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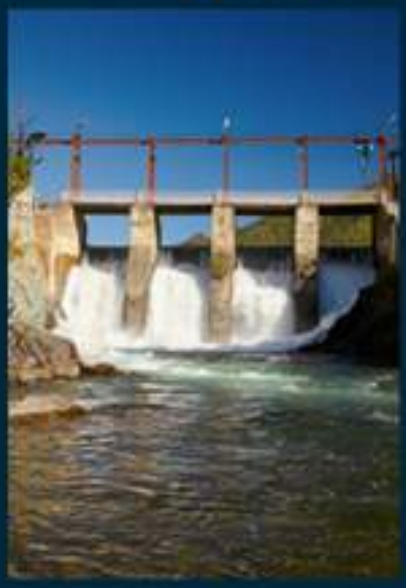




# EUCERS Newsletter

European Centre for Energy & Resource Security
Department of War Studies, King's College London

Issue 45
June 2015

## Introduction

Welcome to the 45th edition of the EUCERS Newsletter for the month of June.

This issue's general article section includes one piece by EUCERS Research Associate, Dr Slawomir Raszewski on European energy security options. In our second article, I briefly outline the impacts of renewable energy systems on the structure of the electricity grid in light of two recent events on the smart-grid market.

We would also like to draw your attention to our most recent EUCERS Strategy Paper Number Six on "The Future Role of Coal: International Market Realities vs. Climate Protection? by EUCERS-Research Director Dr Frank Umbach. The paper is available on our homepage (www.eucers.eu).

Please be aware that applications for the 2015/2016 *KAS Energy Security Fellowship* are closing on June 30. For more information, please refer to our website.

Also, EUCERS is conducting its yearly *Executive Energy Seminar 2015* from the 13th to the 17th of July, at King's College London, under the chairmanship of Dr Frank Umbach, Research Director at EUCERS. The one week seminar will revolve around "*Changes and Challenges in International Energy Markets*". In order to attend please RSVP to carola.gegenbauer@kcl.ac.uk or call 020 7848 1912 for more information.

In EUCERS on the Road we continue to inform you about conference participation and presentations of our members, as well as latest publications.

I hope you enjoy the newsletter!

Justus Andreas
*Research Associate and Newsletter Editor at EUCERS, King's College London*

**In this Month's Edition:**

**ARTICLES**

## A perfect storm? Energy Union, Energy Security and the EU-Russia energy politics

*Dr Slawomir Raszewski*

Dr Slawomir Raszewski is a Research Associate at EUCERS. Previously a Research Associate at Queensland (Australia) and a Research Fellow at Ankara (Turkey), Slawomir holds a Ph.D in International Energy Politics and Governance from the University of Leeds (UK).

The conventional way of assessing the ability of a country to cope with energy price shocks or supply interruptions would be to look at its energy dependence. Yet the EU is a slightly different case because it is a bloc of 28 member states who depend on Russian gas supplies to varying extents.

The EU is the world's largest energy importer: 53% of all EU energy comes from imports, of which 39% belong to Russian gas supplies. Apart from the Ukraine pipeline, there are two other lines: one through Belarus and Poland and another that runs under the Baltic Sea from Russia to northern Germany.

This import dependence costs the EU €400bn (£290bn) a year overall – a staggering amount, particularly on the back of a financial crisis. This affects the EU's economic competitiveness on the global stage. Hence there is a need to rethink energy policy in the union.

### *The EU-led Energy Union*

The EU's planned energy union is an attempt to achieve the EU energy objectives dating back a decade or so: reduce energy dependence, become a single energy market and cut emissions.

These objectives have been difficult to implement. The EU had inadequate powers to make them happen and the interests of individual member states sometimes differed. Neither are the policies themselves always compatible.

An energy union will not necessarily change these problems in itself – not unless member states agree to make hard choices. These would include prioritising security over sustainability; EU intervention over free market logic, over the missing connections for a single energy market; and energy efficiency. The intensifying geopolitical situation with Russia might make the difference, of course.

### *A Caspian pipeline connection*

Since the early 2000s, the EU sought to reduce its dependence on Russian gas by building a dedicated long-distance pipeline through the Balkans and Turkey to the Caspian Sea. This would have connected gas supplies from Azerbaijan and Turkmenistan with demand primarily in south-eastern Europe – the area most threatened by the Russians cutting off the Ukraine pipe.

Originally conceived as the Nabucco pipeline project, which was going to run from Azerbaijan, the plan was scrapped after the EU failed to reach an agreement with Turkmenistan and the pipeline hit political and legal obstacles.

It has since been replaced by a project principally with Azerbaijan to deliver gas from the second phase of the Shah Deniz field. This so-called Trans Anatolian Pipeline (TANAP), due to come into operation in 2018, will only have the capacity to cope with 1% of EU demand in its initial form.
Unveiled earlier on this year, the so-called 'Turkish Stream' project aims at interconnecting Russia and Turkey through an offshore pipeline section. The pipeline onshore section is expected to connect to the Turkish-Greek border. The routing of the pipeline project is essentially a revamped version of the deposed South Stream pipeline project. Officially cancelled by Russia's President Putin in December 2014, the South Stream was planned to run through the Russian, Turkish and Bulgarian exclusive economic zones (EEZ) before connecting to

Bulgaria's shore. The Turkish Stream, instead, will run through EEZ of Russia and Turkey only. The Turkish Stream project arrives at politically sensitive time of EU Russia sanctions and has been perceived as competitive to the EU-backed Trans-Adriatic Pipeline and, by extension, to the decade-long strategy of Southern Energy Corridor championed by the European Union.

EU Russia sanctions, nuclear talks with Iran, conflict in Syria and Iraq and an outset of the 'great game' in the Arctic are directly and indirectly linked to current and future developments in the Black Sea region.

Upgrades could increase gas supplies from the Caspian once political and legal issues are resolved. Renewed discussion on the Trans-Caspian pipeline emerges as P5+1 talks set a deadline to settle the Iran sanctions. Yet, even if resolved this summer it is likely to take another decade before Iran's full gas production capacity is restored. And whatever happens with the Energy Union, the EU cannot ultimately control whether anything will go ahead.

*Liquefied Natural Gas (LNG)*

Liquefied Natural Gas and the regasification infrastructure that is used to restore it from liquid to gas has been the option of choice for EU members in Western Europe over the past few years, including the UK, Spain, Portugal and France.

LNG, which primarily comes from Qatar, has the attraction that as opposed to piped gas it is relatively unconstrained by geopolitics. On the other hand, this lack of constraint makes it a truly global commodity. European countries can easily be outbid for supplies by the most lucrative supply markets in Asia – particularly China, Japan and South Korea.

Yet Poland, Lithuania and Estonia have now also prioritised LNG to diversify away from Russia, not to mention Greece, Cyprus and Croatia. Poland and Lithuania, in particular, approximated stringently the EU energy rules contained in the so-called EU Third Energy Package initiating policies of energy security. Lithuanian Floating LNG terminal is the first regional LNG project completed in December 2014. Located in the port of Klaipeda, the LNG facility's initial capacity is 1 bcm and with planned upscaling is expected to reach a capacity of 2-3 bcm per year. Poland's long-delayed Swinoujscie LNG terminal is expected to be completed by the end of 2015 with initial capacity of 5 bcm due to be expanded to 7.5 bcm per year at a later stage. Both projects aim at diversifying gas supplies. In addition to gas supplies, the Klaipeda floating LNG terminal follows Lithuania's 2010 energy independence strategy to become fully independent from Russian gas supplies. Once operational the Polish LNG terminal may supply up to 50 percent of the country's gas needs at today's rates. In itself, though, the Polish LNG policy does not seek independence from Russian gas supplies but, rather, an equilibrium. The success of these moves will largely depend on whether they can buy enough LNG. Due to energy efficiency measures in Europe coupled with so-called gas glut on regional markets, there exist a window of opportunity for LNG market entrants. The prospect of the US lifting its ban on gas exports may improve the situation. But as well as the current market reality, the other drawback is that LNG does not offer energy security against supply shocks if the price suddenly shoots up.

*Shale Gas*

The lack of an EU-wide policy on unconventional hydrocarbons such as shale gas has been an obstacle for a large-scale effort at developing the industry across the continent. The existing moratoria on fracking in some of Europe's key shale-rich countries including Germany and France has effectively frozen full exploration of the resource.

The most advanced prospection and exploration has been in Poland where 68 boreholes were drilled as of January 2015, though all major western players have pulled out because conditions have proved tougher than they expected. It remains to be seen how local energy companies are going to play in the new environment characterised by absence of international majors. The UK is the second biggest player in exploration of the emerging resource (despite recent bans in Scotland and Wales). Shale gas exploration is likely to take hold in those countries where energy security is the key

prerogative. Depending on the acceptability of fracking and the availability of alternative methods of extraction down the line, unconventional hydrocarbons may grow in importance. But as the shale-prospection momentum slows down, future production only looks likely to satisfy a small portion of future energy needs on the continent.

*This piece is a revised version of an article originally appeared in 'Natural Gas Europe' and 'The Conversation'.*

## Electricity as a Service: A shifting grid environment in times of energy transition

*Jan-Justus Andreas*

The grid is changing. As renewable energies are increasing their share in the energy mix of many countries in the world, they are not only changing the way in which a country's electricity is generated, but also in which it is distributed. The integration of a multitude of different sized energy systems into a country's central electricity grid has led to a great challenge for operators to manage these electricity flows. This adds to the general technological and financial issues of the renewable systems themselves that include questionable efficiency, problems of intermittence and, above all, costs. The amount of new energy installations, however, also brings an even greater opportunity for a more efficient, distributed, 'smart' management of energy.

Two recent developments on the market, Tesla's unveiling of the 'powerwall' and the commenced cooperation between US solar company SolarCity and Google's NestLabs, are underpinning the structural transition from a centralised grid towards a distributed energy supply. This will mean for energy utilities to expand their role of mere generators to increasingly become grid managers, with electricity turning into a service rather than remaining a commodity.

### It's in the Balance - Grid Penetration and Renewables

The first major issue with growing renewable electricity generation is its integration into the existing national grid. While the power system traditionally operated around several central plants owned by major energy companies, the rise of various renewable installations, as well as residential systems, have increased the number of electricity generators. This in turn rendered a country's energy supply and demand dynamic even more complex. As a result of these developments for conventional power plants, grid operators are required to improve the interplay of the systems.

Jan-Justus Andreas was the 2013/14 KAS Fellow at EUCERS and is the Chief Editor of the EUCERS Newsletters. He is currently completing his PhD in Environmental Economics and Environmental Management at the University of York.

To do so, operators are focusing on the fundamental needs of the power system, instead of using the blurry concept of base-load to fit in renewable installations. The needs are represented in three services that are key for the grid to operate reliably: energy, referring to megawatt-hours or energy that is transmitted at a constant rate over a period of time, capacity, which is the ability to produce power on demand, and flexibility, implying the ability to adjust output as supply and demand change. However, no energy system provides all three services economically (compare Figure 1). While traditional base-load resources, such as nuclear, coal, and combined cycle gas (CCG), can provide low cost electricity at a constant rate, they are far less cost-effective when used for capacity or flexibility functions. Less expensive as well as less efficient combustion gas turbines would, on the other hand, be useful to improve capacity and flexibility based on their infrequent use.

Commonly considered the greatest challenge associated with renewable energy generation are issues regarding intermittency and the consequent limit it imposes on the share of for example wind energy in a country's overall energy mix. According

to the National Renewable Energy Laboratory in the United States, however, the variability of renewables, including wind, is largely insignificant on the power system level, which has dealt with significant supply and demand shifts for decades.[1] Hence, at the grid operator scale, the gradual and predictable changes in wind power are in fact easier to address by operators than large-scale outages of conventional plants. Their integration, therefore, is considered rather a matter of management. However, it is exactly here that improvements are needed. As renewables penetration on the grid grows, traditional systems have to respond and adapt to these changes by working harder, ramp faster and turn on and off more often. This results in increasing balancing, interconnection and backup costs.

**Figure 1**: Energy, Capacity, and Flexibility of various energy resources[2]

| | Energy | Capacity | Flexibility |
|---|---|---|---|
| Wind | X+ | Some | Can, but is costly |
| Nuclear | X | X | None |
| Coal | X | X | Little |
| Natural gas comb. cycle | X- | X | X |
| Natural gas turbine | Too costly | X+ | X+ |
| Hydroelectric | Some | X | X |

AWEA AMERICAN WIND ENERGY ASSOCIATION

Improving efficiency of operation, and thereby reducing wear and tear on the equipment and emissions, as well as costs for consumers, requires an improved forecasting of demand and supply of energy. Considering the above brief overview of several energy systems, a modern grid can achieve such efficiency through making use of a diversified portfolio of resources. Currently dominant plans of many governments to shift towards a combination of renewable energy, gas generation, and demand response can be considered a cost effective way to meet the power system's needs. However, the different scales of renewable systems are fragmenting power markets in developed economies further as microgrids and household renewable generation expand.

**Distributed Generation vs. Central Plants - The Revolution at Home**

The second issue lies, therefore, in the increasing decentralisation of the grid. While the integration of renewables can be improved through planning, forecasting and management, the increased distribution of electricity generation through small-scale generators, such as wind farms, biomass facilities and rooftop solar installations, are challenging the grid fundamentally. The traditional model of power provision is based on central generation. Conventional central plants, such as coal, gas and nuclear, are connected to the grid and deliver electricity to the consumer. However, this centralised business model, established and run by major energy companies across the developed markets is on the brink of undergoing a rapid structural change.

Favourable green energy policies, falling technology costs and incentives for distributed energy resources (DER), such as new financing mechanisms to support the installation of solar panels at a household level, have led to significant increases in small scale renewable installations. DER systems are systems of up to 10MW that can be deployed on- or off-grid and include rooftop solar installations and wind generators, but also small hydro, biomass, biogas, and geothermal power. Incentives for DERs are potential reductions in electricity prices through increased competition on the market, reductions of household or community carbon footprints, improved energy security, as well the provision of new revenues by enabling generators to sell electricity back into the grid.

[1] National Renewable Energy Laboratory, 2014, at http://www.nrel.gov/electricity/transmission/western_wind.html

[2] American Wind Energy Association, at http://awea.files.cms-plus.com/AWEA%20Reliability%20White%20Paper%20-%202-12-15.pdf,p.25

Although the growing scale of DERs has led to expansions of power capacity and investment in grid infrastructure, traditionally profiting utilities, they hint at a shift away from centralised utilities companies. Connecting DERs to the same transmission grid as central stations is, nonetheless, associated with a variety of technical issues. These issues refer primarily to questionable power quality, voltage stability (particularly for solar photovoltaics and wind due to the issue of intermittence), harmonics, reliability, protection and control. Issues also surround the two-way electricity flow as customers sell greater volumes of electricity back to the grid, which traditionally only go one way: from the central plant to the consumer.

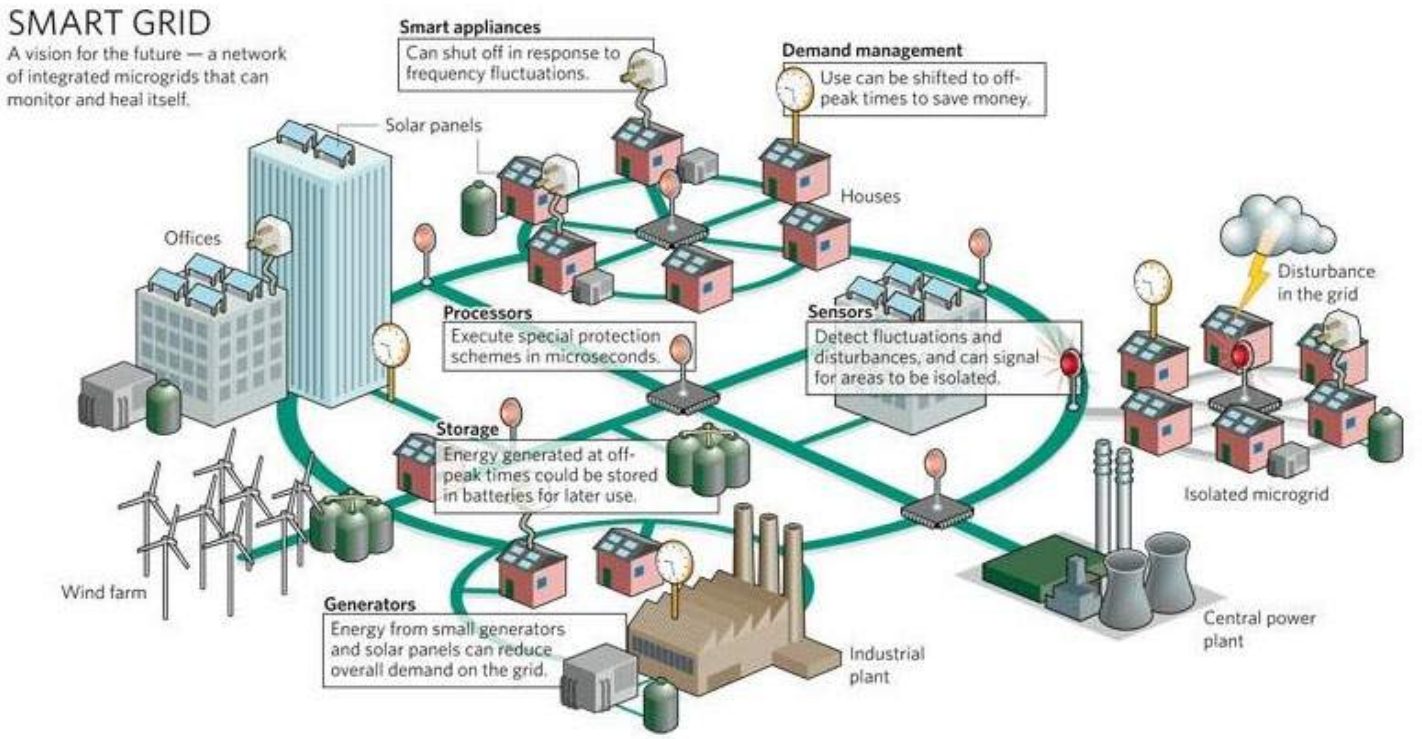
While centralised power systems often transmit their electricity over long distances, DER systems are commonly located in proximity to the load they serve. Growing large scale deployment of DERs can nonetheless impact fundamental grid functions such as frequency control and allocation of reserves. As a result, virtual power plants, grid energy storages and smart grid functions have been added to the grid in many developed markets. Virtual power plants are systems that cluster several types of power sources thereby providing a reliable overall power supply. Energy storages are sometimes classified as a DER system, a distributed energy storage system (DESS), and refer to the large-scale storage of electricity within a grid, for example, to counteract intermittencies.

The term ‘smart grid’ refers to a modernised electrical grid that is utilising digital information and communications technology to gather and act on information automatically, thereby improving efficiency, reliability, and costs of electricity distribution and consumption. It is these smart grid technologies that have brought households themselves to the verge on becoming central players within a country’s power system.

Combining smart technology with household renewables technology is the core piece of the current grid system transformation towards a comprehensive smart grid. As such, the cooperation between SolarCity, the largest US rooftop solar installer and chaired by Tesla's CEO Elon Musk, and Google-owned Nest Labs is a significant development in this area. For the first time, two market leaders in their respective fields are cooperating and thereby potentially accelerating the development of the distributed energy model. This model suggests that innovative technology companies with the ability to monitor the flow of electricity and aggregate household demand will be able to work with traditional utilities companies and provide 'smart' solutions to the above problems associated with decentralised electricity generation (see Figure 2).

As such, smart households are poised to change the way that households manage energy efficiency and the way that grid systems operate. Households and the DER companies that install them will be linked and use smart technology which digitally manages household energy production and consumption, boosting efficiency and enable selling output back to the grid. Technology companies, such as Google, are prone to play an important role as smart grid grows, as they have a major competitive advantage over traditional utilities through their existing digital presence in households. They also have the ability to link home electricity management to other IT devices and apps, improving the overall ‘smart’-experience, making it more marketable. It is therefore not unlikely for them to become significant competitors to the traditional centralised power generators. By joining with companies focused on the installation of technologies like rooftop solar systems, they offer each household electricity at reduced costs and potentially even at a profit through the ability of selling electricity back to the grid.

**Figure 2**: Smart Grid[3]




In order to boost households' efficiency in this regard, and in order to counteract voltage issues associated with intermittent solar and wind generation that can affect mechanical grid equipment, energy storage is the key. Electric vehicles manufacturer Tesla Motors introduced a suite of lithium-ion batteries earlier this year. The so called 'powerwall' allows households and businesses to manage their load in a more flexible way using either the 7 kilowatt hour (kWh) model, or even go off-grid for a limited time with the 10kWh version. The powerwall itself is not revolutionary on a technological basis, as different battery technologies have become commercially available at both the behind-the-meter and grid level. It nonetheless embodies another step towards the development of the decentralised electric industry by promoting flexibility and an efficient way of reducing energy costs as well as emissions.

**The end of utilities as we know them**

This new market environment will increasingly render utilities managers of supply and demand rather than mere electricity generators. Their business model is therefore likely to shift from charging for the supply of electricity or grid usage towards acquiring revenues through services. Such services are likely surrounding the provision of equipment, such as rooftop solar installations and batteries and smart metres to boost energy efficiency. These measures can help cut electricity demand when power is most costly.

Mature power markets are shifting towards the concept of electricity as a service instead of a commodity. As such, while renewable energy transitions might not deserve the title of an energy revolution, their impact on the grid might.

**DISCLAIMER**

*The views expressed in this Newsletter are strictly those of the authors and do not necessarily reflect those of the European Centre for Energy and Resource Security (EUCERS), its affiliates or King's College London.*

[3] PowerGenAsia, 2015, at http://www.powergenasia.com/conference/smartmeter.html

## ANNOUNCEMENTS

*KAS Energy Security Fellowship 2015/16*
We are delighted to announce that this year, the Konrad Adenauer Foundation (KAS) in London will again be funding a research stay at EUCERS, King's College London. The topic of this year's fellowships is: *"From Peak Oil to Oil Glut – What Future for Oil?"*

The Konrad-Adenauer-Foundation funds a 12-month research stay for a European Union (EU) resident research Fellow at the European Centre for Energy and Resource Security (EUCERS) at King's College London. The Fellowship includes a stipend of £28,179, which will pay a monthly stipend of £1,879 for the fellow, university fees and a conference subsistence.

For more information, please visit www.eucers.eu

EUCERS/ISD/KAS Energy Talks
**15. July 2015, 14.00-16.00 with a reception afterwards ♦ King's College London ♦ Council Room (2nd floor) ♦ Strand Campus ♦ London WC2R 2LS**

### Brazil's Emergence as an Energy Superpower

*14.00 Welcome Address and Introduction*
**Professor Dr Friedbert Pflüger,** Director, EUCERS, King's College London
**Hans-Hartwig Blomeier**, Director London Office, Konrad-Adenauer-Foundation (KAS) (tbc)

*Introductory Statements include:*
**Dr Alexandre Strapasson,** Centre for Environmental Policy, Imperial College London and former Consultant for Energy and Climate Change Affairs at the Ministry of the Environment (MMA) in Brazil
**Tulio Cesar Andrade,** Economic Counsellor, Embassy of Brazil in London
**Dr Frank Umbach**, Research Director, EUCERS, King's College London

*Comments by*
**Flavio Lira,** KAS Fellow at EUCERS 2014/15 and PhD Candidate at the Institute of International Relations at the University of Sao Paulo, Brazil
**Thomas Fröhlich**, Brazil Institute, King's College Lodon and former advisor to the German Bundestag
*Discussion*
*16.00 Reception*
In order to attend please RSVP to carola.gegenbauer@kcl.ac.uk or call 020 7848 1912

## EUCERS ON THE ROAD

Our team represents EUCERS at various conferences and events all over the world. This section gives a regular update and overview of conferences and interview contributions by EUCERS Director Professor Dr Friedbert Pflüger, Associate Director Dr Adnan Vantansever and Research Director Dr Frank Umbach.

| | |
|---|---|
| 12.07.15 Berlin, Germany | Frank participated in the Expert Discussion "Risiko und Resilienz im Energiesystem" ("Risk and Resilience in the Energy System") and the Working Group "Rohstoffe für die Energiewende – Metalle im Fokus" ("Raw Materials – Focus on Metals") organized by ACATEC-German Academy of Technical Sciences. |
| 29.05.2015 Vilnius, Lithuania | Frank was part of the "2nd Energy Dialogue at Seimas" on LNG-Perspectives for the Baltic States and Europe. |
| 28.05.2015 Vilnius, Lithuania | Frank presented on "European Energy Strategy and Recent Developments" at the first "Energy Security Course" at the NATO Energy Security Centre of Excellence". |

## PUBLICATIONS

Dr Frank Umbach shares with us their most recent publications and interviews:

Frank wrote on "Coal Ban Could Backfire on West and Impact Developing Economies" for the Geopolitical Information Service (GIS - www.geopolitical-info.com), on 11 June 2015, 4 pp.

Frank published "The Future Role of Coal: International Market Realities vs. Climate Protection?, EUCERS-Strategy Paper Six, King's College, London, May 2015, 66 pp

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If you have found our Newsletter interesting, wish to hear more about our activities, or, indeed, contribute with ideas or essays, please contact Carola Gegenbauer, Operations Coordinator EUCERS on carola.gegenbauer@kcl.ac.uk or call 020 7848 1912.

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