Environment and Sustainability & Nanjing University of Aeronautics and Astronautics, China*

Conference Venue and Practical Information

IPAG Business School

184, Boulevard Saint-Germain
75006 Paris
Phone: +33 (0)1 53 63 36 00
Fax: +33 (0)1 45 44 40 46



Program at a Glance

Thursday, March 24, 2016

01:00pm – 01:45pm	Registration & Coffee	Amphitheatre
01:45pm – 02:00pm	Opening and Welcome Note By **Anna Creti** (*Université Paris Dauphine-LEDA CGEMP and Ecole Polytechnique*), **Khaled Guesmi** (*IPAG Business School*), and **Duc Khuong Nguyen** (*IPAG Business School & Indiana University*)	Amphitheatre
02:00pm – 03:00pm	Keynote Lecture I By **Professor Adonis Yatchew**, *University of Toronto, Canada*	Amphitheatre
03:00pm – 03:15pm	Coffee Break	Amphitheatre
03:15pm – 04:45pm	Parallel Session A Session A1 Session A2 Session A3	Room 1 Room 2 Room 3
04:45pm – 05:00pm	Coffee Break	Amphitheatre
05:00pm – 06:30pm	Parallel Session B Session B1 Session B2 Session B3	Room 1 Room 2 Room 3
07:30pm – 11:00pm	Conference Dinner	Grand Salon, Shangri-La Hotel, Paris

Friday, March 25, 2016

08:30am – 09:00am	Registration & Continental Breakfast	Amphitheatre
09:00am – 10:30am	Parallel Session C Session C1 Session C2 Session C3 Session C4	 Amphitheatre Room 1 Room 2 Room 3
10:30am – 11:00am	Coffee Break	Amphitheatre
11:00am – 12:00pm	Keynote Lecture II By **Professor Lutz Kilian**, *University of Michigan, USA*	Amphitheatre
12:00pm – 01:30pm	Lunch Break	Café Louise
01:30pm – 03:00pm	Parallel Session D Session D1 Session D2 Session D3	 Room 1 Room 2 Room 3
03:00pm – 03:30pm	Coffee Break	Amphitheatre
03:30pm – 05:00pm	Parallel Session E Session E1 Session E2 Session E3	 Room 1 Room 2 Room 3
05:00pm – 05:15pm	Concluding Remarks	Amphitheatre

Detailed Program

Thursday, March 24, 2016

01:00pm – 01:45pm	Registration & Coffee	
01:45pm – 02:00pm	Opening and Welcome Note	
02:00pm – 03:00pm	**Keynote Lecture I** "Subsidiarity and Separation" **Professor Adonis Yatchew**, *University of Toronto, Canada*	Amphitheatre
03:00pm – 03:15pm	Coffee Break	
03:15pm – 04:45pm	**Parallel Sessions A**	
03:15pm – 04:45pm	Session A1: Economic Effects of Commodity Price Fluctuations Chair: Saeed Moshiri, *Allameh Tabataba'i University, Iran*	Room 1
03:15pm – 03:45pm	**Where do jobs go when oil prices drop?** Ana María Herrera, *University of Kentucky, USA* Mohamad B. Karaki, *Lebanese American University, Lebanon* Sandeep Kumar Rangaraju, *Weber State University, USA*	
03:45pm – 04:15pm	**Flexibility in the market for international carbon credits and price dynamics difference with European allowances** Claire Gavard, *Centre for European Economic Research, Germany* Djamel Kirat, *University of Orléans, France*	
04:15pm – 04:45pm	**Heterogenous effects of oil price shocks in Canadian provinces** Saeed Moshiri, *Allameh Tabataba'i University, Iran* Mohsen Bakhshi Mogaddam, *Queen's University Kinston, Canada*	
03:15pm – 04:45pm	Session A2: Financial and Economic Analysis of Energy Markets I Chair: Bernard Ben Sita, *Lebanese American University, Lebanon*	Room 2
03:15pm – 03:45pm	**Oil prices and real estate investment trusts (REITs): Gradual-shift causality and volatility transmission analysis** Alper Gormus, *Texas A&M University, USA* Saban Nazlioglu, *Pamukkale University, Turkey* Ugur Soytas, *Middle East Technical University, Turkey*	
03:45pm – 04:15pm	**Oil price uncertainty and the U.S. stock market analysis based on a GARCH-in-Mean VAR model** Zeina Alsalman, *Oakland University, USA*	
04:15pm – 04:45pm	**Measuring the oil risk effect on industry volatility shocks** Bernard Ben Sita, *Lebanese American University, Lebanon*	

03:15pm – 04:45pm	Session A3: Energy Derivatives: Pricing and Hedging — Room 3
	Chair: Andrea Roncoroni, *ESSEC Business School, France*
03:15pm – 03:45pm	**Electricity suppliers' risks: the failure of intra-day forward contracting** Raphael Homayoun Boroumand, *PSB Paris School of Business, France* Stephane Goutte, *University of Paris 8 & University of Paris Dauphine, France*
03:45pm – 04:15pm	**Forward premia in electricity markets: The effect of non-storability, non-linearity, and fluctuating renewables** Jan Geiger, *University of Heidelberg, Germany* Nikolas Wölfing, *The Centre for European Economic Research in Mannheim, Germany & ETH Zürich, Switzerland*
04:15pm – 04:45pm	**Electricity forward curves with thin granularity** Ruggero Caldana, *Accenture, Italy* Gianluca Fusai, *Cass Business School, UK* Andrea Roncoroni, *ESSEC Business School, France*
04:45pm – 05:00pm	Coffee Break
05:00pm – 06:30pm	**Parallel Sessions B**
05:00pm – 06:30pm	Session B1: European Electricity Markets — Room 1
	Chair: Anna Creti, *University of Paris Dauphine & Ecole Polytechnique, France*
05:00pm – 05:30pm	**Intermittent renewable generation and network congestion: an empirical analysis of Italian power market** Faddy Ardian, *Ecole Polytechnique, France* Silvia Concettini, *Ecole Polytechnique, France* Anna Creti, *University of Paris Dauphine & Ecole Polytechnique, France*
05:30pm – 06:00pm	**Integration of European electricity markets: Evidence from spot prices** Klaus Gugler, *Vienna University of Economics and Business, Austria* Adhurim Haxhimusa, *Vienna University of Economics and Business, Austria* Mario Liebensteiner, *Vienna University of Economics and Business, Austria*
06:00pm – 06:30pm	**Forecasting generalized quantiles of electricity demand: A functional data approach** Brenda López Cabrera, *University of Humboldt, Germany* Franziska Schulz, *University of Humboldt, Germany*
05:00pm – 06:30pm	Session B2: Energy Policy Analysis — Room 2
	Chair: Ingmar Schumacher, *IPAG Business School, France*
05:00pm – 05:20pm	**Transition towards a hydrogen-based passenger car transport: comparative policy analysis** Alena Kotelnikova, *Ecole Polytechnique, France*

05:20pm – 05:40pm	**Is China a pollution haven for the G-7 economies? A trade-gravity panel approach** Sarah Najm, *University of Reading, UK*
05:40pm – 06:00pm	**A comparative review of investment conditions for electricity and gas TSO in the European Union** Sébastien Douguet, *Microeconomix, France* Jean-Michel Glachant, *European University Institute, Italy* Armand Jiptner, *Bengs, France* Wim Palmers, *BearingPoint, France* Vincent Rious, *Microeconomix, France & European University Institute, Italy*
06:00pm – 06:20pm	**Equity as a foundation of future climate policy** Lucas Bretschger, *ETH Zurich, Switzerland* Max Meulemann, *ETH Zurich, Switzerland*

05:00pm – 06:30pm	Session B3: Dynamics of Energy Markets	Room 3
	Chair: Olivier Massol, *IFP Énergies Nouvelles and IFP School, France & City University London, UK*	

05:00pm – 05:30pm	**Forecasting oil price realized volatility: A new approach** Stavros Degiannakis, *Panteion University of Social & Political Sciences & Hellenic Open University, Greece* George Filis, *Panteion University of Social & Political Sciences, Greece*
05:30pm – 06:00pm	**On the size and significance of OPEC's spare production capacity** Axel Pierru, *King Abdullah Petroleum Studies and Research Center, Saudi Arabia* James L. Smith, *Southern Methodist University, USA* Tamim Zamrik, *King Abdullah Petroleum Studies and Research Center, Saudi Arabia*
06:00pm – 06:30pm	**Market power and spatial arbitrage between interconnected gas hubs** Olivier Massol, *IFP Énergies Nouvelles and IFP School, France & City University London, UK* Albert Banal-Estañol, *University of Pompeu Fabra, Spain & City University of London, UK*

07:30pm – 11:00pm	Conference Dinner	Grand Salon, Shangri-La Hotel, Paris

Friday, March 25, 2016

08:30am – 09:00am Registration and Continental Breakfast

09:00am – 10:30am Parallel Sessions C

09:00am – 10:30am Session C1: Energy and Climate Models Amphitheatre

Chair: Ted Temzelides, *Rice University, USA*

09:00am – 09:30am **Limit-pricing and the (in)effectiveness of the carbon tax**
Saraly Andrade de Sá, *ETH Zurich, Switzerland*
Julien Daubanes, *ETH Zurich, Switzerland*

09:30am – 10:00am **Policy analysis using an emulator of integrated assessment models**
Fabio Sferra, *Climate Analytics, Germany*
Niklas Roming, *Climate Analytics & Potsdam Institute for Climate Impact Research, Germany*
Mario Krapp, *Climate Analytics & Potsdam Institute for Climate Impact Research, Germany*
Michiel Schaffer, *Climate Analytics, Germany*
Marcia Rocha, *Climate Analytics, Germany*

10:00am – 10:30am **Robust dynamic energy use and climate change**
Xin Li, *International Monetary Fund, USA*
Borghan Narajabad, *Board of Governors of the Federal Reserve System, USA*
Ted Temzelides, *Rice University, USA*

09:00am – 10:30am Session C2: Energy Efficiency and Carbon Emissions Room 1

Chair: Fatih Karanfil, *University of Paris-Ouest, France & Galatasaray University, Turkey*

09:00am – 09:30am **Tradable emission permits: Beyond pollution abatement motives**
Maria Eugenia Sanin, *University of Evry Val d'Essonne & Ecole Polytechnique, France*

09:30am – 10:00am **Capitalization of energy efficiency in the housing market**
Erdal Aydin, *Maastricht University, The Netherlands*
Dirk Brounen, *Tilburg University, The Netherlands*
Nils Kok, *Maastricht University, The Netherlands*

10:00am – 10:30am **Trade and environment: further empirical evidence from heterogeneous panels using aggregate data**
Thomas Jobert, *Nice Sophia Antipolis University, France*
Fatih Karanfil, *University of Paris-Ouest, France & Galatasaray University, Turkey*
Anna Tykhonenko, *Nice Sophia Antipolis University, France*

09:00am – 10:30am	Session C3: Interactions between Energy and Financial Market I	Room 2
	Chair: Takashi Kanamura, *Kyoto University, Japan*	
09:00am – 09:30am	**Energy market implications for emerging market debt markets** Eleanor J. Morrison, *University of London, UK*	
09:30am – 10:00am	**Evidence of change in the dependence structure between oil price and stock markets** Heni Boubaker, *IPAG Business School, France* Nadia Sghaier, *IPAG Business School, France*	
10:00am – 10:30am	**A financialization model of crude oil markets** Takashi Kanamura, *Kyoto University, Japan*	

09:00am – 10:30am	Session C4: Commodity Markets	Room 3
	Chair: Benoît Sévi, *University of Grenoble Alpes, France*	
09:00am – 09:30am	**Variance risk premia in commodity markets** Marcel Prokopczuk, *Leibniz University Hannover, Germany & University of Reading, UK* Chardin Wese Simen, *ICMA Centre, University of Reading, UK*	
09:30am – 10:00am	**Common factors of commodity prices** Simona Delle Chiaie, *European Central Bank* Laurent Ferrara, *Bank of France, France* Domenico Giannone, *Federal Reserve Bank of New York and CEPR, USA*	
10:00am – 10:30am	**Insider trading in oil markets** Olivier Rousse, *University of Grenoble Alpes, France* Benoît Sévi, *University of Grenoble Alpes, France*	
10:30am – 11:00am	Coffee Break	
11:00am – 12:00am	**Keynote Lecture II** "A General Approach to Recovering Market Expectations from Futures Prices With an Application to Crude Oil" **Professor Lutz Kilian**, *University of Michigan, USA*	Amphitheatre
12:00pm – 01:30pm	Lunch Break	
01:30pm – 03:00pm	**Parallel Sessions D**	

01:30pm – 03:00pm	Session D1: Financial and Economic Analysis of Energy Markets II	Room 1
	Chair: Albert Banal-Estañol, *University of Pompeu Fabra, Spain & City University of London, UK*	
01:30pm – 02:00pm	**On the transition of Europe's power market - Economic consequences of national policies** Geoffrey J. Blanford, *Electric Power Research Institute, USA* Christoph Weissbart, *IFO Institute, Germany*	

02:00pm – 02:30pm	**Energy tax reform in time of crisis: The case of energy-dependent and open economies** Emmanuel Combet, *CIRED, France*
02:30pm – 03:00pm	**Effects of mergers on hub prices: An ex-post evaluation of the GDF/Suez merger** Elena Argentesi, *University of Bologna, Italy* Albert Banal-Estañol, *University of Pompeu Fabra, Spain & City University of London, UK* Jo Seldeslachts, *German Institute for Economic Research, Germany & KU Leuven, Belgium*

01:30pm – 03:00pm	Session D2: Energy Price Modeling and Forecasting	Room 2
	Chair: Duc Khuong Nguyen, *IPAG Business School, France & Indiana University, USA*	

01:30pm – 02:00pm	**Targeted filtration with a difference for inference and long-horizon forecasts: Application to the real price of crude oil** Stephen Snudden, *Queen's University, Canada*
02:00pm – 02:30pm	**Forward premia in electricity markets with fixed and flexible retail rates: Replication and extension** Silvester Van Koten, *University of Economics, Czech Republic*
02:30pm – 03:00pm	**A conditional dependence approach to CO_2-energy price relationships** Julien Chevallier, *IPAG Business School & Paris 8 University, France* Duc Khuong Nguyen, *IPAG Business School, France & Indiana University, USA* Juan Carlos Reboredo, *Universidade de Santiago de Compostela, Spain*

01:30pm – 03:00pm	Session D3: Renewable and Alternative Technology Policy	Room 3
	Chair: Eoin Ó Broin, *CIRED, France*	

01:30pm – 02:00pm	**The natural resource curse and institutions in post-Soviet countries** Roman Horváth, *Charles University, Czech Republic* Ayaz Zeynalov, *Charles University, Czech Republic*
02:00pm – 02:30pm	**Policy measures to promote electric mobility – A global perspective** Theo Lieven, *University of St. Gallen, Switzerland*
02:30pm – 03:00pm	**Exploring the role of transport infrastructure in a low-carbon world** Eoin Ó Broin, *CIRED, France* Céline Guivarch, *CIRED, France*

03:00pm – 03:30pm Coffee Break

03:30pm – 05:00pm	Parallel Sessions E

03:30pm – 05:00pm	Session E1: Interactions between Energy and Financial Market II	Room 1
	Chair: Khaled Guesmi, *IPAG Business School, France*	
03:30pm – 04:00pm	**The dynamic effects of oil price shocks on corporates balance sheets** Khalid Elfayoumi, *German Institute for Economic Research, Germany*	
04:00pm – 04:30pm	**Contagions of spillover effects between the oil price and exchange rates** Shupei Huang, *China University of Geosciences and Ministry of Land and Resources, China & Parthenope University of Naples, Italy* Haizhong An, *China University of Geosciences and Ministry of Land and Resources, China & Parthenope University of Naples, Italy* Xiangyun Gao, *China University of Geosciences and Ministry of Land and Resources, China & Parthenope University of Naples, Italy*	
04:30pm – 05:00pm	**Oil risk and financial contagion** Khaled Guesmi, *IPAG Business School, France* Ilyes Abid, *ISC Paris Business School, France* Anna Creti, *University of Paris Dauphine & Ecole Polytechnique, France* Julien Chevallier, *University of Paris 8 & IPAG Business School, France*	

03:30pm – 05:00pm	Session E2: Energy Consumption, Environment and Growth	Room 2
	Chair: Amany A. El Anshasy, *United Arab Emirates University, UAE & Alexandria University, Egypt*	
03:30pm – 04:00pm	**The energy-economic growth relationship: A new insight from the EROI perspective** Florian Fizaine, *University of Paris-Sud, France* Victor Court, *University of Paris-Ouest Nanterre La Défense, IFP Energies Nouvelles & the Climate Economics Chair, France*	
04:00pm – 04:30pm	**Time-varying analysis of CO2 emissions, energy consumption and economic growth nexus: Statistical experience in next-11 countries** Muhammad Shahbaz, *COMSATS Institute of Information Technology, Paskistan & IPAG Business School, France* Mantu Kumar Mahalik, *National Institute of Technology, India* João Ricardo Sato, *Federal University of ABC, Brazil*	
04:30pm – 05:00pm	**Energy intensity and environmental performance in the GCC countries: Long-run evidence from a heterogeneous panel** Amany A. El Anshasy, *United Arab Emirates University, UAE & Alexandria University, Egypt* Marina-Selini Katsaiti, *United Arab Emirates University, UAE*	

03:30pm – 05:00pm	Session E3: Energy Transition and Alternative Energies	Room 3
	Chair: Saraly Andrade de Sá, *ETH Zurich, Switzerland*	
03:30pm – 03:50pm	**Is energy transition beneficial to sectors with high employment content? An input-output analysis for France** Quentin Perrier, *CIRED, France* Philippe Quirion, *CNRS, France*	
03:50pm – 04:10pm	**Economics of co-firing rice straw with coal in old and new Vietnamese power plants** An Ha Truong, *University of Science and Technology of Hanoi, Vietnam* Minh Ha-Duong, *University of Science and Technology of Hanoi, Vietnam & CIRED, France* Hoang Anh Nguyen Trinh, *University of Science and Technology of Hanoi, Vietnam & CIRED, France*	
04:10pm – 04:30pm	**Long-term macroeconomic impact of US unconventional oil and gas production: a general equilibrium perspective** Florian Leblanc, *CIRED, France*	
04:30pm – 04:50pm	**Optimal pro-biofuel policies with land-use inertia** Saraly Andrade de Sá, *ETH Zurich, Switzerland*	

05:00pm – 05:15pm	Concluding Remarks	Amphitheatre

Keynote Lecture I

Professor Adonis Yatchew, *University of Toronto, Canada*

"Subsidiarity and Separation"

The costs of decarbonizing energy systems can be costly, even in countries (such as Canada) which are richly endowed with renewable energy resources. We suggest two principles for improving the efficacy and efficiency of these initiatives. The first is subsidiarity, which asserts that in a hierarchy, decisions and actions should be taken at the lowest level at which they can be executed competently; in the present context, the implication is that governmental agencies should not make choices that individuals, communities, firms or associations could make effectively. The second is separation, in particular a clear separation between policymaking on the one hand, and regulation and implementation on the other.

Keynote Lecture II

Professor Lutz Kilian, *University of Michigan, USA*

"A General Approach to Recovering Market Expectations from Futures Prices With an Application to Crude Oil"

Futures markets are a potentially valuable source of information about price expectations. Exploiting this information has proved difficult in practice, because time-varying risk premia often render the futures price a poor measure of the market expectation of the price of the underlying asset. Although this expectation in principle may be recovered by adjusting the futures price by the estimated risk premium, a common problem is that there are as many measures of the market expectation as there are estimates of the risk premium. We propose a general solution to this problem that allows us to select the most accurate estimate of the expectation for any set of risk premium estimates. We illustrate this approach by solving the long-standing problem of how to estimate the market expectation of the price of crude oil. We provide a new measure of oil price expectations that is substantially more accurate than the alternatives and more economically plausible. Our analysis has implications for the estimation of economic models of energy-intensive durables, for oil price forecasting, and for the measurement of oil price shocks.

Session A1

Where do jobs go when oil prices drop?

Ana María Herrera, *University of Kentucky, USA*
Mohamad B. Karaki, *Lebanese American University, Lebanon*
Sandeep Kumar Rangaraju, *Weber State University, USA*

In this paper, we estimate a factor augmented vector autoregressive (FAVAR) model to investigate the effect of oil price shocks on total private job flows as well as on industry-level job creation and destruction. Following an unexpected oil price drop in the first year, we find that in oil and gas extraction and support activities for mining exhibit a reduction in job creation and an increase in job destruction. Instead, industries in construction, manufacturing and services exhibit a rise in the net employment change. As a result of the oil price decrease the pace of gross job reallocation slows down. We demonstrate that the increase (decrease) in private job destruction (creation) observed during the first year is primarily driven by the response of closing (expanding) firms in services and manufacturing.

Flexibility in the market for international carbon credits and price dynamics difference with European allowances

Claire Gavard, *Centre for European Economic Research, Germany*
Djamel Kirat, *University of Orléans, France*

We analyze the price dynamics of European allowances (EUA) and international carbon credits (CER) in the second phase of the European carbon market. We first test for structural breaks in the price series of carbon permits. We find that both EUA and CER futures price series present breaks in November 2008 and November 2011. We develop and estimate a model combining fundamental drivers associated with the demand for quotas by installations and risk-return considerations related to the financial nature of carbon permits. Although carbon permits present some characteristics of financial assets, we find that an increased volatility is not associated with an increased return. This means there is no interest for an agent in holding carbon permits if this agent does not have to cover carbon emissions. While the corresponding returns present comparable dynamics, the long-term relationships between the price of these two types of permits and their drivers differ significantly. Energy prices have a nonlinear impact on the EUA price but a linear one on the CER price. Whereas the price of allowances is demand-driven, we suggest the existence of a supply-side effect for credits, and explain it by the flexibility in the related market. The impact of the European economic activity is smaller on credits than on allowances.

Heterogenous effects of oil price shocks in Canadian provinces

Saeed Moshiri, *Allameh Tabataba'i University, Iran*
Mohsen Bakhshi Mogaddam, *Queen's University Kinston, Canada*

Canadian economy has become more prone to oil market developments as its oil production and exports from conventional and nonconventional oil sands resources have been increasing markedly since 2000s. The macroeconomic effects of oil price shocks is, however, more complicated than other oil-exporting countries, mainly because of the Canada's diversified economic activities in a federal political system. Canada consists of oil-exporting and oil-importing provinces, and oil price shocks generate demand side and supply side effects in those provinces, respectively. The oil shocks also generate spillover effects through interprovincial trade and labour movements. The aggregate analysis of the oil price shocks, therefore, masks the provincial and industry heterogeneities and may generate misleading results and policy implications. In this study, we develop a dynamic panel VAR model to investigate the impacts of oil price shocks on Canadian economy taking into account the provincial heterogeneities and the spillover effects. We also test for asymmetric effects of positive and negative oil price shocks on provinces and the differences in the pre and post 2000 periods.

Session A2

Oil prices and real estate investment trusts (REITs): Gradual-shift causality and volatility transmission analysis

Alper Gormus, *Texas A&M University, USA*
Saban Nazlioglu, *Pamukkale University, Turkey*
Ugur Soytas, *Middle East Technical University, Turkey*

According to literature, oil price shocks and volatility can have sector-specific impacts in the market. While these studies include most asset groups, the dynamic relationship between the oil market and Real Estate Investment Trusts (REITs) has not been tested. This study examines the role of oil price shocks and volatility on six REIT categories: Residential, Hotel, Healthcare, Retail, Mortgage and Warehouse/Industrial REITs for the January 2005 - December 2013 period. In addition, a new causality approach is proposed by augmenting the Toda-Yamamoto method with a Fourier approximation. This approach is capable of capturing gradual or smooth shifts and does not require a prior knowledge regarding the number, dates, and form of structural breaks. The so-called Fourier Toda-Yamamoto causality (mean spillover) test finds uni-directional causality running from oil prices to all REITs, except for the mortgage REITs. In the latter case, the causality is reversed. The relatively new and simple causality in variance test shows that there is bi-directional volatility transmission between the oil market and all REITs. Our results have important implications for REIT managers and investors.

Oil price uncertainty and the U.S. stock market analysis based on a GARCH-in-Mean VAR model

Zeina Alsalman, *Oakland University, USA*

This paper uses a bivariate GARCH–in-mean VAR model to examine the effect of oil price uncertainty on the U.S. real stock returns at the aggregate and sectoral level. Estimation results suggest that there is no statistically significant effect of oil price volatility on the U.S. stock returns. The absence of an uncertainty effect might be explained by the fact that companies are likely to hedge against fluctuations in oil prices. It could also stem from the ability of most companies to transfer the higher cost of oil to customers. Moreover, the impulse responses indicate that, accounting for oil price uncertainty, oil price increases and decreases have symmetric effects on the U.S. aggregate stock returns, in that energy price increases and decreases are estimated to have equal and opposite effects on the U.S. financial market. However, this symmetric effect doesn't hold across all the sectors studied in this paper.

Measuring the oil risk effect on industry volatility shocks

Bernard Ben Sita, *Lebanese American University, Lebanon*

I examine the information sequential hypothesis in complementary oil markets. Unlike the underreaction hypothesis suggested as an explanation to the lagged negative oil effect of financial return, a sequential information schedule through crude oil and gasoline provides a differential dynamic in the way oil risk is channeled to financial markets. Not only do I find that the market response to oil volatility risk is contemporaneous, but that crude oil triggers financial risk at the time of information, whereas gasoline effects of financial risk are subsequent to crude oil effects.

Session A3

Electricity suppliers' risks: the failure of intra-day forward contracting

Raphael Homayoun Boroumand, *PSB Paris School of Business, France*
Stephane Goutte, *University of Paris 8 & University of Paris Dauphine, France*

As market intermediaries, electricity suppliers purchase electricity from the wholesale market or self-generate to "deliver" their customers. However, electricity suppliers are uncertain about how much electricity their residential customers will use at any moment of the day until they actually turn switches on. While demand uncertainty is a common feature of all commodity markets, suppliers generally rely on storage to manage it. Singularly, electricity suppliers are exposed to joint volumetric and price risk on an hourly basis given the physical attributes of electricity. In the literature on electricity markets, few articles compare the efficiency of forward contracts, options and physical assets (i.e. powerplants) within intra-day hourly hedging portfolios whereas electricity markets are precisely hourly markets. We analyze portfolios made of forward contracts and/or power plants for specific hourly-clusters based on electricity market data from 2013 to 2015 from the integrated German-Austrian spot market. Through a VaR and CVaR model, we prove that intra-day hedging with forward contracts is structurally inefficient compared to financial options and physical assets no matter the cluster hour.

Forward premia in electricity markets: The effect of non-storability, non-linearity, and fluctuating renewables

Jan Geiger, *University of Heidelberg, Germany*
Nikolas Wölfing, *The Centre for European Economic Research in Mannheim, Germany & ETH Zürich, Switzerland*

Financial commodity markets are considered to be governed by the 'cost of carry' no-arbitrage condition. Since electricity can hardly be stored in large scale, this condition does not apply to electricity forward contracts. Bessembinder and Lemmon (JoF, 2002) show how this can lead to a significant forward premium, defined as the difference between the forward price and the expected spot price, depending on the convexity of the industries marginal costs and the skewness of realised spot prices. This work presents a generalisation of the model to account for characteristics that govern real world electricity markets but haven't been considered by Bessembinder and Lemmon, such as the cost of flexibility and the possibility of negative prices. Increasing shares of renewable energies make these aspects ever more relevant. The model is taken to data from the German electricity wholesale market, a market which has seen an enormous increase in fluctuating renewable energy inflows in recent years.

Electricity forward curves with thin granularity

Ruggero Caldana, *Accenture, Italy*
Gianluca Fusai, *Cass Business School, UK*
Andrea Roncoroni, *ESSEC Business School, France*

We put forward a constructive definition of electricity forward price curve with thin granularity. This case encompasses timescales with hourly frequencies on, including half-hourly and quarter-hourly cross-sections. The resulting assessment is jointly consistent to both risk-neutral market information, as represented by baseload/peakload quotes, and historical market information, as mirrored by periodical patterns exhibited by time series of spot price records. Our method combines suitable nonparametric filtering with monotone convex interpolation in a way that the resulting curve is positive, stable, local, and monotonic. An empirical investigation in the EPEX spot market assesses effectiveness and representativeness of the resulting forward price estimates with hourly granularity.

Session B1

Intermittent renewable generation and network congestion: an empirical analysis of Italian power market

Faddy Ardian, *Ecole Polytechnique, France*
Silvia Concettini, *Ecole Polytechnique, France*
Anna Creti, *University of Paris Dauphine & Ecole Polytechnique, France*

This article investigates the effects of increasing renewable production on the frequency and the cost of electricity network congestion. A larger renewable output may relieve importing needs in some under-supplied regions whereas it may put an additional stress on the infrastructure, amplifying transportation needs, if production and consumption sites do not coincide. The impact of renewable supply on network congestion may be explicitly examined in electricity markets organized as two or more inter-connected sub-markets (or bidding zones) where transmission rights are assigned through implicit auctions. Using a unique database tracking all the transactions in the Italian Power Market we have estimated two econometric models on five zonal pairings: a multinomial logit model to assess the effects of renewable production on the occurrence and the direction of congestion and a two stage least square model with segmented regression to quantify the impact of renewables on congestion costs. Our analysis suggests that a larger local RES supply decreases the probability of suffering congestion in entry and increases the probability of causing a congestion in exit compared to no congestion case. The estimations on congestion cost reveal that increasing RES production tends to push the congestion cost towards zero. However, larger shocks may determine a change in flow directions whose only result is to modify the sign of congestion cost and not its absolute value. The analysis of the links between renewable production and congestion results to be extremely relevant in the path toward the implementation of the European Electricity Target Model which envisages the creation of bidding zones (defined or not by national borders) within a single EU market. Our results have significant implications for the definition of optimal environmental and energy policies when locational investment signals are also carefully taken into account.

Integration of European electricity markets: Evidence from spot prices

Klaus Gugler, *Vienna University of Economics and Business, Austria*
Adhurim Haxhimusa, *Vienna University of Economics and Business, Austria*
Mario Liebensteiner, *Vienna University of Economics and Business, Austria*

This paper seeks to investigate the current state of market integration among European electricity day-ahead spot prices. On theoretical grounds we show that market integration brings about benefits, such as lower average prices and increased welfare from allocative efficiency. Yet, price convergence leads to higher prices in the low-price market and to lower prices in the high-price market, which brings about winners and losers and thus makes the political implementation of market integration cumbersome. In our empirical analysis, we utilize a large sample of spot prices and combine it with other data such as interconnector capacity congestion and market coupling. Firstly, we provide evidence that cointegration increased from 2010–2012 but then declined until 2015, most likely due to increased feed-in from intermittent renewable. Secondly, we assess the speed of price adjustment from shocks and reach the conclusion that the efficiency of integration is rather modest. In general, integration among European electricity markets has a large potential for improvements from additional capacity investments and further promotion of market coupling.

Forecasting generalized quantiles of electricity demand: A functional data approach

Brenda López Cabrera, *University of Humboldt, Germany*
Franziska Schulz, *University of Humboldt, Germany*

Electricity load forecasts are an integral part of many decision-making processes in the electricity market. However, most literature on electricity load forecasting concentrates on deterministic forecasts, neglecting possibly important information about uncertainty. A more complete picture of future demand can be obtained by using distributional forecasts, allowing for a more efficient decision-making. A predictive density can be fully characterized by tail measures such as quantiles and expectiles. Furthermore, interest often lies in the accurate estimation of tail events rather than in the mean or median. We propose a new methodology to obtain probabilistic forecasts of electricity load

that is based on functional data analysis of generalized quantile curves. The core of the methodology is dimension reduction based on functional principal components of tail curves with dependence structure. The approach has several advantages, such as flexible inclusion of explanatory variables including meteorological forecasts and no distributional assumptions. The methodology is applied to load data from a transmission system operator (TSO) and a balancing unit in Germany. Our forecast method is evaluated against other models including the TSO forecast model. It outperforms them in terms of mean absolute percentage error and mean squared error.

Session B2

Transition towards a hydrogen-based passenger car transport: comparative policy analysis

Alena Kotelnikova, *Ecole Polytechnique, France*

Major OECD countries (Germany, Japan, etc.) have put in place a wide range of policy instruments addressing Zero Emission Vehicle (ZEV) deployment. This paper draws a cross-country comparison between existing policy instruments in favour of the deployment of Fuel Cell Electric Vehicle (FCEV). For this purpose, a number of indicators are developed such as vehicle affordability, annual advantage in running cost, state financial participation, etc. While FCEV fixed cost is lower in Denmark, Norway and Japan, it is higher elsewhere. The initial negative difference in possession price could be compensated with advantage in running cost in France, Sweden and California within ten years. The analysis of policy instruments addressing vehicle deployment is completed with a discussion on specificity of price- and quantity-based instruments facing technology uncertainty. This paper also makes an assessment of hydrogen infrastructure deployment approaches. Coverage and Availability indicators enable to distinguish 'local' (niche) and 'global' (nationwide) strategies. According to the present analysis, Denmark and Japan provide the most favourable conditions for the hydrogen mobility deployment. These countries have coordinated ramp-up of vehicles and infrastructure and lead according to both vehicle- and infrastructure-related indicators.

Is China a pollution haven for the G-7 economies? A trade-gravity panel approach

Sarah Najm, *University of Reading, UK*

This study contributes to the academic debate on trade and the environment by exploring whether the G-7 economies may have grown greener at the expense of increasing imports from China. We construct an environmental policy indicator to reveal the G-7's decarbonization progress in comparison to China. More specifically, we investigate the impact of environmental policy strictness on the emission intensity of imports in a gravity panel-data framework covering the annual period from 1994 to 2014. The preliminary results of this study suggest that on average a stricter environmental policy has a positive impact on the emission intensity of imports from China. This analysis is crucial to bridge the gap between policy concerns in relation to energy markets and the global economy.

A comparative review of investment conditions for electricity and gas TSO in the European Union

Sébastien Douguet, *Microeconomix, France*
Jean-Michel Glachant, *European University Institute, Italy*
Armand Jiptner, *Bengs, France*
Wim Palmers, *BearingPoint, France*
Vincent Rious, *Microeconomix, France & European University Institute, Italy*

A wave of investments is particularly expected for the electricity TSOs in the EU: they should increase by 28% in the coming 5 years. One can then wonder the TSOs' financial ability to cope with it and the potential barriers that may hinder those investments and increase their financing costs. To answer this question, we assessed the evolution of 40 electricity and gas TSOs in 14 representative Member States standing for 85% of the EU GDP with a model taking into account the interaction of investment plans, the regulatory framework and the financial conditions of TSOs developed by Henriot (2013). We also characterised the financial markets the TSOs rely on. We found that despite currently very favourable interest rates, a major share of investments (69%) mainly in the power transmission sector is at risk for financial reasons in the 10 coming years in the EU. The regulatory framework is the main barrier with this regard. We hence propose a set of recommendations to overcome these difficulties, in particular, a methodological convergence of the regulatory regimes at the EU level, a sound and sensible application of incentive regulation, more transparent regulatory decisions and a more open access to capital.

Equity as a foundation of future climate policy

Lucas Bretschger, *ETH Zurich, Switzerland*
Max Meulemann, *ETH Zurich, Switzerland*

By adopting the Paris agreement in 2015 the world has moved towards a more comprehensive international climate policy. But to achieve the agreed temperature target it is necessary to increase worldwide policy ambitions in the future. We argue that equity and distributional aspects will constitute a crucial foundation for this process. The paper starts by relating climate policy to basic economics and then explains the importance of equity in light of the Paris agreement. We analyze three different methods to allocate the efforts and emission rights of a climate agreement to show that distributional aspects are at the core of the negotiations. This motivates our online "climate calculator" that compares the country-specific carbon budgets based on three different methods: The equity principles method, an egalitarian distribution of carbon space, and an allocation based on a uniform carbon tax. It is shown that the equity principles proposal serves as a compromise between the more extreme proposals.

Session B3

Forecasting oil price realized volatility: A new approach

Stavros Degiannakis, *Panteion University of Social & Political Sciences & Hellenic Open University, Greece*
George Filis, *Panteion University of Social & Political Sciences, Greece*

This paper adds to the extremely limited strand of the literature focusing on the oil price realized volatility forecasting. More specifically, we evaluate the information content of four different asset classes' volatilities when forecasting the oil price realized volatility for 1-day until 66-day ahead. To do so, we concentrate on the Brent crude oil and fourteen other assets, which are grouped into four different asset classes, based on Heterogeneous AutoRegressive (HAR) framework. Our out-of-sample forecasting results can be summarised as follows. (i) The use of exogenous volatilities statistically significant improves the forecasting accuracy at all forecasting horizons. (ii) The HAR model that combines volatilities from multiple asset classes is the best performing model. (iii) The Direction of Change suggests that all HAR models are highly accurate in predicting future movements of oil price volatility. (iv) The forecasting accuracy of the models is better gauged using the Median Absolute Error and the Median Squared Error. (v) The findings are robust even during turbulent economic periods. Hence, different asset classes' volatilities contain important information which can be used to improve the forecasting accuracy of oil price volatility.

On the size and significance of OPEC's spare production capacity

Axel Pierru, *King Abdullah Petroleum Studies and Research Center, Saudi Arabia*
James L. Smith, *Southern Methodist University, USA*
Tamim Zamrik, *King Abdullah Petroleum Studies and Research Center, Saudi Arabia*

We develop a structural model of an oil producer that maintains a buffer of spare capacity to stabilize the market price of its output. We derive an analytical formula for the marginal value of spare capacity. Using historical price and spare capacity data, we estimate the model's parameter for three groups of producers: Saudi Arabia, OPEC core, and OPEC. We apply the principle of revealed preference to infer the loss function that appears to have motivated the investment in spare capacity and compare it to the estimated size of economic losses due to oil supply disruptions derived from a well-known world macroeconomic model. We also examine the extent to which each group of producers' intervention has damped price volatility during the last fifteen years. Our results suggest that the buffer capacity created was in line with global macroeconomic needs, and show that each group has effectively used its spare capacity to stabilize the oil price.

Market power and spatial arbitrage between interconnected gas hubs

Olivier Massol, *IFP Énergies Nouvelles and IFP School, France & City University London, UK*
Albert Banal-Estañol, *University of Pompeu Fabra, Spain & City University of London, UK*

This paper examines the efficiency of the arbitrages performed between two regional markets for wholesale natural gas linked by a capacity-constrained pipeline system. We develop a switching regime specification to (i) detect if the observed spatial arbitrages satisfy the integration notion that all arbitrage opportunities between the two markets are being exploited, and (ii) decompose the observed spatial price differences into factors such as transportation costs, transportation bottlenecks, and the oligopolistic behavior of the arbitrageurs. Our framework incorporates a test for the presence of market power and it is thus able to distinguish between the physical and behavioral constraints to marginal cost pricing. We use the case of the "Interconnector" pipeline linking Belgium and the UK as an application. Our empirical findings show that all the arbitrage opportunities between the two zones are being exploited but confirm the presence of market power.

Session C1

Limit-pricing and the (in)effectiveness of the carbon tax

Saraly Andrade de Sá, *ETH Zurich, Switzerland*
Julien Daubanes, *ETH Zurich, Switzerland*

The conventional analysis of policy-induced changes in resource extraction is inconsistent with the actual way OPEC is exerting its market power. We claim that OPEC is practicing limit pricing, and we extend to non-renewable resources the limit-pricing theory. Facing a very inelastic demand, an oil extractive cartel seeks to induce the highest price that does not destroy its demand, unlike the conventional Hotellian analysis: the cartel tolerates some ordinary substitutes to its oil but deters high-potential ones. With limit pricing, policy-induced extraction changes do not obey the usual logic. For example, oil taxes have no effect on current oil production. Extraction increases when high-potential substitutes are promoted, but can be effectively reduced by supporting ordinary substitutes. The carbon tax not only applies to oil; it also penalizes its ordinary (carbon) substitutes, whose market shares are taken over by the cartel. Thus the carbon tax ambiguously affects current and long-term oil production and carbon emissions.

Policy analysis using an emulator of integrated assessment models

Fabio Sferra, *Climate Analytics, Germany*
Niklas Roming, *Climate Analytics & Potsdam Institute for Climate Impact Research, Germany*
Mario Krapp, *Climate Analytics & Potsdam Institute for Climate Impact Research, Germany*
Michiel Schaffer, *Climate Analytics, Germany*
Marcia Rocha, *Climate Analytics, Germany*

Many researchers and policy makers perceive Integrated Assessment Models of climate change mitigation (IAMs) as a "black box", whose behavior and results are sometimes not fully understood. This hinders the dissemination of scientific findings. Hence, the goal of this study is to provide a simplified version of IAMs able to emulate the main results and key dynamics of multiple existing models. Results can be used for real-time support in decision-making and capacity building at the level of stakeholders and policy makers. At the same time, this IAM emulator opens up possibilities of increased flexibility regarding input data, regional, spatial and temporal resolution. The emulator could also be coupled with other models of sub-sectors whose integration into IAMs was not yet attempted due to inertia present in complex software development. Finally, for the same reasons, the emulator could be applied in very different settings than is usually the case for IAM, like for example, Monte-Carlo simulations and integrated coupling to models of the natural environment. Implementation is done using only open-source software tools like python and R and modern methods of software engineering. A focus is put on keeping the documentation up-to-date with the model development to ensure that results can be reproduced.

Robust dynamic energy use and climate change

Xin Li, *International Monetary Fund, USA*
Borghan Narajabad, *Board of Governors of the Federal Reserve System, USA*
Ted Temzelides, *Rice University, USA*

We study a dynamic stochastic general equilibrium model in which agents are concerned about model uncertainty regarding climate change. An externality from greenhouse gas emissions damages the economy's capital stock. We assume that the mapping from climate change to damages is subject to uncertainty, as opposed to risk, and we use robust control to study efficiency and optimal policy. We obtain a sharp analytical solution for the implied environmental externality and characterize dynamic optimal taxation. The optimal tax that restores the socially optimal allocation is Pigouvian. We study optimal output growth in the presence and in the absence of concerns about model uncertainty and find that these can lead to substantially different conclusions regarding the optimal emissions and the optimal mix of fossil fuel. In particular, the optimal use of coal will be significantly lower on a robust path, while the optimal use of oil/gas will edge down.

Session C2

Tradable emission permits: Beyond pollution abatement motives

Maria Eugenia Sanin, *University of Evry Val d'Essonne & Ecole Polytechnique, France*

In this paper we study how the electricity market characteristics determine the choices made by electricity generators in the U.S. market for SO_2 allowances. Counterparts can be chosen among three alternatives: market makers, brokers or another generator. We find that the SO_2 allowances market is de facto regionalized due to the regionalization of the electricity market. The national dimension only appears when there are local imbalances in the electricity market that give strong incentives to search for a better price outside of the region. Additionally, we identify the influence of the regulatory framework, i.e. the division in phases and the chosen allowance surrender date. Finally, we show that the previous results are robust to Enron's abnormal behavior during 2000-2001 and its posterior bankruptcy.

Capitalization of energy efficiency in the housing market

Erdal Aydin, *Maastricht University, The Netherlands*
Dirk Brounen, *Tilburg University, The Netherlands*
Nils Kok, *Maastricht University, The Netherlands*

The carbon externality from energy consumption in the residential sector is an important topic of societal debate. Much of the current policy making hinges on the assumption that markets efficiently capitalize home energy performance into transaction prices. However, the existing literature on the topic suffers from omitted variable bias, leading to inaccurate estimates. This study uses an instrumental variable approach on a large sample of dwellings to examine the capitalization of energy efficiency in the housing market. Using the exogenous variation in energy efficiency generated by 1973-74 oil crisis, as well as the evolution of building codes as instruments, we document that a 50 percent increase in energy efficiency leads to an increase in the transaction price of about 11 percent for an average home in the Dutch housing market. Our findings also indicate that the extent of energy efficiency capitalization does not significantly change when information asymmetry is reduced through the presence of Energy Performance Certificates (EPC). These findings are important for public policy regarding investments in home energy efficiency.

Trade and environment: further empirical evidence from heterogeneous panels using aggregate data

Thomas Jobert, *Nice Sophia Antipolis University, France*
Fatih Karanfil, *University of Paris-Ouest, France & Galatasaray University, Turkey*
Anna Tykhonenko, *Nice Sophia Antipolis University, France*

Despite the growing body of work devoted to the impacts of international trade flows on the environment, the current state of empirical research is still controversial. Empirical studies using panel data face two simultaneous challenges. One is associated with the potential presence of unobserved cross-country heterogeneity in the panel, while the other is due to the use of aggregate data on international trade. In this paper, we apply both the dynamic fixed effects and empirical iterative Bayes estimators to a global panel of 55 countries to show that when country heterogeneity is accurately accounted for in the estimation, it is possible to obtain significant impacts of trade variables on the environment, even though we use aggregate data. Based on the estimation results and further information on the stringency of environmental regulations in both developed and developing countries, we identify different country groups having similar features with respect to the trade-environment relationship. These findings suggest that multilateral actions and agreements on climate change should account for differences in countries' trade structures and development levels that determine their capabilities to mitigate and adapt to climate change.

Session C3

Energy market implications for emerging market debt markets

Eleanor J. Morrison, *University of London, UK*

This paper examines the impact of oil price innovations on emerging market sovereign total bond returns as measured by the JP Morgan Emerging Market total return bond index for a group of emerging market oil exporting and oil importing countries from 2004 to 2015. Globally emerging markets have benefited from investor desire for global diversification and search for higher yield return. This recent wave of investor demand has equally benefited African countries that have historically missed out of investor demand through schemes such as the Brady bond program. Oil prices were found not to be statistically significant in determining the total return bond index of emerging market countries. Investor access to capital through global quantitative easing programs was statistically significant factor on bond yield premium.

Evidence of change in the dependence structure between oil price and stock markets

Heni Boubaker, *IPAG Business School, France*
Nadia Sghaier, *IPAG Business School, France*

In this paper, we study the contagion effect between energy and stock markets in ten MENA countries during the recent global financial crisis 2007-2009. In particular, we verify whether this effect depends on the country's oil position. For that, we investigate the dependence structure between oil price changes and stock market returns using different copula functions. Specifically, we test for changing in dependence structure using the local change point (LCP) testing procedure. The empirical results provide strong evidence of asymmetric dependence structure between oil price changes and stock market returns for all countries. In addition, this dependence structure is larger in oil-exporters than oil-importers. Furthermore, there is significant change in this dependence structure. For all countries (except Kuwait and Jordan), the copula parameters and the tail dependence coefficients are greater during crisis periods than calm ones, thus indicating the presence of a contagion effect.

A financialization model of crude oil markets

Takashi Kanamura, *Kyoto University, Japan*

This paper theoretically and empirically investigates the financialization of crude oil markets. We propose a simple correlation model between stock and crude oil prices based on the supply and demand relationship taking into account the impact of stock markets on crude oil markets. Based on the correlation model, the optimal allocations of stock, crude oil and a risk free asset are obtained by solving the Merton's problem under the assumption of a log utility function. By using the price correlation model it is empirically shown that the correlations between S&P 500 and WTI crude oil prices are positive and increasing. In contrast, the correlations between S&P 500 and Brent crude oil prices are close to zero, which are lower than the correlations between S&P 500 and WTI crude oil prices. It may suggest that the financialization of crude oil markets be limited to WTI crude oil markets. The optimal allocations of S&P 500, WTI or Brent crude oil and a risk free asset are empirically obtained based on the correlation model. It is shown that after the 2008 financial turmoil the optimal WTI crude oil positions decrease in line with the optimal S&P 500 positions while the optimal Brent crude oil positions are not relevant to the optimal S&P 500 positions. The results may suggest that after the 2008 financial turmoil WTI crude oil be financialized and do not show the diversification effect to S&P 500 while Brent crude oil be not the case. These results are fully supported by the other empirical studies using the dynamic conditional correlation (DCC) model of Engle (2002). Additional empirical studies using crude oil and natural gas prices based on the DCC model suggest that WTI crude oil prices have higher correlations with the US natural gas prices than Brent crude oil prices, implying that WTI crude oil markets still have strong impacts on the other energy markets while the financialization of WTI crude oil has recently proceeded.

Session C4

Variance risk premia in commodity markets

Marcel Prokopczuk, *Leibniz University Hannover, Germany & University of Reading, UK*
Chardin Wese Simen, *ICMA Centre, University of Reading, UK*

We use a large panel of commodity option prices to study the market price of variance risk. We construct synthetic variance swaps and find significantly negative variance risk premia in nearly all commodity markets. An equally-weighted portfolio of short commodity variance swaps earns an annualized Sharpe Ratio of around 40 %. We document increasing comovements across bonds, commodities and equity variance swap returns, suggesting that the variance swap markets are increasingly integrated. Finally, we show that commodity variance risk premia are distinct from price risk premia, indicating that variance risk is unspanned by commodity futures.

Common factors of commodity prices

Simona Delle Chiaie, *European Central Bank*
Laurent Ferrara, *Bank of France, France*
Domenico Giannone, *Federal Reserve Bank of New York and CEPR, USA*

The high level of co-movement among commodity prices indicates that a few common forces could drive the bulk of commodity price fluctuations. In this paper, we estimate common factors from a large cross-section of commodity prices. We distinguish between global factors, category-specific factors and commodity-specific components. We find that the bulk of the fluctuations in commodity prices is well summarized by a single global factor. However, while the variations in crude oil are explained to a greater extent by block-specific shocks, the role of global sources has increased markedly since the late 1990s. The estimated factor is partly predictable and its predictability increases substantially during periods of high commonality. Looking at historical episodes of major commodity price changes, we find evidence that this single factor is associated with global demand shocks.

Insider trading in oil markets

Olivier Rousse, *University of Grenoble Alpes, France*
Benoît Sévi, *University of Grenoble Alpes, France*

The aim of the present work is to focus on the possibility of information leakage before the inventory information announcements and their effects on returns. Specifically, we examine the use of private information on inventory levels in oil futures markets traded in NYMEX-CME over the 2007-2014 period. The U.S. Department of Energy communicates each Wednesday at 10:30 about the level of oil inventories and this news is known as having the largest impact on oil prices. We investigate the potential trading by informed investors over the two hours and a half before the official news release. Using intraday data we compute the order imbalances over short intervals (2, 5 or 10 minutes) and show that significant order imbalances exist in days when news release corresponds to a surprising inventory level. The effect is more pronounced for positive surprises (stock level higher than expected) than for negative surprises. The bulk of order imbalance takes place around the beginning of the outcry trading session when liquidity is the highest. Our results can be taken as providing preliminary evidence that inventory level that is to be released by the DOE each Wednesday is private information and that some traders are able to benefit from their insider position to make money with the news. More generally, our results call into question the overall informational efficiency of the most liquid commodity market in the world.

Session D1

On the transition of Europe's power market - Economic consequences of national policies

Geoffrey J. Blanford, *Electric Power Research Institute, USA*
Christoph Weissbart, *IFO Institute, Germany*

Prospects for the European power market indicate that it nearly has to fully decarbonize by 2050 to reach the economy-wide target of an 80 % CO_2-emission reduction. Existing research on the European power market emphasizes the future role of renewable energy sources (RES) and flexibility measures along that decarbonization path. We add to this by using the EU-REGEN model to explain the penetration of RES from an economic perspective, their spatial distribution, and the complementary role of conventional generation technologies. Furthermore, we identify economic consequences of national energy and climate targets. Our study shows that onshore wind power will be the most crucial generation technology for the future European power market. Its geographic distribution is driven by resource quality. Gas power will be the major conventional generation technology for backing-up wind power. Moreover, a complete phase out of coal power proves to be not economically optimal. The paper demonstrates that existing national targets have a negative impact on especially the German region with higher prices and lower revenues. The remaining regions profit or are hardly affected. We encourage an EU-wide coordination on the expansion of wind power with harmonized policies. Yet, this requires profitable market structures for both, RES and conventional generation technologies.

Energy tax reform in time of crisis: The case of energy-dependent and open economies

Emmanuel Combet, *CIRED, France*

Many arguments against higher energy taxes and environmental pricing assume that a unilateral reform will necessary harm the production costs and the purchasing power of households, and therefore, in the aftermath of the crisis, exacerbate the economic downturn. This paper considers the most extreme arguments which assume that no substitution possibilities away from energy are available in the short to medium run. Unemployment is due to non-clearing wages in the labour market and a shortage of demand in the product market. Under such circumstances, however, a tax shift from labour to energy can boost employment if external trade is sufficiently sensitive to production costs and if the reform succeeds in shifting the tax burden away from production costs to the final consumers' incomes. When external trade is less sensitive to production costs, what matters the most is the domestic market. In that case, the effect is positive only if wages adjust to compensate the higher final energy bills of consumers, and thus, maintain the level of internal demand.

Effects of mergers on hub prices: An ex-post evaluation of the GDF/Suez merger

Elena Argentesi, *University of Bologna, Italy*
Albert Banal-Estañol, *University of Pompeu Fabra, Spain & City University of London, UK*
Jo Seldeslachts, *German Institute for Economic Research, Germany & KU Leuven, Belgium*

This paper presents an analysis of the effects of mergers in energy markets. In particular, we assess the effects of an important merger, namely Gaz de France's acquisition of Suez in 2006, which aimed to create one of the world's largest energy companies. We perform an econometric analysis, based on Difference-in-Difference techniques, to evaluate quantitatively the price effects of the merger and the remedies on the market for trading on the Zeebrugge hub in Belgium, as removing barriers to entry and facilitating access to the hub were part of the objectives of the main remedies imposed to the merging parties. Our evidence suggests that the remedies were effective in limiting the potential anti-competitive effects of the merger, as the net effect of merger and remedies shows a price decline. The estimated decline in prices is also consistent with the view that ownership unbundling has generated better access to the hub. In this respect, the remedies seem to have done more than simply mitigate the potential anti-competitive effects of the merger.

Session D2

Targeted filtration with a difference for inference and long-horizon forecasts: Application to the real price of crude oil

Stephen Snudden, *Queen's University, Canada*

Filtration by growth rates with targeted lag selection can influence inference and improve long-horizon forecast accuracy. This paper proposes the method of targeted filtration. The method targets lower-frequencies of the data which correspond to respective forecast horizons. Frequency-dependent structural relationships can be targeted to influence inference and dynamic properties. The method is applied to auto-regressive models of the global market for crude oil. The frequencies targeted vary structural shock persistence and the corresponding oil market elasticities. Targeted filtration can significantly improve forecast precision at horizons of up to four years.

Forward premia in electricity markets with fixed and flexible retail rates: Replication and extension

Silvester Van Koten, *University of Economics, Czech Republic*

Bessembinder and Lemmon (2002) analyze forward premia in electricity markets when retail rates are fixed. I run simulations to replicate their findings for fixed tariffs and extend their analysis to flexible tariffs. I am not able to replicate their findings for fixed tariffs for two of their four main predictions, and the regression they proposed, used in many empirical studies, seems not be able to reliably capture the relationships. I show that their predictions can mostly be extended to the case of flexible rates. Empirical studies should thus explicate if their data concern fixed or flexible rates and adjust their predictions accordingly.

A conditional dependence approach to CO_2-energy price relationships

Julien Chevallier, *IPAG Business School & Paris 8 University, France*
Duc Khuong Nguyen, *IPAG Business School, France & Indiana University, USA*
Juan Carlos Reboredo, *Universidade de Santiago de Compostela, Spain*

This paper uses the conditional vine copula approach to model the dependence structure between European-based carbon allowances and major energy prices. The paper makes two central contributions: (i) we extend the previous works of Reboredo (2013,2014) by allowing for a complete coverage of energy markets including natural gas, coal and electricity, beyond the carbon-oil dependencies, and (ii) we treat the dependence issue in a multivariate setting. Besides, the consideration of the electricity market in this context offers the possibility to gauge its influence through the computation of the fuel-switching mechanism.

Session D3

The natural resource curse and institutions in post-Soviet countries

Roman Horváth, *Charles University, Czech Republic*
Ayaz Zeynalov, *Charles University, Czech Republic*

We examine the effect of natural resource exports on economic performance during the 1996-2011 period in the 15 independent countries that formerly comprised the Soviet Union. These countries were a largely homogeneous group with respect to social and institutional context; however, these countries began to demonstrate marked differences from one another with respect to these factors during the transition, which has resulted in unique cross-section and time variation. Using several panel regression models that address the endogeneity and clustering issues, our results suggest that natural resources crowd out manufacturing sector unless the quality of domestic institutions is sufficiently high.

Policy measures to promote electric mobility – A global perspective

Theo Lieven, *University of St. Gallen, Switzerland*

Research that addresses policy measures to increase the adoption of electric vehicles (EVs) has discussed government regulations such as California's Zero Emission Vehicle (ZEV) or penalties on petroleum-based fuels. Relatively few articles have addressed policy measures designed to increase the adoption of EVs by incentives to influence car buyers' voluntary behavior. This article examines the effects of such policy measures. Two of these attributes are monetary measures, two others are traffic regulations, and the other three are related to investments in charging infrastructure. Consumer preferences were assessed using a choice-based conjoint analysis on an individual basis by applying the hierarchical Bayes method. In addition, the Kano method was used to elicit consumer satisfaction. This not only enabled the identification of preferences but also why preferences were based on either features that were "must-haves" or on attributes that were not expected but were highly attractive and, thus, led to high satisfaction. The results of surveys conducted in 20 countries in 5 continents showed that the installation of a charging network on freeways is an absolute necessity. This was completely independent from the average mileage driven per day. High cash grants were appreciated as attractive; however, combinations of lower grants with charging facilities resulted in similar preference shares in market simulations for each country. The results may serve as initial guidance for policymakers and practitioners in improving their incentive programs for electric mobility.

Exploring the role of transport infrastructure in a low-carbon world

Eoin Ó Broin, *CIRED, France*
Céline Guivarch, *CIRED, France*

The rate and manner in which transport infrastructure (e.g. roads, railway tracks, airports) is deployed will play an important role in determining energy demand, greenhouse gas emissions and the economic impact of the transport sector. To date, the inclusion of transport infrastructure in Integrated Assessment Models (IAMs) has been rudimentary. This paper describes an exercise whereby the approach to the inclusion of transport infrastructure for automobiles, public transport and air travel in the IMACLIM-R Global E3 IAM has been developed to incorporate the costs of investment in infrastructure and some physical constraints on its deployment. There are two key findings. The first is that recalibrating the baseline to include costs and constraints on the deployment of infrastructure results in lowered GDP and higher energy and carbon intensity. This is because investments in infrastructure increase the activity of the construction sector and this slows structural change of the economy towards more productive and less carbon intensive sectors. The second key finding is that in a scenario where the deployment of infrastructure is restricted (e.g. as a policy measure) in addition to a fixed carbon budget constraint being applied, the GDP loss is less than with the carbon budget only constraint. This suggests that restricting infrastructure deployment in a carbon budget scenario lowers the cost of mitigation. With the carbon budget fixed i.e. carbon targets are met, the avoided investment in transport infrastructure, and the 'relatively' lowered oil prices that this results in from less automobile activity, creates more activity in public transport and air travel and also moves investment to more productive sectors. This suggests that there is a double dividend from restricting infrastructure

deployment – a lower cost of mitigation i.e. a better economy, and carbon emissions targets being met, not to mention less use of automobiles.

Session E1

The dynamic effects of oil price shocks on corporates balance sheets

Khalid Elfayoumi, *German Institute for Economic Research, Germany*

The current view on the transmission of oil shocks to the financial markets primarily points at demand effects; however, this paper shows that the price responses of different classes of financial securities to oil shocks are heterogeneous, and provides evidence that this heterogeneity cannot be justified on the grounds of the demand channel alone. Allowing for the link between oil price shocks and markets uncertainty provides some explanation but is still not enough to explain other parts of the puzzling observations, particularly the case of small firms and high yield bonds. In answering these questions, this paper introduces revenue recycling by the energy sector ("Petro-dollar" recycling) as one of the key channels driving the dynamics of financial markets' responses to oil shocks. The analysis provides further evidence that these seemingly puzzling heterogeneous responses of financial securities are consistent with oil exporters portfolio adjustments after oil shocks. In addition to highlighting the larger role that should be assigned to uncertainty and revenue recycling effects, the paper also provides two more contributions: It sheds more light on the transmission mechanism of the demand channel through firms' balance sheet items. It also underlines the interpretation of a supply shock as a "disruptive" disturbance that significantly impacts financial markets despite its insignificant effect on oil prices. Besides contributing to the Oil/Financial markets nexus, the results provide keys to help active investors seeking to optimize their portfolios in the aftermath of oil shocks. One of the main contributions of the paper is its integration of three key datasets: Fama-French Benchmark portfolios, Quarterly Financial Report (QFR), and Treasury International Capital (TIC) data.

Contagions of spillover effects between the oil price and exchange rates

Shupei Huang, *China University of Geosciences and Ministry of Land and Resources, China & Parthenope University of Naples, Italy*
Haizhong An, *China University of Geosciences and Ministry of Land and Resources, China & Parthenope University of Naples, Italy*
Xiangyun Gao, *China University of Geosciences and Ministry of Land and Resources, China & Parthenope University of Naples, Italy*

The international oil price has spillover effects with the exchange rates; such spillovers between oil price and exchange rates could spread from one country to another with increasingly globalization. Aiming to explore the contagion among the spillovers between the oil price and exchange rates. First, we use the wavelet transform to remove the effect of the random effect to improve the estimation of the bi-variable vector autoregression models for each pair of oil price and exchange rate. We find that most of the exchange rates have bidirectional Granger causality with the oil price except THB/USD, CNY/USD, HKD/USD and CHF/USD. In terms of response direction, most of the exchange rates respond to the oil price in negative way at the beginning and then transform into lasting fluctuation. Concerning the response magnitude, impacts of exchange rate to oil price are greater than the impact of oil price to the exchange rate. Then we construct two single direction and one bidirectional networks. In these three networks, CAD/USD-oil nexus could be considered as the major exchange rates and has the widely influence to other nexuses. The spreading in the single direction network is much faster than in the bidirectional network, which implies that the former networks are suitable for the short-term decision-making and the later could offer more comprehensive reference to the long-term policy formulation.

Oil risk and financial contagion

Khaled Guesmi, *IPAG Business School, France*
Ilyes Abid, *ISC Paris Business School, France*
Anna Creti, *University of Paris Dauphine & Ecole Polytechnique, France*
Julien Chevallier, *University of Paris 8 & IPAG Business School, France*

In this paper we test for the existence of equity market contagion originating from oil price fluctuations to regional and domestic stock markets. The data are collected over the period from April 1993 to April 2015. We apply an International Capital Asset Pricing Model (ICAPM) from a three-factor setting to capture the unexpected return and disentangle simple correlation due to fundamentals

and contagion. We investigate four regions: the European Monetary Union (EMU), Asia-Pacific (AP), the Non-European Monetary Union (NEMU) and North America (NA). We define contagion as the excess correlation that is not explained by fundamental factors. Oil risk is shown to be a factor as important as contagion, which it amplifies in the context of regional markets all strongly interlinked with the USA.

Session E2

The energy-economic growth relationship: A new insight from the EROI perspective

Florian Fizaine, *University of Paris-Sud, France*
Victor Court, *University of Paris-Ouest Nanterre La Défense, IFP Energies Nouvelles & the Climate Economics Chair, France*

In the present paper we relate the recent estimations of the historical (1800-2011) global EROI of fossil fuels production performed by Court and Fizaine (2015) to the tremendous increase in Gross World Production that the global economy has encountered during the same period. We first show that on this entire period of study, there is a power inverse relationship that exists between the average price of aggregated fossil energy and its EROI. More precisely, we find that this long-term relationship is constituted of short-term relations that shift over time. We interpret these shifts as short-term cycles of EROI decrease/price increase/innovation to higher EROI. Furthermore, on the more restricted 1950-2011 time period on which we have continuous year-to-year data, we find a clear correlation between the EROI level of aggregated fossil energy and the growth rate of the Gross World Production (GWP). With the same data, we are also able to show that in order to have a positive growth rate, the global economy cannot afford to allocate more than 15% of its GWP to energy expenditures. In other words, this also means that considering the current energy intensity of the global economy, our primary energy system needs to have at least a minimal $EROI_{min}$ of approximately 6.5:1 (that conversely corresponds to a maximum tolerable average price of energy three times higher than current level) in order for the global economy to present a positive growth rate. From these different results, we then propose a business cycle model based on the EROI dynamics. Our study supports the idea that a coherent economic policy should first of all be based on an energy policy consisting in improving the net energy efficiency of the economy. Doing so would lead to a "triple dividend": an increase of the global economy EROI (through a decrease of the energy intensity of capital investment), a decrease of the sensitiveness of the economy to energy price volatility, and a decrease of GHG emissions associated with fossil energy consumption.

Time-varying analysis of CO_2 emissions, energy consumption and economic growth nexus: Statistical experience in next-11 countries

Muhammad Shahbaz, *COMSATS Institute of Information Technology, Paskistan & IPAG Business School, France*
Mantu Kumar Mahalik, *National Institute of Technology, India*
João Ricardo Sato, *Federal University of ABC, Brazil*

This paper detects the direction of causality among CO_2 emissions, energy consumption and economic growth in Next-11 countries for the period of 1972-2013. The relationship among these variables changes due to changes in economic, energy and environmental policies as well as regulatory and technological advancement with the passage of time. We use novel approach i.e. time-varying Granger causality and found that economic growth is cause of CO_2 emissions in Bangladesh and Egypt. Economic growth causes energy consumption in the Philippines, Turkey and Vietnam but the feedback effect exists between energy consumption and economic growth in South Korea. In case of Indonesia and Turkey, we find the unidirectional time-varying Granger causality running from economic growth to CO_2 emissions thus validates the existence of EKC hypothesis which indicates that economic growth is achievable at the cost of environment. The paper gives new insights for policy makers to attain sustainable economic growth while maintaining environmental quality for long run.

Energy intensity and environmental performance in the GCC countries: Long-run evidence from a heterogeneous panel

Amany A. El Anshasy, *United Arab Emirates University, UAE & Alexandria University, Egypt*
Marina-Selini Katsaiti, *United Arab Emirates University, UAE*

Although energy wealth rankings place the six Gulf Cooperation Council (GCC) countries among the richest in the world, the GCC economies face unsustainable growth in energy use and continuous environmental degradation. This paper examines the long-run relationship between per capita CO_2 emissions and energy intensity in the GCC, while controlling for economic activity, the size of the manufacturing sector, and institutional qualities. We use heterogeneous panel techniques that account

for heterogeneity and cross-country dependence for the period 1971-2011. We find that energy intensity and emissions are cointegrated in all GCC countries and that conservation and energy efficiency policies have greater potential in reducing emissions in Kuwait, Oman, and the UAE. However, energy efficiency and conservation alone may not be viable policy options to significantly cutting emissions in the next decades. A regional goal of mitigating emissions by 10% would require a reduction in energy intensity by 12%, on average. Therefore, investing in Carbon Sequestration (CS) technologies and having a strong commitment to renewable energy seem essential ingredients to any sustainable energy and environmental strategy. Last, we find that judiciary independence is an essential institutional quality that ensures the successful implementation and the stringent enforcement of long-term environmental policies.

Session E3

Is energy transition beneficial to sectors with high employment content? An input-output analysis for France

Quentin Perrier, *CIRED, France*
Philippe Quirion, *CNRS, France*

Employment has been a key issue of the public debate on energy transition in France. We develop an original methodology, based on input-output analysis, to compare the employment content of each economic sector to the national average, and break down the differences into five components: final consumption import rates, intermediate consumption import rates, taxes and subsidies, salary levels and labor share in value added. We then estimate the employment content and the greenhouse gas (GHG) content of all French economic sectors in 2010, in order to study intersectoral substitutions stemming from an energy transition. Our results show that employment content variations are explained, in order, by salary levels, final goods import rates, labor share in value added, intermediate consumption import rates, and finally taxes and subsidies. In addition, we find that sectors with high GHG content and low employment content (power production, heavy industries) are covered by the EU ETS, while those with both high employment and GHG content (agriculture, food processing and transport) are not. Concerns about employment impacts might be part of the explanation. Finally, we identify substitutions that would stimulate economic activity in sectors with lower GHG and higher employment contents - and not only because of lower salaries.

Economics of co-firing rice straw with coal in old and new Vietnamese power plants

An Ha Truong, *University of Science and Technology of Hanoi, Vietnam*
Minh Ha-Duong, *University of Science and Technology of Hanoi, Vietnam & CIRED, France*
Hoang Anh Nguyen Trinh, *University of Science and Technology of Hanoi, Vietnam & CIRED, France*

Is co-firing five percent of rice straw in coal-fired power plants a cost-effective approach to reduce pollution? Co-firing biomass in existing plants is held to be cheaper than building 100% biomass power stations. As a renewable fuel, biomass causes less carbon dioxide emissions than coal. In addition to these aspects, we also assess the impacts of co-firing on fuel transportation, on local air pollution by the plant, on rural employment and on national trade balance. We estimate these costs and benefits of retrofitting co-firing on two existing coal-fired power plants in Vietnam. One is an old plant, relatively small (100MW), using pulverized coal combustion. The other is a new plant, ten times larger using fluidized bed technology. We find that the retrofit is not an attractive investment, even in the old plant where using straw would be cheaper than coal. We find public benefits to co-firing, the most important being extra income for farmer from selling straw to the plant. We find that the public external benefits are greater than the private opportunity cost: within our parameters, using co-firing appears a socially interesting option.

Long-term macroeconomic impact of US unconventional oil and gas production: a general equilibrium perspective

Florian Leblanc, *CIRED, France*

This paper assesses the macroeconomic impact of long-term shale gas and light tight oil production in the United States. We endogenize those resources production within a Computable General Equilibrium (CGE) framework which technical inertias and short-term disequilibrium of a second best world. Our scenarios find moderate and bounded GDP increases despite increasing unconventional resources production. Lower energy prices and energy imports needs create long-term lockins which later on slow down GDP growth differential. In fact, an early higher refined oil dependency on the demand side face later on increased tensions on oil markets due to Middle East resource depletion. We study the tradeoff between long-term competitiveness and the real exchange rate appreciation caused by resource production, and find little evidence of a positive effect on investment in the production of energy intensive tradable goods. We simulate a policy that would moderate such a Dutch disease effect. The conditions under which the US could benefit from lower energy prices to increase its competitiveness are bounded by its ability to manage its current account in the short-term accordingly, with adverse general equilibrium effects on GDP and employments.

Optimal pro-biofuel policies with land-use inertia

Saraly Andrade de Sá, *ETH Zurich, Switzerland*

Pro-biofuel policies are to cause a large expansion of "semi-perennial" energy crops (e.g. sugarcane, switchgrass, miscanthus...) that exhibit long harvesting cycles (up to 20 years), unlike annual energy crops that need to be replanted every year (e.g. corn). This paper shows that semi-perennials introduce inertia in land conversion to energy crops; although empirically observed, this inertia has never been taken into account in the design of pro-biofuel policies. The scientific debate over the net social benefits of biofuel production is progressing but still unsettled. Thus, I characterize optimal pro-biofuel policies in presence of scientific progress. In this context, inertia in land conversion to semi-perennial crops justifies a departure from the standard Pigovian prescription: biofuels should be subsidized at a lower rate when energy crops are semi-perennial than when they are annual, despite identical returns.

List of Participants

First Name	Last Name	Institutions
	A	
Ilyes	Abid	*ISC Paris Business School, France*
Zeina	Alsalman	*Oakland University, USA*
Saraly	Andrade de Sá	*ETH Zurich, Switzerland*
Erdal	Aydin	*Maastricht University, The Netherlands*
	B	
Albert	Banal-Estañol	*University of Pompeu Fabra, Spain & City University of London, UK*
Stelios	Bekiros	*European University Institute, Italy & Athens University of Economics and Business, Greece*
Bernard	Ben Sita	*Lebanese American University, Lebanon*
Marie	Bessec	*University of Paris Dauphine, France*
	C	
Julien	Chevallier	*University of Paris 8 & IPAG Business School, France*
Emmanuel	Combet	*CIRED, France*
Silvia	Concettini	*Ecole Polytechnique, France*
Anna	Creti	*University of Paris Dauphine & Ecole Polytechnique, France*
	D	
Julien	Daubanes	*ETH Zurich, Switzerland*
Simona	Delle Chiaie	*European Central Bank*
	E	
Balázs	Égert	*OCDE*
Amany A.	El Anshasy	*United Arab Emirates University, UAE & Alexandria University, Egypt*
Khalid	Elfayoumi	*German Institute for Economic Research, Germany*
	F	
George	Filis	*Panteion University of Social & Political Sciences, Greece*
Florian	Fizaine	*University of Paris-Sud, France*
	G	
Claire	Gavard	*Centre for European Economic Research, Germany*
Victor	Gordillo Zavaleta	*Aramco Overseas Company, The Netherlands*
Stephane	Goutte	*University of Paris 8 & University of Paris Dauphine, France*
Khaled	Guesmi	*IPAG Business School, France*
	H	
Shupei	Huang	*China University of Geosciences and Ministry of Land and*

		Resources, China & Parthenope University of Naples, Italy
	K	
Takashi	Kanamura	*Kyoto University, Japan*
Mohamad B.	Karaki	*Lebanese American University, Lebanon*
Fatih	Karanfil	*University of Paris-Ouest, France & Galatasaray University, Turkey*
Lutz	Kilian	*University of Michigan, USA*
Alena	Kotelnikova	*Ecole Polytechnique, France*
	L	
Yannick	Le Pen	*University of Paris Dauphine, France*
Florian	Leblanc	*CIRED, France*
Mario	Liebensteiner	*Vienna University of Economics and Business, Austria*
Theo	Lieven	*University of St. Gallen, Switzerland*
	M	
Olivier	Massol	*IFP Énergies Nouvelles and IFP School, France & City University London, UK*
Max	Meulemann	*ETH Zurich, Switzerland*
Eleanor J.	Morrison	*University of London, UK*
Saeed	Moshiri	*Allameh Tabataba'i University, Iran*
	N	
Sarah	Najm	*University of Reading, UK*
Saban	Nazlioglu	*Pamukkale University, Turkey*
Duc Khuong	Nguyen	*IPAG Business School, France & Indiana University, USA*
	O	
Eoin	Ó Broin	*CIRED, France*
	P	
Quentin	Perrier	*CIRED, France*
Axel	Pierru	*King Abdullah Petroleum Studies and Research Center, Saudi Arabia*
	R	
Vincent	Rious	*Microeconomix, France*
Hatem	Rjiba	*IPAG Business School, France*
Andrea	Roncoroni	*ESSEC Business School, France*
	S	
Maria Eugenia	Sanin	*University of Evry Val d'Essonne & Ecole Polytechnique, France*
Franziska	Schulz	*University of Humboldt, Germany*
Ingmar	Schumacher	*IPAG Business School, France*

Benoît	Sévi	*University of Grenoble Alpes, France*
Fabio	Sferra	*Climate Analytics, Germany*
Nadia	Sghaier	*IPAG Business School, France*
Muhammad	Shahbaz	*COMSATS Institute of Information Technology, Paskistan & IPAG Business School, France*
Stephen	Snudden	*Queen's University, Canada*
	T	
Ted	Temzelides	*Rice University, USA*
Frédéric	Teulon	*IPAG Business School, France*
An Ha	Truong	*University of Science and Technology of Hanoi, Vietnam*
	V	
Silvester	Van Koten	*University of Economics, Czech Republic*
	W	
Christoph	Weissbart	*IFO Institute, Germany*
Chardin	Wese Simen	*University of Liverpool, UK*
Nikolas	Wölfing	*Centre for European Economic Research in Mannheim, Germany & ETH Zürich, Switzerland*
	Y	
Adonis	Yatchew	*University of Toronto, Canada*
	Y	
Ayaz	Zeynalov	*Charles University, Czech Republic*

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