EUCERS Newsletter

Newsletter of the European Centre for Energy and Resource Security (EUCERS) **Issue 85, June/July 2019**

Introduction

Dear readers and friends of EUCERS,

It is my great pleasure to welcome you to this edition of the EUCERS newsletter. As always, we present you with two articles concerning the topic of energy security.

In the first article, TÜV UK Associate David Bradbury asks the question why we need nuclear power.

The second article, written by Franklin Servan-Schreiber, outlines how nuclear waste can be used to create energy.

As always, please feel free to keep us informed about your research projects and findings as we look to remain at the forefront of new knowledge and innovative ideas.

Thank you for your interest in EUCERS and for being part of our community.

Yours faithfully,
Thomas Fröhlich
EUCERS Newsletter Editor

In this Month's Edition:

ARTICLES

Why do we need nuclear power?

By David Bradbury

Nuclear Power has been around since the 1960's as an option for generating electricity without emissions of carbon dioxide. Since that time nuclear power has avoided, globally, the emission of some 60 billion tonnes of carbon dioxide up to 2013, approximately six times the amount avoided by wind power and solar power combined. Despite that success some people now believe that nuclear power will no longer be needed in future because other forms of renewable energy will take up the role of supplying carbon-free power.

David Bradbury is a nuclear expert with over 40 years in the nuclear industry and currently an associate with TÜV UK. He was Head of Fuel Cycle and Radioactive Waste Research team whilst at the CEGB in the 1980s. David has published over 50 technical papers on radwaste processing and is an inventor or co-inventor of 16 patents.

Before accepting that, it is important to assess where we actually are in our progress towards global carbon-free power. Carbon dioxide emissions from power generation are not decreasing, they are increasing (Figure 1) despite a target of near zero by 2050, widely accepted as being necessary for avoiding damaging climate change. The actual contribution of solar and wind power is small (as shown in Figure 1) despite large investment in the relevant facilities, which we can witness all around us. With just 30 years left to achieve such an ambitious goal of decarbonising power generation and so little tangible sign of success so far it seems strange to discount the future contribution of a technology (nuclear power) that has a proven history of success.

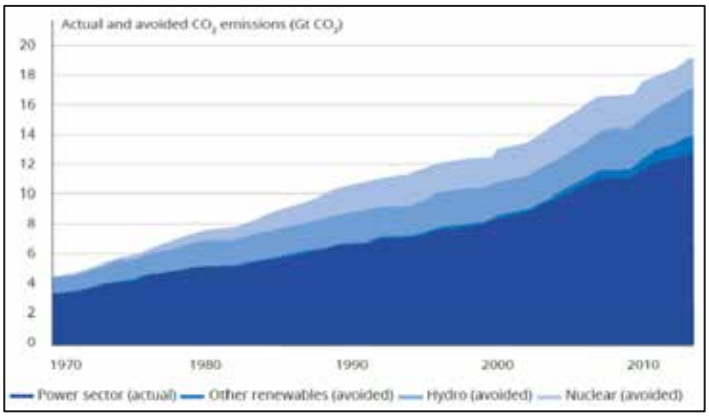


Figure 1 – Carbon dioxide emissions from power generation (Source: IAEA)

The reasons why renewable energy, specifically wind and solar power, find it so difficult to make concrete progress are bound up in fundamental and unchangeable factors – diffuseness, intermittency and high resource use. Nobody can make the sun shine at night, for example. Technological progress can partially overcome these drawbacks, but it takes a lot of effort, investment and (most importantly) time to do so. The technologies have not yet reached mature equilibrium where continued investment in new facilities will be required to offset losses due to retiring equipment, instead of adding new capacity. That point will be coming soon since the lifetime of these facilities is generally expected to be 20-30 years.

It is instructive to analyse two countries which have proceeded down different paths, namely France and Germany. France has an extensive nuclear power capacity installed in the latter part of the twentieth century, whereas Germany, despite having had an efficient and effective nuclear component to its electricity generation, is pursuing a policy of nuclear phaseout together with arguably the most aggressive deployment of renewable energy in the world. German electricity is twice the price of French electricity (ca, 30 cents/kWh in Germany versus ca. 15 in France) to pay for the renewable energy initiatives, but yet French citizens are responsible for 4.6 tonnes of carbon dioxide emissions per capita per year, as opposed to German citizens responsible for 8.9 tonnes (source Wikipedia). One important culprit for the Germans is the burning of lignite coal to produce replacement power for the lost nuclear capacity. It is sometimes stated that Germany is "in transition". That is all very well, but the German energy policy has been in place since the Fukushima accident in 2011, eight years ago. The goal for decarbonisation is just 30 years away. With the current situation still worsening how long is "transition" supposed to last?

The experience of displacement of fossil fuel generation by renewable energy technologies has proved to be remarkably slow and sluggish in comparison with nuclear power, as shown in Figure 2. That may seem counter-intuitive because wind turbines and solar panels are quick to install, whereas nuclear power stations take a long time to build. The key to nuclear power success (where it has occurred) has been parallel construction, where the relatively small number of power stations required to supply a large proportion of a country's total power needs are constructed at the same

time. Even though the French power stations individually took nearly ten years to build, France went from essentially zero to 85% carbon-free electricity in just two decades. There is no sign of that rate of displacement being matched by renewable energy anywhere.

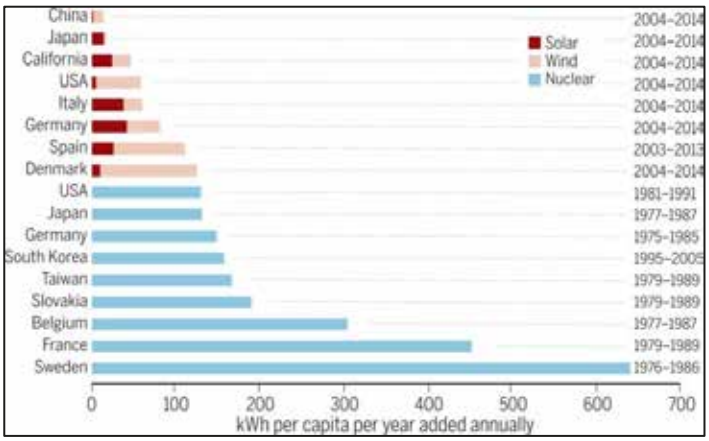


Figure 2 – Rate of displacement of carbon emitting power generation (Source: Ciao et al. Science 353, (6299) 547-548)

Another advantage for nuclear power is the longevity and low resource use of the power stations. Originally light water power reactors were designed to last forty years, but all around the world licensing for life-extension to sixty and even eighty years is now in place or contemplated. There is even talk of one hundred years life being achievable. A nuclear power fleet becomes like a fixed national infrastructure (similar, say, to the channel tunnel). The resources used by nuclear power facilities are a small fraction of those used for other forms of energy generation (figure 3). One must also remember that resources used almost invariably end up as waste – an issue that renewable energy technologies have yet to face up to because they are not yet being decommissioned in large numbers.

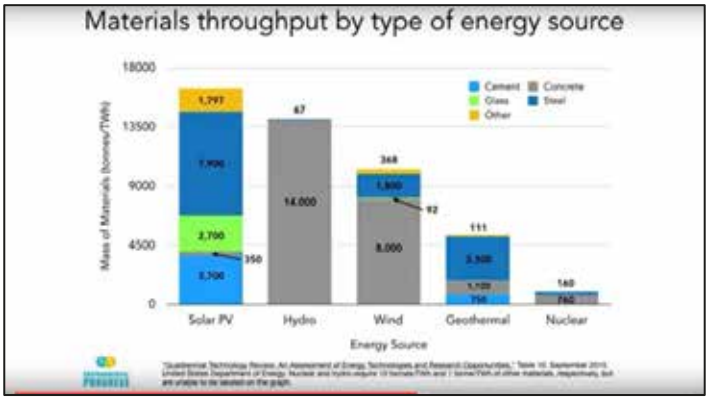


Figure 3 Materials used by different energy technologies

Few people would disagree that nuclear power has a bad image. There are lots of well-rehearsed reasons for that, not least the initial use of nuclear technology in the atomic bombing of Japan and the major nuclear accidents at Three Mile Island, Chernobyl and Fukushima. Those accidents in each case caused public reaction out of all proportion to the actual damage to people as a result of radiation exposure. Other factors (psychological fear of radiation, disruption caused by evacuation etc) caused more damage than radiation exposure even though that was the key factor of public concern. Unreasonable public concern drives regulatory and remedial measures, which can be counter-productive and increase costs. It has been estimated that 1,368 people died as a result of the evacuation of the population around Fukushima following the accident (up to 2016), whereas the deaths from radiation exposure, which the evacuation was intended to prevent, were zero and would still have been zero if the evacuation had not taken place. Japan is continuing to pay a huge price in both economic and carbon-emissions term as it struggles in the face of public opposition to restart its nuclear fleet. Such inconsistencies should be addressed by worldwide public education in the interests of meeting climate change goals - we cannot afford to discount potentially useful technologies just because they have a poor public image if that is not justified by the facts.

Nuclear power technology hasn't changed much in more than fifty years, but that doesn't mean that it cannot be improved. Key developments are taking place which might return to the path of progress abandoned in the 1970's. There are more than 150 designs of small nuclear reactors currently being considered for deployment. These reactors have key advantages compared with current designs because of the possibility of mass production, reduction of costs through implementation of "passive" safety features and transportability. In future nuclear power should be able to "come when needed and go when finished", which would allow access for a far higher proportion of the world's population to the benefits of nuclear generated electricity. Fuel cycle developments should allow used nuclear fuel (currently "nuclear waste") to become the nuclear fuel of the future when combined with the deployment of fast-neutron reactors. In this scenario there is enough uranium already mined to power the human race for over 1,000 years.

Nuclear power is at a cross roads, if no further development takes place the technological base from which it works will wither and die and there will be no future option for its deployment. Without nuclear power it seems most unlikely (on present trends) that the climate change goals will be achieved. Those who advocate the phaseout of nuclear power might then claim that renewable energy didn't

succeed in time because of lack of sufficient government action and support. There will be an alternative explanation – that the nuclear phaseout policy was wrong.

This article is a summary of David Bradburry's presentation at the 2nd EUCERS-KAS Energy Talk 2019.

Destroying nuclear waste to create clean energy? It can be done!

By Franklin Servan-Schreiber

If not for long-term radioactive waste, then nuclear power would be the ultimate "green" energy. The alternative to uranium is thorium, a radioactive ore whose natural decay is responsible for half of our geothermal energy, which we think of as "green energy." More than 20 years of research at the European Centre for Nuclear Research (CERN), the birthplace of the internet and where Higgs boson was discovered, demonstrate that thorium could become a radically disruptive source of clean energy providing bountiful electricity any place and at any time.

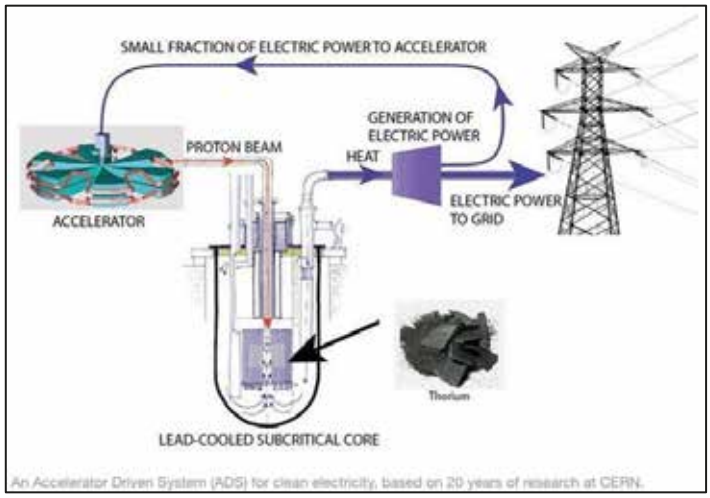
Coal and gas remain by far the largest sources of electricity worldwide, threatening our climate equilibrium. Non-fossil alternatives, such as solar power, use up a forbidding amount of land, even in sunny California, plus the decommissioning will pose a serious recycling challenge within 20 years. Solar is best used on an individual household basis, rather than centralized plants. Wind requires an even larger surface area than solar.

As Michael Shellenberger, a Time magazine "Hero of the Environment", recently wrote: "Had California and Germany invested $680 billion into nuclear power plants instead of renewables like solar and wind farms, the two would already be generating 100% or more of their electricity from clean energy sources." Correct, but the disturbing issue of long-term nuclear waste produced by conventional, uranium based, nuclear plants still remains.

In the early 1990s, Carlo Rubbia, Nobel prize winner in physics (1984) and then CERN's director general, launched a small experiment applying cutting-edge accelerator technologies toward energy production. The First Energy Amplifier Test (FEAT), funded by the European Commission, successfully demonstrated the principles of a clean and inherently safe process of energy production, based on widely available thorium. Since then, numerous experiments have demonstrated the feasibility of a large scale-up for industrial use. They also demonstrated that existing long-term (240,000 years or more) nuclear waste can be "burned up" in the thorium reactor to become a much more manageable short-term (less than 500 years) nuclear waste.

Franklin Servan-Schreiber is a Senior Associate at Earthmind and a member of the executive committee of the International Thorium Energy Committee. Previously, he worked at the World Economic Forum, the International Olympic Committee and Sony Research Laboratories.

An Accelerator-Driven System (ADS), as the process is called, comprises an assembly of key technologies developed at CERN: an accelerated proton beam focuses on a metal target, usually lead, in a process called spallation. This spawns neutrons that in turn convert thorium into fissile uranium233, producing heat by way of nuclear fission. The heavy uranium233 nuclei divides into smaller nucleus such as zirconium (think Shopping Channel jewellery) or xenon (used in camera flash bulbs), with only minimal radioactive waste produced.



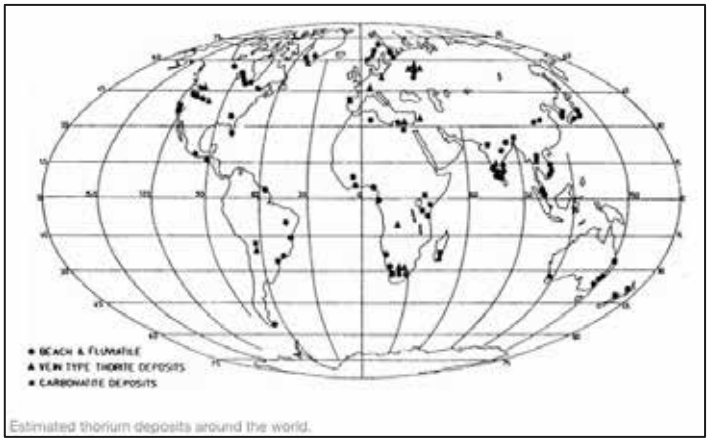
An Accelerator Driven System (ADS) for clean electricity, based on 20 years of research at CERN.

The advantages of an ADS over other energy production process are many:

- Clean: No emissions are produced (CO_2, nitrogen or sulphur oxides particles, among others), unlike with fossil fuel. Heat is generated from the transmutation of thorium into the highly radioactive uranium233 and its subsequent fission into smaller particles.
- Feasible: ADS technology development has been proven to be a bounded problem with a realistic development timeline. In comparison, fusion is an unbounded problem that does not have a constrained development timeline.
- Transmutation of nuclear waste: the ADS process has been proven to transmute long-term nuclear waste, harmful for 240,000 years or more, into short-term radioactivity waste of less than 500 years toxicity. The technology would solve the

intractable problem of very long-term radioactive waste storage.

- No military usage: The International Atomic Energy Agency has repeatedly stated that the technology is "intrinsically proliferation resistant."
- Large thorium reserves: enough for 20 centuries at 2018 level of global electricity consumption. Thorium is well distributed around the globe, with no nation having a monopoly.
- High energy density: 1 tonne of thorium would provide the energy equivalent of 3 million tonnes of coal, or 200 tonnes of natural uranium enriched for use in a nuclear reactor.
- Inherent safety: the process operates at atmospheric pressure therefore the plant can't explode (unlike Chernobyl). The reaction also stops immediately when the proton beam is interrupted, providing inherent safety.
- Smart grid friendly: Immediate ON/OFF capability would make ADS power plants ideal for base load energy production for smart grids.
- Small footprint: A 500MW ADS plant would only be as large as a medium-size factory, compared to 26 km2 (10 mi2) for the 550MW Topaz solar farm in the sunny California desert. In the wintery north-west, an equivalent solar farm would be almost three times larger, approximately 62 km2. Wind turbines require even more space.
- Proximity: inherent safety and small size make ADS ideally suited for any use, industrial or urban, and able to be located in remote regions, including high latitudes with little sunshine.
- Decarbonized hydrogen production: reactors could be set close to abundant freshwater at high latitudes for clean hydrogen production, allowing the conversion of electrons into a green gas used for transport, heating and industrial processes.



Estimated thorium deposits around the world.

ADS technology advances the double promise of boundless clean electricity, together with the destruction of highly toxic long-term nuclear waste. Its inherent safety will allow power plants to be located anywhere, even close to urban areas, and in any climate. ADS offers the possibility to provide sustainable energy on demand and with easy integration into smart grids. Combined with the production of green hydrogen, it could decarbonize our entire energy needs, from transport to industrial.

The development of this promising technology offers hope for a paradigm shift in clean energy production, achievable in years instead of decades, helping the fight against global warming.

This article was first published on the website of the World Economic Forum: https://www.weforum.org/agenda/2018/11/destroying-nuclear-waste-to-create-clean-energy-it-can-be-done/

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ANNOUNCEMENTS

Save the Date: 3rd EUCERS-KAS Energy Talk 2019, 23 September

Pathways to Climate Security III -
Natural gas and "green gas": Ideal partners for a low-carbon economy?

September 23, 2019, 14:30 - 16:30 followed by a reception ♦ War Studies Meeting Room ♦ Strand Campus ♦ King's College London ♦ WC2R 2LS

Dear EUCERS members,

We would like to cordially invite you to the third instalment of 2019's EUCERS/KAS Energy Talk Series. It will take place on September 23, 2019, from 14:30 -16:30 in the War Studies Meeting Room at King's College London Strand Campus. It will be followed by a reception.

Please register by filling your name and affiliation in the following under the following link **https://bit.ly/2YrUXzu** to attend.

This panel discussion will explore the potential contributions and drawbacks of natural gas in global efforts to mitigate threats from climate change whilst attempting to maintain economic competitiveness and energy security.

The **provisional programme** is as follows:

14:30 Welcome Address and Introduction

Professor Dr Friedbert Pflüger, Director, EUCERS, King's College London
Mr. Felix Dane, Director UK & Ireland, Konrad Adenauer Foundation

Introductory statements by

-Prof. Albert Bressand, Energy & International Governance, UCL
-Dr. Timm Kehler, Chairman, Zukunft Erdgas e.V. (tbc)
-Mr. Philipp Offenberg, Adviser, European Political Strategy Centre
-Frank Umbach, Research Director, EUCERS, King's College London

15:30 Discussion

16:00 Reception

New EUCERS website online

After a short period without an active online presence, the new online home of EUCERS - www.eucers.com - went live on 1 August.

Please visit the site and give us your feedback and recommendations by emailing thomas.froehlich@kcl.ac.uk

Report of the 1st EUCERS-KAS Energy Talk 2019

The first EUCERS-KAS Energy Talk of 2019 took place in the War Studies meeting room at King's College London on 1 April. Following the 2018 series of workshops on the relation between climate and security, the talk focused on the impact of renewable energies on global decarbonisation efforts. Different perspectives and backgrounds, including academia, civil society, consultancy and industry, enriched the panel and led to a fruitful discussion. The event, which was chaired by Professor Dr Friedbert Pflüger, examined various scenarios regarding the current and future role of renewables in achieving climate security. Is the new renewable-energy-pillar the one and only pillar leading to a decarbonised society? Are there any limits and/or dangers to be taken into account?

In his opening statement, Professor Pflüger brought to the attention of the panel the link between climate and security. He then briefly outlined the main topics of the upcoming workshops, namely nuclear energy, natural & green gas and mobility & climate change. Following Professor Pflüger's welcome, Mr Felix Dane Director of the Konrad-Adenauer-Foundation for the UK & Ireland, gave his remarks.

The first input came from Mr Thomas Krupke, CEO of Clere AG and former CEO of Solon SE. Both companies are active in the growing market of renewable energy and environmental technology. Since 2002, Thomas Krupke has held executive positions in the field of renewable energies in Berlin.

Before this, he worked as a management consultant for public and private clients both in Germany and the rest of Europe.

Mr Krupke started by asserting that renewables do have an impact. Such impact may not be as positive in the short-term, yet it appears to be very positive in the mid- and long-term. For instance, 20 years ago 1kW of photovoltaic electricity had a cost of about €1 in Germany, while today its cost has been reduced to €0.4 cents. Similar developments can be observed in the wind and energy storage areas. Indeed, there is confidence that in the next 20-30 years the costs of renewables will halve again, and hopefully in a few years it will be possible to produce energy for €0.2/0.3 cents. Nonetheless, Mr Krupke pointed out that renewables are only able to cover a part of the newly built assets and that the current electricity and energy need is far higher than what renewables can cover at the moment. Solar, for instance, is currently able to set up only 8 power plants per year worldwide. He also brought to the attention of the panel that 80% of the renewables production capacity is located in China and welcomed any intention of the Chinese government or of any company operating there to invest in expanding their production capacity, as he asserted that Europe cannot produce competitively.

Moreover, Mr Krupke urged the need for energy efficiency, as he believes that there are far more possibilities to reduce electricity needs than what has been done so far. He also urged the need for an energy storage system, which is crucial to the further development of decarbonisation. He then raised the point that about 98% of the studies on the cost of solar and wind energy have ignored replacement investments for existing fossil power plants, which in turn means that solar and wind are not as expensive as we are led to think. Finally, Mr Krupke called for further investments in renewables. Some of the major investors in the world, such as insurances like Allianz, have already stopped investing in coal companies in an effort to cut back the use of fossil fuels. In addition, the costs of investing in renewables are only relatively high. To generate Germany's entire household electricity would cost €75 billion, and this is not a monumental amount if spread out over 12-14 years. He added that lots of private investors are looking forward to bringing the equity to the table. Similarly, he sees no reason why banks should not be willing to invest in renewables, considering that they are a secure credit with a very low risk of failure. He concluded by acknowledging that renewable energies are undergoing very fast development. In the next 10-15 years, for example, we will be able to pay energy from home on a flat rate. Despite this, politicians are not always as fast in pursuing the decarbonisation process and he directly referred to the failures of the German government in this respect.

The next intervention came from Peter Mather, BP Group Regional President, Europe and Head of Country, UK. He began by stating that his industry and in particular his company (BP) has never been in denial about the challenges of climate change. He asserted that BP was probably the first of the oil and gas companies to acknowledge a possible causal link between the burning of fossil fuels and climate change back in the late 90s. In the early 2000s, the company set up an alternative energy business in relation to climate change, which however fell off the agenda of the industry for a while due to the financial crisis and the subsequent fall of the oil price. Yet, Mr Mather assured that today the company is very conscious about climate change. In particular, a dual challenge permeates the whole company: responding to the growing demand for energy in a way that is sustainable for the planet.

Mr Mather is aware that the current trajectory of oil and gas companies like BP is not good enough to meet the Paris goal. Despite affirming that renewables have a massive role to play, he also recognised that the energy demand will grow by about a third between now and 2030, as a consequence of the forecasted doubling of the world GDP. He clarified that the energy demand will not double thanks to stronger efficiency, especially in the emerging economies. According to current trajectories, renewables should account for about half of that growth in energy demand. In line with these trends, BP set up a division called Alternative Energy about

15 years ago, which focuses on 4 main areas: carbon capture and storage, solar, wind and biofuels.

As far as solar energy is concerned, BP has already been in the business for 40 years, but it made an extremely low positive return (only ¼ out of 160/4). The mistake of the company was that it was in the manufacturing end of photovoltaic cells and that it was manufacturing in places like Germany, Spain and the US. However, the market was moving rapidly to China and other places, hence BP simply was in the wrong part of the value chain. As a consequence, it decided to exit the solar business for a while. It has now re-entered the business in partnership with Lightsource and they now have a new entity called Lightsource BP operating not in the manufacturing sector, but rather in the deployment of solar funds. In the wind sector, BP mainly operates in North America. In the bio fuel sector, the company is mainly active in Brazil. As far as carbon capture, use and storage (CCUS) is concerned, it was hard for BP to get projects off the ground in the past. Nonetheless, it now has a couple of projects running in the UK as part of the Oil and Gas Climate Initiative (OGCI).

Mr Mather acknowledged that BP is only spending half a billion a year in renewables out of 15 billion, but he stated that they are increasingly developing the right solutions for consumers, and he is positive that the amount spent in renewables will grow quite substantially with time. He also added that his firm believes in the role of natural gas as a partner to renewables. Although natural gas is not completely carbon-free, but only half the emissions of coal, he still thinks it is a good way to complement the intermittency of renewables. He then briefly illustrated BP's three-pronged approach to the dual challenge and to the low carbon transition. Firstly, BP needs to reduce its carbon emissions. In this regard, targets have been put in place and there will be more projects with no carbon emissions. Secondly, BP has to improve its products, including petrochemical processes, transport fuels and electrification. For the last five years, the company has underestimated the growth of electric vehicles, but it now wants to be part of that innovation. Thirdly, BP needs to create new business.

Mr Mather concluded his speech by recognising that the world faces the aforementioned dual challenge and that renewables have defied all expectations in terms of the cost curve. However, he added that the international community will not be able to tackle climate change with renewables alone and that companies like his own still have a role to play.

The third to intervene was Dr Frank Umbach, Research Director of EUCERS, King's College London. He began his intervention by affirming that he has always favoured renewable energies. This is firstly because they provide additional energy resources in the global, national and regional energy mix, thus enhancing and fostering energy security. Secondly, as already mentioned by the other panellists, the costs of renewables (solar, wind, but particularly energy storage such as batteries) have drastically fallen, to the point that even under the presidency of Trump, and despite its pro-coal policies, the share of coal in the US is still falling. Thirdly, although renewables constitute only 6% of the overall electricity produced in 2017, the US Energy Information Administration (EIA) predicts that they will reach 21% by 2040, and most optimistic forecasts even speak of 48%. Yet, this also means that, contrary to the predictions of some, global energy production will still be mixed by 2040-2050.

Dr Umbach raised a further issue. In the past, we have been concentrating on the expansion of the generation of electricity and are heading every year to new capacities, but we are not able to transport these new capacities to the consumers' side, because there insufficient attention is being paid to the construction and modernisation of the grid system. That is, grid development has never been integrated into a holistic concept.

Moreover, global investments in wind and solar have declined in 2018 by 8%. This obviously deviates from the trajectory required by the Paris Agreement. When

taking the overall investments in green energy, studies have suggested that we need 2.3 trillion US dollars annually in order to achieve the climate goal of a 1.2 Celsius decrease in global temperatures. In 2018, investments reached 1.8 trillion. The gap is evident: investments are still not sufficient to meet the climate targets. Indeed, global emissions have risen by 2.7%, much faster than the previous years. Most importantly, China's emissions account for 27% of worldwide emissions. This has to do with the fact that China's coal consumption is rising. In fact, the government re-opened 50 of its previously halted coal power plants and forecasts predict that China's coal consumption might rise by 4.7%. India and South East Asian countries are going down a similar path. All this means that the fate of the world climate does not depend on Europe's efforts only, but it will be deeply influenced by countries like China and India.

Dr Umbach made one last remark in relation to the digitalisation of the energy sector. He referred to a study, promoted by the Konrad Adenauer Foundation, which looked at the global impact of digitalisation, including the energy sector. It illustrated how digitalisation will incredibly raise the amount of raw materials needed for digital products such as lithium and cobalt. Indeed, digitalisation relates not only to the demand of the energy sector, but to all sorts of industrial and consuming sectors, as they all need raw materials. The study also showed that digitalisation technologies, renewables included, are much more material and resource intensive than the old energy world. Hence, supply security and raw materials should be seen as part of the redefined energy supply security concept of the future. Digitalisation seems to be outpacing any kind of energy gain that has been anticipated up to now. Due to the huge electricity demand of digital devices, Dr Umbach is sceptical about the predicted energy gains and therefore also about the ability to reach climate targets.

The last intervention came from Simon Chin-Yee, PhD, and EUCERS Fellow, who discussed his newly written policy paper Strategy Paper 18. He started by quoting the chair of the Intergovernmental Panel on Climate Change (IPCC), Hoesung Lee, who claimed that we have now 11-12 years to tackle climate change at the global level, if we do not want to risk a climate catastrophe. He continued by clarifying the four main points of the IPCC 2018 report, which was rather optimistic in comparison to previous forecasts. In fact, according to the report, it is still possible to limit global warming to 1.5 degrees, but for this to be possible we cannot continue on the current business model. Put differently, changes need to happen but can indeed happen. Secondly, the report stressed the importance of understanding the difference between 1.5 and 2 degrees, which does mean survival for certain plant-species. The third point was to insist on the necessity of making lifestyle choices, such as conserving bio-diversity or planting more trees, and not only on focusing on cutting emissions. In other words, mitigation and adaptation must happen at the same time. Finally, the report suggested that we do have the technologies necessary to tackle climate change.

Dr. Chin-Yee went on by illustrating the two main sections of his paper. The first part looks at the global climate regime as a whole, at what has happened before and after Paris, and it stresses the importance of putting the Paris Agreement in place, especially in relation to the varying capacities of different countries. The second and main part of Dr. Chin-Yee's policy paper looks at 5 case studies or 5 different ways in which human security is affected by climate change. It looks at extreme weather events, with reference to the recent hurricane in Mozambique; at the sea-level rise, with reference to the Pacific island states and to the issue of climate refugees. It looks at violent conflicts, with a focus on Sub-Saharan states, where the link between climate change, conflicts and migration is disentangled. It looks at cross-border migration in relation to the migration of Syrian refugees to Jordan and how this phenomenon has had a drastic impact on the energy needs of Jordan. Lastly, the paper looks at climate change as a threat multiplier. That is, climate change will worsen the conditions of countries that already have conflict zones, such as South Africa or Indonesia. Dr. Chin-Yee concluded by asserting that

the studies on the relation between climate change and security are manifold.

The recording of the event can now be found online: https://soundcloud.com/warstudies/event-pathways-to-climate-security-i/s-Xakcd

and a full event documentation can be found on the website of the Konrad Adenauer Foundation UK:

https://www.kas.de/web/grossbritannien/veranstaltungen/detail/-/content/der-einfluss-erneuerbarer-energien-auf-globale-dekarbonisierungsbemuehungen-1--eucers-kas-energy-tal

Simon Chin-Yee's report on Climate Change and human security can be found here: https://www.kcl.ac.uk/sspp/departments/warstudies/research/groups/eucers/pubs/k-ws-climatechangehumansecurity- eucers-paper18-web.pdf

EUCERS ON THE ROAD

20.06.2019 Nur-Sultan, Kazakhstan	Frank gave a presentation on "Digitization, Energy, Security and New Silk Road" at the Conference 'Europe and Kazakhstan – Strategies for BRI and Digitization' organized by the Konrad-Adenauer-Foundation (KAS).
29.05.2019 Berlin, Germany	Frank participated at the Simulation-Expert Workshop "Nord Stream 2 – Coping with the Impacts", organised by the Konrad-Adenauer-Foundation (KAS).

PUBLICATIONS

Umbach, Frank "Threatening EU's Capacity Mechanisms: Understanding Unintended Consequences for the Clean Energy Package", EurActiv, 26 June 2019, 4 pp. (https://www.euractiv.com/section/energy/opinion/threatening-eus-capacity-mechanisms-understanding-unintended-consequences-for-the-clean-energy-package/).

— "EU-China Relations at the Crossroads!, Geopolitical Intelligence Service (GIS), 20 June 2019, 9 pp. (https://www.gisreportsonline.com/eu-china-relations-at-a-crossroads,politics,2905,report.html).

— "Perspektiven der europäischen Energiesicherheit und die Rolle Deutschlands" („Perspectives oft he European Energy Security and the Role of Germany"), Der Mittler Brief. Informationsdienst zur Sicherheitspolitik, 34. Jahrgang, Nr. 2/2. Quartal 2019, 8 pp.

— "Rare Earth Minerals Return to the U.S. Security Agenda", Geopolitical Intelligence Service (GIS), 1 August 2019, 9 pp. (https://www.gisreportsonline.com/rare-earth-minerals-return-to-the-us-security-agenda,economy,2939.html).

— "Deutsche Klimapolitik am Scheideweg. Provinzialistische „Klimahysterie" versus Herausforderungen der internationalen Klimaschutzpolitik" („German Climate Policy at Crossroads: Provincial 'Climate Hysteria' vs. Challenges of the international Climate Protection Policy"), in: Europäische Sicherheit und Technik (ES&T), Juli 2019, S. 29-33.

IN THE MEDIA

Our Research Director, Frank Umbach, gave an interview to the NZZ: Gerald Hosp, 'Der Röhrenblick Berlins. Die Nord-Stream-2-Gaspipeline ist ein Spaltpilz zwischen Deutschland und den USA sowie innerhalb der EU', NZZ, 1.4.2019, S. 9

EUCERS-KAS Energy Talk 2/2019 featured on ICIS Industry News

The 2nd EUCERS-KAS Energy Talk 2019 was featured on the website of industry intelligence provider ICIS. The full article can be found here [paywall]: https://www.icis.com/explore/resources/news/2019/06/26/10383653/cheaper-nuclear-possible-but-investment-challenges-remain

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