

DÁIL ÉIREANN

AN COMHCHOISTE UM CHUMARSÁID, GNÍOMHÚ AR SON NA HAERÁIDE AGUS COMHSHAOL

JOINT COMMITTEE ON COMMUNICATIONS, CLIMATE ACTION AND EN- VIRONMENT

Dé Máirt, 26 Meitheamh 2018

Tuesday, 26 June 2018

Tháinig an Comhchoiste le chéile ag 12 p.m.

The Joint Committee met at 12 p.m.

Comhaltaí a bhí i láthair /Members present:

Teachtaí Dála /Deputies	Seanadóirí /Senators
Eamon Ryan,	Tim Lombard.
Bríd Smith,	
Brian Stanley.	

Teachta//Deputy Hildegard Naughton sa Chathaoir /in the Chair

Business of Joint Committee

Chairman: We will go into private session.

The joint committee went into private session at 12.06 p.m., suspended at 12.09 p.m. and resumed in public session at 12.11 p.m.

Future Exploration, Energy Supply and Energy Security: Discussion

Chairman: I draw the attention of witnesses to the fact that by virtue of section 17(2)(l) of the Defamation Act 2009, witnesses are protected by absolute privilege in respect of their evidence to the committee. However, if they are directed by the Chairman to cease giving evidence on a particular matter and they continue to so do, they are entitled thereafter only to a qualified privilege in respect of their evidence. They are directed that only evidence connected with the subject matter of these proceedings is to be given and they are asked to respect the parliamentary practice to the effect that, where possible, they should not criticise or make charges against any person, persons or entity by name or in such a way as to make him, her or it identifiable. I also advise witnesses that any submission or opening statement they make to the committee will be published on its website after this meeting. Members are reminded of the long-standing parliamentary practice to the effect that they should not comment on, criticise or make charges against a person outside the Houses or an official either by name or in such a way as to make him or her identifiable.

I remind witnesses and members to turn off their mobile phones or switch them to flight mode as they interfere with the sound system, making it difficult for parliamentary reporters to report the meeting and adversely affect television coverage and web streaming.

I welcome Mr. Tim Gould, head of the world energy outlook team at the International Energy Agency, IEA. He has been invited here to engage with the committee in a policy discussion on future exploration, energy supply and energy security. I also welcome Mr. Matt Collins of the Department of Communications, Climate Action and Environment. I ask Mr. Gould to proceed with his presentation to the committee. One of the monitors is not working but all members have received a copy of Mr. Gould's presentation and it will come up on the screen behind him.

Mr. Tim Gould: I thank the Chair. It is a great privilege to be invited to appear before the committee and I thank it for the opportunity to represent the IEA and provide members with some context for their important discussions. We very much welcome this engagement on these important issues.

At the IEA, I have the honour of co-leading a group that produces our world energy outlook, which is our attempt to think through some long-term scenarios for global energy out to 2040. I wish to provide context for some of the current big upheavals in the world of energy which are of great importance in terms of future effects. The first upheaval is the continued growth of oil and gas production in the United States as a result of the shale revolution. It has been an unparalleled expansion of oil and gas production and has important implications for market dynamics, trade flows and energy security discussions. There is another unfinished revolution in terms of the cost of key clean energy technologies. All members are aware that those costs have come down very sharply in recent years and will, in our view, continue to do so in the future.

Solar photovoltaic, PV, is a good example, but I also highlight the evolution in terms of the costs of offshore wind power generation in Europe which will take place in the next few years.

The changing role of China in global energy is another issue of global importance. China's past is not going to be the same as China's future. China is becoming a leading country in the deployment of some clean energy technologies. More than the half the solar PV deployed worldwide in 2016 and 2017 was in China. In a variety of areas, including electric mobility, we will find China taking a leading position. One of the most evocative phrases in this discussion is about the drive to make China's skies blue again. That has also had important implications for gas markets as getting coal-fired boilers out of the residential sector and industry in China and replacing them with gas is a big part of Chinese strategy to deal with air pollution.

These four upheavals show the importance of electricity in our lives and in the world of energy. There are a number of different aspects to that. While electric vehicles are obviously in people's minds, we would highlight a few other things. In emerging economies, demand for cooling is going to grow very strongly in the future. There are a range of applications at the intersection of energy and digitalisation that will have implications for electricity. There are many ways to think all of this through.

In the world energy outlook, we have a couple of scenarios that I wish to bring to the committee's attention. One of them is called the new policies scenario, which gives us an indication of where we are heading. We look at what governments are doing and say they want to do. That includes all of the nationally determined contributions under the Paris Agreement. We think through what they mean alongside continued technology development for the future of energy.

The second scenario I would like to bring to the committee's attention is the sustainable development scenario. For that, we took our inspiration from the sustainable development goals agreed at the end of 2015, in particular three energy related components, namely, alignment with the Paris Agreement, full, universal access to modern energy by 2030, and a reduction in the pollutants that cause poor air quality. We are assessing what else would need to happen to get us into a pathway that would be consistent with those ambitions.

Before I talk about the future, I would like to say a couple of words on where we are today. Slide 3 of the presentation shows the change in energy use globally in 2017. It was another big year for renewables but most of the growth was met by other fuels. After two years of decline, coal use rebounded in 2017. It was another large year for the increase in oil consumption while gas also had a 3% increase on the previous year. When we think about the future of global energy demand growth, it is not just a story about different fuels. It is also a story about the efficiency of energy use. At the IEA we are concerned that the flow of new energy efficiency policies and their stringency appears to be weakening at a time when it needs to redouble.

The next slide shows the end uses of energy around the world. The figure varies according to different end uses but overall only around 30% is covered by some sort of mandatory energy efficiency measure. There is an awful lot of work to be done to try to use what for us is the most important hidden fuel to reach global goals. The net result is shown on slide 5 in respect of energy related CO₂ emissions. After three years that appeared to be setting quite an encouraging trend, when the levels plateaued between 2014 and 2016, they started edging higher once again in 2017, particularly because of that rebound in coal use. The starting point for our discussion is that we are moving in the opposite direction from the one mandated by the Paris Agreement, which of course refers to an early peak and subsequent rapid decline in greenhouse gas emissions.

One other potential shortfall is in the traditional part of the energy system, namely, oil and gas. Oil and gas investment has come down very sharply since the fall in oil prices in 2014. The fall in dollar terms is not necessarily representative of the fall in activity because costs have come down quite significantly over the same period. We are concerned that if the dynamic shale sector in the United States is taken out, the pace of investment in other parts of the conventional oil and gas space will fall short of what may be needed to meet growth in demand in the coming years. That means that if we do not see some improvement, given where the level of demand is headed, we could see a tightening of markets sometime in the early 2020s.

We have discussed some uncertainties. One thing about which we can be more sure which I would like to highlight is that the world will need more energy resources in the future. The median expectation based on UN population projections is that there will be an extra 1.7 billion on the planet between now and 2040, all of whom pretty much will be living in towns and cities. The design of cities, how they are heated and cooled and how we practice mobility are critical variables in assessing future global energy needs. Even with progressive improvements in energy efficiency, we are talking about a 30% increase in global primary energy demand between now and 2040. It can be viewed in different ways, but essentially it means adding China and India of today to the global energy balance or, alternatively, the United States and the European Union of today. That is an important element of how the discussion will be framed. How that growth in energy demand will be met is changing quickly. The scenario in the past 25 years was very different when compared to what is projected to happen in the next 25 in global energy demand. In the past 25 years we met the growth in demand primarily through the use of coal, oil and gas, but in the future coal will fall to the back of the pack, growth in the use of oil will be much less rapid, while there is an element of continuity attached to gas. However, the heavy lifting will be done by renewables and other low carbon sources of energy. That will give a different picture of the energy system as we move forward. The change in energy policy in China has been instrumental in some of these global trends.

I mentioned electrification at the beginning of my statement and return to it. There is an important story in terms of its growth and composition. As the committee knows, this is an area in which renewables are taking the lead. Two out of every \$3 that go into the power generation sector, based on what we see and the policies in place, will go into renewables, led by solar photovoltaics and wind energy. In terms of volume, that means that India has to put in place an energy system the size of that in place in the European Union and that China needs to put in place an additional electricity system the size of that in place in the United States. When we talk about global trends in investment and emissions, the choices made in these countries will be critical. This is not just about investment dollars moving to electricity generation, the debate on energy security is also moving towards electricity because this is not a business as usual scenario for the global electricity sector. The electricity sector needs to operate much more flexibly than in the past. There are issues of market design that need to be tackled. There will be a much larger contribution from decentralised renewables in the system. A different way of approaching some of the complex systems for co-ordination and balancing is needed.

Electric vehicles are in the fast lane. Their use is growing rapidly in some countries, with Norway being a good example. Electric vehicles now account for some 40% of new vehicle sales. One million vehicles were added to the global electric fleet in 2017, but to put the matter in context, there are around 1 billion cars on the road worldwide. There is likely to be a significant increase in the electric car fleet between now and 2040. That is where we might expect it to be, based on the things governments are stating they wish to do. That, together with efficiency improvements, will have major implications for the amount of oil used in passenger

cars. Even though we will have a much bigger car fleet in 2040, according to our main set of projections, the amount of oil used in that car fleet will be lower than what we use today. This does not mean that the era of oil is over because passenger cars account for just 25% or 26% of global oil demand. There are other sectors that continue to push higher. I emphasise the role of sectors such as trucking, aviation, international shipping and petrochemicals in that context because they are the ones to watch from a policy perspective if we want to turn around the oil demand trajectory.

I have spoken about our new policy scenario. I would now like to say a couple of words about our alternative scenario which tries to hit three policy objectives related to climate, air quality and access. Many of the things about which I have spoken - the rise in renewables, increasing efficiency and the changes in China - are positive for global emissions trends. The development of solar photovoltaics in India is another very good example. However, all they succeed in doing is slowing the growth in global emissions. As I mentioned, we need to turn it around. Our sustainable development scenario tries to think through what it would mean to have that transformation in the global energy system. It is among the more ambitious of the scenarios that aim to achieve a 1.7° or 1.8° stabilisation of global average temperatures in 2100. It is clear from what is on the screen that this scenario would have significant implications for global primary energy use.

In the sustainable development scenario I am setting out what would the world look like in 2040? We would be alleviating many of the hazards about which I have spoken. There would be universal access to modern energy sources. There would be fewer premature deaths from poor air quality. We would be on track to meet obligations under the Paris Agreement. It would be a significantly more efficient and a much more electrified energy world. Rather than having 300 million electric vehicles on the road, in this scenario there would be closer to 900 million. This scenario would involve penalising the most carbon-intensive fuels. There would still be room in these circumstances for natural gas. In this scenario worldwide consumption of natural gas would increase by comparison with what is happening today. It varies according to different countries, regions and sectors and also over time. That is an important message.

I will set out how much this scenario would cost. Overall investment would have to increase by 15% compared with the first scenario. Most of the additional expenditure would be on the end-use side. This means that it would involve securing the efficiency improvements we believe are essential. Much more money would have to go into the electricity sector. A significant amount of investment in upstream gas and oil production would still be required. I would like to explain why that would be the case for oil. As members of the committee will be aware, production from existing oilfields declines quite rapidly over time. On average, a post-peak field will lose approximately 6% of its production every year. That 6% decline is much larger than anything one is likely to be able to generate on the demand side. That means that the big gap between production and demand would need to be filled with new projects. There is still around \$7 trillion worth of new investment in upstream oil and gas even in a scenario that is fully consistent with the Paris Agreement.

We need to be aware of the context that global energy-related CO₂ emissions are on the rise again in 2017. There is still an awful lot to do to bring us back on to a Paris-compliant trajectory. Electrification and digitalisation are big trends for the future but they also create new policy dilemmas that need to be addressed. The big message from our sustainable development scenarios is that the world does not need to choose between climate, access and quality. We believe that there is an integrated way to deal with these three issues. We are talking about the

need to reconfigure the investment flows into the energy sector but that does not mean that there is no need for investment in new oil and gas projects.

From the perspective of the International Energy Association, IEA, we remain ready to work not just with our member countries. We work increasingly with India, China, Indonesia, Brazil and South Africa, all of which are very close partners of the IEA, to ensure reliable, affordable and clean energy in the future.

Chairman: In your concluding remarks, you said that investment in new oil and gas projects is required even in deep decarbonisation scenarios, which might come as a surprise to some members. Could you expand on your reasoning for that? We are considering legislation here to ban offshore oil and gas exploration. Could we get your views on that and on missing our 2020 targets? There are concerns about reaching our 2040 targets. Is there any country you could highlight that is doing well in this space and to which we could look as an example to follow?

Deputy Brian Stanley: I thank the witness for the presentation. It paints a good overall picture of what the situation is. It points out some stark realities about where we are going with energy use and demand, and how we meet our obligations. The witness mentioned that solar energy was one of the cheapest options. In warmer climates it will obviously be more efficient but it has been shown that in this hemisphere a substantial amount of solar energy can be captured. In this State we have a problem getting that industry up and running. I would like the witness's views on that. It is difficult to get grid connections. The whole process of getting solar farms in place is very difficult. We have no records in regard to what the State has control over, such as public buildings. We built lots of new schools over the past five to ten years, which is good news, but the downside is that we have not put solar panels on those big flat roofs that are facing south in many cases.

We had the second-worst record in the EU for tackling climate change. Considering that we are not a heavy industrial State, from an IEA point of view, does the witness have any explanation as to why our record is so poor?

The other question the witness might address is in relation to Brexit. What kind of alternatives are there if Brexit goes the wrong way? It is likely to have some impact on our supplies of fossil fuel, which we are over-reliant on. What kind of alternatives does the witness think that we should be taking up there?

On the scenarios the witness painted, how do they correspond to our obligations under the Paris Agreement?

I know competition is slightly different from sustainability but the witness might just touch on competition in the Irish electricity market. We have the fourth-highest electricity prices in the EU 27. There is substantial competition in the market but the competition does not seem to be enough. Does the IEA have any view on how we can address that?

Mr. Tim Gould: I thank the Chair and Deputy Stanley for the questions. I should probably say upfront that my comments on the Irish situation will be limited and there are a number of reasons for that. At the moment an in-depth review of Ireland's energy policy is under way. The visit took place relatively recently. There is a process that will result, in the not-too-distant future, in the IEA coming up with a detailed in-depth review of Ireland, which will have recommendations attached to it. I do not think it would be appropriate for me to go too much into all that when there is that parallel process, not least because my comparative advantage in this

setting will be to frame things rather than go into the detail. I also understand the committee will have subsequent opportunities to talk about those issues in more depth.

The first issue is a very important one. Why, in a world which needs to move away from fossil fuels, do we still see a need for investment at least in oil and gas? The answer is that we start from a position where fossil fuels remain the overwhelming majority of energy consumed worldwide today. In terms of primary energy demand, 25 years ago that figure was around the high 70s in percentage terms. Today, we are pretty much at the same percentage. We have not really moved the needle yet in terms of the share of fossil fuels in global primary energy. What that means in practice is that given the way that current fields decline and given the reliance of the system on those fossil fuels currently, there is a continued need to keep projects coming in even if policy on the demand side is very stringent.

I mentioned the example of oil and it is important to come back to that because we have a demand trajectory and a sustainable development scenario. Global oil demand has been rising by well over one million barrels a day per year for the past few years. What would need to happen in that sustainable development scenario is for that to subside relatively quickly, reach a peak very soon and then start declining by the 2030s by more than 1% per year. Even under that aggressive trajectory for oil demand, there is still a gap relative to where production from current fields is that would need to be filled with new projects.

When gas consumption grows, by definition, new investment is also needed in those fields. It is important to understand the reason companies invest. More than 80% of the investment that goes into the oil and gas sector is not to meet demand growth; it is just to keep us roughly where we are, to keep production flat, due to those declines underlying the system. That is a little bit of the dynamics behind why we still need investment in new oil and gas.

On the issue of exploration, it is well understood that fossil fuel reserves around the world, in aggregate, are more than sufficient to blow a hole in the carbon budget that is consistent with the Paris Agreement. Depending on what assumptions are taken, the carbon budget for Paris is somewhere between 500 gigatons and 1,200 gigatons. The CO₂ embedded in today's fossil fuel reserves is around 3,000 gigatons. It is roughly three times more than we need or would be able to combust in order to be consistent with Paris. There are a number of caveats, however. The vast majority of that is coal, a big chunk of which is not consumed or combusted in any scenario for the future. There are also non-combustion uses of oil and gas, in particular, that need to be brought into the picture because not all the oil and gas we produce goes into those combustions. Some of it goes as a feed stock into petrochemical while some of it goes into the manufacture of fertilisers, for example. There are no direct emissions associated with those. Under those circumstances one also needs to take into account the circumstances of countries which do not have reserves. For that period when fossil fuels are still being used, one could understand the logic of those countries wanting to explore in respect of those fossil fuels if they have a reasonable chance of success and to reduce their import bills and gain revenue as a result. There would also be companies, which may be interested and may have niche positions within the upstream, looking for additional resources to develop. Even in the case of the large players which have a lot of reserves on their books, if there were other opportunities that may be more advantageous, they may seek to explore those as well. Even in a very carbon-constrained world, one can see a justification in many places to try to find new oil and gas even within the constraints of something like the Paris Agreement.

On the question on solar PV, it is one of the cheapest forms of energy on a levelised-cost basis, which means that if one looks at the costs over the lifetime of a project and one compares it

with other sources of generation, it works out in many countries as one of the cheapest options. That does not tell one everything about the value of that generation, because it may not come at the right times of day for a given system, so one needs to think through the implications of that when looking at the portfolio of renewables that make sense for an individual country. Where solar PV has done well, it has needed a helping hand from governments. That type of support has tended to change over time. Initially, in many countries, it was in the form of feed-in tariffs. Feed-in tariffs have some advantages in terms of simplicity but what they fail to capture is that they often do not move with the times. One does not capture the dynamism of the market so one can miss the opportunity to get cheaper renewables into one's system. What many countries are doing instead is looking at auctions. A well-designed auction can help to incentivise some of those cost reductions and bring the best-value resources into a system. Typically, utility-scale projects bring the most value. One has to have a very promising resource in order for rooftop projects to be a sure-fire winner. That does not mean that there are not cases when they make sense, but rather those kinds of projects obviously find it much easier to go ahead in California, where they are now going to be essentially mandatory on new builds, than in some other climates.

The question on Brexit is very difficult to answer in the absence of a feel for which way that is going to go. Deputy Stanley made reference to possible implications for supply of energy to Ireland. From an IEA perspective in principle, diversity is a virtue. Looking at alternative ways to bring resources into the country is always going to be a positive from an energy-security perspective, if it passes a cost-effectiveness threshold.

The Deputy asked about countries that we could bring into the comparison that may be of interest for Ireland. There we run into some difficulties. We can obviously find countries that have moved ahead faster in the share of renewables in the mix or the emissions reductions they have achieved, but the starting points were also very different. As Ireland has quite a distinctive profile in that respect, not least because of the role of the agriculture sector, I hesitate to find a sufficiently precise analogy. However, I think there are plenty of good policy examples from around Europe and even further afield that could be of interest to Ireland. That is one reason why we very much welcome Ireland's participation in things like the peer review mechanisms at the International Energy Agency, IEA. That provides a ready-made mechanism to bring some of those learnings to bear. Likewise we very much value the contributions of Ireland in areas where it has been at the leading edge of some of the work on policy issues within the IEA. Renewables integration is certainly one of those. I refer to the experience with onshore wind.

Chairman: Are there countries that provide examples of good, well designed auctions? Are there any examples of that?

Mr. Tim Gould: There certainly are plenty of countries that have designed auctions very effectively. Within the IEA family, Brazil is a good example of a country that has managed this very well. Mexico is a newly joined member of the IEA that has really contributed some very good examples of how auctions can be designed both to bring renewables into the system and to bring in the type of technology that best matches the needs of the system. It is not a guarantee that in a system that has good solar potential, adding a PV, photovoltaic, system is necessarily the right thing to do. There may already be a fairly saturated market at the key times of day for PV systems. It may be necessary to find a different technology mix that would be the best complement to the system. Thinking through the regulatory ways of encouraging both renewable investment in general and the right type of renewable in the right place in the system is the challenge many policymakers have faced. There are some good examples of that in the IEA

family.

Deputy Eamon Ryan: I thank Mr. Gould. He is very welcome and it is very good to get this overview. It is disappointing that he cannot specifically speak about some of the key policy issues we are facing. I would be interested to know when that country report is due. It would be interesting to know how we as a committee might engage with that. It is also disappointing that Mr. Gould cannot speak specifically about policies. When it comes to our upcoming debate on Deputy Bríd Smith's Bill to end oil and gas exploration, I expect Mr. Collins will be quoting him chapter and verse to argue the need to maintain oil and gas production. I do not want to put words in his mouth, but that is what I would imagine. I am afraid I radically and fundamentally disagree with Mr. Gould. I am disappointed that the IEA seems to be increasingly behind the curve regarding the energy revolution that is taking place and needs to take place. It is increasingly having to update its scenarios, it has underestimated the renewables revolution and so on.

I have a couple of questions to tease out the specific issues about whether we should proceed with on oil and gas exploration. One of the various interesting graphs Mr. Gould showed the committee depicted alignment with the Paris Agreement goals. It very simply shows that there are currently 33 million gigatonnes of emissions from energy use. By a rough reading of the graph, following the trajectory to 2050 rather than 2040, that figure needs to decrease to something like 15 gigatonnes. If that reduction from 33 gigatonnes to 15 gigatonnes is a global figure, that is, if the globe is more than halving its emissions from energy in that period, what emissions reduction should be sought from a very wealthy western developed country like Ireland, with massive renewable resources? What is the reduction we are likely to see in such a scenario? There are loads of questions but I am interested in one thing Mr. Gould said at the outset that seems to be true, namely, that the shale revolution is continuing despite the recent lower prices for oil, which are now edging back up. Does Mr. Gould have an estimate of the levelled-out cost of oil production from shale reserves? It is very interesting to see the declining production from current sources set out in Mr. Gould's graph. Does he have any estimate of the volume or scale that shale production could go up to? Obviously there are constraints around water production and energy use.

The other question I have in that regard is on what is Mr. Gould's best estimate of the cost of production from deepwater offshore north Atlantic reserves. Can we compare the cost per barrel of production from shale in North Dakota and the cost per barrel of production from the Porcupine Bank, 200 miles off the west coast of Ireland? Does Mr. Gould have any estimates on that?

The graph showing the contraction of production from current resources is very interesting. Is the oil demand graph based on the sustainable scenarios Mr. Gould talks about? It is. Most of that demand is in petrochemicals, plastics, aviation and shipping. Are there knock-on consequences? I always remember the oil processing industry saying it is necessary that a barrel goes in different locations. If petroleum, kerosene or heavy oil is being lost, the processing industry does not quite work. I am interested in how that is going to work.

Lastly I will come back to my key point. Deputy Bríd Smith and I met with representatives of Oil Change International. Their assessment, which I have no reason to doubt, was that the simple maths of what we need to do to meet the Paris Agreement obligations meant that even existing production from gas and oil fields, as well as coal, must be left in the ground. Why are they wrong while the IEA is right? This is difficult. We are comparing modelling approaches. They presented us with very clear analysis and very simple maths showing why existing production fields have to be left undeveloped.

Lastly, Mr. Gould said that there may be countries that want to maintain oil exploration for strategic reasons. Whatever about 2050, I am sure Mr. Gould will agree that by any analysis, in a country like Ireland there will be zero oil and gas production by 2060. However, we might want to hold onto it as a secure asset or to improve the balance of payments. Can Mr. Gould give examples of those countries? How does Ireland compare with other countries? That argument might apply to a very poor country in the developed world. How can that argument be justified in a country like Ireland, one of the richest countries in the world with a balance of payments among the best in functioning economies? How does it really work as an argument when the oil and gas market is increasingly fungible? Does Mr. Gould think our oil and gas security really is dependent on having our own resources? Thanks to our reaction to the Russian gas crisis of the last decade, do we not now have a fungible gas and oil market where such security reasons do not really hold sway in a country like Ireland?

Deputy Bríd Smith: My questions are somewhat along the same lines. Mr. Gould is very welcome and I thank him for his input. I am looking at some information on the establishment of the Paris-based International Energy Agency in 1974. It was established in the wake of an oil crisis to ensure reliable, affordable and clean energy for its member countries. Has it ever reassessed its policy direction in light of climate change? It would seem to me that this statement of aims does not match what we have to do in the current crisis, particularly given the Paris Agreement and the obligations thereunder. The presentation states that even as renewables grow so too must the production of oil and gas and the conclusion that is arrived at is that we need more, and not less, investment in oil and gas over the next period. I find this very disturbing because I do not think that this helps us to meet targets under the Paris Agreement, nor, as we face a global crisis, does it convey any sense of urgency or that this planet is going to burn and we have to do something to stop it. As mentioned by Oil Change International, it finds the scenario, as a basis for new investment in oil and gas, as seriously bad information to give to governments. The witness said he cannot comment on what happens in Ireland because there is an in-depth review of Irish energy policy taking place. This worries me because an organisation that was set up to take advantage of the production of oil and gas in the middle of an oil crisis in 1974 is now advising the Government on how it will project its energy policy in the future.

In short, what we are saying, and what I would like the witness to comment on, is that all countries, particularly a country like Ireland which has access to wave, water, wind and solar power, should be investing massively in these areas and divesting in fossil fuel energy. That is the purpose of the Bill that will be brought before the House for scrutiny next week. I would like the witness to comment on that in order to see how in his opinion we get the balance right and that we keep global warming below 2% if we are to meet Paris Agreement requirements. Does that mean the witness can really marry this contradiction that he has laid out before us that we need to invest more in the production more oil and gas because that is what he seems to be saying here?

Chairman: I am going to bring in Senator Lombard.

Senator Tim Lombard: I will be brief as most of the important questions have been aired. I welcome Mr. Gould and thank him for his presentation. Could I ask him about the scenario on renewables and where they fit in. I refer to low-carbon renewables. Where does the witness see wave energy coming into the scenario for renewables? What would his projection be in the future with the costing of wave energy given the work that is being done in places like Cork, in particular? Does the witness think that wave energy is going to be a significant driver in this area?

What is the witness's view, although this might be a little off the beaten track, on carbon storage? Does carbon storage play a part in this? What is his view in the long term as to where carbon is stored and using redundant gas fields, for example, Kinsale gas field off Cork. How would that fit into the scenario?

The witness had a slide showing that renewables have to go forward and renewables under low-carbon with nuclear. I get the impression from looking at the slides that the witness believes there will be an increase in nuclear in the future if we are to progress in the renewable cycle with the low-carbon element. Can he expand on the nuclear proposal and where he thinks that nuclear fits into that policy on a global level?

Chairman: There are a lot of questions there. Mr. Gould can answer them in order of preference.

Mr. Tim Gould: I thank members very much for the questions. I will start with the questions on the International Energy Agency, IEA, and its mission. It is correct that the IEA was founded in 1974 in the wake of the oil embargo, with the purpose of safeguarding the energy security of its members. To a large degree that initial mission remains at the core of IEA. We have an important function in relation to oil security. In the intervening period, the energy security debate has changed. Our member countries have asked us to look at the things they think are the most important on their energy policy-making agenda. Over time we have become a leading policy institution, not just on hydrocarbons but we have a very active energy efficiency mandate and division and we would like, under the leadership of our current executive director, to become a global hub for clean energy transitions. We have received a lot of additional funding from our member governments to work specifically with China, India and other countries that are going to be the key countries for the prospects of meeting global sustainability goals to help them think through the changes that would be necessary in order for that to happen. In our view that kind of global dialogue on today's energy security agenda, which is very much around sustainability, is the critical function of the IEA and one we are determined to pursue.

That helps me to answer the question on the in-depth review. This review is not conducted by my colleagues in the secretariat. It is a peer review by countries, member states of the IEA, as a way to share policy ideas, guidance and best practices of the sort that came up in the earlier discussion, on the understanding that that might be relevant context. Everyone is facing the same challenges in a way.

I want to talk about what remains to be done. In terms of what has been done so far, particularly in the power sector, we need to give due weight to the importance of the progressive de-carbonisation of electricity. There are some very challenging issues, however, in many of the end use sectors around heat, transportation and industry, where the answers are not obvious. One has to bring in a wide variety of technologies in order to resolve some of them. One that was mentioned is carbon capture, utilisation and storage, CCUS. We will continue to need cement, iron and steel in the future and there are not many ways in which one can reduce the carbon intensity of the production of these products. One of the more promising avenues is through capturing, utilising or storing the CO₂. That is why from an IEA perspective, we think that CCUS needs to be part of the conversation about energy transitions and why we have tried to bring leading people from our member governments, from non-member governments and from industry together to see how can we practically move that agenda forward as well.

I will touch on the question on nuclear energy which in our projections varies widely according to country preferences. There are countries that in our view will move ahead new nuclear

deployment. China is leading that but there are some others as well, including Russia, and there are likely to be some additional new sites constructed in India. Equally, there are countries that are moving away from nuclear as an option. The new Korean government has said that it would like to rely less on nuclear and coal in the future and more on natural gas and renewables. We have to take into account all of that variability in policy around the world when we put together scenarios of that kind. What is certainly true is that nuclear, with long-lead times and being very capital-intensive, is having a tough time at the moment in many liberalised markets when one has other renewable options that can come to market much more rapidly.

Wave energy is another good example of a technology that looks to be very interesting but where the costs are currently high compared with other renewable options. Where one has a particularly interesting site, and where one has someone willing to take on that initial risk by putting the capital in, then it can look interesting. As was seen with the recent announcement in the UK, however, particularly with the cost of off-shore wind coming down, one needs someone to take the plunge and try to put these projects in place, so one can have the learning in place and try to get costs for the next round of projects. I think that applies to wave and to a number of ocean energy technologies that are currently too expensive to come in at scale and where one does need that push to try to get them in larger volumes.

I will return to the beginning of our discussion. We only model our scenario up to 2040. One could plot a number of possible variants for global energy related CO₂ emissions after that but 15 gigatonnes would be a reasonable place to think about for 2050. We have not yet looked at how that plays out across the different regions. It will not be long before we do move to a 2050 horizon for our modelling and then we will be able to give a much clearer indication not at country level within the European Union but certainly for the European Union as a whole, and what that might imply for the level of ambition.

Deputy Eamon Ryan: Let us take 2040 if we cannot go beyond that, if we are going from 33 gigatonnes down to 17 gigatonnes, which is what Mr. Gould has suggested for the 2040 projections, how does he think that might be distributed? How would a rich, wealthy country in the west be seen to contribute to that versus India or Africa?

Mr. Tim Gould: I would be happy to provide the Deputy with the numbers on how it plays out because that is public information. They are available in the book. If the Deputy is agreeable, I will get back to him with the information on how different regions around the world would take on additional responsibilities in a sense.

Deputy Eamon Ryan: Would there be a much more significant reduction in a western developed country than it would be in a developing country?

Mr. Tim Gould: It depends also on the extent to which one is turning over one's stock, in a sense. Countries that are growing fast also have the opportunity more readily than some advanced economies to build new infrastructure, so in a sense it also relates to how much one is looking to meet additional demand in one's country as opposed to replacing retiring infrastructure. That puts something of a constraint. When one is looking at a least-cost way of managing that, typically, when one has the opportunity to build something new and one can build zero emissions infrastructure, then that also has an impact on the way that the emissions reductions are shared across the different countries in the world.

Deputy Eamon Ryan: Mr. Gould's graph shows an overall reduction of 200 million tonnes of oil equivalent in Europe versus significant expansion in China, India and elsewhere. I will

get the relevant reference.

Mr. Tim Gould: That is for the main scenario, so that is the one that tells us where policies today are leading us. That is not an indication for the future.

Deputy Eamon Ryan: If we went on a sustainable scenario then the reduction in Europe would probably be even more significant.

Mr. Tim Gould: There is an additional efficiency push, which would most likely lead to a reduction in the total amount of energy consumed in the European Union, but there would also need to be a shift in the composition in favour of lower emissions technologies.

Deputy Eamon Ryan: It would probably be a multiple of that.

Mr. Tim Gould: Yes. Even when one does get down to a much lower emissions system, that does not necessarily have uniform implications for different fuels within that system. I want to highlight one aspect of the role of natural gas in that respect. As members all know, one of the issues that is facing policymakers is that there is a large share of renewables in the system. Those renewables are variable and one needs to be able to cover for those moments when, famously, the wind is not blowing and the sun is not shining, so we need to think through the implications of that dark winter day or that period during the winter when wind is not producing as much as it could. One needs to think about how we guarantee the security of electricity supply under those circumstances. In typical systems where one is looking to try and compensate for that variability over a relatively short period of time then there is a multitude of options.

Deputy Eamon Ryan: One might be the North Sea offshore grid initiative where one would connect the electricity system much wider, so one would have Scandinavian hydro, Alpine hydro and French nuclear energy. I understand that is one of the European Union's major initiatives in terms of providing such a secure energy supply.

Chairman: I might let Mr. Gould finish his response before Deputy Bríd Smith speaks unless it is on the same issue.

Deputy Bríd Smith: I would like to hear the answers to what has been raised.

Chairman: I will come back to Deputy Bríd Smith after letting Mr. Gould finish answering all the questions.

Mr. Tim Gould: It is undoubtedly the case that greater interconnection can help one to manage flexibility. One of the reasons offshore wind is very promising in that respect is that by moving further offshore, one has fewer restrictions in terms of turbine size and area covered. One can tap into more consistent wind speeds and generate much higher capacity utilisation than one can for the onshore counterpart. One could reach perhaps up to 60% utilisation for that offshore wind resource compared with a lower figure for the onshore. That helps with some of the intermittency issues but still, when one is looking to cover the winter heating load of a country like Ireland, it is difficult and in our view would be expensive to try to manage that entirely through, in a sense, the all-electric route. That would require the building of a large amount of additional electricity generation and transmission capacity to cover that eventuality.

In our view there is a role in this discussion also for molecules. One can debate what sort of molecules they might be but at least for the interim period that is most likely to be natural gas as a way to provide that security over those periods in the system where other renewable elements

are not in a position to do the heavy lifting. Those molecules at the moment are natural gas in many systems, including here, but in the future they could be renewable natural gas. There is a significant biomethane potential in this country, as in some others, and there is also a very interesting discussion about the role of hydrogen in future energy systems. Hydrogen could come from electrolysis, so it could be offshore wind producing electricity that is then turned into hydrogen or it could be through steam reforming of natural gas with carbon capture and storage. There would be ways to also cover that eventuality in the system here in the context of a deeply decarbonising outlook.

I have jumped a number of questions so I would like to come back if I may to the question of shale. I was asked about the break-evens and how high it could go and to compare break-evens with offshore production elsewhere in the world. The break-evens vary widely across different players in the US. There are players that have been proven to operate when the oil price is very low - below \$40 a barrel - and there are others, particularly when one moves out of the so-called sweet spots, which would probably need a higher price because the resource quality is less good. How does that compare with offshore production? Offshore costs have come down very significantly in recent years so I do not think it is reasonable to assume that offshore is always at the high end of the cost code. If one looks at some of the new projects in the Gulf of Mexico or some of the Brazilian projects, they have costs that are still attracting significant investment from companies. Many of the new conventional projects that are going ahead at the moment are indeed in that offshore space. Companies are saying that a project which had a \$70 break-even a few years ago when it was costed is now coming in at between \$30 and \$40. Those costs may come up again as activity levels increase but that is at least where we are at the moment. There are high-quality offshore projects going ahead which have relatively low break-evens in terms of where they sit on the global cost curve. What those costs might be at some point in the future in Ireland is impossible to say for the moment. One could make the case that it is one reason to try to find out, but at the moment there is not enough information to form an opinion on that. The Deputy made an important point on the consequences of a sustainable development scenario for the composition of the demand barrel because in practice the demand would shift towards lighter products, particularly where some liquid petroleum gas, LPG, is needed in some rural areas to enable clean cooking for those still cooking with solid biomass, and for the role of petrochemicals. The lighter end of the barrel will become more prominent in global demand and there is a hole in the middle where gasoline and diesel start to become less important because of changes in the transportation sector. Demand for the heavier product would become scarce. That is an unprecedented challenge for the refining industry if the changes take place. It has coped with changes of a similar order in the past but they would be a significant shift in what the refining industry is asked to do in the future.

There were a couple of questions about why our analysis is different from the analysis of Oil Change International. I have read some of its work but I do not have it in my mind so I would not be in a position to comment in detail on the analysis it has produced. We start from the Paris Agreement and we consider what it would mean for the global energy system so we work backwards from a point in the future which we believe would be consistent with the Paris Agreement. That gives us the sorts of results the committee has seen in our scenarios. That also gives us oil and gas demand trajectories that we relate to a detailed resource model that considers production curves and decline rates in detail. That is how we end up with the conclusion that to satisfy that demand some oil and gas projects need to go ahead. One point I would like to emphasise and which was not clear in my earlier presentation is that in the sustainable development scenario we are not talking about an increase in oil and gas investment in respect of today; we are talking about a gradual decline in the importance of that investment to the energy system

in the context of a fundamental shift in those investment dollars or euro or whatever they are towards clean energy technologies and energy efficiency.

Why in a fungible oil and gas market would Ireland need its own production? It is not completely obvious, at least in respect of gas, that there is a movement towards a more liquid and competitive gas market in the absence of the ability to import LNG. It is not obvious that Ireland has any direct access to that market and that would also provide a reason to think about developing its own resources for the purposes of meeting domestic demand.

Deputy Eamon Ryan: We cannot trust the Brits.

Deputy Bríd Smith: Does the IEA believe that gas is a clean fuel? Mr. Gould seems to hint that natural gas can play a role in this transition to clean fuel. If so, can he explain scientifically why he says that? For an international agency the perspective he gives us is not very global because he seems to argue that there is a role for further exploration and development of oil and gas, yet science acknowledges that at least 80% of all fossil fuels on the planet should remain in the ground if we are to reach the Paris goals. If Mr. Gould is starting from the Paris Agreement surely he should look forward instead of backwards and starting by asking how we get to what the agreement demands. He does not tell us in his reports how much the planet will overheat if we follow what he says is necessary, what degree it will reach or where we will be in respect of the agreement, apart from saying that we have a 50:50 chance of meeting the targets. He would not get on a plane if he thought it had a 50% chance of crashing.

A little bit more needs to come from what is called the International Energy Agency. Without wishing to insult any of the witnesses and the work they do, I believe their work is heavily influenced by the oil and gas industry and that it is not fitting for the IEA to be the advisory body in a world that is trying to meet the Paris targets. It should be weighted much more heavily towards renewable and clean energy. One committee member, who has left the meeting, asked about carbon capture and storage. Could Mr. Gould give us information on that because we are far from being able to achieve it and if we cannot achieve it, will we not have to cut our emissions further and faster?

Deputy Eamon Ryan: This is all meant in the best spirit of differing views but it is awkward that in this analysis the IEA should keep open aspects of oil and gas production. Mr. Gould mentioned offshore oil and gas in the Gulf of Mexico and there have been massive finds in Brazil but we have gone out 135 times and have found only trace elements of oil but nothing commercial. Even the gas we are likely to find is a long distance out and will never come ashore in an Irish pipeline. It would probably shipped to a terminal somewhere else. There is no reason to think that would give us security. I am uncomfortable that the IEA is pushing the idea that we must keep the oil and gas open.

Mr. Gould is right that it is a huge challenge which will involve a massive concentration on efficiency more than anything else, including biomethane and carbon storage. I am certain, however, that if he was betting his family's inheritance and was investing the \$7 trillion in either offshore wind in Ireland or offshore oil and gas, I know which one he would choose. I cannot believe that anyone would advise the State that oil and gas would be the right investment. That is partly because we are in such trouble on climate action and have such emissions from agriculture it will be difficult and we have other inbuilt difficulties in transport. Energy is one of the areas where we could make the leap. While the defence of the need for oil and gas exploration may apply in a global context, it could not be justified for ongoing investment in an Irish context. We were recently rated the second worst in Europe on climate action. Last year

Germanwatch and Climate Action Network rated us as 49th in the scale. We could respond to the global divestment movement, which has made a significant positive contribution to the climate debate to say, like the French, we will not go offshore. No one will discover anything commercial in Irish waters for under \$100 dollars a barrel. We will not go over \$100 dollars a barrel again. We will kill oil by making it too cheap to deliver. The scary part of the presentation is the analysis that shale oil can be produced at less than \$40 a barrel. How do we get oil below \$40 a barrel to kill it?

Mr. Gould said we help the Chinese but the Chinese could help us when it comes to this transition because they are electrifying transport. While we are good on grid integration in this country, what I hear from the Chinese is spectacular. I am slightly nervous about an organisation with such a large American representation because I regret that America and Britain are increasingly economic nationalist outliers. As a progressive European country we want to be a leader in renewables and efficiency and take what the Chinese are learning to help us here rather than us telling them what to do, particularly if the view is that oil and gas are the future with a \$7 trillion investment. That is not what we need. Investment is required in this massive revolutionary need. The International Energy Agency, IEA, should be leading this rather than defending the oil and gas industries in the way I have heard today.

Chairman: I invite Mr. Gould to answer those questions and then to make his final comments.

Mr. Tim Gould: I thank the Deputy for his questions. China highlights a number of the areas that are important. China has been investing heavily in renewables but it is also investing heavily in natural gas infrastructure. That brings me to the question of what are the environmental credentials of natural gas. One can look at that in different ways. In terms of combustion emissions, gas has no particulate emissions. That is one of the reasons it is preferred to coal. In the Chinese context, and in some other contexts where the Deputy is concerned about air quality and likewise in terms of sulphur emissions, those are negligible for gas but quite significant for coal. Gas emits some nitrous oxide when combusted but relative to oil products, which are the main source in that respect, the share of gas in nitrous oxide emissions worldwide is around 10%. In terms of carbon dioxide, CO₂, combustion emissions, and it depends on the qualities concerned, there is something of the order of a 40% reduction from coal to gas but there is the issue of methane emissions-----

Deputy Eamon Ryan: On the issue of methane emissions in the context of the share of emissions to which Mr. Gould is referring, some of the latest research has shown that the level of methane emissions is significantly higher and that it is as bad as coal.

Mr. Tim Gould: We certainly recognise the concern. In last year's World Energy Outlook publication we examined in detail the question of methane emissions from natural gas and looked at the best information available. We worked with non-governmental organisations, NGOs, and companies to find out the best numbers that exist for methane emissions. The data on those are relatively scarce, particularly in many parts of the emerging economies. We found, on average, that in terms of the gas value chain, the figure is 1.7%. I say that with a precision that belies the uncertainty around that number, but 1.7% of gas is lost to the atmosphere and not used productively in the chain from production to consumption. It is a complicated discussion because there are different ways of converting the climate impact of methane versus CO₂ but we would need to get up to leak rates around or above 3% in order to start to have the discussion about gas being as bad for the climate as coal on a life-cycle greenhouse gas emissions perspective.

Our analysis on the climate side suggests there are still significant benefits from using gas versus coal. On the air quality side, it is fairly unarguable that this would bring benefits relative to other combusted fuels. There are other options. Renewables is the option that does not come with those levels of emissions.

Deputy Bríd Smith: I apologise for interrupting but it is very misleading to say it is a clean alternative energy. Compared with coal it is cleaner, but that does not make it clean. It certainly does not make it clean in terms of the discussion about how we reach our targets.

Mr. Tim Gould: That is precisely the conclusion we reached in this analysis. It is completely the wrong benchmark for the gas industry to compare itself with the more carbon intensive fuel. We need to bring those methane emissions down to as low a level as is practically possible. We need to maximise the potential benefits we get from natural gas. For us, that is one of the key variables that needs to be part of the discussion when we talk about the future of natural gas. As the Deputy asked about the role of natural gas in the system, we also need to recognise that it does useful things for the energy system. From an industrial perspective, it brings the option of high temperature heat, where renewable options are less readily available. In respect of the power system, which we discussed, it provides an important element of electricity security, particularly in countries that have heavy winter heating loads.

There could be a role for natural gas in parts of the transport sector where electrification is difficult, for example, with respect to some of the heavy freight in some countries and in the international maritime sector. That are elements that gas brings to the table in terms of its versatility in performance that make it very much part of this conversation about the way we need to move ahead.

It is also important to recognise there is a good deal of inertia in the system. There is a good deal of energy consuming equipment that has a long shelf life. Replacing it quickly in a way that removes the need for the fuels that feed that equipment is not a simple task. There are discussions on the speed with which we can replace the infrastructure that has taken many decades to build up. That process needs to move quickly. When we talk about deep renovations of our building stock, that is not simple from a policy perspective, a public acceptance perspective or a cost perspective. When introducing new processes in the industry, there are complex issues involved, including competitiveness in the industry, which need to be taken into account.

Regarding the transport sector, within the passenger car segment, there are options with respect to electrification that are moving ahead rapidly in some countries and less rapidly in others, but other parts of the sector are much more difficult nuts to crack, namely, the areas I highlighted which are aviation and shipping. There is a degree of inertia there which needs to be taken into account when one puts together these analyses.

We in the IEA talk to many people, including a large range of NGOs and people representing different technologies in all parts of the energy industry. We have a range of technology networks examining ocean energy, solar PV, and different aspects of end-use sufficiency. They bring together the best experts-researchers from governments and academic institutions to try to find ways of making this transition quicker. That is very much the way we see our role. My concluding remark is that at the core of the IEA's mission since 1974 has been the notion of providing energy services reliably, securely, affordably and sustainably but we have to think about-----

Deputy Bríd Smith: It is not sustainable in the way our energy services have been pro-

vided.

Mr. Tim Gould: That is clearly the direction of travel. It is our intention to work with member governments and non-member governments to manage that process as well and as quickly as we can.

Deputy Eamon Ryan: I do not dispute the good intentions of the people in the IEA but the figures that are most frightening, as Mr. Gould said, are that 30 years ago, more than 70% of our energy system was reliant on fossil fuels and today the figure is 70%. We have known that for 30 years. We knew what Jim Hansen said 30 years ago was pretty accurate but we have done nothing about that. That is scary because the scale of this change is difficult. We need to up our game by a factor of ten to do what we must do.

Chairman: I thank Mr. Gould for coming before the committee and for comprehensively replying to all the questions. I also thank Mr. Matt Collins from the Department for attending. We will publish Mr. Gould's opening statement on our website. Is that agreed? Agreed.

The joint committee adjourned at 1.35 p.m. until 1.30 p.m. on Wednesday, 27 June 2018.