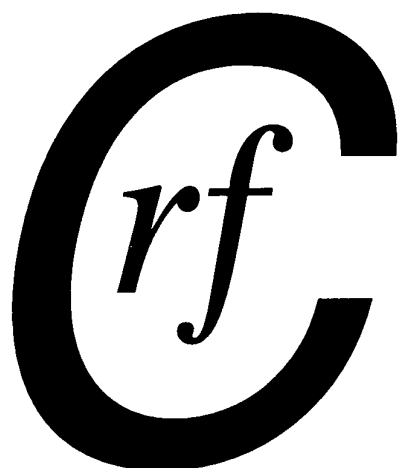


# NEWSLETTER



*of  
the  
Coal Research Forum*



## **EDITOR'S MUSINGS:**

I would like to wish you all season's greetings on behalf of myself and the Executive Committee on what may be the final New Year issue of the CRF newsletter. However, it will not be the last New Year issue of our newsletter as by this time in 2018, (and before then if all goes well) you should be reading the FERF newsletter, that is the Fuel & Energy Research Forum newsletter. A short article in this newsletter describes why we are changing and what we are intending to become early in 2017.

Well, as if one seismic event wasn't enough for one year we now have had two in a year! And I don't mean any ruling by the UK government on the use of fracking in this country either! Perhaps after Brexit some of us thought, "Well, it could be possible, couldn't it? But nah, surely no one will vote Trump into power". Wrong yet again, Mr Editor! Do we know anything about what the outcome of the US election will hold for the UK (except perhaps that Nigel Farage probably will not have a role) - well not yet? Will it cause a renaissance to the coal industry in Pennsylvania? What future for the COP21 climate change accord? Is clean coal going to be the answer in the US? Or now that we have a new president in place in the White House and the campaign is over will everything become 'normal' again? Like many things at the moment, we simply don't know and we shall just have to wait and see. As the Chinese might have said "we may be living in interesting times".

The main event from the CRF's perspective was ECCRIA 11, held at The Edge in Sheffield and a full report of the event is included in this newsletter. It was, as far as I have been able to judge, a success. We also held a joint meeting with the APGTF on 7<sup>th</sup> December entitled "Workshop: Power generation (coal, gas, and biomass) under increasingly stringent emissions regulations" which will be reported full in the next newsletter.

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## **An Important Announcement from the Forum Executive Committee.**

During 2016, the Forum Executive Committee has had extensive discussions regarding the long term planning and future of the Forum. The Forum was established 28 years ago to fill the need for a body to encourage Industry and Academe to work more closely together on coal research issues for the mutual benefit of both areas, where the Forum has well fulfilled this role over the last nearly 30 years. The Forum continues to have a full and active annual programme of events and activities and has significant financial reserves. However, with the various announcements over the last few years, particularly the closures of all of the UK deep coal mines, the planned closure of all UK coal fired power stations by 2025 and the withdrawal of Government funding from the scale up Carbon Capture and Storage projects, interest in coal research in the UK has been fading. However, this is definitely not the case worldwide, where interest in coal and coal use is expanding.

The Forum Executive Committee has, therefore, recognised the need for a long term strategic plan for the future of the Forum and thus began a review of this situation in early 2016 culminating with a Special Executive Committee meeting held at the end of September 2016. The Executive Committee discussed what were the right kind of seminars and conferences for its Members and how to encourage more participants to attend these events, what other services the Forum should be providing to its Members, the recruitment more Members from overseas countries, and the expansion of the Forum's activities to include, for example, biomass and waste.

The Executive Committee fully recognised that without a long term strategic plan for the future, the Forum might gradually become less viable over the next ten years or so and that there was the need for action now. The Executive Committee thus considered a number of alternatives and proposed that the best way forward was an expansion, restructuring and renaming of both the Forum and its activities to appeal to a wider Membership. The overall conclusion was that the Forum should expand its current objectives, and form a new Forum entitled "The Fuel and Energy Research Forum" to actively include biomass and waste and other fossil fuels of interest to our Members. As part of this process, there has been a re-evaluation of and renaming of some of the Forum's current Divisions, now to be called Interest Groups.

The Forum will, of course, still well cover coal issues, however, the Forum Executive Committee will be putting forward a proposal recommending a change to the Forum's Constitution in early February, and on the basis that the Membership approve this change, the new Forum will be announced and presented at the 2017 Annual Meeting to be held at the University of Sheffield on 26<sup>th</sup> April 2017.

### **Student Bursaries for 2017-2018**

Travel and subsistence bursaries of up to £300 are on offer to bona-fide full-time students who wish to attend appropriate National and International coal-related conferences, (please see the Calendar of Coal Research Events for details of future conferences), and whose supervisor is a member of the Coal Research Forum. To apply, please send the abstract submitted to the conference with a brief supporting letter from your supervisor together with details of the expected expenditure and other sources of funding applied for, to:

Prof. J.W. Patrick,  
Dept. of Chemical and Environmental Engineering,  
Faculty of Engineering,  
The University of Nottingham,  
Energy Technologies Building,  
Innovation Park, Triumph Road,  
Nottingham NG7 2TU

The requirements for eligibility for award of a bursary are that the recipient will submit a short report about his or her impressions of the conference to the Newsletter Editor for inclusion in the next edition. In addition, this report will provide some brief details of the beneficiary, their topic of study and the reasons for wishing to attend the conference. Potential applicants should see the template for these reports on the CRF website, [www.coalresearchforum.org](http://www.coalresearchforum.org), where such reports must comply with these requirements.

Please note that these bursaries are only for travel and subsistence to attend the conference, (i.e. not for conference or other fees). In addition, priority will be given to applicants who will be attending the whole of a conference rather than one day of a multi-day event and will be using the conference accommodation provided should this be required. It may not be possible to fund all applications for bursaries or meet the request in full as this will depend on the funds available at the time.

**11<sup>th</sup> European Conference on Coal Research and Its Applications**  
**5<sup>th</sup> to 7<sup>th</sup> September 2016**  
**University of Sheffield**  
**The Edge**

The latest biennial CRF conference in the now familiar ECCRIA series was held at the University of Sheffield in early September. The setting for the conference was a very pleasant part of the university campus known as The Edge. This location housed student and hotel accommodation and the lecture theatres making it very convenient for all who attended. The format was as before with two and a half days of oral presentations being given in parallel sessions and a series of poster presentations.



Sheffield proved to be an attractive venue for the conference with just over 120 participants attending from 17 different countries. The aim of the CRF has always been to maintain competitive registration fees at three levels, CRF member, CRF non-member and student, in the expectation of being able to attract as many research students as possible. As always the motivation behind the conference is to bring together researchers in universities and participants from industry who are interested in or are carrying out similar industrial research. In addition to the conference an opportunity was provided for attendees to visit the PACT (Pilot-scale Advanced Capture Technology) core facilities in Beighton, near Sheffield.

Delegates began to arrive at the Edge Hub to register at 8.00am on the opening day of the conference. Maggi Churchouse (Conference Manager) and her able body of helpers quickly dealt with the stream of attendees and by 9.15am Professor John Patrick of the University of Nottingham welcomed the delegates to ECCRIA 11 and Sheffield. As Matthew Bilson, Programme Director for Energy 2050, who was to give the opening address on behalf of the university, was unfortunately delayed it was decided that the keynote speaker Brian Ricketts,

Secretary General of EURACOAL, would be invited to start the proceedings proper with his keynote address. Please note that many of the presentations can be viewed using the following link: - [http://www.maggichurchosevents.co.uk/crf/programme\\_abstracts.htm](http://www.maggichurchosevents.co.uk/crf/programme_abstracts.htm)

The keynote presentation was entitled "Energy Union and EU Energy and Climate Policy" and Brian has kindly agreed to provide the text of his talk:-

*Good morning ladies and gentlemen. It's my privilege to speak here in Sheffield. It's a European Conference and I represent a European association – the European Association for Coal and Lignite. I'm not sure how much longer I will be able to stay at EURACOAL: many of you must have voted for Brexit – even here in Nick Clegg's constituency. So, as well as representing a pariah industry in Brussels, I also now come from a pariah state. I guess that exit negotiations will take some time, so I should survive a while longer on the continent.*

*EURACOAL has 33 members from 18 countries: coal producers, coal importers and coal consumers from Finland in the north to Turkey in the south, from Spain in the west to Ukraine in the east. The creation of the European Coal and Steel Community in 1952 marked the very beginning of what we now call the European Union. Access to coal and steel under fair market conditions was an essential step to stop future wars over these key resources. Six nations joined the community under this flag: black for coal, blue for steel. The UK joined a lot later, in 1972, after President de Gaulle had vetoed our entry ... twice. EURACOAL was formed in 1953, although our name has changed a couple of times, most recently in 2002 when the original European treaty came to an end, after fifty years.*

*Moving on to 2015 the EU produced 100 million tonnes of hard coal and 400 million tonnes of lignite or brown coal. In addition, we imported almost 200 million tonnes of coal – with Russia being the largest coal exporter to the EU. If you were to draw a line from Cologne in Germany to Ankara in Turkey, you would see that brown coal or lignite is important in many of the countries along that line.*

*The market for coal in Europe these last few years has been good, although since the economic crisis that began in 2008, prices have been lower than producers would have liked, sometimes depressingly low. EURACOAL aims to create a favourable policy environment for coal in Europe. We have had some significant successes over the years, but now face a relatively hostile political landscape, because of the priority given to climate policy by Europe's political leaders. In terms of economic added value, the EU coal industry supplies energy worth around €25 billion annually. It directly employs almost a quarter of a million (240,000) men and women, a figure that rises to well over one million when indirect jobs and Energy Community countries are included.*

*Whilst the share of coal is important across the EU, for many member states it is essential. Almost half of Germany's electricity comes from coal and one third of Denmark's – facts that you will rarely hear in Brussels. Almost half in Bulgaria and more than half in Greece and the Czech Republic. And in Poland, over 80% of electricity generation depends on coal and lignite. Coal has been consistently cheaper than both oil and gas. It is an especially competitive fuel for power generation.*

*Why do energy prices matter? Well, it might be no coincidence that the world suffered one of its worst economic crises at exactly the same time that we endured high energy prices. In the case of oil and gas, prices stayed high for too long, acting as a drag on economic recovery. We should not sleepwalk into a situation where we depend on imports for over 90% of our oil supply and over 80% of our gas supply.*

*Around the world coal is the most abundant source of energy, the most affordable and the most accessible: 88% of the EU's conventional energy reserves are in the form of coal and lignite. Germany is the world's biggest lignite miner – almost 180 million tonnes each year. Last year, the German government tested public reaction to a phase-out of lignite mining. This came as a shock to the industry. In February 2015, the Vice Chancellor, Sigmar Gabriel, proposed an additional tax*

on older lignite power plants. In the end, after strong lobbying by industry and unions, the result was not a tax, but a subsidy for older lignite plants. These would be kept for a few years as a 2.7 GW "national capacity reserve", before closing. Then, last summer, the Environment Minister, Barbara Hendricks, spoke of the need to agree a phase-out plan for lignite ... like Germany has already agreed for hard coal ... and like it already has for nuclear power plants, after Fukushima. She tabled a report in which seven professors call for a "long-term coal consensus" to promote trust in the Energiewende or "energy transition". She wants the lignite mining industry to agree to disappear.

Why do we now find ourselves talking about a phase out of lignite mining in Germany? It's the latest victory for the "green" movement. Past successes have included the nuclear phase-out, the banning of shale gas exploitation in some countries and, of course, the Paris Agreement of last December which aims to control the temperature of our planet. There are plenty of people who believe in extreme climate change. They live in fear and make others fear that we are somehow destroying the planet. In Europe, politicians respond with ever-tougher climate targets that already, today, cost the economy tens, maybe hundreds of billions of euros every year.

The reality is that the "green" movement is not a warm and cuddly panda. The WWF panda wants a revolution. "Greens" are actually authoritarian and want to allocate capital, not according to free market principles, but according to their own "green" ideology. Perhaps the biggest support for that ideology came last year from the Pope in his encyclical "Laudato Si" on the care of our common home. His Holiness writes of a sick planet, wracked by environmental damage caused by man's irresponsible use and abuse of natural resources and modern technologies. He proposes that fossil fuels be progressively replaced, preferring gas over coal as the lesser of two evils during an "energy transition" to renewables.

With the Pope onside, the "green" movement has an important ally. The Paris Agreement is a reflection of just how far "green" thinking has permeated all corners of society. Perhaps, the most interesting thing about the encyclical is not what it says, but who influenced it. The Pope did not give a PowerPoint presentation in the Vatican when the encyclical was launched last year. Instead, Professor Hans Joachim Schellnhuber was on hand to present his version of what he calls the "Great Transformation".

Professor Schellnhuber is a member of the Vatican Academy that advises the Pope. He also heads up the Potsdam Institute for Climate Impact Research in Germany. For many years, he has been a trusted scientific advisor to Chancellor Merkel. Now, he has the ear of the Pope. He presents humanity as a problem that causes the planet to suffer. In doing so, he has embraced the Gaia Theory which treats the world as a living being. Schellnhuber shifted the debate from the problem of "global warming" to one of "climate tipping points" with runaway, catastrophic impacts. In 1995, he put forward the 2°C limit for global warming. This was adopted by the German government in a statement at the first UNFCCC Conference of the Parties in Berlin, chaired by Angela Merkel who was then Environment Minister.

I think that it is important for every one of us to take a closer look at climate science and reach our own views. Science is a process of discovery, the majority or consensual view is not necessarily the right view, and any view must always be challenged. Churchill warned that, "Scientists should be on tap, not on top." Well, it seems that politicians have allowed climate scientists to get on top because fighting fear – real or imaginary – is a route to power. Trade unionists are now more concerned with climate issues than preserving jobs. There are "No Jobs on a Dead Planet", is the slogan used by the European Trade Union Confederation.

So, the coal industry faces a fundamental threat to its business, with NGOs leading the attack. Brussels is dominated by NGOs, people paid by NGOs and people who think like NGOs. Big business used to influence the media, but now NGOs are more canny at using social media, feeding in stories that influence public opinion. Nowhere more so than in the area of climate change. The most outspoken critic of coal in the US is Bill McKibben who runs an NGO called 350.org ("350" because he thinks that the 450 ppm limit for CO<sub>2</sub> in the atmosphere is too high).

*He gets support from rich US benefactors and the Guardian newspaper in the UK is running his "Keep it in the ground" campaign. It is a very successful campaign, more successful than all the PR departments of all the world's oil and gas companies. But it is not journalism.*

*Turning now to the title of my talk. The Energy Union proposal was made by Donald Tusk in April 2014 when he was still Prime Minister of Poland. He's now President of the European Council. His six-point proposal to ensure Europe's future energy security was sensible and well-balanced. It included the rehabilitation of coal. The Energy Union communication from the Commission takes us in an altogether different direction. The underlying thesis is not energy security, but climate action and a move away from fossil fuels. The future use of coal is "incompatible with its decarbonisation agenda". Those are the words of Vice President Šefčovič and Commissioner Arias Cañete in a letter to EURACOAL. One of the mysteries of Energy Union is why indigenous coal is ignored, but gas imported from Russia, central Asia and the Middle East is seen as desirable. Why is gas from Iran an objective of the European Commission, in preference to mining coal and lignite from beneath our own feet?*

*Clean coal with CCS is what the European Commission wants from industry. They tell us that with CCS, coal would have fewer problems. We have to work with today's political visions. So, that means offering CCS as a solution, but the technology is not universally supported. Poland has identified an area of the Baltic Sea for CO<sub>2</sub> storage that is very distant from its coal-fired power plants in Silesia. In Germany, the government blames public opinion which is against any new infrastructure. In the UK, E.ON cancelled a new coal-fired power plant near London when the government refused to give its political support. In 2008, climate activists who had caused criminal damage at Kingsnorth were acquitted by a UK court after arguing that they acted to prevent the damaging impacts of climate change. Why should E.ON face the onslaught of NGOs without the support of government for a project that was designed with CCS? It was a turning point.*

*CCS alone is not enough. We have to offer something more. Right now, the only option looks like less coal use over the coming decades, in balance with a growing share of renewables. We need to appear to be disappearing; over the next twenty years, maybe thirty. Agreeing this as a high-level principle might take the heat off us and allow coal mining to continue within the agreed EU carbon cap. The practicalities of doing a deal are significant. When energy policy decisions look difficult, the European Commission points to the Treaty obligations that mean each member state is free to decide on its own energy mix and on how it exploits its own energy resources – Article 194 of the Lisbon Treaty that EURACOAL welcomed. Coal use in the member states is not the responsibility of the Commission, but the Commission has it within its power to kill coal use in the member states. This leaves EURACOAL fighting skirmishes on the Emissions Trading System (ETS), Industrial Emissions Directive (IED), Large Combustion Plants Best Reference (LCP BREF) and other regulations, without a positive picture from the top on coal's role.*

*We have won some of those skirmishes. EURACOAL put in a huge effort on ETS back loading and persuaded a few more MEPs to vote against, after the Polish government had done the heavy lifting. But that was in a previous era. The previous Polish government was brought into the tent as President of the Council and Prime Minister Kopacz agreed to new climate targets in October 2014. More generally, much of the European Parliament now looks green – it's the new centre ground in politics.*

*Turning now to implementation of Energy Union through the 2030 framework for EU climate and energy policy. It sets the toughest targets in the world and these are now in the Paris Agreement. The 2030 framework was outlined by the Commission back in January 2014; largely agreed at a European Council meeting in October 2014; and detailed in a Commission communication of July 2015 which is now being debated in the European Parliament. To win the support of those member states who are heavily dependent on coal, including Poland, EU leaders agreed to a compensation package – a carrot to accept targets that will certainly damage coal use.*

Firstly, EURACOAL believes that the headline 40% GHG reduction target is too ambitious and should not even be on the table without a legally binding international agreement. Unbelievably, the Paris Agreement imposes legally binding targets only on EU member states (Art.4.18). You may well ask how that happened. It is a long story of “high-ambition coalitions” led by the Marshall Islands. The US would not accept any legally binding commitments, because Congress would never approve them.

Secondly, a 27% EU-wide target for renewable energy. EURACOAL does not believe we need any renewable targets. The EU ETS is designed to deliver greenhouse gas emission reductions. Measures to support renewables simply disrupt the market-based approach preferred by industry.

Renewables are heavily promoted as an alternative to fossil fuels. An enormous investment has been made in renewables – mainly wind and solar with impressive growth in capacity since the year 2000: 71 GW of solar PV and over 100 GW of wind. Unfortunately, the growth in actual output – useful electricity – has been less spectacular. Wind turbines generate less than one quarter of their rated capacity (name-plate capacity in MW), and solar PV panels achieve little more than 10% of their rated capacity. Compare this with a coal-fired power plant which can easily deliver 80% of its rated output (i.e. an 80% load factor). What we are seeing in Europe is the construction of a second energy system. We continue to depend on the existing system when the wind doesn't blow or the sun doesn't shine. So investing in renewables should not be seen as an alternative to conventional generation: we need both. The question to ask is whether we can afford both?

Thirdly, the ETS allowance cap should shrink by 2.2% each year from 2021. We say that the current 1.74% annual reduction in ETS allowances auctioned or allocated is already tough. If we improve the efficiency of coal-fired power plants in Europe – as is being done in Germany – then we could expect an annual decrease in emissions of around 1%. Achieving over 2% would require dramatic technology changes that are simply not yet available – such as large-scale energy storage – or would be costly – such as nuclear energy or carbon capture and storage.

What is proposed, and essentially now agreed by member states, means that carbon emissions from the ETS sector – from all coal and lignite plants, from all gas plants, from fertiliser plants and from most of industry – must fall to zero by 2058.

Fourth, a new market stability reserve for Phase IV of the ETS which might not work.

Fifth, the Commission proposes that carbon leakage protection should continue and industry will continue to fight over these titbits, cannibalising itself in the process. There will also be funds to support innovation and modernisation.

A tough climate target in the EU is a bonanza for gas. To achieve the proposed 40% target means change. There are various possibilities – renewables, nuclear and CO<sub>2</sub> capture and storage – but these will not be driven by emissions trading, they all need direct subsidy. The first change to be driven by the ETS is fuel switching from coal to gas. We estimate that this will happen at a carbon price of €55/tCO<sub>2</sub>. It will mean wealth flows out of the EU, to gas suppliers in Norway and Russia. Overall, electricity consumers in Europe would have to pay an extra €100 billion each year. Some argue that we need flexible gas plants to balance intermittent renewables. We certainly do need flexible plants, but modern coal plants are just as flexible. The ramp rates for new coal and gas plants are remarkably similar, but coal plants are cheaper to run.

Before I conclude, here's some good news. Coal-fired power plants may be enjoying something of a renaissance in Europe. New plants have opened recently in Bulgaria, Germany, the Netherlands, Italy, the Czech Republic Poland and Slovenia. If coal remains competitive and if government policy values security, then there is every chance that coal will survive as a strong component in Europe's future energy mix. Despite the green rhetoric.

*EURACOAL promotes a 3-step approach for the future. The modernisation of existing power plants and the construction of new state-of-the-art power plants would reduce local air pollution and protect the climate with immediate emission reductions of one third or more in the case of CO<sub>2</sub>. Research and development will ensure performance improves in the future. Ultimately, CCS will be required to achieve the EU's ambitious climate targets. To stay relevant in a globalised economy, Europe has to stay ahead of the technology curve. We have to believe in the power of science and technology, and not allow ourselves to be seduced by ideological promises of a happy, 'green' world.*

*Good science gave us: James Watt and his steam engine; Michael Faraday and electromagnetism. Thomas Edison and his power station, his electricity distribution networks and, of course, his light bulb. He wrongly thought that DC was better than AC. It was Nikola Tesla, a Serbian, who got that right, which means that we now transmit electric power over long distances. A Polish lady, Marie Curie (Maria Skłodowska) gave us nuclear power. Everything that these men and women did for us is still relevant today: 80% of global electricity generation comes from thermal power plants with steam turbines. However, there is a new shift in political power. The advent of digital communication allows us all to find out what is going on and to have our say. Those who understand the power of this revolution are doing very nicely. The NGOs, for example, are doing much better than big, bad industry – NGOs are persuading politicians about what is best for humanity.*

*At the UN meeting in Paris last December, politicians agreed to prepare five-year plans for the energy sectors of almost every nation on Earth. In the EU, we are about to embark on the preparation of 28 national energy and climate plans: five-year plans that come straight out of the era of central planning. Central planning failed. Are we about to embark again on a failed project? No one appears to be questioning what politicians are doing in the name of climate.*

*At the EU level, we have a climate and energy policy that assumes a further shift to imported natural gas. This policy is destroying the EU's wealth and leaves us strategically vulnerable. We all want a cleaner more prosperous future. Reducing pollution is a good thing. We need pragmatic policies that encourage investment to modernise our energy infrastructure and make it fit for the 21<sup>st</sup> century – valuing all energy sources. And that must include investment in coal and lignite. They are not forbidden fruits; they are resources to be used wisely for the benefit of us all. Thank you.*

Following the keynote address Matthew Bilson was able to deliver his 'better late than never' welcome to the University of Sheffield. Using the normal format for the ECCRIA series, that is operating with parallel session where themes are chosen which do not clash, the conference began.

Session 1A was entitled IFRF: recent projects. This title was chosen following the recent move to Sheffield of the IFRF and provided an opportunity to review the history and prospects of the foundation (Philip Sharman). This was followed by papers outlining some of the more noteworthy research of the recent past work on the isothermal plug flow reactor (Leonardo Tognotti), the Solid Fuel Database (Jaroslav Hercog) and Fourier Transform IR studies on flames (Neil Fricker).

Session 1B was almost a showcase for some of the modelling work being carried out at the University of Hull under Professor Meihong Wang with three of the four paper from this university. The topics were varied and included dynamic modelling, validation and analysis of rotating packed bed absorbers for post-combustion carbon capture (Oko); modelling of a cruise ship energy system integrating post-combustion carbon-capture, (Xiaobo Luo) and a paper on thermodynamic performance evaluation of supercritical CO<sub>2</sub> closed Brayton cycles for coal-fired power generation, (Olumayegin). The other paper in this session was from the Ningbo Campus of the University of Nottingham by Xiang Luo and concerned the use of Aspen Plus for enhanced biomass gasification application.



Session 2A was entitled Biomass 1 and contained four papers. Szuhanski looked at the effect of particle size on combustion performance on a biomass fired 250kw test facility and Bridge studied the impact of biomass co-firing with unreactive coals. Newbolt investigated the prediction of biomass particle size after milling and Klimov examined the torrefaction and combustion of coal sludge/straw pellets.

Session 2B was entitled Carbonisation and two papers from Cardiff University concerning coal injection into blast furnaces were presented. Steer looked at the implications of char reactivity and Sexton examined the char physical structure in the injection process. Zhang from the University of Newcastle showed how coke oven monitoring was possible using multivariate statistical processes whilst Castro Diaz considered increasing the use of lignin in coking blends through torrefaction and mild oxidation.

Session 3A comprised four papers on Instrumental Methods. Cugley (University of Kent) described flame characterisation through the use of digital imaging and spectroscopy and Farias Moguel (University of Sheffield) looked at large eddy simulation of a coal flame. Shang from Tsinghua University studied the carbon capture process using slow feature analysis and Troiano (University of Naples) looked at near-wall phenomena in entrained-flow slagging gasifiers.

Session 3B was entitled Modelling 2 and contained five presentations. Two papers were from Kazakhstan, Ustimenko explained how it was possible to improve the efficiency of coal ignition using plasma and Tokmurzin used a Eulerian-Lagrangian approach to simulate gasification of local coals. Lewtak, from the Institute of Power Engineering in Poland, described modelling and experimental studies on pulverised lignite and Kryjak (RJM International) described the modelling of the devolatilization and combustion of a Colombian coal. Silvester from the University of Nottingham studied the liberation of mineral matter and transformations during coal combustion.

The first day of technical sessions was followed by the poster presentation and reception and buffet from 4.30pm to 7.30pm. A total of 19 posters were featured and covered a variety of topics including the evaluation of a pump for CO<sub>2</sub> transport; studies on a Colombian coal/biomass stoker; kinetics of Turkish coals; characterisation of dewatered Indonesian lignite; flame stability measurements and flow characteristics of coal/biomass mixtures amongst others.

Day 2 of the conference featured a series of presentations (Sessions 4A, 5A and 6A) that were made by the partners of a recently completed EU-funded project known as RELCOM, (**R**eliable and **E**fficient **C**ombustion of **O**xxygen/**C**oal/**R**ecycled **F**lue **G**as **M**ixtures). The 12 papers covered a range of activities carried out by the project partners. Session 4A included the study of nitrogen and sulphur release during oxy combustion; mechanisms for NO<sub>x</sub> chemistry in oxy-fuel combustion and the validation of the FSCK radiation model for oxy coal combustion. Session 5A contained papers on the study of mercury emissions under oxy fuel conditions; dust explosion risks; combustion of low-volatile coal and engineering analysis and modelling. Session 6A described testing at the Spanish Ciuden's 20MWth test facility and its CFD modelling under oxyfuel firing and that of a 40MW burner for oxyfuel firing. More information on the project partners, their activities and their findings can be found on the RELCOM website as follows: - <http://www.relcomeu.com/index.php>

The parallel sessions for day 2 opened with three papers on emissions. Firstly, Dennis described how using CFD assisted design decisions and improved NO<sub>x</sub> reduction on a 500MWe coal-fired UK boiler. The next paper by Ellul showed how optimising air/fuel balance and combustion control system upgrades achieved similar benefits. Ottolini explained the benefits of using a proprietary additive with SNCR to obtain improved NO<sub>x</sub> reductions in a 100kWth test facility.

The second session, themed as Biomass 2 (5B), comprised five papers. Firstly, Mould showed how the conversion of a coal-designed boiler to fire biomass required substantial reviews of

existing power plant equipment and Riaza then looked at the effect of ignition and combustion behaviour of single particles of coal and biomass to assist milling requirements. Andrews presented two papers on the development of flame propagation studies of fine biomass and on a category of biomass known as steam-exploded pine wood. The final paper by Oji looked at the co-pyrolysis of cellulose and waste plastic to produce syngas.

Session 6B comprised four papers on coal-derived products and began with a talk on the effect of steam and moisture on the pressurised gasification of German lignite by Long. Castro-Diaz investigated the possibility of using weathered medium volatile coal to enable their use as coking coals and Gülec examined the effect of using a Mordenite catalyst in the methylation of coal tar naphthalene oils. The final paper in this session by Sugano investigated the chemical reaction mechanisms of recycling degraded polymer asphalt for roads and pavements.

Session 7A contained four papers on ash and mineral matter. Reinmüller showed how ashing temperature, method and sample heterogeneity influenced the occurrence of certain mineral phases in a suite of two coals, a biomass and RDF. Yang developed and described a dynamic ash deposition model for Zhundong lignite, a fuel which is found in vast amounts in China. Lester showed some of his work on the automation of the ash fusion test and explained how behavioural difference can be related to initial mineral composition whilst accurately predicting slagging and fouling. The session was concluded by Oboirien who demonstrated that the use of low grade coal for power generation is possible as the bottom ash from the conversion processes can be converted into stable geopolymers, some of which have other uses.

The topic for Session 7B was fluidised bed technology. Li opened the session with a paper whose aim was to investigate limestone sulfation behaviour under oxy-fuel circulating bed combustion conditions. Zhou described work done on a CFB test facility in which char and lignite were re-fired to demonstrate the low NO<sub>x</sub> emissions that were possible with this configuration. Chilton used a pilot scale bubbling FBC to study agglomeration in a range of biomass materials. Instrumental analysis of the deposits has been used to shed light on the mechanism of their formation.

The final half day of the conference began with parallel sessions each of five papers on Combustion (A stream) and Carbon Capture and Storage 1 (B stream).

The combustion theme was opened by Pikkarainen who explained that the transformation of our energy systems will set new requirements for "conventional" power plants such as coping with CO<sub>2</sub> and other emissions and acquiring load following capability. The development of future power plant concepts needs a combination of tools including experimental work, modelling and simulation and techno-economical assessments. The flexibility of coal fired power plants can be improved by integration of solar energy, gas combustion capabilities and coal fired power plant being a part of the gas economy. Wiatros-Motykas showed how improvements to plant performance could be achieved for coal and biomass fired boilers. Ndibe compared NO<sub>x</sub> formation and reduction for pulverised coal and biomass fired boilers and showed that torrefied and non-torrefied biomass behaved similarly in NO<sub>x</sub> formation and reduction behaviour. Williams showed that in a fixed bed combustor, coal produces a significant amount of soot and PAH whereas pine alone significantly reduces the emission and co-combustion of coal/pine briquettes reduces emissions further. Javed ended the session with a paper which described the current practices and challenges in coal utilisation in Pakistan.

CCS 1 also contained five papers and was opened by Lockwood who surveyed the next generation of carbon capture technologies. Phiciato described recent work on the dual-stage drying of Indonesian lignite and Chen presented his work on the production and testing of carbon capture solid sorbents. Akram described work on the PACT centre, more specifically the successful commissioning of new 1 tonne/day CO<sub>2</sub> absorber. Yamada closed this session by presenting his work on amine-impregnated solid sorbents which were developed for energy efficient CO<sub>2</sub> capture. By the blending of polyamine and alkanolamine the extent of CO<sub>2</sub> absorption was increased.

The last session of the conference, session 9, comprised Characterisation (A) and Carbon Capture and Storage 2 (B), both sessions containing four papers. Session 9A was opened by Perkins who described some microscopic techniques for the characterisation of carbon-based materials. Sakurovs provided an intriguing paper on the importance of nanoporosity and how it may be important in the better understanding of what makes a good coking coal. Small Angle Neutron Scattering (SANS) has provided information about the microstructure of coals that cannot be readily obtained in any other way. Using SANS allows us to be able to readily measure *both* the total porosity and gas-accessible porosity in materials as a function of pore size is currently a unique and very useful ability. Thompson's answer to his paper title of "Do PCDDs in iron ore sinter plant emissions have a fingerprint as well?" was, perhaps not surprisingly, – Yes! Chaves described the development of an automated char classification model for use on Colombian coals using image analysis.

Session 9B was opened by Chen who explained some experimental and modelling investigations of oxy-coal combustion based on Langmuir-Hinshelwood kinetics. Stechly continued the modelling theme by describing CFD predictions of biomass combustion in a 250kW combustion test facility. Finney compared metal aerosol emissions from the air-firing of coal and biomass for carbon capture applications using the PACT facility data. Huynh provided the last technical paper at the conference when he continued investigating the performance of some of the PACT facility, this time using particle radiation with both air and oxy-coal combustion regimes.

The conference closed 12.45pm and in his closing address as Chairman of the conference Professor John Patrick of the University of Nottingham thanked the University of Sheffield for the use of their excellent facilities and support, to the presenters who have helped to provide such a stimulating set of papers and not least to the attendees without whom the conference would have never happened! John wished the attendees a safe journey home and hoped to see them at the next ECCRIA conference wherever that might be.

**Workshop: Power generation (coal, gas, and biomass)  
under increasingly stringent emissions regulations  
6<sup>th</sup> December 2016  
The Marconi Room at the IET,  
(Institution of Engineering and Technology),  
Savoy Place, London, WC2R 0BL**

The Workshop focussed on the technical and commercial impacts of increasingly stringent emissions regulations on the operation of power and CHP plants, fuelled by coal, gas, biomass and waste. The Industrial Emissions Directive IED 2010/75/EU came into force on January 1<sup>st</sup> 2016 and applies to new and existing plant. In some cases, there are moving targets set by Best Available Technology. Also, there are trends in regulations from other countries on NO<sub>x</sub>, SO<sub>x</sub>, Hg, and particulates that signal likely future limits. There is also the possibility of plant being fitted with carbon capture and this will have an impact on other emissions and waste streams, and these too must comply with legislation.

Speakers explained the impact of current and anticipated legislation and share experience on available technologies and performance. The morning session comprised four papers from DEFRA, the EA, Uniper and Ramboll. The afternoon session comprised six sessions covering USC boiler and emission control, biomass conversion and co-firing, CCS plants, catalytic emission control and gasification for IGCC.

The presentations from this event can be viewed on the CRF website at, [www.coalresearchforum.org/pastmeetings.html](http://www.coalresearchforum.org/pastmeetings.html)

## SUMMARIES FROM THE TECHNICAL PRESS

### News alerts in coal and energy research

Please be aware that links to some of the news articles are not retained on the web indefinitely. Consequently, links which were active when the newsletter was written may, in time, become unavailable. It is hoped that this will not detract from the value of the article.

#### **UK faces energy shortages and soaring bills even before winter sets in** **1<sup>st</sup> September 2016, Ben Chapman, The Independent**

Britain may struggle to find the electricity supply it needs to meet demand even before the winter sets in as spare capacity falls to its lowest in a decade. Analysts warn that prices could surge as the National Grid is forced to rely on back-up generation.

Even a “moderately cold winter” would increase the likelihood of National Grid needing to use its backup tools, pushing up power prices, according to Felix Chow, a project manager at Aurora Energy Research in Oxford. “Unpredictable variations in weather and plant availability means the capacity margin this winter could potentially be as low as 2.5 per cent,” he said.

A looming scarcity of gas plants, that at times generate half of the nation’s energy supply, means spare capacity is at its lowest in a decade. For this winter, National Grid has contracted 10 power stations to provide back-up electricity, but the contracts don’t start until November. UK utilities have closed coal plants that made up 9 per cent of total generation capacity in the past year, leaving the nation’s power supplies vulnerable on cold days with little wind.

For more visit:- <http://www.independent.co.uk/news/business/news/uk-energy-bills-shortages-winter-national-grid-electricity-prices-weather-a7219491.html>

#### **‘Dutch must shut new coal-fired power plants to meet energy targets’** **2<sup>nd</sup> September 2016, unattributed, Dutch News nl**

Ministers will have to close one or two brand new coal fired power stations if they are to meet climate change targets set down in a landmark court case last year, Trouw reports on Friday. In June 2015, judges in The Hague ruled the Dutch government must reduce greenhouse gas emissions by at least 25% by 2020 compared with 1990 – in line with international agreements.

This can only be done relatively cheaply by closing the power stations, according to a confidential report by research bureau CE Delft. The report is due to be published next week, but Trouw has a leaked copy. Alternatives to shutting down the power stations would be costly and would lead to higher petrol and energy prices and increased subsidies for solar and wind farms, the CE Delft report said. Closing one of two power stations would cost the average household €30 a year, but the carbon dioxide measures would add €80 a year to household bills. For more visit:- <http://www.dutchnews.nl/news/archives/2016/09/95019-2/>

#### **Albion Colliery: The forgotten mining disaster** **2<sup>nd</sup> September 2016, Rhiannon Beacham, BBC News**

It was a coal mine that first created and then devastated a community, and it is also said to be the unlikely setting for a Bee Gees music video. Fifty years after its closure, how does the south Wales community of Cilfynydd remember the Albion Colliery? “Albion is the forgotten explosion,” said Ceri Thompson, curator at Big Pit National Coal Museum. Much has been reported about the worst mining disaster in UK history, which occurred at Senghenydd, Caerphilly county, in 1913, killing 440 people. And Mr Thompson said it is often mistakenly believed the second worst in Wales happened at Gresford, Wrexham, in 1930.

But decades earlier, on 23 June 1894, a total of 290 men and boys were killed by an explosion at the Albion - 123 horses were also killed. A large number of those who died were from north and west Wales, lodging in the village while working to raise enough money to bring their families

to Cilfynydd. They included the great grandfather of Miss Money Penny actress Samantha Bond, who discovered the fact while researching her family history for BBC One's *Who Do You Think You Are?* programme. "Hardly a house in the village wouldn't have been affected in some way, either by the breadwinner or people lodging there being killed," said David Gwyer, assistant curator at Pontypridd Museum. "People gathered at the pit head when the news spread, relatives and sightseers turned up en masse. "Also, a typical thing with so many disasters at the time, there were ghoulish tourists and people who took advantage of that, turning up with barrels of beer to sell." Eleven of those killed were never identified and a memorial for them now stands at St Mabon's Church, in Llanfabon, near Nelson.

For more visit:- <http://www.bbc.co.uk/news/uk-wales-south-east-wales-36914191>

## **China ratifies Paris climate change agreement ahead of G20**

**3<sup>rd</sup> September 2016, Tom Phillips, The Guardian**

China has announced its ratification of the Paris climate change agreement, paving the way for a hotly anticipated joint US-China statement on the fight against global warming later on Saturday. In a brief dispatch on Saturday morning, China's official news agency, Xinhua, said members of the country's rubber-stamp parliament, the National People's Congress, had voted "to review and ratify" the historic deal.

The announcement comes as Xi Jinping and Barack Obama are expected to meet in China ahead of the start of the G20 on Sunday to make a joint statement on climate change. Activists believe the centrepiece of that statement, which Chinese and American officials have spent weeks negotiating, will be a formal commitment by both countries to ratify the deal.

The Paris agreement, sealed last December after two weeks of intense negotiations, needs to be ratified by 55 countries, representing 55% of global emissions, in order to come into effect. "China and the US together account for about 38% of global emissions. So if they ratify the agreement it will bring the Paris agreement entering into force much closer to reality," said Li Shuo, the Beijing-based senior climate policy adviser for Greenpeace East Asia.

For more visit:- <https://www.theguardian.com/world/2016/sep/03/china-ratifies-paris-climate-change-agreement>

## **Drax supports thousands of jobs and contributes millions of pounds to Yorkshire – research**

**7<sup>th</sup> September 2016, Mark Caski, Yorkshire Post**

Yorkshire energy giant Drax contributed £493m to the region's economy last year, helping to support 4,500 jobs, research has shown. The Group's UK operations, which includes Drax Power Station - Europe's largest decarbonisation project near Selby in North Yorkshire - had a far larger national impact, with the knock on effect through companies in its supply chain last year contributing £1.2 billion to the UK economy and supporting 14,150 jobs.

The findings come from researchers at Oxford Economics studied the impact of Drax Group on the UK's economy as the company nears completion of a major high tech engineering and infrastructure scheme to upgrade half the generating units to use sustainable biomass in place of coal. Employment covered a wide range of sectors including high-skilled manufacturing of industrial components, engineering and technical machinery, construction, IT, professional business services and transport. Drax Group chief executive, Dorothy Thompson, said: "This report shows Drax is supporting more than 14,000 jobs across the UK, with the vast majority resulting from our upgrades to biomass technology.

## **UK will miss its 2020 renewable energy targets, warn MPs**

**9<sup>th</sup> September 2016, Fiona Harvey, The Guardian**

The UK will fail to meet its targets on renewable energy generation, with take-up of clean fuels for heating and transport falling badly behind aims, MPs have warned. The findings of the influential energy and climate change committee (ECC) show that ministers have little clear

plan for meeting the 2020 target to meet 15% of energy needs from renewable sources. This includes a target to generate 30% of electricity from wind, solar and other low-carbon sources by the end of the decade, and to generate 12% of heating energy and 10% of transport fuels from clean sources by the same date. The UK is not legally bound to meet the heat target, which is advisory.

These targets were set under the EU's renewable energy plan, but ministers are still required to meet them despite the Brexit vote. The UK is faring best on renewable electricity, the target for which may be met if current trends continue, but the proportion of renewable energy used for transport has fallen in the last year, and heating remains a significant problem. Angus MacNeil, the Scottish National party MP who chairs the committee, said: "The experts we spoke to were clear: the UK will miss its 2020 renewable energy targets without major policy improvements. Failing to meet these would damage the UK's reputation for climate change leadership. The government must take urgent action on heat and transport to renew its efforts on decarbonisation."

For more visit:- <https://www.theguardian.com/environment/2016/sep/09/uk-will-miss-its-2020-renewable-energy-targets-warn-mps>

## **Scientists expect to calculate amount of fuel inside Earth by 2025**

**9<sup>th</sup> September 2016, unattributed, ScienceDaily**

With three new detectors coming online in the next several years, scientists are confident they will collect enough geoneutrino data to measure Earth's fuel level. Scientists have developed numerous models to predict how much fuel remains inside Earth to drive its engines -- and estimates vary widely -- but the true amount remains unknown. In a new paper, a team of geologists and neutrino physicists boldly claims it will be able to determine by 2025 how much nuclear fuel and radioactive power remain in the Earth's tank. The study, authored by scientists from the University of Maryland, Charles University in Prague and the Chinese Academy of Geological Sciences, was published on September 9, 2016, in the journal *Nature Scientific Reports*.

"I am one of those scientists who has created a compositional model of the Earth and predicted the amount of fuel inside Earth today," said one of the study's authors William McDonough, a professor of geology at the University of Maryland. "We're in a field of guesses. At this point in my career, I don't care if I'm right or wrong, I just want to know the answer."

For more visit:-

[https://www.sciencedaily.com/releases/2016/09/160909094848.htm?utm\\_source=feedburner&utm\\_medium=email&utm\\_campaign=Feed%3A+sciencedaily%2Fmatter\\_energy%2Ffossil\\_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29](https://www.sciencedaily.com/releases/2016/09/160909094848.htm?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+sciencedaily%2Fmatter_energy%2Ffossil_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29)

## **Inexpensive semiconducting organic polymers can harvest sunlight to split carbon dioxide into alcohol fuels**

**20<sup>th</sup> September 2016, unattributed, ScienceDaily**

Chemists at The University of Texas at Arlington have been the first to demonstrate that an organic semiconductor polymer called polyaniline is a promising photocathode material for the conversion of carbon dioxide into alcohol fuels without the need for a co-catalyst. "This opens up a new field of research into new applications for inexpensive, readily available organic semiconducting polymers within solar fuel cells," said principal researcher Krishnan Rajeshwar, UTA distinguished professor of chemistry and biochemistry and co-Director of UTA's Center for Renewable Energy, Science & Technology.

"These organic semiconducting polymers also demonstrate several technical advantages, including that they do not need a co-catalyst to sustain the conversion to alcohol products and the conversion can take place at lower temperatures and use less energy, which would further reduce costs," Rajeshwar added.

Rajeshwar and his co-author Csaba Janaky, professor in the Department of Physical Chemistry and Materials Science at the University of Szeged, recently published their findings in The Royal Society of Chemistry journal *ChemComm* as "Polyaniline films photoelectrochemically reduce CO<sub>2</sub> to alcohols." In this proof-of-concept study, the researchers provide insights into the unique behavior of polyaniline obtained from photoelectrochemical measurements and adsorption studies, together with spectroscopic data. They also compared the behavior of several conducting polymers. For more visit:-

[https://www.sciencedaily.com/releases/2016/09/160920115723.htm?utm\\_source=feedburner&utm\\_medium=email&utm\\_campaign=Feed%3A+sciencedaily%2Fmatter\\_energy%2Ffossil\\_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29](https://www.sciencedaily.com/releases/2016/09/160920115723.htm?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+sciencedaily%2Fmatter_energy%2Ffossil_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29)

### **Aberthaw power station pollution 'too high', EU court rules**

**21<sup>st</sup> September 2016, unattributed, BBC News Wales**

The coal-fired station in the Vale of Glamorgan was accused of pumping out more than double the legal amount of toxic nitrogen oxides for seven years. RWE Generation said it was "disappointed" but that environmental protection was of the utmost priority.

The UK government claimed the power station was not in breach of the rules. But the court disagreed and the UK government must pay court costs. The station is already due to be downgraded from 2017 due to market conditions. Aberthaw has been specifically designed to burn the low-volatile coal which comes from opencast mines in Wales. Welsh coal is harder to burn than coal from elsewhere and Aberthaw's boilers have been permitted to produce higher emissions of nitrogen oxides than other UK plants. But this was challenged by the European Commission and the case went to court 18 months ago.

For more visit:- <http://www.bbc.co.uk/news/uk-wales-37407037>

### **UK researchers tap into China's scientific powerhouse**

**23<sup>rd</sup> September 2016, Pallab Ghosh, BBC News**

The UK government is to outline its plans to strengthen collaborative research between Britain and China. The Science Minister, Jo Johnson, will give details while opening a joint UK-Chinese plant research centre just outside Shanghai. Scientists at the centre will investigate new ways of growing crops to feed an expanding global population. The centre is the latest effort by the UK to tap into the rapid growth in scientific investment by China.

Chinese research has grown rapidly in the past 20 years. Spending on R&D is now over 40 times what it was in 1995, amounting to £150bn in 2015 - just over 2% of the country's economic production (GDP). That compares with the UK government's spending on R&D of £8.4bn, which is just under 0.5% of Britain's GDP. Despite this spending mismatch, the quality of UK research is still among the highest in the world. In order to maintain Britain's leading status, research leaders have decided that it is important to leverage our science spending with the emerging new science superpower. For more visit:-

<http://www.bbc.co.uk/news/uk-politics-37420086>

### **Imperial College London and EDF Energy launch new SparkFund**

**28<sup>th</sup> September 2016, Neasan O'Neal, Imperial College**

Imperial College London and EDF Energy have launched a new series of collaborative projects to research areas of common interest in the energy sector. Energy Futures Lab and the EDF Energy R&D UK Centre have launched the new SparkFund initiative. The initiative will support three projects over the next three months to investigate research areas that are of interest to academia and industry.

EDF and the College have a long standing relationship working on many different topics ranging from nuclear engineering to energy system design and economics. The SparkFund initiative follows on from the FlexiFund programme, which has run for the last four years. "The FlexiFund projects demonstrated the success of working closely with industry" says Professor Tim Green, Director of Energy Futures Lab, "but with the pace of change and

innovation within the energy sector EDF Energy R&D UK Centre and we wanted a new approach to testing concepts and ideas quickly before investing in larger scale projects". The SparkFund was conceived to fund innovative precursor research projects related to the UK energy challenge. The initiative aims to provide an environment where collaborations between academia and industry can flourish, bringing together world-leading experts from across the College and EDF Energy R&D UK Centre. For more visit:-

[http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/administration/energyfuture/slab/newsummary/news\\_19-9-2016-10-54-27](http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/administration/energyfuture/slab/newsummary/news_19-9-2016-10-54-27)

### **Reservoirs are a major source of global greenhouse gases, scientists say 28<sup>th</sup> September 2016. Chris Mooney, The Washington Post**

A new paper, slated to be published next week in BioScience, confirms a significant volume of greenhouse gas emissions coming from a little-considered place: Man-made reservoirs, held behind some 1 million dams around the world and created for the purposes of electricity generation, irrigation, and other human needs. In the study, 10 authors from U.S., Canadian, Chinese, Brazilian, and Dutch universities and institutions have synthesized a considerable body of prior research on the subject to conclude that these reservoirs may be emitting just shy of a gigaton, or billion tons, of annual carbon dioxide equivalents. That would mean they contributed 1.3 percent of the global total.

Moreover, the emissions are largely in the form of methane, a greenhouse gas with a relatively short life in the atmosphere but a very strong short-term warming effect. Scientists are increasingly finding that although we have begun to curb some emissions of carbon dioxide, the principal greenhouse gas, we are still thwarted by methane, which comes from a diversity of sources that range from oil and gas operations to cows. The new research concludes that methane accounted for 79 percent of carbon dioxide equivalent emissions from reservoirs, while the other two greenhouse gases, carbon dioxide and nitrous oxide, accounted for 17 percent and 4 percent.

"There's been kind of an explosion in research into efforts to estimate emissions from reservoirs," said Bridget Deemer, the study's first author and a researcher with Washington State University. "So we synthesized all known estimates from reservoirs globally, for hydropower and other functions, like flood control and irrigation." For more:-

[https://www.washingtonpost.com/news/energy-environment/wp/2016/09/28/scientists-just-found-yet-another-way-that-humans-are-creating-greenhouse-gases/?utm\\_term=.5ab119216b4a](https://www.washingtonpost.com/news/energy-environment/wp/2016/09/28/scientists-just-found-yet-another-way-that-humans-are-creating-greenhouse-gases/?utm_term=.5ab119216b4a)

### **Dutch parliament votes to close down country's coal industry 23<sup>rd</sup> September 2016, Arthur Neslen, The Guardian**

The Dutch parliament has voted for a 55% cut in CO2 emissions by 2030, which would require the closure of all the country's coal-fired power plants. The unexpected vote on Thursday night by 77 to 72 would bring the Netherlands clearly into line with the Paris climate agreement, with some of the most ambitious climate policies in Europe. It is not binding on the government, but the Liberal and Labour parties say they will now push for speedy implementation of the motion.

Five Dutch coal-fired power stations were closed last year but the country still has another five plants in operation. Three of these came online in 2015, and have been blamed for a 5% rise in the country's emissions last year. The Dutch Liberal MP and vice president of the parliament, Stientje van Veldhoven, told the Guardian: "Closing down big coal plants – even if they were recently opened – is by far the most cost effective way to achieve the goals of the Paris agreement, and all countries will need to take such far-reaching measures. We cannot continue to use coal as the cheapest source of energy when it is the most expensive from a climate perspective."

For more visit:- <https://www.theguardian.com/environment/2016/sep/23/dutch-parliament-votes-to-close-down-countrys-coal-industry>



## **Big switch in UK power generation from coal to gas** **29<sup>th</sup> September 2016, Jacqueline Echevarria, Energy Live News**

There has been a large switch in power generation from coal to gas during the second quarter of the year. Coal has accounted for 5.8% of all electricity generated in the country, a record low, according to new data released by BEIS. Gas has taken the largest generation share, accounting for 45.2% followed by renewables which fell from 25.4% during the same period last year to 24.9% in 2016 due to less favorable weather conditions. Nuclear power accounted for 21.3% of total electricity generated.

BEIS added total energy production was 3.6% lower than in the same period last year but final energy consumption was 1.7% higher. In terms of switching suppliers, government figures showed they have increased for domestic customers for electricity and gas. More than one million customers switched their electricity supplier in the second quarter of 2016, 43% higher than the same period in 2015. For gas, 32% more customers moved to a new firm.

Source:- <http://www.energylivenews.com/2016/09/29/big-switch-in-uk-power-generation-from-coal-to-gas/>

## **While global methane emissions are up, study says fossil fuels not the culprit**

**5<sup>th</sup> October 2016, Susan Phillips, State Impact**

A new study from NOAA, the National Oceanic Atmospheric Administration, puts a new twist on a tricky question about the impact of increased oil and gas production on greenhouse gas emissions. Scientists have detected increased rates of methane emissions globally since 2007. That uptick corresponds to the rapid boom in U.S. shale gas and shale oil production, and some hypothesized that the two could be connected. But it turns out that the correlation may not necessarily be a cause.

The research published Wednesday in the journal *Nature* found that although previous methane emissions from fossil fuel production, which includes coal, oil and gas, were significantly underestimated, the overall atmospheric increases in methane is not due to oil and gas production. NOAA, which has been measuring methane in the atmosphere since 1984, says the global increase in methane could be coming from microbial sources including wetlands, rice paddies and agricultural livestock like cows. Methane is considered more potent a greenhouse gas than carbon dioxide because although it breaks down more quickly than CO<sub>2</sub>, it traps heat 28 times more effectively over the course of 100 years.

For more visit:- <https://stateimpact.npr.org/pennsylvania/2016/10/05/while-global-methane-emissions-are-up-research-shows-fossil-fuels-not-the-source/>

## **Organic semiconducting polymers can harvest sunlight to split CO<sub>2</sub> into alcohol fuels**

**6<sup>th</sup> October 2016, unattributed, ScienceDaily**

Chemists at The University of Texas at Arlington have been the first to demonstrate that an organic semiconductor polymer called polyaniline is a promising photocathode material for the conversion of carbon dioxide into alcohol fuels without the need for a co-catalyst.

"This opens up a new field of research into new applications for inexpensive, readily available organic semiconducting polymers within solar fuel cells," said principal researcher Krishnan Rajeshwar, UTA distinguished professor of chemistry and biochemistry and co-Director of UTA's Center for Renewable Energy, Science & Technology. "These organic semiconducting polymers also demonstrate several technical advantages, including that they do not need a co-catalyst to sustain the conversion to alcohol products and the conversion can take place at lower temperatures and use less energy, which would further reduce costs," Rajeshwar added.

Rajeshwar and his co-author Csaba Janaky, professor in the Department of Physical Chemistry and Materials Science at the University of Szeged, recently published their findings in *The*

Royal Society of Chemistry journal *ChemComm* as "Polyaniline films photoelectrochemically reduce CO<sub>2</sub> to alcohols." In this proof-of-concept study, the researchers provide insights into the unique behavior of polyaniline obtained from photoelectrochemical measurements and adsorption studies, together with spectroscopic data. They also compared the behaviour of several conducting polymers.

For more visit:- <https://www.sciencedaily.com/releases/2016/10/161006121112.htm>

## **Shale gas, not EPA rules, has pushed decline in coal-generated electricity, study confirms**

**7<sup>th</sup> October 2016, unattributed, ScienceDaily**

Cheap shale gas produced by fracking has driven the decline in coal production in the United States during the last decade, researchers at the Great Lakes Energy Institute at Case Western Reserve University have found. Power plants, which use 93 percent of the coal produced nationally, have been operating under the same EPA regulations signed into law by President George H.W. Bush in 1990. Proposed new rules since then have all been challenged in court and not implemented until June 2016, when the EPA's restrictions on mercury and other toxic emissions were approved by the U.S. Supreme Court.

Consumption of coal continued to grow under those 1990-era EPA rules until 2008, and then went into steady decline, dropping by 23 percent from 2008 thru 2015. The data show the drop in those years to be correlated with the shale revolution, as natural gas production increased by a factor of more than 10 and its price dropped in half, the researchers say. And, due to the continuing -- and in some cases accelerating -- technological and economic advantages of gas over coal, the decline in coal is expected to continue at least decades into the future. Their study is published in *The Electricity Journal*.

For more visit:-

[https://www.sciencedaily.com/releases/2016/10/161007105548.htm?utm\\_source=feedburner&utm\\_medium=email&utm\\_campaign=Feed%3A+sciencedaily%2Fmatter\\_energy%2Ffossil\\_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29](https://www.sciencedaily.com/releases/2016/10/161007105548.htm?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+sciencedaily%2Fmatter_energy%2Ffossil_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29)

## **Is fracking in the U.K. really so bad?**

**7<sup>th</sup> October 2016, Kate Wheeling, PS Magazine**

Yesterday, the government in the United Kingdom approved a permit for fracking in Lancashire County. Communities Secretary Sajid Javid approved plans for the oil and gas company Cuadrilla to begin drilling in Lancashire, reversing a previous decision by the County Council. The company could begin drilling as early as April of 2017, and it will be the first time horizontal fracking, which extracts more gas from between layers of shale rock, will be allowed in the U.K. The government's decision came just one day after the Paris Agreement—a global pact to begin the transition from a world dependent on fossil fuels to one that runs on clean energy—went into effect.

Environmentalists see the fracking approval as a setback. "Fracking goes against everything we need to do to tackle climate change," Pollyanna Steiner, a Friends of the Earth campaigner, told the BBC. "The government must end its fixation with dirty fossil fuels and focus instead on harnessing the U.K.'s huge renewable energy resource."

For more visit:-

<https://psmag.com/is-fracking-in-the-u-k-really-so-bad-f68b372d9fc3#.pcuenvw5v>

## **World Bank says Paris climate goals at risk from new coal schemes**

**9<sup>th</sup> October 2016, Larry Elliott, The Guardian**

Slowing down construction of coal-fired power stations will be vital to hit globally agreed climate change goals, the World Bank president, Jim Yong Kim, said as he outlined a five-point plan to flesh out last year's Paris agreement to reduce CO<sub>2</sub> emissions.

Speaking at a climate ministerial meeting in Washington during the bank's annual meeting, he said there was no prospect of keeping global warming at or below 2C (3.6F) if current plans for

coal-fired stations, especially those earmarked for Asia, were built. "Many countries want to move in the right direction. We can and should all help to find renewable energy and energy efficiency solutions that allow them to phase out coal," Kim said.

The World Bank president said achieving the climate change target required action in five areas. In addition to slowing down growth in coal-fired power stations, Kim said climate ambition needed to be baked into development plans for every developing country. It was important that the \$90bn (£72bn) of planned infrastructure spending over the next 15 years was for low-CO<sub>2</sub> and climate-resilient investment.

He called for the ramping up of energy-efficient appliances and less use of hydrofluorocarbons, which are used in air conditioning units. "Phasing down HFCs could prevent close to half a degree of global warming by the end of the century," he said.

Calls for the "greening" of finance by the Bank of England governor, Mark Carney, were also strongly backed by Kim who said the sector needed to be "fit for purpose to assess climate risks and opportunities".

For more visit:- <https://www.theguardian.com/environment/2016/oct/09/world-bank-jim-yong-kim-paris-climate-coal-power-emissions>

## **Unravelling the science behind biomass breakdown**

**18<sup>th</sup> October 2016, unattributed, ScienceDaily**

Lignocellulosic biomass—plant matter such as cornstalks, straw, and woody plants—is a sustainable source for production of bio-based fuels and chemicals. However, the deconstruction of biomass is one of the most complex processes in bioenergy technologies. Although researchers had already uncovered information about how woody plants and waste biomass can be converted into biofuel more easily, they have now discovered the chemical details behind that process.

A team led by Jeremy Smith, a University of Tennessee (UT)-ORNL Governor's Chair and the director of the UT-ORNL Center for Molecular Biophysics (CMB), uses computer simulations to investigate the chemistry of biomass deconstruction. Smith's collaborators from the BioEnergy Science Center, a DOE Bioenergy Research Center led by ORNL, previously developed a pre-treatment method for breaking down biomass that initiates delignification, the removal of the rigid plant molecule lignin. The co-solvent enhanced lignocellulose fractionation pre-treatment involves aqueous solutions of tetrahydrofuran (THF), a versatile organic solvent. This co-solvent mixture uniquely interacts with cellulose, the main structural component of plant cell walls, to enable its breakdown.

For more visit:- <https://www.sciencedaily.com/releases/2016/10/161018194926.htm>

## **Biomass costlier than solar and dirtier than coal and gas concludes new report**

**18<sup>th</sup> October 2016, David Pratt, Clean Energy News**

Solar installations offer a cheaper alternative to biomass over the lifetime of a system according to a new report from the Natural Resources Defense Council (NRDC), which also claims that biomass produces higher carbon emissions than coal and natural gas. The new study from the US-based environmental advocacy group has examined the full system costs of renewables like wind and solar relative to biomass under carrying assumptions about the total economic costs of each.

The analysis took into account the latest technology costs, the cost of ensuring reliability of supply, and carbon costs and concluded that in 2020, biomass will be more costly than wind and solar alternatives. This is due in part to the continually falling costs of these renewable technologies which are expected to continue into the next decade. Meanwhile, biomass conversion is already a mature technology and so the potential for technology costs to fall is limited. This means that comparatively little capital cost reduction is expected over time while

fuel costs, which make up the bulk of biomass costs, are highly uncertain whereas solar installations do not carry this lifetime cost.

Sasha Stashwick, a senior advocate with NRDC, said: "The economics of biomass don't make sense as the UK strives to replace coal and decarbonize its power sector. This report clearly indicates that when you account for total economic costs, cleaner alternatives like wind and solar are the lower cost solution for a coal-free UK. It's just good economic sense."

The report also pointed to scientific evidence from the former Department for Energy and Climate Change (DECC) and elsewhere that shows many forms of biomass - especially biomass from forests - produce higher carbon emissions than even fossil fuels. All biomass is still treated as a "carbon neutral" fuel in the UK, with utilities only required to account for emissions associated with the cultivation, processing, and transport of biomass and not its burning. The study argues that the true costs of pollution, even for scenarios that do not include a full accounting of biomass carbon emissions, further adds to the case against the technology versus low carbon alternatives.

NRDC has therefore called on government to reform the UK's bioenergy policies so as not to encourage biomass, which it dubs as one of the "more expensive and dirtier solutions to the country's energy needs". Historically, biomass has received significant levels of support from government under the Renewable Heat Incentive (RHI) by dominating deployment under the scheme. However, policy is shifting around the technology, with DECC including proposals in a consultation released in March to reduce the incentives available for biomass under the non-domestic RHI scheme. The new Department of Business, Energy and Industrial Strategy (BEIS) recently showed signs of the government's increasing shift away from biomass by implementing a surprise cut to RHI support for biomass CHP systems.

Source :- <http://www.cleanenergynews.co.uk/news/renewable-heat/biomass-costlier-than-solar-and-dirtier-than-coal-and-gas-concludes-new-rep>

## **Turning biofuel waste into wealth in a single step**

**20<sup>th</sup> October 2016, unattributed, EurekaAlert**

Lignin is a bulky chain of molecules found in wood and is usually discarded during biofuel production. But in a new method by EPFL chemists, the simple addition of formaldehyde could turn it into the main focus. Reducing our reliance on fossil fuels means turning to plant-derived biofuels and chemicals. But producing them cost-effectively from plants and other organic matter - collectively referred to as biomass - is a major engineering challenge. Most biomass comes in the form of non-edible plants like trees, grass, and algae, which contain sugars that can be fermented to produce fuel. But biomass also contains lignin, a bulky, complex organic polymer that fills wood, bark, and generally gives plants rigidity. Because it is difficult to process, lignin is usually discarded during biofuel processing. EPFL scientists have now turned lignin from a nuisance to an important source of biofuel by simply adding a common chemical, converting up to 80% of it into valuable molecules for biofuel and plastics. The patent-pending method, which can be scaled up to industrial levels, is published in *Science*.

For more visit:- [https://www.eurekaalert.org/pub\\_releases/2016-10/epfd-tbw101916.php](https://www.eurekaalert.org/pub_releases/2016-10/epfd-tbw101916.php)

## **Royal Society accused of allowing 'anti-scientific coal baron' to preach benefits of global warming**

**20<sup>th</sup> October 2016, Ian Johnston, The Independent**

One of the world's leading climatologists has attacked Britain's prestigious Royal Society for hosting an "anti-scientific" speech about the benefits of global warming by "coal baron" and "climate change denier villain" Matt Ridley. Viscount Ridley, a journalist and hereditary peer, insisted mainstream scientists were exaggerating the risks because they had a "vested interest in alarm" during the event run by the Global Warming Policy Foundation, a sceptic think tank, at the world's oldest scientific institution. He claimed "environmental predictions of doom" would "always" turn out to be wrong; the "best evidence" suggested the planet would not get as warm as experts predict; and that climate models had been "consistently wrong".

Higher amounts of carbon dioxide, which plants use to grow, were also causing beneficial “global greening”, Lord Ridley said, citing academic research. However, Professor Michael Mann, who led research that produced the famous “hockey stick” graph showing how humans were dramatically increasing the Earth’s temperature, accused Lord Ridley of buying “into the sort of conspiratorial thinking uttered by Donald Trump”. The US presidential candidate has claimed global warming is a hoax perpetrated by China on the US. The Royal Society’s decision to host the speech was “presumably as a gesture of ‘open-mindedness’”, Professor Mann, of Penn State University in the US, told *The Independent*.

For more visit:- <http://www.independent.co.uk/environment/royal-society-global-warming-climate-change-benefits-matt-ridley-michael-mann-a7372306.html>

### **Renewable energy: Scientists accidentally turn carbon dioxide into ethanol**

**21<sup>st</sup> October 2016, Tegan Taylor, ABC News**

A team of scientists has turned a waste product — carbon dioxide — into a fuel — ethanol — in a relatively simple process. And it happened almost by accident. The US Department of Energy Oak Ridge National Laboratory scientists were running a solution of carbon dioxide dissolved in water over a charged surface in the hopes of describing a reaction when they made their serendipitous discovery.

“We discovered somewhat by accident that this material worked,” study lead author Adam Rondinone said. “We were trying to study the first step of a proposed reaction when we realised that the catalyst was doing the entire reaction on its own.” The catalyst in question was nanoscopic spikes of carbon, studded with copper nanoparticles, that was electrified to essentially reverse the combustion process. “They are like 50-nanometer lightning rods that concentrate electrochemical reactivity at the tip of the spike,” Dr Rondinone said. The solution of carbon dioxide dissolved in water turned into ethanol with a yield of 63 per cent. This type of reaction typically results in a mix of several different products in small amounts.

For more visit:- <http://www.abc.net.au/news/2016-10-21/energy-scientists-accidentally-turn-carbon-dioxide-into-ethanol/7954546>

### **The methane riddle: What is causing the rise in emissions?**

**25<sup>th</sup> October 2016, Fred Pearce, environment 360**

The stomachs of cattle, fermentation in rice fields, fracking for natural gas, coal mines, festering bogs, burning forests — they all produce methane, the second most important greenhouse gas, after carbon dioxide. But how much? And how can we best cut these emissions? And is fracking frying the planet, or are bovine emissions more to blame?

Until now, the world has not had a definitive answer to these questions. But in recent months, researchers believe they have finally begun to crack the problem — and the results are surprising. The amount of methane in the atmosphere has more than doubled in the past 250 years. It has been responsible for about a fifth of global warming. But it has a confusing recent history. The steady rise of emissions stopped in the 1990s. Emissions were stable for almost a decade until 2007, but then abruptly resumed their rise. What has been going on? Fracking of natural gas in the U.S. and elsewhere has frequently been blamed for the resumed rise in emissions. But new studies are raising serious questions about that.

Researchers are now saying that, globally at least, the increase in recent years is due to the activities of microbes in wetlands, rice paddies, and the guts of ruminants. “Despite the large increase in natural gas production, there has not been an upward trend in industrial emissions,” says Stefan Schwietzke, of the U.S. National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colo., who is the lead author of one of the new studies.

For more visit:-

[http://e360.yale.edu/feature/methane\\_riddle\\_what\\_is\\_causing\\_the\\_rise\\_in\\_emissions/3047/](http://e360.yale.edu/feature/methane_riddle_what_is_causing_the_rise_in_emissions/3047/)

## **Renewable energy capacity overtakes coal**

**25<sup>th</sup> October 2016, Andrew Walker, BBC News**

The International Energy Agency says that the world's capacity to generate electricity from renewable sources has now overtaken coal. The IEA says in a new report that last year, renewables accounted for more than half of the increase in power capacity. The report says half a million solar panels were installed every day last year around the world.

In China, it says, there were two wind turbines set up every hour. Renewable energy sources, such as wind, solar and hydro are seen as a key element in international efforts to combat climate change. At this stage, it is the capacity to generate power that has overtaken coal, rather than the amount of electricity actually produced. Renewables are intermittent - they depend on the sun shining or the wind blowing, for example, unlike coal which can generate electricity 24 hours a day all year round. So renewable technologies inevitably generate a lot less than their capacity. Even so it is striking development. The IEA's Executive Director Fatih Birol said "We are witnessing a transformation of global power markets led by renewables".

For more visit:- <http://www.bbc.co.uk/news/business-37767250>

## **Australia's coal seam gas emissions may be vastly underestimated – report**

**25<sup>th</sup> October 2016, Michael Slezak, The Guardian**

The coal-seam-gas industry could be vastly underestimating its emissions, jeopardising Australia's commitments made at Paris and swamping any benefits gas has over coal, according to a landmark report by the Melbourne Energy Institute, commissioned by the Australia Institute. The report found the industry's true emissions could easily amount to twice the emissions Australia has promised to cut by 2030.

While no studies in Australia have examined emissions from methane escaping directly into the atmosphere, in the US those measurements show it is often 170 times higher than that claimed by the Australian industry and 34 times higher than that what the Australian government reported to the UN. "We're potentially not measuring the equivalent of the emissions from our entire transport sector," said Mark Ogge, principal advisor at the Australia Institute. "If the emissions are a lot more than what is being estimated now, it could jeopardise our commitments made at Paris," said report author Tim Forcey from the Melbourne Energy Institute.

For more visit:- <https://www.theguardian.com/environment/2016/oct/26/australia-coal-seam-gas-emissions-may-be-vastly-underestimated-report>

## **Dutch unveil giant outside vacuum cleaner to filter dirty air**

**26<sup>th</sup> October, Agence France-Presse, The Guardian**

Dutch inventors have unveiled what they called the world's first giant outside air vacuum cleaner – a large purifying system intended to filter out toxic tiny particles from the atmosphere surrounding the machine. "It's a large industrial filter about eight metres long, made of steel ... placed basically on top of buildings and it works like a big vacuum cleaner," said Henk Boersen, a spokesman for the Envivity Group which unveiled the system in Amsterdam.

The system is said to be able to suck in air from a 300-metre radius – and from up to seven kilometres (more than four miles) upwards. It could treat some 800,000 cubic metres of air an hour, filtering out 100% of fine particles and 95% percent of ultra-fine particles, the company said, referring to tests carried out by the Energy Research Centre of the Netherlands (ECN) on its prototype. "A large column of air will pass through the filter and come out clear," Boersen told AFP on Tuesday, speaking on the sidelines of a major two-day offshore energy conference in Amsterdam. Fine particles are caused by emissions from burning wood and other fuels as well as industrial combustion, and have "adverse effects on health", according to the European Environment Agency.

About 90% of EU residents are exposed to levels of such particles – which can be carcinogenic – above those recommended by the World Health Organisation. As for ultra-fine particles, they are released by emissions from vehicles as well as aeroplanes, according to Envinity, and can “damage the nervous system, including brain cells, and also cause infections”.

For more visit:- <https://www.theguardian.com/world/2016/oct/26/dutch-unveil-giant-outside-vacuum-cleaner-to-filter-dirty-air>

### **Study: Coal ash not culprit for cancer-causing contaminant**

**27<sup>th</sup> October 2016, unattributed, Fox News**

A cancer-causing heavy metal found in well waters (in the USA) near coal ash pits and other industrial sites is much more widespread and naturally occurring than previously thought, university researchers said last Wednesday.

The presence of hexavalent chromium is more related to volcanic rock found in North Carolina and nearby states than the pits used to store the waste left after burning coal, Duke University geochemistry professor Avner Vengosh said. Badly tainted ground water was found in wells more than 18 miles from a coal ash storage basin in central North Carolina's Piedmont region, according to the study published in the American Chemical Society's publication *Environmental Science & Technology Letters*.

“The most important thing is to make sure the industry, the coal ash issue, is not off the table.” Vengosh said. “Ground waters near ash ponds are contaminated. We see evidence for that. But the issue with hexavalent chromium, we're finding, is unrelated and much larger than we thought.

The U.S. Environmental Protection Agency says hexavalent chromium is likely to be carcinogenic when ingested. The chemical was portrayed as poisoning residents in a California town in a movie describing the work of former legal clerk and sleuth Erin Brockovitch.

For more visit:- <http://www.foxnews.com/health/2016/10/27/study-coal-ash-not-culprit-for-cancer-causing-contaminant.html>

### **New research suggests CO2 can be scrubbed from the atmosphere to avoid climate change crisis**

**28<sup>th</sup> October 2016, Jaimee Bruce, Nature World News**

There is now a new research that proposes a revolutionary method to scrub carbon dioxide from the atmosphere to combat global warming. Cornell researchers proposed utilizing a “bioenergy-biochar system” that could eliminate carbon dioxide from the atmosphere until other removal methods become economically accessible. This ground breaking research appeared in the Oct. 21 edition of *Nature Communications*. Biochar, a carbonized plant matter made by charring organic material without using air, is stable and has carbon-eliminating properties. It can be sowed into the soil to act as a fertilizer substitute and increase crop production.

Dominic Woolf, a Cornell research associate in crop and soil sciences and lead author of *Optimal Bioenergy Power Generation for Climate Change Mitigation With or Without Carbon Sequestration*, said, “If we continue on current emissions trajectories, we will need to draw down excess carbon dioxide from the atmosphere if we're going to avoid catastrophic levels of climate change. We're offering a mitigation model that can do that. It's not a silver bullet, but it may be among the tools we need in a portfolio of carbon dioxide mitigation strategies.”

For more visit:- <http://www.natureworldnews.com/articles/30815/20161028/new-research-suggests-co2-scrubbed-atmosphere-avoid-climate-change-crisis.htm>

## **NREL researchers discover how a bacterium, Clostridium thermocellum, utilizes both CO2 and cellulose to make biofuels**

**28<sup>th</sup> October 2016, unattributed, Altenergymag.com**

Scientists at the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) made the surprise discovery that a metabolic pathway to take up CO<sub>2</sub> exists and functions in a microorganism capable of breaking down and fermenting cellulosic biomass to produce biofuels including hydrogen and hydrocarbons. Clostridium thermocellum is among the most efficient bacteria in directly converting cellulosic materials into hydrogen and hydrocarbons biofuels. Most bacteria feeding upon organic carbon compounds, such as glucose or xylose, release CO<sub>2</sub> as a waste byproduct, decreasing the maximum amount of products the microorganism can produce per carbon atom measured as carbon efficiency. Other scientists have found the addition of a form of CO<sub>2</sub>, known as bicarbonate, into the medium containing the bacterium actually promotes the growth of C. thermocellum, yet its mechanistic details remained a puzzle. This enhanced growth implied the bacterium had the ability to use CO<sub>2</sub> and prompted NREL researchers to investigate the phenomena enhancing the bacterium's growth. For more visit:-

<http://www.altenergymag.com/news/2016/10/28/nrel-researchers-discover-how-a-bacterium-clostridium-thermocellum-utilizes-both-co2-and-cellulose-to-make-biofuels/24982/>

## **Why Europe's climate action has been put on hold**

**31<sup>st</sup> October 2016, Aline Robert, EurActiv.com**

Angela Merkel's absence from the COP 22 is symbolic of a European climate and energy policy beset by indecision and infighting. EurActiv France reports. The German Chancellor will be conspicuously absent from the COP 22 in Marrakesh this November. François Hollande, Matteo Renzi and Mariano Rajoy all plan to attend the UN climate conference. This absence speaks volumes about Germany's motivation to pursue its climate pledges from the COP 21 in Paris last year. As promised, Berlin published its 2050 climate action plan in September. But while the text tables reductions to greenhouse gas (GHG) emissions of 80-95%, it says little about how the country intends to tackle its two main problems: coal-fired power stations and transport. For more visit:-

<http://www.euractiv.com/section/energy/news/why-europes-climate-action-has-been-put-on-hold/>

## **UK to invest £390m per year in research and innovation**

**31<sup>st</sup> October 2016, Jacqueline Echevarria, Energy Live News**

There will be "significant research investment" in those areas including how to deliver and put into use innovations in access to water and climate science, build resilience and integrate weather disaster risk reduction into development approaches and scale up access to clean energy. The DFID will also work closely with BEIS to address those challenges.

Other areas of funding include tackling diseases, poverty and improving education. DFID Secretary Priti Patel said: "The UK is a research super-power whose global leadership is changing and saving lives across the world. "British innovation in fighting extreme poverty is more important than ever. That's why I am determined to put top-quality research and evidence at the heart of UK aid. The UK in partnership with world-leading organisations can help address the great global challenges of today."

Source:- <https://www.energylivenews.com/2016/10/31/uk-to-invest-390m-per-year-in-innovation-and-research/>

## **Finland considers ban on coal-fired power stations by 2030 - Rehn**

**2<sup>nd</sup> November 2016, Tuomas Forsell, Thomson Reuters Foundation News**

Finnish government is considering banning all coal-fired power stations by 2030 to help meet emission reduction goals, Minister of Economic Affairs Olli Rehn said on Wednesday. Coal-fired power generation accounted for 7 percent of all electricity production last year, with 45 percent coming from renewable sources and 34 percent from nuclear, according to Statistics



Finland. "Finland is well positioned to be among the first countries in the world to enact a law to ban coal ... This will be my proposal," Rehn told Reuters.

The ban, if approved by all coalition partners, would be part of the Nordic country's new energy strategy, which the centre-right government is due to present to parliament later this month. "Giving up coal is the only way to reach international climate goals," Rehn said, adding that the move would also reinforce Finland's image as a "clean tech" country.

The government has previously said that it wants Finland to source more than half of its energy needs from renewables, and to halve the use of imported oil for domestic needs during the 2020s. Last year Britain announced plans to phase out all its coal-fired power plants by 2025, other than any fitted with carbon capture and storage (CCS) systems. Denmark is aiming to become fossil fuel-free by 2050, but it has no binding targets or bans for coal use.

Source:- <http://news.trust.org/item/20161102175846-qgxzn/>

## **Greece set to win €1.75bn from EU climate scheme to build two coal plants**

**3<sup>rd</sup> November 2016, Arthur Neslen, The Guardian**

Greece appears on track to win access to a controversial EU programme that could earmark up to €1.75bn (£1.56bn) in free carbon allowances for the building of two massive coal-fired power plants. The 1100MW coal stations will cost an estimated €2.4bn, and emit around 7m tonnes of CO<sub>2</sub> a year, casting doubt on their viability without a cash injection from an exemption under Europe's carbon trading market.

The European parliament's industry committee last month approved a rule change allowing Greece to join the scheme, the '10c derogation' of the emissions trading system (ETS). Now, positive votes in the environment committee next month and at a plenary in February could set wheels in motion for the coal plants.

Gerben-Jan Gerbrandy, a Dutch Liberal MEP on the environment committee, said: "Lignite [coal] has no future and should not be stimulated in any way. Greece's intention of using public funds to revive its lignite-based model should not be allowed. Article 10C is there to help poor countries towards a sustainable energy future. Lignite does not fit these criteria." "You couldn't make this up," added Imke Lübbecke, WWF Europe's head climate and energy policy. "The ETS was intended to reduce greenhouse gas emissions but it now risks being abused to facilitate investments in the new coal plants, which would operate well within the 2060s. For more visit:- <https://www.theguardian.com/environment/2016/nov/03/greece-set-to-win-175m-from-eu-climate-scheme-to-build-two-coal-plants>

## **UK coal-powered electricity projected to fall by record amount**

**3<sup>rd</sup> November 2016, Adam Vaughan, edie.net**

The amount of electricity generated from UK coal power stations is on track to fall by two-thirds this year, a decline which analysts said was so steep and fast it was unprecedented globally. Climate change thinktank Sandbag said the drop was due to a doubling in the price of a carbon tax and the lower price of gas. The group has written to the chancellor, Philip Hammond, urging him not to water down the carbon floor price in this month's autumn statement, which the steel industry has been lobbying the government to do.

Using data up to the end of October from the Office for National Statistics and the national grid, the thinktank estimated coal generation would fall 66% by the year's end. Coal generation fell 23% in both 2015 and 2014 on the year before, and 10% in 2013. Energy industry sources said the forecast for 2016 appeared to be broadly in line with expectations.

This year has seen a series of record lows for coal after three major plants closed, including the last remaining coal plant in Scotland. For several days in May the country's coal

plants produced no power for the first time in more than a century, and output was so low that from April to September, solar panels generated more power.

"It's on top of four years' worth of falls," said Dave Jones, an analyst at Sandbag. "That fall is completely unprecedented. Everyone's talking about what they can do to reduce greenhouse gas emissions, people talk a few percentage points here or there, but 66% is completely unprecedented in any country ever." Jones said the price of a tonne of carbon doubling from £9 to £18 in 2015 under the carbon floor price scheme was the driving force making coal plants uneconomic. Gas, which has been cheaper this year, has largely filled the gap in recent months.

The government last year pledged to phase out coal power entirely by 2025 to help meet its climate change commitments, but is yet to issue a consultation on the move. Sandbag said the decline in coal had seen emissions from the fuel go from 22% of the UK's total carbon footprint in 2012, to just 5% now. Official statistics show emissions dropped 4% in 2015 due to a rapid decline in coal, and the fall will almost certainly be much greater this year.

"The carbon price support has driven a remarkable decarbonisation of UK electricity," said Jones. "The UK is now on track for a coal phase-out before 2025, but the chancellor must maintain the carbon price support, or emissions will begin growing again." UK Steel confirmed it was lobbying the government to reduce the carbon floor price to bring down energy prices.

Source:- <http://www.edie.net/news/6/UK-coal-powered-electricity-projected-to-fall-by-record-amount/>

## **China to cap use of coal at 55 per cent of total power output by 2020**

**7<sup>th</sup> November 2016, unattributed, South China Morning Post**

China aims to cap coal-fired power generating capacity at 1,100 gigawatts by 2020, higher than the current ceiling but accounting for less of the country's total power supply as the top global energy market seeks to increase the use of cleaner renewable fuels. Announcing its five-year plan for the power industry, the National Energy Administration said on Monday it aimed to have 2,000 gigawatts of electricity generating capacity by 2020, of which at least 320 gigawatts would come from solar and wind power and 110 gigawatts from natural gas.

The administration said that as part of its long-term plan to shift to clean power China would eliminate or delay at least 150 gigawatt of coal-fired power projects between 2016 and 2020. The new ceiling for coal output is up from 960 gigawatts in a previous five-year plan for the period to 2015, but it will put the share coal in the total at more than 50 per cent, down from over two-thirds. Analysts, however, said that it was still relatively high. For more visit:-

<http://www.scmp.com/news/china/economy/article/2043620/china-cap-use-coal-55-cent-total-power-output-2020>

## **With Trump, coal wins, planet loses**

**9<sup>th</sup> November 2016, Elizabeth Kolbert, The New Yorker**

Peabody Energy is, by its own description, the "largest private sector coal company in the world." It's also bankrupt. The company, based in St. Louis, filed for Chapter 11 this past April. On Wednesday, on the news of Donald Trump's victory, Peabody's stock surged almost fifty per cent. That one figure speaks volumes—and forests and coral reefs and coastal cities. For the planet, the stakes in yesterday's election were enormous—"almost unthinkably large," as David Roberts put it, at Vox—and now the results are in. The ramification of Americans' choice will be felt, literally, for millennia.

To the extent that Trump offered any major policy positions during the campaign—besides, that is, on building a wall—he made clear what his plans were in the areas of energy and the environment. He called climate change a "hoax"; he said he would "cancel" the international climate treaty negotiated last year, in Paris; and he promised to repeal the regulations that the Obama Administration put in place to reduce carbon emissions from power plants. In September, it was reported that Trump planned to pick Myron Ebell, a well-known climate-

change denier and a lobbyist for Koch Companies Public Sector L.L.C., to lead his transition team for the Environmental Protection Agency. The choice made sense, as Trump said repeatedly that he wanted to abolish the E.P.A.

But key to this treaty (that isn't exactly a treaty) are the commitments that each country has made to reduce its own emissions. The U.S. pledged in Paris to reduce its emissions by at least twenty-six per cent (using a baseline of 2005). And key to the U.S.'s pledge are power-plant regulations that were finalized by the E.P.A. last August. While it's difficult and time-consuming to roll back rules that have been finalized, it's certainly possible, and, in any event, these rules are now being held up by litigation. To make a long, complicated legal story short, Trump's pick to fill the vacancy on the Supreme Court left by Antonin Scalia will, almost certainly, cast the deciding vote on the rules' legality.

"What they do is a disgrace," he told Fox News last month. How many of these things can Trump actually do? The answer is: More than you might think, and certainly more than you'd hope.

The Paris climate accord was very carefully constructed so that it did not require ratification by the United States Senate, since it was clear that the Republican majority wouldn't approve it. The U.S. has already signed off on the agreement, and it officially went into force on November 3rd. In fact, negotiators are meeting in Marrakech right now to discuss how to implement it. Meanwhile, Trump could undermine the agreement simply by *saying* that the U.S. isn't going to live up to its pledge. If America, the world's second-largest emitter, isn't going to bother to fulfill its commitment, why should any other nation?

An argument can be made that the fate of the planet will be decided by global economic forces more than by any particular treaty or set of regulations. An argument can also be made that the Paris accord was never worth all that much, as all it did was slow down the race toward planetary disaster. Both of these arguments are probably, to a certain extent, true. Still, there's an awful lot of damage that a Trump Presidency can, and likely will, do.

James Delingpole, at Breitbart, put it this way: "The liberal-left just lost the 'battle' against climate change." Companies like Peabody Energy will be the ones to profit from that. And, in hundreds and hundreds of years, the impacts of the fossil fuels that we're now burning will still be playing out.

Source:- <http://www.newyorker.com/news/news-desk/with-trump-coal-wins-planet-loses>

## **Can we meet global energy demands with nuclear power?**

**9<sup>th</sup> November 2016, unattributed, ScienceDaily**

An international team of scientists suggests that we must ramp up energy production by nuclear power if we are to succeed in warding off the worst effects of greenhouse gas emissions on climate change. The team suggests that beginning in 2020 we could achieve an annual electricity output of 20 terawatts without needing to develop carbon dioxide trapping and storage technology for the tens of billions of tons of emissions that would otherwise drive global warming to catastrophic levels. For more visit:-

[https://www.sciencedaily.com/releases/2016/11/161109110926.htm?utm\\_source=feedburner&utm\\_medium=email&utm\\_campaign=Feed%3A+sciencedaily%2Fmatter\\_energy%2Ffossil\\_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29](https://www.sciencedaily.com/releases/2016/11/161109110926.htm?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+sciencedaily%2Fmatter_energy%2Ffossil_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29)

## **Low growth in global carbon emissions continues for third successive year**

**14<sup>th</sup> November 2016, unattributed, ScienceDaily**

Global carbon emissions from burning fossil fuels did not grow in 2015 and are projected to rise only slightly in 2016, marking three years of almost no growth, according to researchers at the University of East Anglia (UEA) and the Global Carbon Project.

The projected rise of only 0.2% for 2016 marks a clear break from the rapid emissions growth of 2.3% per year in the decade to 2013, with just 0.7 per cent growth seen in 2014. The new data is published in the journal *Earth System Science Data*. It shows emissions growth remained below 1 per cent despite GDP growth exceeding 3 per cent. Decreased use of coal in China is the main reason behind the 3-year slowdown.

Prof Corinne Le Quéré, Director of the Tyndall Centre at UEA who led the data analysis, said: "This third year of almost no growth in emissions is unprecedented at a time of strong economic growth. This is a great help for tackling climate change but it is not enough. Global emissions now need to decrease rapidly, not just stop growing."

For more visit:- <https://www.sciencedaily.com/releases/2016/11/161114082243.htm>

### **UKERC calls for urgent action on UK energy during this Parliament 16<sup>th</sup> November 2016, unattributed , UKERC**

The UK Energy Research Centre is today calling for urgent action during this Parliament to ensure a coordinated, cross-government approach to energy. In advance of the Chancellor's Autumn Statement next week, and the forthcoming Industrial Strategy and Emissions Reduction Plan, the authors warn that without action now, investor confidence will fail to recover and the UK will fail to meet its legally binding emissions targets. As shown by the most recent Ernst and Young Renewable Energy Country Attractiveness index, confidence has been negatively impacted by recent policy changes. Professor Jim Watson, UKERC Director and one of the authors of the review, said: 'The UK has a world leading policy framework for emissions reduction in the Climate Change Act and there has been good progress so far. But this progress has been negatively affected by recent policy changes. It will not last into the 2020s unless policies are significantly strengthened in this Parliament.' - See more at:

<http://www.ukerc.ac.uk/news/ukerc-calls-for-urgent-action-on-uk-energy-during-this-parliament.html>

### **Engineering a more efficient system for harnessing carbon dioxide 17<sup>th</sup> November 2016, unattributed, ScienceDaily**

Despite the vast diversity of organisms on the planet that express enzymes for the conversion of carbon dioxide into such organic compounds as sugars -- as plants do through photosynthesis - - the efforts to harness these capabilities to transform CO<sub>2</sub> into high-value products such as biofuel and renewable chemicals have met with limited success. While increasing concentration of CO<sub>2</sub> in the atmosphere poses a challenge, researchers also see it as an opportunity.

Now a team from the Max-Planck-Institute (MPI) for Terrestrial Microbiology in Marburg, Germany, by tapping the DNA synthesis expertise of the U.S. Department of Energy Joint Genome Institute (DOE JGI), has reverse engineered a biosynthetic pathway for more effective carbon fixation. This novel pathway is based on a new CO<sub>2</sub>-fixing enzyme that is nearly 20 times faster than the most prevalent enzyme in nature responsible for capturing CO<sub>2</sub> in plants by using sunlight as energy. The study was published in the November 18, 2016 issue of *Science*.

For more visit:- <https://www.sciencedaily.com/releases/2016/11/161117141233.htm>

### **France to shut down all coal-fired power plants by 2023 17<sup>th</sup> November 2016, Charlotte England, The Independent**

France will shut down all its coal-fired power plants by 2023, president Francois Hollande has announced. Speaking at an annual UN climate change conference on Wednesday, Mr Hollande vowed to beat by two years the UK's commitment to stop using the fossil fuel to generate power by 2025. Mr Hollande, a keynote speaker at the event in Marrakech, Morocco, also praised his US counterpart Barack Obama for his work on climate change, and then appeared to snub president-elect Donald Trump. Mr Trump is reportedly seeking ways to withdraw from the Paris agreement, a global treaty to limit climate change. "The role played by Barack Obama was crucial in achieving the Paris agreement," Mr Hollande said, before adding, in what has been perceived as a dig at Mr Trump, that becoming a signatory to the treaty is "irreversible". "We

need carbon neutrality by 2050," the French President continued, promising that coal will no longer form part of France's energy mix in six to seven years' time.

For more visit:- <http://www.independent.co.uk/news/world/europe/france-close-coal-plants-shut-down-2023-global-warming-climate-change-a7422966.html>

### **Cement materials are an overlooked and substantial carbon 'sink'**

**21<sup>st</sup> November 2016, unattributed, ScienceDaily**

A new study involving the University of East Anglia (UEA) shows that cement structures are a substantial but overlooked absorber of carbon emissions -- offsetting some of those emitted during cement production itself

Conducted by the China Emission Accounts and Datasets (CEADs) group, an international team of researchers led by UEA's Prof Dabo Guan, it found that the natural carbonation process of cement materials represents a large and growing 'sink' of CO<sub>2</sub>. However, while the Intergovernmental Panel on Climate Change (IPCC) guidelines for emissions inventories provide methods for quantifying CO<sub>2</sub> emissions during the cement production process, they do not consider carbon absorbed through cement carbonation. For more visit:- <https://www.sciencedaily.com/releases/2016/11/161121112302.htm>

### **Carbon dioxide injected into basalt converts to rock**

**22<sup>nd</sup> November 2016, unattributed, Carbon Capture Journal**

Lab studies on basalt have shown that the rock, which formed from lava millions of years ago and is found throughout the world, can rapidly convert CO<sub>2</sub> into stable carbonate minerals. This evidence suggests that if CO<sub>2</sub> could be locked into this solid form, it would be stowed away for good, unable to escape into the atmosphere. But what happens in the lab doesn't always reflect what happens in the field. One field project in Iceland injected CO<sub>2</sub> pre-dissolved in water into a basalt formation, where it was successfully stored. And starting in 2009, researchers with Pacific Northwest National Laboratory and the Montana-based Big Sky Carbon Sequestration Partnership undertook a pilot project in eastern Washington to inject 1,000 tons of pressurized liquid CO<sub>2</sub> into a basalt formation.

After drilling a well in the Columbia River Basalt formation and testing its properties, the team injected CO<sub>2</sub> into it in 2013. Core samples were extracted from the well two years later, and Pete McGrail and colleagues confirmed that the CO<sub>2</sub> had indeed converted into the carbonate mineral ankerite, as the lab experiments had predicted. And because basalts are widely found in North America and throughout the world, the researchers suggest that the formations could help permanently sequester carbon on a large scale.

For more visit:- <http://www.carboncapturejournal.com/ViewNews.aspx?NewsID=3854>

### **Greece must end its reliance on dirty coal**

**29<sup>th</sup> November 2016, Nikos Mantzaris, The Guardian**

It isn't a great surprise to learn that a director of Greece's Public Power Corporation believes in exemptions for lignite – an especially polluting type of coal burnt at Greek power plants (Letters, theguardian.com, 24 November). However, the claim that Greece is "among the best performers in emission reductions" must not go unchallenged.

In a recent report, Lifting Europe's Dark Cloud: How cutting coal saves lives, we revealed how Greek lignite plants, responsible for hundreds of premature deaths and thousands of cases of respiratory illness every year, have in fact been granted special exemptions to EU limits set in the industrial emissions directive. As a result, when it comes to emissions of sulphur dioxide (SO<sub>2</sub>), nitrous oxides (NO<sub>x</sub>), dust and mercury, Greek plants are undoubtedly among the worst performers in Europe. For more visit:-

<https://www.theguardian.com/environment/2016/nov/29/greece-must-end-its-reliance-on-dirty-coal>

## **EU targets energy waste and coal subsidies in new climate package**

**30<sup>th</sup> November 2016, Arthur Neslen, The Guardian**

Europe will begin phasing out coal subsidies and cut its energy use by 30% before the end of the next decade, under a major clean energy package announced in Brussels on Wednesday. The 1,000 page blueprint to help the EU meet its Paris climate commitments also proposes measures to cut household electricity bills, integrate renewables into power markets, and limit use of unsustainable bioenergy. The EU's climate commissioner Miguel Arias Cañete said that the new energy efficiency target was a centrepiece of the package, and would curb energy imports, create jobs and bring down emissions. "Europe is on the brink of a clean energy revolution," he told a press conference in Brussels. "And, just as we did in Paris, we can only get this right if we work together." For more visit:-

<https://www.theguardian.com/environment/2016/nov/30/eu-declares-war-on-energy-waste-and-coal-subsidies-in-new-climate-package>

## **Five ways to take action on climate change**

**3<sup>rd</sup> December 2016, Fatih Birol, The Guardian,**

The Paris agreement has been ratified. Only one year after negotiating this historic treaty, it has come into force. This signals that the vast majority of governments around the world remain committed to fighting climate change.

Yet that was the easy part. Actually realising these commitments made at COP21 in Paris will require concerted, concrete action for many years to come. Though the vast majority of countries in the world have clear goals in the form of nationally determined contributions (NDCs), these are not action plans, nor are the NDCs strong enough to actually keep global average temperature from rising more than 2C.

The Paris agreement is a truly global commitment, spanning developed and developing countries around the world. Yet for many developing and least-developed countries, in particular, contributing to the fight against climate change requires taking targeted actions while also prioritising economic development and poverty reduction. Here are five areas in the energy sector that offer such a win-win. For more visit:-

<https://www.theguardian.com/global-development-professionals-network/2016/dec/03/five-ways-to-take-action-on-climate-change>

## **Drax moves away from coal to bid on Opus Energy and gas plants**

**6<sup>th</sup> December, Reuters, The Guardian**

Britain's largest coal power producer, Drax, is bidding to buy Opus Energy and four gas stations in a move away from its coal legacy that has been welcomed by investors. Drax said it has made a £340m offer for business energy provider Opus Energy, an acquisition that will create Britain's fifth-biggest business energy retailer in combination with Drax's existing Haven Power customers. For more visit:- <https://www.theguardian.com/business/2016/dec/06/drax-coal-opus-energy-gas-plants>

## **New catalyst for capture and conversion of atmospheric carbon dioxide**

**7<sup>th</sup> December 2016, unattributed, Science Daily**

Research at the University of Pittsburgh's Swanson School of Engineering focused on developing a new catalyst that would lead to large-scale implementation of capture and conversion of carbon dioxide (CO<sub>2</sub>) was recently published in the Royal Society of Chemistry journal *Catalysis Science & Technology*.

Principal investigator is Karl Johnson, the William Kepler Whiteford Professor in the Swanson School's Department of Chemical & Petroleum Engineering. Postdoctoral associate Jingyun Ye is lead author. The article "Catalytic Hydrogenation of CO<sub>2</sub> to Methanol in a Lewis Pair Functionalized MOF" is featured on the cover of *Catalysis Science & Technology* (vol. 6, no. 24) and builds upon Dr. Johnson's previous research that identified the two main factors for

determining the optimal catalyst for turning atmospheric CO<sub>2</sub> into liquid fuel. The research was conducted using computational resources at the University's Center for Simulation and Modeling. For more visit:-

[https://www.sciencedaily.com/releases/2016/12/161207124105.htm?utm\\_source=feedburner&utm\\_medium=email&utm\\_campaign=Feed%3A+sciencedaily%2Fmatter\\_energy%2Ffossil\\_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29](https://www.sciencedaily.com/releases/2016/12/161207124105.htm?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+sciencedaily%2Fmatter_energy%2Ffossil_fuels+%28Fossil+Fuels+News+--+ScienceDaily%29)

## **Demand for rare earths sparks research for recovery from coal**

**8<sup>th</sup> December 2016, Sonal Patel, Power Magazine**

Global demand for the 17 periodic table elements—15 within the chemical group called lanthanides, plus yttrium and scandium—has soared in recent years as they become increasingly integrated in new technologies. Some major end uses include generators for wind turbines, permanent magnets and rechargeable batteries for hybrid and electric vehicles, automotive catalytic converters, fluid cracking catalysts in petroleum refining, and phosphors in color television and flat panel displays, including in cell phones and laptops.

REEs aren't exactly "rare": Some are moderately abundant in the earth's crust, even more than copper and lead. But they are not distributed evenly, most often occurring in low concentrations in a variety of minerals and coal, making them difficult to extract and separate economically. The U.S., which was once the world's leader in REE production (from the 1960s to the 1980s) and capable of fulfilling all its domestic REE needs, has become almost entirely reliant on imports. About 87% come from China, owing to lower costs. However, this has raised alarm from the Department of Defense, which particularly relies on two REEs, yttrium and dysprosium, for critical applications. For more visit:- <http://www.powermag.com/demand-for-rare-earths-sparks-research-for-recovery-from-coal/>

## **Batteries charged to play bigger role in UK energy grid**

**9<sup>th</sup> December 2016, John Moylan, BBC News**

It's battery farming, but not as we know it. In a big step forward for green energy, the government has said that low-carbon batteries will play a role in balancing the national grid for the first time. About 500MW of battery storage will come online by 2020-21, it said, helping to assure electricity supply at times of high demand. It follows a market-wide capacity auction that also saw agreements signed with gas and coal-power providers. Gareth Miller of energy research group Cornwall said the success of batteries in this year's auction was a "significant step". "It may represent only a fraction of total capacity but I think the role of batteries is only going to grow. And lithium ion batteries are a much cleaner way of storing electricity. "That said, the government must overcome a number of policy obstacles if it wants to speed this growth," he added. For more visit:- <http://www.bbc.co.uk/news/business-38263177>

## **UK plans to ban underground coal gasification**

**9<sup>th</sup> December 2016, Jacqueline Echevarria, Energy Live News**

The UK Government has announced it "minded to not support" underground coal gasification (UCG) projects. Its decision follows a report by consultant Atkins, commissioned by BEIS, which states the technique of injecting oxygen and steam underground to release gas from coal seams would significantly increase the country's emissions. It also points out if power stations use gas through this method, it would be up to between 40% and 100% dirtier in terms of CO<sub>2</sub> emissions than burning gas from the North Sea and imports.

Exploiting all the UK's coal reserves would release the equivalent of 24 years of the country's total greenhouse gas emissions, it adds. BEIS will discuss the findings of the review with interested parties and make a final decision in due course. A spokesperson said: "We have made a firm commitment to reducing the UK's carbon emissions and our recent ratification of the historic Paris Agreement shows we are serious about global action on climate change. "The Atkins report finds that emissions from underground coal gasification would be too high to be consistent with our commitment to a low-carbon future. We are therefore minded to not support the development of this technology in the UK." Earlier this year the Scottish

Government confirmed it will not support UCG developments. Source:-  
<http://www.energylivenews.com/2016/12/09/uk-plans-to-ban-underground-coal-gasification/>

## New RFCS coal-related projects started in 2016-17 (Awaiting notification)

Note: It is our usual CRF Newsletter practice to publish the annual list of coal-related projects funded by the RFCS through the Technical Group Coal (TGC), Coal mining operation, mine infrastructure and management and unconventional use of coal deposits and Technical Group Coal (TGC) Coal preparation, conversion and upgrading.

However, at the time of going to press, this information had not been released and so therefore it will be included in the next CRF Newsletter.

## CALENDAR OF COAL RESEARCH MEETINGS AND EVENTS

Date	Title	Location	Contact
6 <sup>th</sup> to 8 <sup>th</sup> February 2017	Eurocoalash 2017	Brno, Czech Republic	For more information visit:- <a href="http://www.fch.vut.cz/eca2017/">http://www.fch.vut.cz/eca2017/</a>
March 2017	12 <sup>th</sup> IEA CCC Workshop on Mercury Emissions from Coal	South Africa	For more information visit:- <a href="http://www.iea-coal.org.uk/site/2010/our-conferences-and-workshops?">http://www.iea-coal.org.uk/site/2010/our-conferences-and-workshops?</a>
<b>Wednesday 26th April 2017</b>	<b>Coal Research Forum Annual Meeting and Seminar of the CRF Coal Combustion Division</b>  <b>Combustion Safety and Flame Stability, (Provisional Title).</b>	<b>Business School South Building, Triumph Road, Jubilee Campus, University of Nottingham, Nottingham.</b>	<b>Dr. David J.A. McCaffrey</b> Secretary of the Coal Research Forum Tel : 01242-236973 E-mail : <a href="mailto:mail@coalresearchforum.org">mail@coalresearchforum.org</a>  <b>Dr. Gerry Riley</b> Chairman of the CRF Combustion Division Tel : 01962-831256 E-mail : <a href="mailto:griley@rjm-international.com">griley@rjm-international.com</a>
8-12 May 2017,	8th IEA CCC Clean Coal Technologies Conference	Carbonia, Italy <a href="#">Website</a>	For more information visit:- <a href="http://www.cct2017.org/">http://www.cct2017.org/</a>
17 <sup>th</sup> to 19 <sup>th</sup> July 2017	2 <sup>nd</sup> Chemistry in Energy Conference organized by the Royal Society of Chemistry Energy Sector	The Edge, University of Sheffield	For more information visit:- <a href="http://www.maggichurchouseevents.co.uk/cec/">http://www.maggichurchouseevents.co.uk/cec/</a>
<b>Tuesday 12<sup>th</sup> September 2017</b>	<b>Joint Seminar of the UKCCSRC with the Coal Research Forum's Carbon Capture and Storage and Advanced Power Generation and Gasification Divisions</b>	<b>The Edge, University of Sheffield, Sheffield</b>	<b>Prof. Jon Gibbins</b> Chairman of the CRF Carbon Capture and Storage Division Tel : 0114-215-7234 E-mail : <a href="mailto:j.gibbins@sheffield.ac.uk">j.gibbins@sheffield.ac.uk</a>  <b>Dr Robin Irons</b> Chairman of the CRF Advanced Power Generation and Gasification Division Tel : 07765-896878 E-mail : <a href="mailto:robin.irons@uniper.energy">robin.irons@uniper.energy</a>
<b>Monday 17<sup>th</sup> to Wednesday 19<sup>th</sup> September 2018</b>	<b>12th European Conference on Coal Research &amp; Its Applications, ECCRIA 12</b>	<b>TBA</b>	<b>Dr. David J.A. McCaffrey</b> 12th ECCRIA Conference Chairman Secretary of the Coal Research Forum Tel : 01242-236973 E-mail : <a href="mailto:mail@coalresearchforum.org">mail@coalresearchforum.org</a>