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The European Energy Union

REVITALIZING THE DEBATE ON A COMMON ENERGY POLICY



Friedbert Pflüger

By Friedbert Pflüger

At the end of March, as a result of developments in Ukraine that are of particular concern to Poland, the Prime Minister, Donald Tusk, called for the establishment of a European Energy Union, which was intended to put a better face on emerging energetic challenges. According to Mr. Tusk, the main rationale behind such an institution would be to confront the Russian dominance on the gas market with a strong European counterpart in charge of resource purchases – thereby establishing some balance.

To this end, Mr. Tusk presented the six goals of the envisaged European Energy Union: conducting joint negotiations with outside energy suppliers, enhancing solidarity mechanisms, improving energy infrastruc-

ture, making full use of fossil fuel sources available in Europe, diversifying oil and gas imports, and contributing to the energy security of the EU's neighbours. While this call for a European Energy Union is still far from finding the necessary broad support for becoming the foundation of a new European institution, it has already achieved a great accomplishment – it has revitalised the debate on a common energy policy and a European energy market. 'The jury is still out' on its future impact.

At the Energy Security Summit of the Munich Security Conference, held at the end of May in Berlin, Germany's Minister of Foreign Affairs, Frank Walter Steinmeier, addressed and qualified the Polish proposal. Minister Steinmeier, whilst underlining that currently the most important element of

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the plan is completing the single European energy market, warned against measures that could impair competition by re-invigorating nationalised energy agencies and the creation of cartels. In contrast to those comments, European Energy Commissioner, Günther Oettinger, acknowledged that a policy aiming at a uniform gas price in the common market is desirable. However, he was cautious about embracing the idea of the establishment of a single institution to regulate gas imports, as being the best course of action to reach this goal. In his speech, Mr. Oettinger rather put the accent on the need for increasing storage and diversification – which are also both important elements of the Tusk Plan.

Mr. Tusk's keystones are definitely notable aims of a European energy policy and I am confident that they have the potential to contribute to the improvement of energy security. However, not even Mr. Tusk himself, hardly expected all of his proposals to be immediately and wholly adopted by European national governments and Brussels. For European politics, the two most important factors for energy security seem

to remain competition and diversification – even going beyond the Southern Corridor and the Caspian Sea Region, as Commissioner Oettinger has suggested.

In the medium to long-term,, the Trans-Adriatic Pipeline (TAP), Azerbaijan, the Eastern Mediterranean, Iraqi Kurdistan, Iran, and even US LNG, might offer viable alternatives to Russian gas. Not only would such diversification reduce the reliance on single suppliers, it would also strengthen European bargaining power and lower prices. It should be the role of the EU to support such developments, without infringing on competition or alienating long-standing partners. It should be noted, though, that despite advances in renewables and diversification, Russian gas will probably remain an essential factor in covering European energy demand for years to come.

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Interview with Mr. Jarosław Zagórowski, CEO, JSW (Jastrzębska Spółka Węglowa S.A.) and Vice-Chairman of CEEP's Board of Directors



Jarosław Zagórowski

By Witold Nieć

The media have speculated about the profits and losses of a free trade agreement between the United States and the EU. Meanwhile, during the EEC (European Economic Congress) you stated that one way or another, the U.S. government would be reluctant to deepen energy co-operation with the EU. Could you tell us why?

Without a doubt, the United States and the European Union are already economic enti-

ties that work very closely together. This type of co-operation will bring mutual benefits. It's mainly about jobs and employment expansion. The discussion about free trade between the United States and the European Union has been going on for nine years. In this regard, it is necessary to pursue a more active policy. I'm not entirely convinced that cheap energy in Europe, obtained via cheap gas imports from the US, will be in the interests of the United States. After all, it will worsen their competitive advantage, which has been built so effectively, thanks to energy prices.

So far, virtually all discussions about energy in Europe have taken place between politicians and environmentalists. Changes can be seen, but are they significant enough to say that industry is finally being listened to? Are its arguments being treated seriously?

It is a fact that a very long debate on energy policy in the European Union took place between EU officials and environmentalists. Nobody listened to the entrepreneurs. That's why CEEP was established as the first industry organisation in Central Europe to

Interview with Mr. Jarosław Zagórowski, CEO, JSW (Jastrzębska Spółka Węglowa S.A.) and Vice-Chairman of CEEP's Board of Directors

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represent the interests of energy and energy-intensive sectors of this region at the European Union level. Together, it is easier to support the integration process of the energy sector and energy-intensive industry in Central Europe, within the framework of a common EU policy. I am afraid that the issue of security of energy supply will soon be an important topic of concern for many governments in the EU. By eliminating conventional sources of energy generation, we make economies dependent on the safety of energy supplies, which are vulnerable to political situations, and if it comes to production sources, we make ourselves face the risk of unstable production caused by bad weather conditions, for instance. In Poland's case, regardless of a not very favourable EU policy towards coal, the Polish energy-mix will still occupy a leading position, because of the historical development of the Polish energy system based on indigenous resources of coal and lignite. A weak, ill-managed energy policy may lead to further deterioration in the EU's industrial competitive advantage, due to the high costs incurred by additional charges associated with energy production. This, in turn, is causing the relocation of production and thus, jobs, outside the EU. It is

creating conflicting goals. A poorly-applied environmental policy is not conducive to the competitiveness of industrial development policy in the EU. It can also stand in opposition to social policy. However, I believe that all objectives will eventually be reconciled.

How has the current situation in Ukraine influenced our European discussion on energy security? Do you think that this whole situation may cause the demystification of coal and put end to the discussions on decarbonisation?

Indeed, we now have a heated debate on the situation of the Polish mining industry. A few problems have multiplied, such as low prices on world markets, for both coal and coke. Then, there is another situation with regard to defining energy policy in the context of the energy-mix and energy security situation, as indicated by Ukraine. It is good that such a debate occurred, because the problems faced by the Polish mining industry have to be somehow solved in the end. Will the situation in Ukraine make the European Union look more favourably towards Polish coal? I do not know, but I hope so. Without a doubt, we can observe that the

Polish government is looking at Polish coal in a different way, treating it as a stabilizer of the energy system and a guarantor of safety. It seems that the EU should better explain that the policy of decarbonisation really should not be understood as the elimination of carbon from the energy mix, but more a reduction of CO₂ emissions. Coal can be more environmentally-friendly by increasing the efficiency of energy systems and by the implementation of new burning technologies which minimize CO₂ emissions.

Today in the U.S., energy for industry costs half of what it costs in Europe. Do you think that we can reach similar prices in Poland or Europe?

As already mentioned, I would not be so optimistic. I do not think that for the United States, energy prices in Europe at the same level as they are in the U.S., is an important issue. I think that the EU must work on energy prices on its own behalf, and not wait for someone to help it, because, as I said, despite all the political correctness, everyone actually builds their own competitive advantage in order to protect jobs for their citizens. Globally, only the EU, due to addi-

ENERGY-ECHO

HEDEGAARD PRAISES US EPA'S proposals to curb power plant emissions

US President Obama's draft rule is the strongest single action the US has taken to date to tackle climate change, and Climate Action Commissioner, Connie Hedegaard, immediately reacted with the warm words: "...an important step for an Administration, and a President who is really investing politically in fighting climate change". She added: "If implemented, this measure will help the country meet its 2020 emissions target". The move sent a positive signal to the world. The US Environmental Protection Agency (EPA) proposed the rule on the 2nd of June. It aims to reduce greenhouse gas GHG emissions from existing US power plants to 30% below 2005 levels by 2030. As the electricity sector is responsible for a third of all US GHG emissions, environmental experts agree that this is a very big deal, especially given that there are no limits on GHG emissions from power plants at present. This is a pity that Ms He-

Interview with Mr. Jarosław Zagórowski, CEO, JSW (Jastrzębska Spółka Węglowa S.A.) and Vice-Chairman of CEEP's Board of Directors

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tional fees charged on energy prices (CO₂), exercises a policy of exporting jobs outside its borders.

I believe that the problem of global warming should be handled by other means than by an increase in energy costs in Europe, and it certainly should be done on a global scale.

You said once, while discussing the direction of investments realised by JSW SA, that you were going to ensure energy independence, hence the investments in this area. How close to, or how far, from this goal, is the company?

I often emphasise the important role of energy in the JSW Group, calling it a "third leg of JSW". Indeed, in addition to coal and coke, energy is an important link. In the short-term, our aim is to improve the efficiency of the JSW Group, by minimizing the cost of energy used by plants in the main area of operation, i.e. mines and coking plants. Currently, the Group's power - about 75% of consumed energy - is used by our factories. By the end of 2015, we will be energy self-sufficient, and the surplus of electricity and heat will be sold on the external market. After 2015, JSW

Group will have a production capacity of about 300 MWe. In the longer term, we visualise a scenario in which the area of energy in the Group may be a significant source of revenue and act as a stabilizer during periods of downturn in the coking coal market.

We want to continue to reach this goal by burning 'waste', and therefore, energy, such as methane from our mines, coke oven gas, or coal of low quality: non-commercial, small distributed sources of manufacturing, but very specialised and dedicated to the fuel and its properties.

Owned by JSW Group – Spółka Energetyczna Jastrzębie – are carrying out the biggest-ever investment of JSW energy - a high-performance unit, CFB, with power greater than 75 MW, for 507 million zł. It was necessary to urgently restore the depreciated assets in heat, which, in two years, will no longer meet the requirements of environmental protection and emission parameters of the EU Directive IED. After 2016, in accordance with EU rules, mining companies will have to pay high penalties for storage, among others, of fine coal tailings. JSW and SEJ can avoid this problem, by burning them or-

ganically (to the amount of about 170,000 tonnes per year) in the fuel in the fluidized bed boiler, at EC Zofiówka.

A modern installation will be placed in CHP Zofiówka. Construction works on the surface of 26,000 square meters will progress without shutting down the old power plant, which has been operating since 1973. Investment in Zofiówka is part of a strategy to diversify production at JSW group, for which energy (with the possibility of selling surplus electricity and heat) is the third pillar of development, apart from mining and coke. In Poland, modern energy has begun in the company, from pioneering projects of methane usage from coal mines, which is, for the miners, a hazardous waste. The second stage was the creation of special plants for clean burning coals of lower quality. The third work is the use of coke oven gas to produce electricity and chemical intermediates.



Jarosław Zagórowski
CEO, JSW (Jastrzębska Spółka Węglowa S.A.)
and Vice-Chairman of CEEP's Board of Directors.

degaard forgets that CO₂ emissions in the USA are 17 tonnes per capita per year, whereas in the EU, the average is 7,5 tonnes. It means that the USA should decrease their emissions by 56% to catch up with the EU, which will not happen even by the end of the 2030 horizon, but the EU meanwhile, will still decrease its emissions.

US CLIMATE ACTION

Key actions the US has taken to reduce its GHG emissions: 1) President Obama's setting of a target back in 2009, of a US-wide goal to cut emissions to 17% below 2005 levels by 2020 (the EU's target is -20% by 2020 compared to 1990 levels); - 2) The EPA 2012 regulations that increased the fuel efficiency of cars and light trucks; - 3) California's adoption of an economy-wide emissions trading system; launched in 2013; - 4) An emissions trading scheme for the power sector covering nine North-Eastern US states, launched in 2008; - 5) EPA rules, proposed in September 2013, still being finalized, on GHG emissions from future power plants./EP

Speaking with one voice

DANIEL GROS, DIRECTOR OF THE CENTRE FOR EUROPEAN POLICY STUDIES (CEPS) TALKS WITH MAREK ORZECZOWSKI



Daniel Gros

By Marek Orzechowski

Marek Orzechowski (MO): Diversifying external energy supplies, upgrading energy infrastructure, completing the EU's internal energy market, and saving energy – these are the main points of the comprehensive strategy put forward by the Commission to strengthen the security of supply. These 'new aspects' of the strategy sound very good compared to the old ones. However,

what in reality is really new in the EU Commission's paper: 'A New Energy Strategy', which was presented on the 28th of May?

Daniel Gros (DG): Nothing, the usual mixture of analysis and good intentions. The problems are well-known and it is, anyway, difficult to say anything new.

(MO): The strategy also highlights the need to co-ordinate national energy policy decisions, and the importance of speaking with 'one voice' when negotiating with external partners. The desire to speak with 'one voice' has been associated with the EU for years, yet, as experience shows – this is not easy to achieve. Is the Union really able to speak with 'one voice' on crucial issue of energy security?

(DG): The problem is well-known: but getting the EU to speak with 'one voice' is a long-term process, which will take, in the best forecasts, over a decade. The interests of various Member States are very different. Most EU-15 Member States (where 80% of the gas is used) are nicely diversified, while

some of the new Member States are over-dependent on Russia, through no fault of their own (i.e. those in the Baltics). Others are, at least to a good degree, responsible for their own high dependence, because they are only now starting to think about diversification of sources or fuels (e.g. nuclear). Poland is an example of this, but one can also list Bulgaria, Slovakia, and Hungary, in this regard.

(MO): EU Energy Commissioner, Oettinger, has famously said: "We must avoid falling victim to political and commercial blackmail... Only concrete actions will help us". What specific/concrete steps would you recommend to the Commissioner?

(DG): In theory, the first step should be to develop new critical infrastructure to link markets and open new supply routes. This would mean, however, EU money and a political will to overcome NIMBY in terms of power interconnectors. Both are unlikely to be forthcoming.

This is why I feel that one should go for 'de-

EU UNVEILS PLAN TO CURB RELIANCE ON RUSSIAN GAS

Launching the paper on European Energy Security on the 28th of May, Günther OETTINGER, the Energy Commissioner, stated that at a time of crisis between Russia, Ukraine and the EU, "energy independence has risen up the agenda, and is a concern to all". Although EU countries import 88% of oil that they use, as well as 42% of solid fuel, the main concern of the commission and governments is gas: 66% of Europe's gas is imported. Total energy import costs amount to 1 billion euros per day. Of the 400 billion cubic metres of gas consumed in the EU each year, around 40% comes from Gazprom. Europe is better placed than during the gas crises in 2006 and 2009, but we have differing situations across Europe. Ireland, the UK, Portugal and Spain import no gas from Gazprom, but 18 countries import, not only from Russia, but elsewhere. Finland, Estonia, Latvia, Lithuania, Bulgaria and Slovakia import 100% of their gas needs from Russia. "We want to complete the internal energy market and move away from a monopoly, which is Russia in this instance", Oettinger declared. 10 billion cubic metres per year could come from Norway in the short-term, but experts have indicated that a larger increase in long-term supply will depend on whether Norway develops new gas fields in the Barents Sea.

Speaking with one voice

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mand aggregation'. The Poles call this 'Energy Union', but that is too big a concept. I would plump for an EU EEA-wide gas import agency which would be the only one to make (new) contacts with Gazprom (existing contracts would just run their course). This EU agency would then sell to anybody at the same price (via a pipeline at the EU border). This should increase competition and might trigger more private investment in infrastructure. The task for the Commission would then be to ensure that the dominant importers do not continue to carve up the market by undermining new infrastructure.



*Daniel Gros is the Director of the Centre for European Policy Studies (CEPS) in Brussels. The former advisor to the European Parliament from 1998 to 2005. He is editor of the journals, *Economie Internationale* and *International Finance*.*

ENERGY DIALOGUE AT THE REICHSTAG



Arash Duero

By Arash Duero

The 49th Energy Dialogue at the Reichstag - at the invitation of Prof. Dr. Friedbert Pflüger, Janusz Reiter, and Central Europe Energy Partners (CEEP) – discussed 'The rescue of the Energiewende: where do we stand?'. The panel discussion was held on May the 9th, 2014.

Mr. Sigmar Gabriel, German Minister for Economic Affairs and Energy, opened the discussion by pointing out that

the fundamental challenges of the 'Energiewende' have largely been overlooked over the past few years. He declared that an overhaul of the Renewable Energy Act, a key pillar of the 'Energiewende', is necessary in order to correct market distortions, protect households from future power price increases and ensure industrial competitiveness. In addition, he stressed that reforms to the law should only serve as a transitional solution, until a sustainable and more market-oriented framework can be developed

by 2017. Mr. Gabriel concluded by stating that the 'Energiewende' needs to progress "as de-centrally as possible, and as centrally as necessary."

Mr. Ewald Woste, the CEO of Thüga, and President of the German Association of Energy and Water Industries, identified four key elements necessary for a successful energy transition: a greater role for natural gas, better management and a bundling of competencies, more market incentives, and an emphasis on energy efficiency.

Mr. Jan Kulczyk, CEO of Kulczyk Holdings, and Vice-Chairman of Central Europe Energy Partners (CEEP), noted that the EU lacks a common energy policy, with 28 nations all pursuing different policies. He suggested that the establishment of a fully-functioning, single energy market should be a top EU priority and could help develop a common European energy policy. Mr. Kulczyk also expressed concern that rapidly increasing electricity prices in the EU will have a detrimental impact on European industry's global competitiveness, particularly vis-à-vis the U.S., where power prices are significantly lower.



Arash Duero

Energy Consultant, Pflüger International Consulting GmbH

KEY ELEMENTS 'ON THE AGENDA'

The European Energy Security Strategy



Dariusz Szymczycha

By Dariusz Szymczycha

The agenda of the European Council meeting to be held on June the 26th and 27th, includes the following: „discuss ways of reducing the EU’s energy dependence, on the basis of the comprehensive plan presented by the Commission, and the Commission’s in-depth study of EU energy security”.

“During the crisis between the Russian Federation and Ukraine, the issue of energy and energy security has been a major element

on the EU’s agenda. The issue of energy supplies has moved up on our list of priorities and is a cause of concern for everybody”, proclaimed Commissioner Guenther Oettinger on May 28th, when he presented the European Energy Security Strategy draft prepared by the European Commission. It is hard to resist the impression that the current dynamics of EU discussions on energy are related to PM Donald Tusk’s ‘Energy Union’ initiative. The concept, the PM’s visits presenting the idea of closer co-operation in this regard, and support for the energy union, voiced by many European heads of government – these have all had an impact on Brussels, as it has been acting faster than we are normally accustomed to. The exact extent to which Tusk’s ideas have been included in the European Energy Security Strategy is not the most important aspect of the situation. What is important is that such fundamental idea has not been ignored, that the EU has recognised the issues resulting from energy dependency, and that it wants to act quickly and in a co-ordinated manner.

The documents show that the European En-

ergy Security Strategy is not only about gas, with the Commission, for instance, proposing to extend the target as regards the interconnection of installed electricity capacity to 15% by 2030 (Member States have already committed to ensure interconnectivity of 10% by 2020). The Commission has suggested that particular attention should be paid to investments in new nuclear power plants to be built in the EU, using non-EU technology. These plants are not dependent on Russia for the supply of the nuclear fuel. However, the EU is more concerned about gas than oil. Why? Virtually 90% of oil imported by the EU, arrives by sea, and this offers lots of flexibility to change supply sources and routes. In the case of gas, transport routes are determined by the pipeline network, as only a small fraction of it is shipped by sea. Additionally, several EU Member States depend on a main supplier with limited, or no possibilities, to receive alternative supplies.

So, what can be done to further decrease the EU’s energy dependence in the short-term?

First, an energy security stress test of the EU energy system, to identify supply disruption

risks in the upcoming winter, is recommended. This would be conducted at the regional or EU level by simulating a disruption of the gas supply. The exact details of these stress tests have not yet been agreed.

Another short-term action could be pooling parts of the existing energy security stocks at EU and international level into a virtual common capacity reserve - for instance, under the International Energy Agency. Moreover, supply security plans could be developed at regional and EU level, as was outlined by the Rome G7 Energy Ministerial meeting.

Reverse flow possibilities on gas pipelines are essential in order to be able to respond to a supply crisis. In the Commission’s opinion, Poland is a good example of how reverse flows can contribute to decreasing import dependence. Due to the physical reverse flow on Yamal pipeline, introduced in April 2014, Poland would be able to cover up to 30% of its domestic consumption, in the case of a disruption of deliveries.

Furthermore, secure supplies in the winter period are also provided by Europe’s under-

The European Energy Security Strategy

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ground gas storage facilities. Current storage levels are around 47 bcm and injections to increase them are ongoing. By the end of October 2014, the stocks must be, at least, at the level of 66-70 bcm.

What can be done in the long run?

Completing the internal energy market by building missing infrastructure links is one obvious measure. The Connecting Europe facility provides 5.83 billion Euro for energy infrastructure from 2014 to 2020. In addition, the Commission has identified 33 infrastructure projects which are critical for the EU's energy security. The Commission will intensify its support for these projects, by bringing together the relevant stakeholders, in order to speed up the implementation of the projects.

On the regulatory side, the third internal energy market package sets the framework for developing the internal energy market. Heads of State and Governments have agreed that the internal market should be completed by 2014. We can see positive developments, yet much remains to be done: for instance, regional co-operation between Member States should be strengthened, operators must speed up implementation of

the network codes for gas and electricity, and the Commission must work with Member States to ensure quick implementation of all Projects of Common Interest.

Diversifying supplier countries and routes are other ongoing developments, with the EU now focusing on supporting the building of new gas pipelines to new supplier countries, such as Azerbaijan. The EU will also enhance co-operation with Norway and North Africa to explore the possibilities of increasing gas imports, whilst increasingly, LNG supplies are growing in importance.

Strengthening emergency and solidarity mechanisms and protecting critical infrastructure are also elements under serious consideration. The Commission will review the Security of Supply regulations for a more precise definition of "protected customers", and for an increase in the number of days, during which, companies have to ensure deliveries to protected customers in severe conditions.

Improving the co-ordination of national energy policies and speaking with 'one voice' in external energy policy has found favour with the EU. The Commission, in fact, aims to be involved at an early stage in intergov-

ernmental agreements with third countries, which could have a possible impact on the security of supply. Who knows, maybe this political concept is the most valuable and far-reaching?

Moderating energy demand is also very much on the EU's 'agenda'. The Commission underlines that buildings are responsible for 40% of our energy consumption, and a third of natural gas use – that is why this sector plays a crucial role. In addition, further efforts to increase energy efficiency in vehicles and products need to be made.

Further development of energy technologies.

Increasing indigenous energy production includes further deployment of renewables, the safe use of nuclear energy, and sustainable production of fossil fuels.

In the Strategy draft, the Commission stresses that the Union's energy security is inseparable from the 2030 framework for climate and energy: "the transition to a competitive, low-carbon economy will reduce the use of imported fossil fuels by moderating energy demand and exploiting renewable and other indigenous sources of energy". -

"Several crucial points raised by the Polish Prime Minister, Donald Tusk, are also presented in this Strategy"- Commissioner Gunther Oettinger recently stated. As regards the EU's common and wide-ranging gas purchase, the Commission's stance appears to be cautious, indicating that joint purchasing should be: "well-targeted, carefully designated and executed, fully in line with EU and trade law". However, many conditions have yet to be met, so a working group of experts from Poland and the Commission has been set up to analyse related questions in detail.

In 2012, 53% of the EU's energy consumption was linked to imports. Today, the EU spends more than 1 billion Euro every day on importing energy. This is almost a fifth of the EU's total import bill! The need to reduce this costly energy factor has become of paramount importance. It needs to be addressed accordingly.

Dariusz Szymczycha

Former Secretary of State in the Chancellery of the former Polish President, Aleksander Kwasniewski. Presently is as a Senior Adviser in Grupa LOTOS S.A.

A CEEP REPORT INTERVIEW - OLGA MALINKIEWICZ TALKS TO JAROSŁAW ADAMOWSKI

Are perovskites the future of photovoltaics?



Olga Malinkiewicz

By Jarosław Adamowski

In April 2014, Olga Malinkiewicz, a Polish researcher currently working at the University of Valencia in Spain, was awarded a prize for her innovative research on perovskites, a chemical compound which could become a less expensive and more effective substitute of silicon in solar cells. Her

work was praised at the prestigious Photonics21 annual meeting in Brussels. The CEEP Report recently interviewed the young researcher to discuss the potential impact of perovskites on innovation in photovoltaics.

What are perovskites and how can they be used to generate energy from renewable sources?

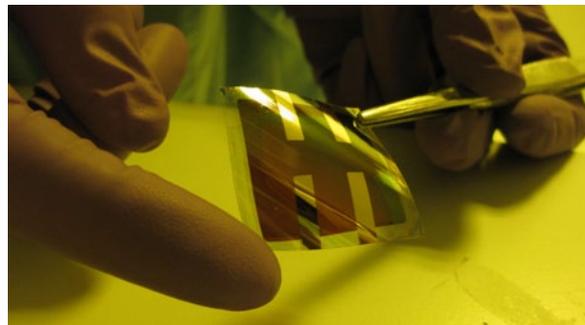
Perovskites are a group of materials which share the same atomic structure as that of calcium titanium oxide (CaTiO_3). Apart from being naturally-formed minerals, they can be easily synthesised in laboratories from relatively cheap basic materials. Perovskites based on lead iodide and methylammonium iodide, have an absorption which is one order of magnitude

higher than, for example, gallium arsenide (GaAs). Therefore, perovskites are really well-suited for photovoltaic applications.

What is the advantage of perovskites in comparison with other materials used in photovoltaics?

They offer a much higher optical absorption than conventional thin-film solar cells. A layer of only 300 nanometres will be enough to absorb most of the incoming sunlight, and they also have very good charge transport properties, which leads to an efficient conversion of light into electricity. Remarkably, these ultra-thin perovskite cells can also deliver voltage as high as 1.1V, which is comparable to the best single crystal GaAs solar cell, and outperform polycrystalline thin-film solar cells based on cadmium telluride (CdTe).

However, what is most exciting about these cells is that, over a



period of just a few years, they have reached a power conversion efficiency of 17%, using common coating or printing techniques.

Can perovskites also be used by other branches of the energy sector?

As far as I know, apart from the solar cells, perovskites have been tested in thermal energy storage systems and as catalysts in water-splitting reactions.

What are your research plans for the near future, are they related to perovskites? In addition to your current scientific work at the University of Valencia, are you involved in any European projects?

Perovskites seem to be a very promising material. However, there still is some research work which has to be done. One of the fields of potential development is improving their stability, and also reducing toxic components.

I'm also involved in a project funded by a grant provided under the European Community's Seventh Framework Programme, the ORION project (Ordered Inorganic-Organic Hybrids using Ionic Liquids for Emerging Applications), a large-scale collaborative project developed by a consortium of 17 partners from eight member states, which was recently finished. Our group is a member of two proposals under the Horizon 2020 programme, but, as this field is just emerging, these projects are still under evaluation.



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