DÁIL ÉIREANN

AN COMHCHOISTE UM THALMHAÍOCHT, BIA AGUS MUIR

JOINT COMMITTEE ON AGRICULTURE, FOOD AND THE MARINE

Dé Céadaoin, 20 Iúil 2022

Wednesday, 20 July 2022

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
Martin Browne,	Lynn Boylan,
Matt Carthy,	Paul Daly.
Michael Fitzmaurice,	
Brian Leddin,	
Michael Ring.	

I láthair / In attendance: Deputies Marian Harkin and Carol Nolan and Senator Eugene Murphy.

Teachta / Deputy Jackie Cahill sa Chathaoir / in the Chair.

Calculation of Methane Emissions: Discussion

Chairman: I remind members, witnesses and persons in the Public Gallery to turn off their mobile telephones. The purpose of today's meeting is to examine two topics. The first session is on calculation of methane emissions and the second will be on sectoral emission ceilings. The committee will hear from a number of expert witnesses and officials from respective Departments.

On 28 February, the legal requirement for mask-wearing in all settings was removed. However, it is still good practice to continue to use face coverings, particularly in crowded areas. The service encourages all members of the parliamentary community to wear face masks when moving around the campus or in close proximity to others.

I wish to bring to everyone's attention some information on privilege. Witnesses giving evidence from within the parliamentary precincts are protected by absolute privilege in respect of the evidence they give to the committee. This means that witnesses have full defence in any defamation action for anything said at a committee meeting. However, witnesses are expected not to abuse this privilege and may be directed by the Chair to cease giving evidence on an issue. Witnesses should follow the direction of the Chair in this regard and are reminded of the long-standing parliamentary practice to the effect that, as is reasonable, no adverse commentary should be made against an identifiable third person or entity.

Witnesses who are giving evidence from a location outside the parliamentary precincts are asked to note they may not benefit from the same level of immunity from legal proceedings as witnesses giving evidence from within the parliamentary precincts and may consider it appropriate to take legal advice on this matter. Privilege against defamation does not apply to the publication by witnesses, outside the proceedings held by the committee, of any matter arising from the proceedings.

Members are reminded of the long-standing parliamentary practice to the effect that they should not comment on, criticise or make charges against any person outside the Houses or an official, either by name or in such a way as to make him or her identifiable. Parliamentary privilege is considered to apply to utterances of members participating online in this committee meeting when their participation is from within the parliamentary precincts. There can be no assurance in relation to participation online from outside the parliamentary precincts and members should be mindful of this when they are contributing.

Today's first session until 1 p.m. is on calculation of methane emissions. The committee will hear from representatives of the Carbon Removals Action Group, Professor Myles Allen, Oxford University, and Dr. Frank Mitloehner from the department of animal science, University of California, Davis, who is joining remotely. I will now call the witnesses to make their opening statements. To leave ample time for questions, I would like them to confine their opening statements to five minutes if that is okay.

Mr. John Hourigan: I thank the committee for inviting us here today. I am a farmer from rural County Limerick and I am founder member and chairman of the Carbon Removals Action Group, CRAG, which was set up in 2019 to help farmers realise the value from their carbon removals, mainly in forestry. This matter is not yet settled by any means.

However, today is focused on methane and while there are several concerns we hope to discuss, and there are goals shared by everyone in this room, we all know that climate change

is real and happening as we speak and steps must be taken to reduce everybody's contribution.

The specifics of what should be included, the criteria for legally binding targets, international commitments that have been made, how they should be included and calculated, which sectoral group they should sit in and how all these decisions are reached and communicated to the farming community and the wider public are points of serious concern. I take this opportunity to introduce my colleagues who are here with me today. Professor Myles Allen needs no introduction. He is a world-renowned climate scientist and is currently professor of geosystem science at the University of Oxford and director of the Oxford Net Zero initiative. He was the co-ordinating lead author on the Intergovernmental Panel on Climate Change, IPCC, special report on the 1.5°C reduction and has been involved with the IPCC's third, fourth and fifth assessments. Ms Nadaline Webster is a co-founder of CRAG and a strategic and creative consultant in the legal technology sector working primarily with early-stage start-ups through to equity events. She lives with her partner, who is an organic farmer in County Limerick.

There are six core points to the discussion on the calculation of methane that urgently need consideration and discussion, which I will address briefly. The relevant sources are listed in the references at the end of this document. One of my main concerns has been the ongoing reputational crisis in Irish agriculture, which is due in no small part to repeated assertions that methane emissions from cattle are largely responsible for global warming. It can be argued that once calculated correctly, methane emissions from cattle are not contributing to increased global temperatures. To quote Professor Allen on the same matter: "Achieving climate neutrality in terms of metric-equivalent emissions could mean eliminating practices, such as ruminant agriculture, that are not actually causing global warming."

The basis for the separate treatment of methane, outside of the carbon cycle of which it is naturally a part, is provided in the 2006 IPCC guidelines. It states:

> CO2 emissions from livestock are not estimated because annual net CO2 emissions are assumed to be zero - the CO2 photosynthesised by plants is returned to the atmosphere as respired CO2. A portion of the C is returned as CH4 and for this reason CH4 requires separate consideration.

It should have stated that the CH4 converts back into CO2, which completes the cycle. This is all absolutely correct but must be applied correctly, which is not the case in Ireland currently. "Separate consideration" should not be taken to mean removing it from the carbon cycle and treating it as a CO2 equivalent.

CO2 emissions from livestock are net zero in absolute terms because of the carbon cycle. Almost all of the CO2 taken in by the animal through the forage it consumes is returned very quickly through respiration from the animal and through the meat and milk consumed by humans. Approximately 50% is respired immediately through respiration. In Ireland, a small amount, which could be 5%, is locked into the soil. Approximately 3% is returned through methane. All the rest goes into the meat and milk. Because of this cycle, all the billions of tonnes of methane produced over millions of years by billions of ruminants has been recycled. It is all gone because there is a system to take care of it.

They are also right in saying that methane requires separate consideration. All scientists who have published on this issue since 2015 agree that biogenic methane requires separate consideration. The problem is that the Government insists on treating biogenic methane as CO2 equivalent, viewing it in the same way as methane from mining, which is a one-way ticket. This gives rise to a situation where 65% of agriculture's carbon footprint is supposedly made

up of biogenic methane, which is not causing any further global warming as long as livestock emissions decline by 3% per decade. Professor Allen will elaborate on this. The Paris Agreement set a temperature goal, not a CO2 equivalent goal. A core part of that is a stable national herd. Contrary to a lot of people's understanding, over the past 40 years, the Irish herd has been largely stable. It has fluctuated but all through the 1990s total cattle numbers were in or around 7 million, peaking in 1998 at 7.67 million, and it now stands at 6.9 million. This is a drop of 10% from the peak of 25 years ago. It is worth noting that in the same timeframe, the number of vehicles on our roads increased by 64% and air travel increased by 350%.

The other sector that is very important involves the ledgers relating to these different things. Land use, land use change and forestry, LULUCF, contains all the removals from forestry and grassland, which are huge. In the agriculture sector, the emissions are put in. We are being hard done by in how emissions generated through anaerobic digestion are categorised.

I will finish with a plea to Ireland to count the methane as separate, to have a separate target for biogenic methane and to listen to the likes of Professor Allen and Dr. Mitloehner, who make the very valid points that we can get to neutral in terms of the impact of global warming by taking on board a correct method of measurement.

Professor Myles Allen: Does the Chairman wish me to speak before Dr. Mitloehner?

Chairman: Perhaps Professor Allen can come in after the questions.

Professor Myles Allen: That would be great.

Chairman: I now invite Dr. Mitloehner to make his opening statement.

Dr. Frank Mitloehner: I thank the Chairman and members of the committee for inviting me to discuss methane emissions from livestock. As a professor of animal science and air quality specialist in the department of animal science at the University of California, Davis, much of my work revolves around studying the emissions of livestock to determine their contribution to air pollution and climate change. My position at the university puts me in the leading agricultural state in the US, from where half of all US produce and 20% of all dairy products come. Here in California, we have a dairy herd very similar in size to that of Ireland. I research and speak throughout the world on animal agriculture discussing how livestock produces greenhouse gas emissions and how we can mitigate them.

We clearly see that demand for animal-sourced foods is rising and the bulk of livestock emissions are coming from less efficient regions of the world. Reducing herd sizes is not a practical solution, especially in Ireland, where farmers are very efficient producers. If they scaled back their herds, production would likely move to another region so that global demand could be met. Given how proficient Irish farmers are, those picking up the slack, so to speak, may well produce less sustainably than Irish farmers. This is called leakage, a phenomenon that could well lead to a spike - not a reduction - in greenhouse gas emissions. Make no mistake animal agriculture has indeed played a role in advancing atmospheric warming, not to the extent that other sectors such as transportation and energy have but a role nonetheless. Furthermore, it can help to limit warming further. Granted, it will require a departure from business as usual and require farmers to embrace innovation and the adoption of new technologies but if you think about it, those things have never been obstacles to those looking to improve their operations.

Across the world, countries are looking for solutions to reduce emissions from their livestock. Here in California, the state is working with farmers to reduce methane emissions in

dairies and they are seeing promising results through collaboration. Farmers can and should be part of Ireland's approach to reducing greenhouse gases. I say this as someone who has dedicated his career to helping to mitigate emissions in the livestock sector and as someone who holds our farmers in the highest regard. The sector has room to improve and could feasibly reduce emissions by 20% to 30% by employing emerging technologies. In fact, we are doing just that in California. Yes, Ireland can reach its goals, keep its farms viable and ensure food systems can meet demand, which will only increase as the global population keeps growing.

The old saying that you cannot manage what you cannot measure applies as well to methane emitted by cattle herds. Ireland is distinctive in that its cattle are primarily raised on pasture, which has significant carbon sequestration capacity. What is surprising is it is not well known how much carbon is being sequestered by Irish farms. That needs to be better understood as we discuss carbon accounting and set emissions targets. Solutions are available right now that can reduce methane emissions from cattle. These solutions will likely need to be tweaked to fit the Irish way of raising livestock but that is not a formidable challenge. Feed additives are promising with significant potential to reduce enteric methane emissions in livestock. Bovaer, also known as 3NOP, has recently been recognised by the European Union as a proven methane-reduction feed additive with the potential of reducing by more than 30% and other additives are on the way.

California has reduced the emissions of more than 2 million Mt CO2 eq annually using anaerobic digesters. We have reduced 30% of the dairy sector's methane over the past five years. While I understand anaerobic digesters are a major departure from the Irish way of dairy production, the critical point is that we are formulating real, workable solutions to a problem many believe can only be tackled through draconian herd size reductions and dietary changes.

The global population is on trend to triple within our lifetimes, representing an enormous food security and natural resource challenge. Even now, we are seeing food security issues reveal themselves as parts of Europe are at war. Meeting these challenges will require the world to produce plant- and animal-sourced food and produce them more efficiently, using both high quality and marginal agricultural lands. However, first, we need to examine the facts and not engage in hyperbole.

Ireland already plays a large role in producing food for the world. More than 90% of its beef and dairy products are used in homes outside its borders. Irish farmers produce animal-sourced foods more efficiently than many other regions, while always striving to improve as they provide nutritious food to those who need it at home and abroad. Given the nation's role in global food supply, we would do well to allow it to be part of a global solution to limiting climate change.

I thank the Chair and I am happy to entertain any questions.

Chairman: I thank Dr. Mitloehner. Both opening statements have set the tone for what we want to discuss today. There are two aspects of what we want to focus on. One is the calculation of methane emissions and the other, which Dr. Mitloehner focused on in his opening statement, is the reduction of emissions. I met him a couple weeks ago in County Tipperary and he said there are the same number of cows in California as we have in Ireland. Over the past five years, they have managed to reduce their emissions by 30%. I know his type of farming there is different to ours, but he spoke on that day on what he has done with feed additives and the way he incorporated them to have an impact on methane emissions. Anaerobic digesters are playing a huge role. One thing I took out of the meeting we had with Dr. Mitloehner at the Horse and

Jockey Hotel is that the organic production of the animal was worth 50% of our milk output. What was being produced out a cow's rear end was worth 50% of what milk she was producing. That shows the value of slurry. In the modern world, if it can be used for energy generation, it has a huge economic value. We are definitely behind the curve not only with regard to America but also the rest of Europe in embracing that technology for the benefit of the entire economy.

I will now open the meeting up to members for questions to both sets of witnesses. Professor Allen said he will come in to contribute when the questions come in. I call Deputy Fitzmaurice.

Deputy Michael Fitzmaurice: I thank the witnesses for coming in. Mr. Hourigan said that basically a cow eats ten or 11 tonnes of grass and that a certain amount of that has carbon in it and a certain amount goes out through the milk. He talked about the methane and stabilising numbers. Does Professor Allen agree with Mr. Hourigan's analysis? I saw something in the media yesterday and I note Professor Allen talked about 3% over ten years. What are his solutions? Can he share some of his in-depth knowledge? Was he on the panel on climate science and what was he doing?

Professor Myles Allen: The Intergovernmental Panel on Climate Change.

Deputy Michael Fitzmaurice: Climate change. Could he explain that?

Ireland is basically a grass-based country. As was outlined by the professor, this could move to other places that might not be as good at doing it. What would his solutions for Ireland be? In the line of this word that is going around at the moment in relation to a "cull" of the national herd - it is causing major problems in Holland at the moment - what would his solutions be in basically all the science that he looked at?

I have a question for Professor Mitloehner. My understanding is that in California, or perhaps some other state in America, they are using a seaweed that has been adapted and the government has given the go-ahead, which has reduced methane. Going back 100, 80, 50 or 30 years, what were the world's herds like? How were they compared to now? Are they stable or are they now less than they were before? What is it like in that way?

We have seen spikes at times when gas wells and that were not being kept. Are there methane spikes associated with other things while the farmer gets the bashing the whole time? What would the percentage of that be? Dumps are another example. I worked in a dump myself. They were redoing it down in Clare and there is a flame burning there all the time because of where there was dumping done for years. What are the percentages? We keep looking at where agriculture is, but no one seems to be looking at where dumps are put or where gas wells are. In some countries, things were not done too well. Could both our witnesses give us a briefing on this?

Professor Myles Allen: I thank the committee for bringing me in. I prepared a short briefing note on technical matters, which I hope was made available to members. I am happy to share it with anybody who does not have a copy of it.

I am here to brief on, specifically, the matter of measurement of methane and its impact on global temperature. On the broader policy questions the Deputy raised, given my citizenship and accent, I do not think I am qualified to speak to them.

However, what I can do as a climate physicist sitting outside of this discussion is tell him a little about how I feel there is a lot of unnecessary animosity in this. He mentioned the 3%

per decade. If you are reducing methane emissions from whatever source by 3% per decade - which as Dr. Mitloehner mentioned, is entirely achievable and, in fact, you can probably do much better than that – those methane emissions then are not contributing to any additional global warming. I choose my words carefully here because they will have, in building up the herd back in the day, contributed to global warming. It is important to acknowledge that in any discussion about sectoral responsibilities. When the Deputy is talking about agriculture's responsibilities, by all means he can talk about what Irish agriculture may have contributed to global warming in the past.

However, all I advocate – this is just speaking as a scientist – is can we please measure the impact of everything we discuss on global temperature? It is a source of some embarrassment that you have a method of characterising environmental impact of greenhouse gases that does not actually reflect the impact on global temperature. The Deputy is looking me like, "So what have you been doing for the past 30 years?" He has a point. He should be looking at me like that. To be fair, we know how to do it right. There are relatively simple ways of calculating the impact of emissions on global temperature and they were all well documented in the recent IPCC report. It is universally agreed among the scientists who work in this sector that that is what we should document. Unfortunately, in the formal reporting requirements that we place on farmers and countries reporting to United Nations Framework Convention on Climate Change, UNFCCC, we are still using this old and, frankly, not fit for purpose metric of CO2 equivalent emissions, which does not reflect the impact of methane emissions on global temperature.

If there is one thing I ask members to take away from this meeting, it is to let Ireland be a policy pioneer in reporting the warming impact of policy on global temperatures. In the briefing note I provided, I included a graph to illustrate the difference it makes. The blue line on that graph represents the actual impact. One can calculate the impact of Ireland's methane emissions on global temperature under a scenario in which, hypothetically, there is a reduction of 51% by 2030 and net zero in 2050. I am not suggesting that is a policy scenario; it is just to illustrate the way these gases behave. The dotted line represents the CO2 equivalent metric, which is the sort of standard carbon footprint that we report and everybody uses, in the context of what those methane emissions are doing. Members will notice that it underestimates the warming caused by Ireland's methane emissions to date. It is not saying not to worry about methane at all but, as soon as methane emissions start to decline, the actual impact on global temperatures follows them down, whereas the carbon footprint calculation suggests that their warming impact carries on up. It even gets the sign wrong when one moves into a situation of declining methane emissions. We are using a tool that does not reflect the impact of emissions on global temperature. I am not suggesting that Ireland abandon that tool. It is embedded in international policy, and I am sure Ireland will carry on using it because everybody else uses it too. What I am suggesting, however, is that reporting requirements be added in. That could even be at farm level. Mr. Hourigan could work out with a pocket calculator his impact on global temperatures. Those reporting requirements would assist in targeting policies to maximise the reduction in global temperature. That is what we are trying to do. We are trying to stop global warming. That is what we should focus policy on.

My response to the Deputy's many questions is to document and report the impact of policies and emissions on global temperatures. That would be a very easy innovation to do and it is something the Climate Change Advisory Council can already do. If that was introduced into the conversation, it would do a great deal to defuse the tension between the farming community and the Government on this issue.

Dr. Frank Mitloehner: I agree with everything Professor Allen just said. I recommend using a matrix that is fit for purpose. It is critical to describe the impact of a sector on warming because this is what it is all about. It is not about carbon equivalent emissions; it is about the impact the sector has on warming. We want to stop additional warming and, therefore, need to find tools to get us there.

The Deputy asked what herd sizes have done in the United States over time. There have been significant changes. Back in the 1950s, we had our peak in beef and dairy populations, with 25 million dairy cows in the country. Today, we have 9 million dairy cows. With that much smaller herd, we are producing 60% more milk. The carbon footprint of the dairy sector has shrunk by two thirds in that period. A drastic improvement in performance has led to a drastic reduction in the warming impact of the sector. I stated earlier that the most recent changes in California have been amazing. In the past five years, the California dairy sector has reduced its methane emissions by 30%. That is all metered and validated by the various agencies in the state. It was made possible by the state incentivising rather than penalising methane reductions, working hand in hand with farmers and generating a market approach to financially incentivise reductions in methane. That is a strategy that works. I have compared it with strategies throughout the world - in New Zealand, European countries and so on - but I have yet to find a strategy that has worked better than the one here in California.

The Deputy asked whether there have been spikes in methane emissions. Up until 2006, there was a plateauing of methane in the United States. This went on for some time. In 2006, there was a sudden uptick in methane. We wondered how that could be. We looked at all the different sources of methane, including livestock, rice paddies, fossil fuel and everything else. The cattle herd had not changed. The livestock sector did not suddenly emit far more than it did prior to 2006. We found that it was the onset of fracking - the extraction of fossil fuels using the fracking method - in 2006 that was largely responsible for the spikes that followed.

Deputy Michael Fitzmaurice: I also asked about the use of seaweed in one of the states.

Dr. Frank Mitloehner: Apologies. We have done research on approximately 30 different feed additives, of which red seaweed is one. It is not a seaweed that is found on the Irish coast; it is a subtropical seaweed from the Australian coast. It contains an active ingredient named bromoform that strongly reduces enteric methane. It is not the only feed additive that works along those lines of disrupting the enzymatic production of methane in the rumen but it is one of them. We are working diligently to find out what kind of active ingredients in what kind of feed additive can have similar effects. It has been shown in dozens of publications that seaweed or 3-NOP can reduce enteric methane, which is the main methane source of Irish agriculture, by between 20% and more than 60%. If one goes too high with the reductions, that might affect performance. However, sizeable reductions can be attained. The question is how to introduce a feed additive into a herd that is largely pasture-based. Ireland has many first-class scientists and that should not be too difficult a question for them to investigate.

Deputy Michael Fitzmaurice: The cattle all drink water.

Deputy Brian Leddin: I thank our guests for attending. I particularly welcome Mr. Hourigan, who is from Limerick. It is a wonder that either of us made it to the meeting, given the celebrations in recent days with Limerick winning the All-Ireland hurling final. It is good to be here and to have our guests here.

I am hearing divergence between the three guests who have contributed on the issue of the

natural process, methane cycle or carbon cycle. Mr. Hourigan stated that it is inherently net zero because methane that is produced by ruminant livestock ultimately gets broken down into CO2 in the atmosphere and that CO2 is then absorbed by the grass growth which is then consumed by the livestock. I do not think that is what Professor Allen is saying. I am interested to hear his comments on this. As I understand what he said, there has been an effect of increased methane in the building up of the herd in recent decades in the context of global warming. There seems to be divergence in that regard, and that methane matters. We know methane is the same molecule whether it comes from an animal, is leaked from a fracking well in the United States or whatever. It is the same molecule, but the argument is that the methane that comes from agriculture is part of this natural process and, ultimately, should be accounted for separately.

Mr. John Hourigan: There is no divergence. CO2 taken in by an animal and released again through the natural cycle is net zero in absolute terms. When you start looking at the methane in its global warming impact and multiplying by 28 to reflect what is happening, that is where Professor Allen comes in. However, on very basic science, it is net zero. I contend that methane from ruminants is very different to that from mining, fracking or whatever. Methane from fracking comes up out of the ground, it has been there for a million years, it converts back to CO2 after 12 years and stays in the atmosphere forever. Before a cow releases a tonne of methane, she has to take in 2.7 tonnes of CO2 from the atmosphere. It goes from the atmosphere into the cow, it is released again and, after 12 years, it goes back to where it came from. It is a cycle. It is quite unlike methane from mining. Do the maths on it for a 100-year period. We have 34.5 billion tonnes of CO2 emitted every year through fossil fuels. Over 100 years, that is 3 trillion tonnes. Mining produces roughly the same amount of methane as animals, which is approximately 100 million tonnes per annum. It goes up into the atmosphere and after 12 years it converts back to CO2. One hundred million tonnes of methane converts to 2.7 billion tonnes of CO2 when you multiply by 2.7. Over 100 years, mining produces 27 billion tonnes of extra CO2 into the atmosphere. For the global herd of cows to produce 100 million tonnes of methane, they would first have to take out 270 million tonnes of CO2. After 12 years, that returns to the atmosphere. After 100 years, leaving aside the global warming potential, GWP, effect of both for now, the methane for those cattle has not added a single tonne of CO2 or methane to the atmosphere. It is part of a cycle. After 100 years, methane from mining has really added to what is left in the atmosphere. The difference could not be more stark.

Professor Myles Allen: I will speak directly on that point. Our long-term legacy on geological timescales is undoubtedly our fossil CO2. In that respect, biological cycles are not affecting the release of fossil CO2 whereas methane from mining is. On multi-century timescales, it is the fossil carbon that matters. That is why I said in my little briefing note that I know that we are talking about methane. I get that we have to stay on topic this afternoon, but I know that the committee is going on to talk about sectoral budgets so please do not forget about fossil CO2 because that is what our great grandchildren will actually care about.

We are focused on methane here. There is no question that increasing a herd size has a warming impact on the planet because it increases the amount of methane in the atmosphere. It stirs up the methane cycle. It may be a natural cycle but if you increase the number of cattle, you are revving it up and increasing the amount of methane in the air at any one time. All I have been arguing for is that it should be reflected in the accounting of the impact of these different gases on global temperatures.

On Dr. Mitloehner's point on fracking, it is important to get this right and dangerous to get wrong. In my briefing note, I quoted a sentence from the recent Intergovernmental Panel on

Climate Change report, which states, "Expressing methane emissions as CO2-equivalent using GWP100 (the standard method) overstates the effect of constant methane emissions on global temperature by a factor of 3 to 4, while understating the effect of any new methane emission source by a factor of 4 to 5". This means that those frackers got away with the impact of their activities on global temperature in the past 20 years being understated by our conventional accounting systems by a factor of four to five, while at the same time we have an accounting system that overstates the impact of a herd that has been around for more than 20 years by a factor of three to four. We do not need to have this problem. We can do this right. We do not need to misrepresent the impact of these gases on global temperature. All I am calling for is that we get it right. Methane is important. That is why it is so important to get its impact on global temperature right in formulating policy.

Deputy Brian Leddin: I thank Professor Allen. I understand that. He has clarified things for me. It is really important that we do not walk out of this room and say that methane from ruminant livestock is effectively benign because it is part of this natural cycle. The inference from that would be that we could increase numbers by ten or 100 times and it would not matter. Professor Allen is not saying that but the inference could be that it is part of this natural cycle. He is very clearly saying that methane does have an impact and he was very clear about the increase in herd size. He said it has had a warming impact.

Professor Myles Allen: Past increases in herd size have had a warming impact and future, hypothetical increases in herd size would have a very significant warming impact. I might point out that some of Ireland's trading partners are planning to increase their herds substantially over the next 30 years. This is one reason why Ireland could have a profound geopolitical impact by starting to report warming impact of emissions in its contributions to the UNFCCC system because we absolutely must discourage countries or at least make it clear to them what they are doing if they increase their herds. They are creating huge amounts of unacknowledged warming.

Deputy Brian Leddin: Would Professor Allen agree that if methane has had this warming impact and if future methane increases would have a greater warming impact, it is also true that reducing methane would have a cooling impact?

Professor Myles Allen: Yes. I would characterise it that it would have the same impact on global temperature as taking CO2 out of the atmosphere. If you reduce a herd it has the same impact on global temperature as planting a lot of trees, actively taking CO2 out of the atmosphere. That is why I say that I do not understand why there needs to be a fight over this because actually, that is a good thing. It is simply not acknowledged in the way that we characterise methane's impact at the moment. If it were acknowledged it might go quite a long way to diffuse farmers' concerns. I can understand that farmers are concerned if they are being asked to reduce global temperatures without that service being acknowledged, whereas if you calculated the impact of interventions on global temperatures, it would be acknowledged. That does not dictate policy, I should stress, it just acknowledges the outcome of policy.

Dr. Frank Mitloehner: There is some confusion over whether methane matters once it is biogenic versus fossil. It is important to mention that if you have a constant source of methane, say, a constant cow herd, then an almost equal amount of methane produced is also destroyed by a process called hydroxyl oxidation not leading to additional warming. A constant source of methane or a near-constant source of methane does not add significant additional warming. If you grow herd sizes, for example, you increase methane. That will increase warming, and significantly so. However, if you manage to reduce methane, which is what we just did here in

the State of California, by 10% to 30%, say, then that reduction of methane leads to a reduction in warming. This is really important to mention. If they view methane not as a challenge but as an opportunity, our farmers could become part of a climate solution. It is really important to tell farmers that methane is only a problem if we ignore it and do not manage it. If we do manage it, we can be part of a solution.

Deputy Matt Carthy: I thank all our guests for being here. As I am sure they are aware, these areas can be incredibly complex. They become more complex when we get evidence that suggests that the accounting and calculation model we are basing all of these conversations on may actually be flawed. I have a question for Professor Allen with regard to the different types of methane. As I understand from the evidence we have received, there is biogenic methane, which is emitted from cattle and has been a focal point of conversation in Ireland, and there is non-biogenic methane that basically comes from mining. Is that correct? Could Professor Allen differentiate between the two in terms of how they are currently calculated and how he sees that they should be calculated?

Professor Myles Allen: They are treated pretty much identically at present. I do not want to spend a long time on this because I do not think it is particularly pertinent to the Irish situation. In 1,000 years' time, it will be the methane released from mining that we will care about. It will not be methane any more. It will be carbon dioxide because it will have oxidised in the atmosphere. It is the carbon dioxide that is our long-term multi-century legacy.

Deputy Matt Carthy: I will stop Professor Allen there on the basis of time. He has spoken about the need to achieve geological net zero. I do not know if this is his area of expertise but I wonder if he could speak to what those mining operations that are emitting this methane are actually used for? In many instances we would not have products like this smartphone and other technologies were it not for those activities. Is that correct? The essential question is if, at a global level, Professor Allen sees a route to achieving that geological net zero.

Professor Myles Allen: The word "net" is important there. The companies that are taking fossil carbon out of the ground need to be made responsible for putting it back. They are more than capable of doing so already. I would love to have that conversation but it is not relevant to methane. It is relevant to the sectoral targets and the conversations the members are about to have.

Deputy Matt Carthy: I think it is because part of the problem we have had in this country is that when it comes to imposing taxes on ordinary consumers or penalising ordinary workers or farmers there is no problem and we can move at the speed of light. When it comes to actually addressing data centres, private jet travel or areas that are actually the real causes of pollution it is very much a case of see no evil, hear no evil.

Mr. Hourigan may wish to respond to my next set of questions. Do the witnesses believe we have an inbuilt deficiency in how we have been approaching our climate action obligations by not assessing on a farm-by-farm basis or having any method or plan to assess the sequestration or storage and emissions that are taking place on each farm so we can reward good practices and address bad practices without having these crazy conversations about linear cuts or whatever the case may be?

Mr. John Hourigan: Absolutely. How I ended up here is that I got my Bord Bia carbon footprint, which indicated I was emitting 714 tonnes of carbon dioxide. I talked to a professor in the University of Limerick who told me my forestry was removing about 400 tonnes and my

grass was removing around another 300 or 400 tonnes, so I was net neutral. Is that not what we all want to be? If more farmers were net neutral, we would not have a problem but we are not allowed to account for what we are removing. Down the line, if we are not allowed account for the removals by our forestry and grassland, it is a pointless discussion. We are going nowhere.

Ms Nadaline Webster: To speak to that, from a strategic point of view, I want to lay out very clearly in layman's terms what is being offered to farmers at the moment. We have initial estimates included in our opening statement that the Intergovernmental Panel on Climate Change, IPCC, says are plus or minus anywhere between 20% and 50%. Our current statement on emissions may well be 50% out. It may be 50% above that. Our research from VistaMilk SFI suggests that methane from dairy cows was overestimated by 18%. When we bring in reductions in methane, to which target are we expected to apply them? Should it be the target that was set in 2018 that may or may not be accurate or a new target that is going to be reassessed now? The same uncertainty factors apply to ongoing estimates of what we are producing. There is a tier 1, 2 and 3 system provided by the IPCC to measure methane emissions. Then we have sectoral divisions which set all of the removals in an industry separate from agriculture and all of the emissions in agriculture. That is contributing in no small part to the reputational crisis the industry is in.

To put it in businesslike terms, I ask members to imagine if a company asked to hire me to make a 30% reduction in its expenditure and an unspecified increase in revenue. I ask what the current expenditure is and the company says it is €22 million. I would say "Wow, that is big" and ask to see the accounts. The company says "No" and that the figure is an estimate. It has some figures but they show what companies like this one emit. It says the figure could be out by between 20% and 50%. I ask how it will measure the reductions I make and the company says it will apply the same estimates. What credit will I get for increasing revenue? Will that be offset against any issues we experience in reductions in expenditure? The company tells me I will be doing it but the increase is actually going to be credited to a different department. I ask if there are penalties for failure to meet these targets. The company says there probably are but it cannot tell me what they are. I ask for a detailed strategy document that makes recommendations for actions and projects likely outcomes from the decisions we make. The company says it does not have one. Am I going to sign that contract?

The Government needs to understand that is what it is asking from farmers right now. There are massive uncertainties. We are here having a conversation on a scientific basis, which I do my best to keep up with, but I think we can all admit that on a national basis, we do not necessarily understand the fine detail of the science; we understand the broad strokes. The agricultural sector is different from other sectors in the sense that what we are applying is a lot more complex. The science in respect of it is still evolving. The measurements are still evolving. I have yet to see a comprehensive roadmap towards how we are going to make this happen without the rural economy falling apart. That is really difficult. From a business perspective, I would say we do not have the tools we need to successfully complete this project. We are making decisions right now on foot of acknowledged incorrect data. If any company came to me with that proposal, I would say I am really sorry but I cannot help.

Deputy Matt Carthy: Will Professor Allen comment on the farm-by-farm assessment and whether we should have a route enabled for that? Ms Webster talked about a number of figures being out. She made reference to dairy emissions being overestimated by 18%. Does Professor Allen share the view that the figures we are working on could be as inaccurate as that?

Professor Myles Allen: More accurate measurement can be addressed and there is a lot of

work going on in Ireland to improve the accuracy of these estimates, which is commendable. Progress can be made there. There is an inaccuracy, one that is completely avoidable, which is reporting stuff in a way that does not reflect impact on global temperature. That is what I have been focusing on. It is this completely avoidable error that results from reporting methane as if it is carbon dioxide equivalent. That is something we can fix.

Dealing with the uncertainties Ms Webster has just spoken about will take time and a lot of effort in terms of pinning down these sources and sinks better. We could fix the problem of not reporting the warming impact tomorrow. It requires exactly the same inputs to calculate the warming impact of Mr. Hourigan's farm as are required to calculate the nominal carbon footprint. Therefore, it is possible to calculate on a farm-by-farm level the impact on global temperature. If that were to be done, it would be interesting for Ireland's farmers. They would discover the things they could do to help reduce global temperatures. If they were planning on doing something like massive herd expansion, they would realise that would have an extremely negative impact on global temperatures and they might be discouraged from doing it. It would be an enlightening exercise for everybody.

As I keep emphasising, this issue with reporting is not a problem we need to have. It is straightforward to calculate the warming impact from exactly the same inputs we use already to calculate carbon footprint.

Ms Nadaline Webster: I should clarify that my comments related to the current proposed system and not to the system Professor Allen has put forward.

Deputy Matt Carthy: I get that. I have a brief question for Professor Allen. Am I correct in saying that for his system of accounting to be taken on board, we would need to get international agreement, which would essentially mean a new Paris accord?

Professor Myles Allen: Not at all.

Deputy Matt Carthy: Okay.

Professor Myles Allen: In the Paris Agreement, the so-called Paris rulebook, parties are encouraged to report "the information [needed] for clarity, transparency and understanding" with their reports to the UNFCCC. In its reporting to the UNFCCC in the context of its national inventory and its forward scenarios, Ireland could report its impact on global temperature. What information could possibly be more relevant to transparency, clarity and understanding than Ireland's actual impact on global temperature? Thereby, Ireland could set an example to the world. Indeed, if Ireland's competitors are increasing their herds and having a highly negative impact on global temperature, then the conversation could be started with them on why they were not reporting their impact on global temperature. After all, we have a collective temperature goal and perhaps countries should report what they are doing to global temperature.

Deputy Matt Carthy: Does Professor Allen not see a potential issue arising if different states are reporting their emissions in different ways?

Professor Myles Allen: I am absolutely not advocating that reporting not be done following the standard rules. I am simply saying that this is about additional information that can be reported along with Ireland's reports to the UNFCCC. In fact, that body encourages countries to report additional information which is relevant. I should have made it clear throughout that I am not advocating throwing out the old system. I appreciate a lot is built on it and so on. I am just saying let us augment it with this simple extra information about what we are doing to

global temperature.

Chairman: I have three more members who wish to put questions and we are running over time. I will confine these speakers to five minutes each. I call Senator Paul Daly.

Senator Paul Daly: I have some questions based on what has come before. I only find one thing more confusing than scientists talking about science and that is lawyers talking about law. In that comparative context, I am coming at this matter purely from the perspective of someone who is a farmer and who represents farmers. It is the livelihoods of farmers that we are talking about, ultimately, regardless of the language we are using. What needs to be done here is to get to a solution that can maintain the livelihoods of farmers while addressing this issue. I am not a denier of climate change. We must get to the bottom of this issue in layman's terms for those out there who are watching with bated breath because this topic concerns their livelihoods. This is what we are, ultimately, talking about.

I will ask my questions and then the witnesses can answer. Time is limited. I will start with Dr. Mitloehner. Based on his experience of what he has seen in Ireland, how comparable is our situation with what has been done in California? Is it comparable? Would that approach be workable here? Are some of those solutions perhaps dependent on geography or based on the local climate? If he was starting with a blank page in Ireland as opposed to where he is, what would he recommend and how would he see this process working? I ask this because the reductions he spoke about are massive and this is the way to go. In his answer, he might again refer to some more of the emerging technologies that may not have hit these shores yet, that might become available to us or that might even turn out to be more advantageous in an Irish context than where Dr. Mitloehner is based and in other parts of the world.

I ask all the witnesses to comment on something I read some time ago. It was a statement by Professor Alice Stanton. We are talking here about the knee-jerk reaction and the narrative is herd reduction. We are talking about reducing meat and dairy production. We are all aware of the extraordinary health benefits of those products. I refer to protein, iron, zinc and the B vitamins, especially B12. Professor Stanton said that if we were to sit down and do an analysis of the substitutes and alternatives being proposed for these high-quality food products, it would be found that the carbon footprint for the nutrient-equivalent amount of food would be higher. Has anybody done this research? Based on that perspective, will we be explaining to our children, grandchildren and future generations who look back to where we are now and are wondering about the fact that while we were in an alarming situation and did our best possible to address it, that we did everything wrong and left those future generations in a worse situation through diet, health and the lack of the desired impact when it came to global warming? Based on what I heard this morning about the natural cycle, as it was explained and as best I could comprehend it, is there potential to do, or has anybody already undertaken, a mathematical or scientific experiment concerning global warming and temperature control and what would be the carbon footprint of the alternatives if we were to go with the knee-jerk reaction of reducing the herd?

Dr. Frank Mitloehner: We have done research at the University of California, Davis, comparing animal-sourced foods with plant-based alternatives. It is a very complex issue. For the most part, plant-based alternatives have a relatively lower carbon footprint simply because there is an addition at appropriate levels to animal-sourced foods. There is not much discussion about that. There are other environmental impact categories, however, where the plant-based alternatives are performing lower. Energy consumption, for example, is, in many cases, higher. Nutrient equivalency is not the same. Even though some of the plant-based alternatives might have the same percentage of protein, most animal-sourced foods come with a package of mul-

tiple essential nutrients. The Senator mentioned some of them, including iron, selenium and vitamin B12. Many of those are very digestible and valuable to human nutrition. There has been a lot of exaggeration in respect of advertising for those plant-based alternatives. There is room for them but it remains relatively small. I do not think there is any major change in nutrition percentages in animal-based versus plant-based foods.

With respect to the Senator's question on mitigation approaches for Ireland, as I mentioned in my written comments and in what I read to the committee, where Ireland is so different is that the country largely has a pastoral animal agricultural sector. Many other developed countries do not. In California, we have little in the way of pastoral systems. Most animals are in free stall barns and other barns. The manure goes into collection areas. Ireland, by and large, has manure that is deposited on the land and on pasture. It is incorporated into the soil. Manure is not stored as much here and it is not being managed as much. The main emission source from Irish animal agriculture is enteric methane, that is, the methane belched out. Ireland is in a lucky situation compared with the United States, where we are not allowed to self-feed additives that lay claim to reducing methane, because Irish farmers can. Ireland has several tools at its disposal that have been shown in peer-reviewed, published research to reduce enteric methane. The question Irish researchers have to figure out is how to get these additives into animals that are normally grazing. For example, a dairy cow that is milked every day could be fed an additive in addition to the concentrate she consumes while being milked. There are other approaches. Reductions in enteric emissions would be very important in the Irish context because they constitute the majority of the carbon footprint of the Irish herd. Ireland has an advantage and will reach its goals faster than we have been doing this year because its focus should be on enteric.

Chairman: Deputy Browne is due to be next but he does not seem to be available. Deputy Nolan may go ahead.

Deputy Carol Nolan: I thank the Chairman. As a rural Teachta Dála from the constituency of Laois-Offaly, I, like many rural Teachtaí Dála, am very concerned about the impact of what is coming down the tracks and what is being imposed on us. The economic impact report commissioned by the *Irish Farmer's Journal* and done by KPMG showed us clearly what lies ahead, which is the destruction of Irish farming and the family farm if a blunt instrument like what is being proposed is used.

My question relates to the fact that all the good work being done on sequestration of carbon is not being accounted for. We have grassland, hedgerows and forestry. Would it not make sense to get farmers more involved in afforestation? Would it not tick that box? Dr. Mitloehner mentioned the fact we do not know how much carbon sequestration is being done by beef farmers. Does he feel an assessment needs to be carried out on the positive work that is being done here by beef farmers in sequestering carbon before a blunt instrument or a calculation is decided? Any pragmatic and logical person would say we should do the assessment first, rather than plunging a whole sector into chaos.

Mr. John Hourigan: Could I make a comment on that?

Chairman: All right but we will let Deputy Nolan finish first.

Deputy Carol Nolan: I would like opinions from the witnesses on that.

Moving to my next question, the global population is set to treble and we have a war in

Ukraine and we all know we cannot get certain food products because of it. Why is there not a special case being made for agriculture in the EU in light of the fact there are issues around food security and farming organisations such as the IFA have said any unfair calculation will threaten food security? Why is there not common sense here, and some logic? I would like Mr. Hourigan's thoughts on that. Does he feel our MEPs need to fight to make a special case for agriculture and for it to be done across Europe?

Mr. John Hourigan: Yes. The special case is one thing but the facts are so important here. The removals by Irish forestry are huge. A paper was produced last week by Gary Lanigan of Teagasc. In the inventory you will find they say Irish mineral soils remove 2.3 million tonnes per year. Gary Lanigan's research has shown that is an underestimation by approximately seven times. Irish mineral soils, according to him, are approximately 15 million tonnes per year. The inventory says 2.3 million. He also mentioned the research on peatlands, which is not completed yet, but he thinks they are overestimated by a factor of at least 2. They have 8.5 million tonnes in for emissions by peatlands. It is probably nearer to 4 million but there are no accurate figures on that. The figures by Gary Lanigan are out, they are current, they are correct and they are massive. That is 1.4 to 1.5 tonnes per acre per annum being removed by Irish grassland farmers. According to the research in places like Florida and Georgia, they are dealing with very depleted soils but they are doing 3.6 tonnes per acre per annum and their method of combating climate change is intensive, grass-based dairy. That is extraordinary. They say the way to take carbon out of the air is to convert the arable land to grass and put intensive grazing animals on it and that is what we are doing.

Deputy Carol Nolan: All right.

Mr. John Hourigan: I think we are in a win-win situation.

Ms Nadaline Webster: Chairman, could I add something?

Chairman: I ask Professor Allen to answer the questions Deputy Nolan put there.

Professor Myles Allen: I would be happy to. On the Deputy's first point about rural constituencies, I want to remind her of Dr. Mitloehner's point about how we do not need farmers to feel threatened by this. In fact, it could easily be seen as an opportunity for farming. We are sort of saddled with this misperception of conflict because of the incorrect way in which we measure the impact of farming on climate. Notwithstanding all the other accounting and measurement issues that have been raised, this is a problem we do not need to have. If we actually measure the impact of the farmers in the Deputy's constituency on climate, on global temperature, rather than on this carbon footprint, farmers would be reassured by the results. That would be a very useful thing for Ireland to do and indeed to show to the rest of the European Union as a way forward. There may be other farming communities in the EU that have not got their minds around this issue as much as the Irish. I dare speculate here but maybe Irish farmers are a bit ahead of some of the other countries in the EU in thinking about this issue, so Ireland could do a favour to its European partners by pointing out that just with this simple, additional piece of information, that is, impact on global temperature, you can do a great deal to diffuse the animosity in this whole discussion.

Chairman: I leave the last comment to Dr. Mitloehner.

Dr. Frank Mitloehner: I completely agree. When it comes to methane, there are of course sources we are all aware of, such as cattle's enteric emissions, their manure and other issues.

They are sources but they are also sinks. Having been to Ireland twice over the past few years and having talked about these topics several times, I emphasise it is important for a country like Ireland that is largely pasture-based to know under what conditions throughout its geography lands can trap and capture carbon and to what extent. At some point carbon is plateauing, carbon capture is plateauing and no longer increasing. There are some lands that capture more than others but it is very important that Ireland assesses not just the sources but also the sinks and how it can amplify the importance of its sinks and how it can increase soil carbon sequestration, for example, through improved pasture management, grazing management and so on. That is very important. I emphasised the need for that two years ago when I visited and again two weeks ago, or whenever it was.

Deputy Carol Nolan: May I make a concluding comment?

Chairman: Okay.

Deputy Carol Nolan: I thank all our witnesses for their comments. There certainly is a problem. In the current debate farmers are being demonised and scapegoated, unfortunately. There needs to be a change in mindset because they are playing their role, believe it or not, in protecting our environment but that is not recognised.

Chairman: With respect, Deputy, we have brought in these men today - and ladies, I am sorry - to give information on the subject.

Deputy Carol Nolan: It was just to take up on the point of the misperception.

Chairman: Yes, but we brought in these witnesses to answer questions-----

Deputy Carol Nolan: I understand.

Chairman: -----on the calculations of methane.

Deputy Carol Nolan: I understand. I have the briefing in front of me and I spoke on the calculations.

Chairman: Yes.

Deputy Carol Nolan: I spoke on that specifically.

Chairman: The point-----

Deputy Carol Nolan: I just want to end on that point. That is a point we are all trying to get across as rural Teachtaí Dála. I did speak to the briefing note, very much so-----

Chairman: Yes, I accept that.

Deputy Carol Nolan: -----and I would like to thank all our guests for their time.

Chairman: Okay. I thank the Deputy.

Deputy Michael Fitzmaurice: I ask the two scientists to give me one indication. Let us say Ireland has 7 or 8 million cattle. If we in Ireland were to reduce methane by 20% what would it do to world temperatures? Would it do anything?

Professor Myles Allen: Should I speak to that?

Deputy Michael Fitzmaurice: Yes, both of ye.

Professor Myles Allen: If that number is expressed, accounting for the size of the world population that is Ireland's, then it would look very substantial. It is very easy for a small country to say, "Oh, we are just a small country so we are not making that much difference." We get the same in the UK. Despite the fact that historically we are very large emitters we love pointing out that we are only-----

Deputy Michael Fitzmaurice: Temperature-wise I am talking about.

Professor Myles Allen: I could calculate it for the Deputy but the point is that for the general discussion one has to think about what would happen if the world did what we are doing. If the world was to reduce methane emissions by 20% it would have a substantial impact. This is why I believe that Ireland could play an outsized role by showing the world how to do it, how to measure it and how to document its success in affecting global temperatures by showing the world how to capture the warming impact of its actions on global temperature.

Deputy Michael Fitzmaurice: Does Professor Allen agree that it can be done the way it is being done in America by new technologies, as Dr. Mitloehner referred to? Is that possible?

Professor Myles Allen: Yes, it is clearly possible, as they have demonstrated. I appreciate that we are out of time but I wish to emphasise again that the debate on methane globally has to be kept in perspective. Even if we were to eliminate methane emissions from the entire ruminant herd worldwide we would shave a few hundredths of a degree off global temperatures.

Deputy Michael Fitzmaurice: I rest my case.

Professor Myles Allen: That is the global number. That is a few years of fossil-fuelled warming.

Deputy Michael Fitzmaurice: I rest my case.

Professor Myles Allen: The elephant in the corner is the increase in global temperatures due to the rates of CO2 from fossil fuels. I know this is not on topic in this session but I hope the committee will be thinking about it in the next session.

Chairman: We must close that now as there are other witnesses joining us remotely who have been waiting in the lobby for the past 20 minutes.

Deputy Martin Browne: I have a couple of questions.

Chairman: I had tried to get the Deputy in earlier. He can ask one question.

Deputy Martin Browne: I have a couple of questions, the first being for Mr. Hourigan with regard to agriculture's contribution to sequestration not being properly recognised. Will he elaborate on this? What needs to be done to address this?

Mr. John Hourigan: What needs to be done is that we are allowed a net carbon footprint and if we have forestry and grassland, that the removals are accounted for so we can have a net carbon footprint. If every farmer in Ireland was net carbon neutral then we would have no problem and there would be no forestry planted until such time as that situation arises when we are allowed to account for them.

Deputy Martin Browne: I have two quick questions for Dr. Mitloehner. There seems to

be two schools of thought on how demands for methane reductions are presented and used to reduce the temperature. For policymakers this poses the distinct question about what approach would be more effective for the end target of reducing the level of greenhouse gasses in the atmosphere. It will also pit different sectors against each other. Are these different views contributing to the confusion and the ultimate resistance to both approaches?

Chairman: Did Dr. Mitloehner catch that?

Dr. Frank Mitloehner: No I did not, I am sorry.

Deputy Martin Browne: There are two schools of thought on how the demands for methane reductions are presented and used to reduce the temperature rise. For policymakers this poses the question about what approach to take and which approach is more effective. It is pitting one sector against another sector. Are these different views contributing to the confusion and ultimately the resistance to both approaches?

Dr. Frank Mitloehner: We have observed here less of a fight of one sector against another. I am actually proud of the protocol that farming has taken, which is where the government has said this is not us using the cane approach of using rules, regulations and fines or taxation to get farmers to reduce emissions. Instead, the state said: "We value our farmers, we want to help them to reduce their carbon footprint, and we do it jointly." They have financially incentivised the reduction of methane. That was an approach that worked. That approach worked because now we have a carbon market that can be accessed by farmers that enumerates and pays them for reducing methane. Our farmers are flocking into ways to reduce methane, not just to be greener and not because it is better for the environment but also to have an additional income stream. To me, that is an approach that works. I have seen other places in the world where taxation was used or herd size reductions were used and I do not believe that these approaches work quite as well. Herd size reduction does not change the demand structure behind it. The demand is still there and will be satisfied by somebody else in the world, and this means emissions are moving from one place to another and, as I alluded to earlier, this leads to leakage that will not change our total livestock impact on climate globally.

Chairman: I thank Dr. Mitloehner.

Deputy Martin Browne: Perhaps I could ask another question.

Chairman: No. I must close the session. We are miles over time.

Deputy Martin Browne: I know you are and I appreciate that but I have just one quick one. Professor Allen has said that Ireland's Climate Change Advisory Council could calculate and publish the warming impact of different sectors of the Irish economy under different scenarios for future emissions, as does the UK's climate change committee. Has he encountered any discussion at this level on doing that into the future?

Professor Myles Allen: I fortunately had a chance to chat to Professor Peter Thorne of the Climate Change Advisory Council, and he can confirm that they absolutely can do that. It is a matter of simply raising those numbers, which they can produce into the national conversation. I must emphasise that this warming impact calculation is not complicated at all. I take the Deputy's point about not liking scientists making things complicated. He is looking here at a scientist who is desperately trying to make things simple. This one is simple. One just calculates the warming impact of activities on global temperature. A lot of the animosity should be diffused from this debate.

Chairman: I thank our witnesses for a very enlightening discussion. They have done their best to stick to the agenda we had here today with regard to the calculation of methane emissions and how we can hopefully reduce them into the future. I propose to suspend the meeting briefly to bring in the witnesses for our next session.

Sitting suspended at 1.27 p.m. and resumed at 1.30 p.m.

Sectoral Emissions Ceilings: Discussion

Chairman: The committee will now hear from the following witnesses: Professor Barry McMullin, Dublin City University, DCU, who is joined remotely by Mr. Paul Price, research assistant, DCU; Professor Peter Thorne, Irish Climate Analysis and Research Unit group, Maynooth University; and Dr Joeri Rogelj, reader in climate science and policy, Centre for Environmental Policy, Imperial College London who joins us remotely. I invite the four witnesses to make their opening statements and to please keep them to under five minutes because members will have a lot of questions.

First, I invite Professor McMullin to make his opening statement.

Professor Barry McMullin: I thank the Chairman for the opportunity to provide evidence on the issues arising from the role of methane in climate policy design. I am a professor in the faculty of engineering and computing, DCU and research climate mitigation policy. I am accompanied remotely at today's session by my colleague, Mr. Paul Price, who currently holds a research fellowship at DCU that was awarded by the Climate Change Advisory Council of Ireland.

We are here as independent academic researchers and do not speak on behalf of either DCU or the Climate Change Advisory Council. In the interest of time, I will shorten my remarks a little but my full statement is available to the committee.

We see the following points as key to ongoing assessment of the role of methane emissions in Irish climate policy. Ireland is a voluntary party to the Paris Agreement. This specifically includes the commitment to quantitative limits on global temperature rise. In Ireland's case, this has been transposed into domestic legislation through the Climate Action and Low Carbon Development (Amendment) Act 2021. The Act established a statutory national "carbon budget" framework and requires this to be implemented in a manner consistent with Ireland's equitable obligations under the Paris Agreement.

First and foremost, Ireland's carbon budgets must be designed and assessed by whether they represent an equitable contribution to meeting the Paris temperature rise goals. In the light of the rapidly destabilising global climate conditions, of which we are all aware, and the recent Intergovernmental Panel on Climate Change, IPCC, Special Report on Global Warming of 1.5°C, this is now understood to mean limiting global temperature rise to 1.5°C over pre-industrial levels with absolutely minimal overshoot of that level in either the amount of temperature rise or the duration of the overshoot.

The global scenarios assessed in the most recent IPCC assessment report 6 are unequivocal that meeting this temperature rise commitment requires rapid and deep cuts in the global emissions of all three of the most significant greenhouse gases that arise from human activities, which are CO2, nitrous oxide and methane.

As members will have heard in the earlier session, there are technical and scientific issues that arise in assessing the temperature impacts from these different gases, particularly when they are combined into a single aggregate carbon budget for policy purposes, as under the Irish Act. The de facto approach to this uses a method referred to as the global warming potential over 100 years, or GWP100. The first Irish carbon budget programme has been expressed with this de facto method. However, it is widely recognised and well understood that this particular method, if used in isolation, may give a poor representation of the trade-offs in warming impact that are associated with the physical characteristics of the different gases. Of the three main greenhouse gases, this particularly affects methane. Indeed, this appears to be recognised in the Act, which requires appropriate consideration of the "distinctive" characteristics of methane. Unfortunately, the text of the Act qualified this further by referring to "biogenic" methane, which serves rather to obscure than to clarify. While there is a significant distinction in the warming impact of methane versus the other gases, there is only a very minor and, effectively, immaterial distinction in warming impact between methane from biogenic versus non-biogenic fossil sources. That is true over the period of decades, say, 50 years ahead, that we are most acutely concerned with because that is when we have to limit and peak global temperature rise. This has led to some unnecessary confusion in the interpretation of the Act's provisions.

Nonetheless, it is very important to state that in developing the recommendations for the first carbon budget programme the Climate Change Advisory Council explicitly took account of these provisions in the Act. The council analysed the limitations of GWP100 aggregation in respect of how a mixed-gas budget relates to temperature impact. This work has been done. The council showed that with any fixed GWP100 budget the temperature impact will vary significantly depending on exactly how that budget is distributed across the different gases. It presented a number of scenarios for this distribution. The council showed that those with relatively smaller budget allocations for methane, which is deeper reductions in methane, correspond directly to lower aggregate temperature impacts.

Separate work at DCU has investigated the warming impact of a wide variety of multi-gas greenhouse gas budget scenarios. We have used the method called GWP*, which was originally developed at the University of Oxford by Professor Myles Allen, from whom the committee has heard evidence this morning. To our knowledge, this was the first application of GWP* to examine multi-gas greenhouse gas budgets at a national level. In our most recent analysis we showed that there is a clear trade-off in Irish climate policy between the degree of reduction in annual emissions of methane and a tacit commitment to future, large-scale net removals of CO2. So the more reduction we make in ongoing emissions of methane then the less commitment we are making to removing CO2 from the future and the less of an IOU that we place on our young people today to remove CO2 in the future.

Based on particular criteria for alignment with the Paris Agreement temperature goals, and physical constraints on CO2 removal in Ireland, we estimate that the annual mass emissions of methane in Ireland would need to fall by about 50% by 2050, relative to 2018 levels, on the basis of an equitable contribution to meeting the temperature goals for Ireland. The faster this reduction in methane is achieved then the lower the risk of overshoot of the Irish contribution to global temperature rise. Please note that this still requires aggregate mass emissions of CO2 and nitrous oxide to be reduced by more than 100%, so methane needs to be reduced by 50% and the aggregate of nitrous oxide and CO2 needs to be reduced by more than 100%, which is to go negative, as was emphasised by Professor Allen.

Some commentary on the distinctive characteristics of methane in general, and the GWP*

methodology in particular, has suggested that it would be sufficient for Irish climate goals if annual mass emissions of methane were initially stabilised and then declined at a very slow rate of 3% per decade or 0.3% per annum. Unfortunately, this suggestion is based on a misleading conflation of climate stabilisation with meeting the temperature rise constraint. These are complementary but quite separate goals. While stabilisation is necessary it is not sufficient in itself. We must stabilise at a temperature where meaningful and managed climate adaptation is still possible. We are seeing visibly how difficult that already is at the current level of temperature rise. This temperature limit is the overriding goal but to achieve same then it is absolutely essential that mass emissions of methane fall rapidly, and substantially, though not quite as fast or as deep as CO2 and nitrous oxide. This is true globally and especially true for Ireland because of its unusually large *per capita* emissions of methane. While improvements in methodology, metrics and calculation can help to refine the quantitative assessment of the required level of reduction, they do not alter the underlying physics.

In the specific case of Ireland, methane emissions are dominated by ruminant agriculture. The relationship with cattle numbers is complex but scales very directly with total output, which is litres of milk and kilos of beef. This has been clearly apparent during the recent rapid and policy-led expansion in dairy production. Previous evidence to this committee from Mr. Price has addressed this in more detail and will not be repeated here. We would simply emphasise that we sympathise greatly with the committee in confronting the distinctive and systemic challenges now facing this sector in Ireland. We would not seek in any way to downplay the difficulties involved. However, we emphasise that, as has been manifest in recent extreme weather events on a global basis, the physical climate system is, unfortunately, entirely indifferent to these difficulties. It will not respond to our aspirations but only to our actions and specifically to our ongoing emissions of greenhouse gases.

We look forward to addressing any questions that committee members may have.

Chairman: I thank the professor for his statement and invite Professor Thorne to make his opening statement.

Professor Peter Thorne: I will give an abridged version of my note because the committee has it and I will highlight some matters in the interests of time.

My first point is that methane is one of three well-mixed greenhouse gases that have varied naturally over millennia and longer. We can measure them for 800,000 years, over successive glacial periods when great ice caps covered North America and Eurasia and interglacial periods such as we have now. The difference in methane concentration is of the order of between 200 to 400 parts per billion.

Since 1750, methane concentrations have increased by more than 1,000 parts per billion and climbing. This is not normal. This is part of human interference in the methane cycle. We know where it comes from. We know it comes from fossil fuels, ruminants, paddy rice fields and waste. Those are the principal sources of that methane. We also know that the elevated greenhouse gas burdens, principally CO2, methane and nitrous oxide, are responsible for the approximate 1.1°C of warming we have seen to date. As members have heard, methane does differ from the other gases. It is a much shorter-lived gas. It is also a much more powerful gas. It is the difference between what is effectively a flow forcer, which is something you can turn on and off very quickly, versus a stock forcer. If you like, it is the difference between an electric heater that can be turned on at the wall and a night storage heater. We can think of methane as the electric heater that we can switch on and off very quickly and the other much

longer greenhouse gases as the night storage heater, which warms up once we have turned it on. That means we have a unique opportunity, scientifically speaking, with methane to turn the heat down that much more quickly. This is important because if we are to avoid the worst impacts of warming and keep to 1.5°C we have to reduce methane abundance in the atmosphere while simultaneously - this is a key point - driving CO2 to net zero. We do not stop warming unless we get CO2 to net zero. We must not let methane confuse us from the ultimate aim which is to get to net zero on CO2.

It is important to note that if we had started seriously on our climate change mitigation efforts globally 30 years ago, we would have a whole range of different options now. In some sense, why methane is important now is that we are so close to 1.5°C. We prevaricated, waited and wanted to continue to burn fossil fuels for so long that if we are to keep to 1.5°C we now have little option but to play with the methane in addition to the longer-lived greenhouse gases to attain that effort. My colleague, Dr. Rogelj, will speak further to that. As has been noted, the legislation speaks to the special circumstances of biogenic methane and methane more general. Biogenic methane is distinct in no way while it is in the atmosphere. While it is emitted and in the atmosphere and causing the warming it is no different at all. The difference arises from the active component of the carbon cycle. Methane's half-life is approximately 12 years, which means if I emit a tonne today, half of that tonne remains in 12 years, a quarter remains in about 24 years, and after a century there is none left effectively, to all intents and purposes. A fossil methane, something from gas extraction, fracking, mining, etc., is a new addition of carbon to the cycle so it hangs around as an additional CO2 burden. It is equivalent to burning fossil fuels and releasing CO2, but it has the added penalty for the first number of years of creating greater warming. That is the difference there.

Quite rightly, policy requires consideration of the relative efficacy of different options in mitigating the impacts of climate change. I think we can all agree on that. We can also agree that methane has a different set of properties. Where there is disagreement is where fundamentally the physics ends and the politics and policy take over. How do we take that? That is embedded in a bunch of assumptions around the immediacy of our climate goals and their relative importance, historical responsibility and-or grandfathering. We should be honest with ourselves that the natural state of Ireland's ruminant population would be pretty close to zero and not the almost 7 million we have. We must also be honest with how we ensure equity between different countries and within communities in terms of the appropriateness of policy targets. These can all lead to very different and differing opinions as to what the correct course of action is. As a scientist, I can tell the committee about the physics and the problems. I cannot tell it the solutions because that is not my job as a scientist. I would like to state on the GWP100 that there is a big problem if we choose to not report in that metric. As Professor Allen said earlier, it is fine, and I would welcome reporting in additional metrics, but for the purposes of the EU's Fit for 55 and UNFCCC, we will be forced to report in GWP100, whether we like it or not. The risk of going our own way in our national approach is that if we end up diverging we would potentially end up with huge penalties in some way or other. I would like to see it change. I think there is a groundswell of opinion that we should treat short-lived forces differently from long-lived forces. That should be done internationally and we should look at it then in terms of cascading it here. A single country cannot do it the opposite way around.

I would like to make a couple of points more broadly than on methane. I despair of how the mitigation conversation in this country centres within its second or third question on agriculture. As the late great Douglas Adams would say, it is making it somebody else's problem for the vast majority of the population who are not farmers. If farmers were successful in getting

to net zero, we would still miss our 51% reduction target because two thirds of our emissions arise from the non-agricultural sectors. We need to be honest with citizens. We need to make sure that we have action across all sectors. If we are going to have action across agriculture - we need it to play its part - it must be a meaningful and effective just transition that protects farmers and reinvigorates rural communities, opening up new markets and opportunities for them. I believe there is that opportunity space. I fundamentally believe in the ingenuity and adaptability of our agricultural sector, if appropriately enabled, to address the mitigation challenge before us, but we need to stop playing around and telling farmers every second year to do something different. They need stability to have the decision-making. They need the certainty to make choices that are viable for their businesses. We cannot tell them to stop producing milk, start producing milk, stop producing milk. This is madness. We need stability in policy so that they can make the right choices. We need to open up opportunities to this sector.

Dr. Joeri Rogelj: I thank the committee for the opportunity to speak at this meeting. I am director of research at Imperial College's Grantham institute for climate change and the environment and the lead author of IPCC reports and emissions reports from the UN environment programme. In addition, I am one of the members of the European Scientific Advisory Board on Climate Change, but I want to emphasise that I am participating here in a fully independent capacity.

We find ourselves today in a world that is more than 1.1°C warmer compared to pre-industrial times. As we experience today, this increase is caused by human activities and causes many extreme weather events - heatwaves, droughts, and flooding, which are exacerbated by this warming. These extremes lead to damage to crops and infrastructure, and also cause animal and human suffering. Methane emissions are a large contributor to this, second only to CO2. The IPCC wrote in its latest report that methane emissions from human activities, like fossil fuel use or agriculture, contribute about 0.5°C to the warming the world experiences today. As other experts, including Professor Thorne, have explained, methane is different from CO2 in that it does not accumulate in the atmosphere in the same way. As a consequence, much of the current 0.5°C of methane warming is not the result of past emissions having accumulated over centuries, like for CO2, but of activities that are taking place today and about which we are making decisions on whether they continue, increase, or strongly decrease their contribution to climate damages and suffering. The calculation of methane emissions is therefore an extremely important topic.

Deep methane reductions are essential. Pathways that meet the goals of the Paris Agreement all require deep methane reductions over the next decades. Put differently, the remaining carbon budget for 1.5°C, that is, the total amount of carbon dioxide we could still emit while keeping global warming below 1.5°C, will be effectively zero if methane emissions are not kept in check. No sector is off the hook to make this happen. Fortunately, scientifically speaking, the calculation of methane emissions is a solved problem. The committee heard about this from other experts as well. Well-established scientific guidelines have been published by the IPCC on how to estimate a country's methane emissions. It is also undisputable and uncontroversial that reporting emissions separately, in tonnes of methane actually emitted, is the least ambiguous and most scientifically accurate way of reporting methane. Currently, the latter approach is also the default way in which countries report their individual methane emissions to the UN, or the UNFCCC in this case.

Challenges arise when greenhouse gases are being aggregated. Under the Paris Agreement, countries aim to achieve global net-zero greenhouse gas emissions. In the EU, this goal is also

known as reaching climate neutrality. To calculate when this goal will be achieved, methane and other greenhouse gases must be converted to an equivalent amount of carbon dioxide emissions before they can be aggregated. If emissions are aggregated with the current standard approach used in the UN and the EU, that is, using a metric called the 100-year global warming potential, the IPCC tells us that achieving net-zero greenhouse gas emissions results in global warming first peaking and then gradually declining. This basically means leading to a reversal of the problem. Other methods, such as GWP*, can lead to other results. For instance, if we switch to some of these newer methods, global warming will merely stabilise but not decline when net-zero greenhouse gas emissions are reached. The choice about how emissions of methane are calculated can therefore weaken the ambition of the Paris Agreement and of the EU's climate neutrality target. We must be honest about this choice when we discuss the calculation of methane emissions.

A second challenge is that these new methods to calculate methane emissions can sometimes, perversely, reward historically high methane polluters. These polluters would be less incentivised to reduce their methane emissions or could be rewarded with emissions credits that take past polluting behaviour as a reference point. This goes against basic notions of fairness and equity and against the scientific evidence that deep methane reductions are necessary to meet the goals of the Paris Agreement. We must remain honest here as well. Fortunately, the scientific literature here also presents solutions to how policy can be designed to avoid these pitfalls.

The scientific evidence clearly shows that deep reductions in methane emissions, including from the agricultural sector, are necessary to meet the Paris Agreement. The evidence also shows us how methane warming from current emissions is an active contributor to climate damage and current climate suffering around the world. Any choice about how to calculate methane emissions and how to incentivise or disincentivise action on methane emissions should keep these overarching concerns in mind. I thank the committee and I look forward to responding to any questions.

Deputy Michael Fitzmaurice: I thank the witnesses for coming in. I have some brief questions. From listening to previous speakers, if there were 100 million cattle in the world in 1930 and if there are also 100 million cattle in the world today, have the same number of cattle today contributed more than they did in 1930? Will the witnesses explain that? Is there more methane in the air or are the cattle different?

Professor Peter Thorne: I can try to answer this question. To keep the warming effect of methane constant, we would need reductions of about 3% per decade. This is because of the warming impact of the methane on the oceans, in particular, which take thousands of years-----

Deputy Michael Fitzmaurice: It is 3% per decade.

Professor Peter Thorne: Yes.

Deputy Michael Fitzmaurice: Okay.

Professor Peter Thorne: That is if we want to keep the warming effect of methane constant. The 100 million cattle today would have an additional warming impact because the effect of the methane being constant is actually a slight increase due to feedbacks within the climate system. Perhaps Dr. Rogelj can provide more information on that. My understanding from the literature is that it would be necessary to reduce emissions by 3% per decade.

Deputy Michael Fitzmaurice: When I asked a previous speaker what would happen if the world decided to reduce by 20% all the methane emitted from all the cattle on the planet, he said it would bring world temperatures down by only hundredths of 1°C. Do the witnesses agree with that?

Professor Peter Thorne: The warming impact, as assessed by the IPCC and as Dr. Rogelj and I said, is half a degree of the emissions. The methane is a flow. Therefore, if we were to reduce the methane burden by 20% across the board - the easier parts of methane are waste landfill and fossil fuels and we should be chasing those - after a period of time, about 20% of that half a degree would have gone.

Deputy Michael Fitzmaurice: I am sorry for interrupting Professor Thorne but what is the length of time involved?

Professor Peter Thorne: It would be the time it would take for the methane to disappear. This is the half-life of methane, the length of time it would take for half of it to be gone.

Chairman: Professor McMullin would like to comment as well.

Professor Barry McMullin: We must distinguish between the long-term temperature effect, which would be relatively small - by "long-term", I mean hundreds to thousands of years - and the short-term effect, which is within this century, say the next 30 to 60 years. Hopefully, we will succeed in peaking global temperature within the next 30 years. We can see what is already happening. If we do not manage to peak temperature within the next 30 years, we will probably be in a global situation that is beyond any prospect of human adaptation. These few decades ahead are critical. The impact of and contribution from methane to maintaining global temperature over these next three to six decades are absolutely critical.

Any reduction in methane flow now will manifest itself exactly in that timescale. Therefore, to limit the peak temperature and keep it at a level that will give us some prospect of surviving, managing or adapting to, then managing down the methane burden is critical. All the models run by the IPCC that meet the 1.5°C goal rely on methane emissions from all sources, including fossil fuels, ruminant agriculture, landfill, rice paddies, etc., reducing substantially in the coming decades. If not, we will not limit the peak temperature.

Deputy Michael Fitzmaurice: I am asking one simple question. The witnesses do not agree with the academics who were here previously who stated that if we reduced methane by 20% worldwide, the outcome would only amount to hundredths of 1°C. Are the witnesses saying that is incorrect?

Professor Barry McMullin: Yes.

Professor Peter Thorne: Dr. Rogelj can probably contribute on this point better. The warming is 0.5°C. On the timescale that would work itself through, which would not be immediate, it would be 20% of the warming. Therefore, it would be 0.1°C.

Deputy Michael Fitzmaurice: It would be 0.1°C.

Professor Peter Thorne: It depends, however, on the timeframe. In the immediate term, it would not be that because it takes time for the methane to oxidise. It depends entirely upon the timescale.

Deputy Michael Fitzmaurice: I was very interested listening to Professor Thorne. He

spoke about the IPCC and the Paris Agreement and all these different things. He also spoke about gas and how detrimental that is in the line of methane and problems in that regard. Is Professor Thorne surprised that natural gas has become green in the EU, even though a cow seems to have become black?

Professor Peter Thorne: There are significant questions that we must still work through in that regard. Gas has been seen as a bridge fuel. Looking at the geopolitical situation and the unprovoked aggression of Russia in Ukraine, we would be wise to try to get our energy from renewable sources entirely as quickly as possible.

Deputy Michael Fitzmaurice: I thank the Chair. That is all I have to say.

Chairman: I would appreciate if members could keep contributions to five minutes.

Senator Paul Daly: I welcome the witnesses. I have three questions, one each for Dr. Rogelj and Professor Thorne and one general question. I am aware that Dr. Rogelj contributed to a session of Climate Change Advisory Council technical budgets committee. A couple of things jumped out at me when I read the committee's report and I ask him to comment on them in light of our scenario. It was stated in the final report that global emissions pathways of greenhouse gases should not be simply used as national emissions pathways. It also stated that climate science cannot tell us how to distribute the efforts among emitters and that this depended entirely on value judgments about what is considered fair and feasible. That would suggest Ireland could target more aggressive cuts in carbon dioxide and more modest cuts in methane and still make an equitable contribution to the Paris targets. Does Dr. Rogelj believe this is an option the Government should have taken?

The EU methane strategy and the global methane pledge are targeting fossil methane for ambitious cuts by 2030, with the agricultural reductions far more modest in nature. However, the director general of the EPA recently announced that for agriculture to achieve even a 22% reduction in total emissions, methane emissions would need to be reduced by 30% by 2030. This seems to be a very significant contribution, particularly given what we have heard from Professor Allen. I ask Professor Thorne to comment on that.

Commentators are driving many sectors and many people against agriculture in this whole debate. It is an unhelpful approach. One is being pitted against the other. Given what the committee has heard today, in particular, that very small reductions in methane can ensure no additional warming results, would we have been better to have set separate legislative targets for methane? This would have avoided the sector versus sector debate we currently find ourselves in.

Dr. Joeri Rogelj: I thank the Senator for his question. On whether it would have been possible to do more to reduce carbon dioxide compared with methane, in principle, the answer is "Yes". In practice, the situation we are in now and the targets governments globally have set in the Paris Agreement on the safe limits for our planet being 1.5°C or below 2°C, mean that very stringent reductions are required in all greenhouse gasses. What constitutes a fair contribution, particularly in a developed western nation, very often borders on, or even goes far beyond, what a country would generally even be technically able to do. In that sense, it would be really hard to convince any of the developing countries that holding back on climate action or reducing emissions where they can be reduced would be a fair contribution to limiting warming to the lowest level possible. This is a conversation to be had with all delegations or with other countries. It is probably not a question that will be answered by Ireland as a single country.

Professor Peter Thorne: On the global and EU methane pledges and more generally action on methane, to come back to my prepared remarks, there is a difference between biogenic and fossil methane in that once the fossil methane oxidises, it is carbon dioxide which is a very long-term commitment. We should absolutely be aiming for zero fossil methane, or as close to zero as we can get. I would argue that some of that is even economically beneficial in a cost-benefit scenario to the fossil fuel industry. It is mad that we have not done it but it does not excuse us for having to consider the biogenic methane piece.

In terms of the national targets, I come back to the fact that we can do what we want inside the country but when it comes to performance at EU or UNFCCC levels, like it or lump it, GWP100 takes precedence. It is our performance against GWP100 that will result or not result in fines from the EU. If the UNFCCC process moves in a different way, it might result in impacts and penalties there. Scientifically, the community is increasingly of the view that there should be at least a bundling of short-lived climate forces, of which methane is the prominent one, from long-lived climate forces, of which carbon dioxide is the prominent one, and treating them differently. That needs to come from the top down. It would be wrong for us to try to fudge the issue nationally and then have many issues in terms of our reporting.

Professor Barry McMullin: I thank Senator Daly. I have some general responses to his questions. On the issue of whether the Act should have been written differently, setting a separate budget for separate gasses would not have achieved what the Senator is hoping for in that the argument would just occur at the point of trying to enact that legislation. We would still have to make a trade-off and some decision about how to trade the contributions from action on different pollutants or gases. We would have had a similar discussion but it would have been even harder to resolve if it was written into legislation. The way the Act functions allows an ongoing discussion in five-year cycles about the contributions from different sectors. That said, this committee might want to consider the matter.

I am not a member of the Climate Change Advisory Council. In the course of the next three years leading up to the second cycle or the revisiting of the carbon budget programme for the follow five years, it might be helpful to invite the council to consider whether any refinements to the way the Act works domestically in Ireland might be appropriate, without compromising our participation in international reporting. There may be a case to be made for that. However, when it comes down to it, we are talking about trade-offs. The more we do in one area, the less we must do in another. On the Senator's specific question as to whether we could do more on carbon dioxide versus less on methane or *vice versa*, that can be assessed. Professor Allen has explained how the methodology his group has developed, GWP*, allows that trade-off to be assessed. I refer the Senator to the documentation I linked to in my submission on the work we have done in Dublin City University where we investigated precisely this in the case of Ireland. The problem is that there is only so much that can be done on carbon dioxide. Ireland has very high *per capita* emissions relative to the global average and as a result, we rapidly run out of equitable space on a global basis for any further emissions of carbon dioxide. We will almost certainly still exceed our equitable budget of warming, even with the most rapid, or more rapid than is currently being contemplated, phasing out of fossil fuel use in Ireland. We will need to actively remove carbon dioxide from the atmosphere, which is a very expensive and not very well proven process depending on the approach taken. We will wind up having to do that. The question is how much of that we will have to do. The figure I mentioned of 50% methane reductions in Ireland by 2050 would be compatible with limiting our commitment to carbon dioxide removal to no more than 200 Mt over this century. That is net removals. Gross removals would probably be closer to double that. However, if we reduce methane by less than 50%

by 2050, we are effectively committing to even more removals of carbon dioxide, if we are to play our equitable role. Otherwise, we just give up and say the temperature is going to go above 1.5°C degrees and is going to stay above 1.5°C degrees. That is the hard choice we are now facing. These are trade-offs. There is no easy substitution between these things.

Chairman: On the hard choices, we hear media reports this morning that one of the major countries in the EU is reintroducing fossil fuels to create energy. It makes one think. I call Deputy Carthy.

Deputy Matt Carthy: Just for some background information, I have a quick question for Professor Thorne. He mentioned the increased prevalence of methane in the atmosphere and said that over the past 700 years it has increased to the tune of 1,000 parts per billion.

Professor Peter Thorne: It is since 1750, which is what we use as a baseline in the Intergovernmental Panel on Climate Change.

Deputy Matt Carthy: Of those 1,000 parts per billion, does he have a breakdown of where that methane emerged in terms of extraction mining, ruminants, rice fields, waste and the different areas from which he said it can emerge?

Professor Peter Thorne: As my colleague, Dr. Rogelj, said, most of that methane, because of its half-life being 12 years, has been emitted in the past 20 to 30 years. It will be from those principal sources. There was a figure in the submission I made that arose from the Intergovernmental Panel on Climate Change. Fossil fuels are contributing approximately 114 Tg annually, landfills and waste contribute approximately 55 Tg, biomass burning contributes 20 Tg to 40 Tg, rice cultivation contributes 25 Tg to 37 Tg and livestock contributes 106 Tg to 113 Tg. The two principal sources globally, and I stress this is globally, are fossil fuels and livestock. They are approximately equal. They are probably about one third each with all other human sources accounting for the remaining third.

Deputy Matt Carthy: I will put a few questions together. I am trying to get a sense of all this and where the witnesses are coming from, particularly Professor McMullin's comments about CO2 and the difficulties in sequestering or abstracting that from the atmosphere. Am I correct in deducing that, essentially, the premise is that farming *per se* may not have been the cause of the problem but is very much an immediate solution that is required?

The second question is in respect of purpose. Does that fit into the considerations of the witnesses as experts in this field, for example, if one is extracting a material or a mineral for use in a wonder drug to cure cancer versus extracting a material for use in the component part of a luxury yacht? They are two very different reasons. Likewise, do they make a distinction in terms of whether a product is required to keep people alive, such as food, or does that fall into their considerations? Professor Thorne mentioned that methane, when it is in the air, is no different, but I contend that the purpose of it is very different in that we have a growing global population that needs to be fed. How and where would he strike the balance in that regard? Ultimately, we have choices. The witnesses are telling us that the hard choices need to be made. However, if we go from the personal up to societal level, our environment Minister has a choice as to whether he gets a first-class business flight or gets on the flight at all. He does not have a choice as to whether he eats, although he can decide what to eat. That brings me to the next part of my question. Do the witnesses see Ireland as having any role or obligation in respect of global food security and should that be taken into consideration at all?

There is a point that arises often in this committee. Somebody could suggest anecdotally that Ireland could stop food production entirely and just rewild the land that is currently being used to produce food. That would bring us a long way towards meeting our global obligations, but it would probably also increase global emissions because the food would need to be produced elsewhere. What consideration, if any, do the witnesses think we should give to the issue of carbon leakage or is it just a matter, as has been said by some guests previously, that we should simply concentrate on our own reductions and not pay too much attention to what the impact of that might be in real terms on a global scale?

Professor Barry McMullin: I hope I can respond to all the Deputy's questions. If I omit something, he should remind me.

On the general area of removals of carbon dioxide from the atmosphere, it is a difficult question. We in DCU, together with colleagues in Trinity College Dublin, completed an EPA project on this question in Ireland a couple of years ago. I can refer the Deputy to the report on that. One must distinguish different forms of storage of that carbon very carefully. Getting it out of the atmosphere is the first thing. The second thing is to get it into permanent geological storage. Carbon storage in soils, hedgerows and forestry is very different from carbon stored in coal, oil or gas, which is secure for geological time periods. The Deputy has seen with the recent wildfires, for example, how vulnerable carbon stores in biomass are to rerelease into the atmosphere. It is a complex area and I would be happy, maybe at another time, to go into that in more detail. However, there are absolutely limits on how much of that we can do in Ireland.

Food security is a desperately important question, with a growing global population and with many people globally already insecure in the context of food. That insecurity has been severely exacerbated by the conflict in Ukraine. It is extremely important that we collectively pay attention to that. The interaction with the discussion we are having today is that not all food is equal in terms of the nutrition relative to the emissions. Different food types are radically different in the ratio of emissions or more general environmental impacts compared to their nutritional value. There is a great deal of research, and the Intergovernmental Panel on Climate Change report summarises this very well, indicating not an absolute abolition of livestock-based food but that a global shift in the balance between food types more towards plant-based foods as a proportion of the global diet is probably an essential element of effective mitigation of climate change because those plant-based foods can be substantially lower in greenhouse gas emissions than livestock-based food. How that plays out in different countries is a complex issue. What Ireland's response to that should be needs much more detailed consideration. That absolutely is a complex issue.

As regards the carbon leakage argument, again it is very important. However, it does not just apply to methane or to agricultural emissions, it applies to emissions from all sources. In my written submission, I mentioned that the Paris Agreement is certainly unsatisfactory in many respects. It is not nearly as effective in terms of achieving global co-operation as we collectively want and need it to be, but currently it is the best we have. The architecture of the Paris Agreement completely relies on good-faith, bottom-up action by the parties to that agreement. It is in our interests as a small country because our absolute impact on the climate is very minor. We are reliant on much bigger countries participating fully in the Paris Agreement and discharging their obligations.

This is where leakage enters into it. How do we influence that? We influence it through diplomatic action by engaging with the other parties through the UNFCCC process and by engaging with other countries in Europe. However, if we go to those other countries and try to

engage them and try to get them to engage in stronger action, naturally the first question they will ask is, "What are you doing?". They will compare our *per capita* contributions with the *per capita* contributions in their own countries. That will be the framework they use to do that. If we want to have any hope – this is completely on a self-interested basis because we do not have to add any collective solidarity to it - it depends on our ability to influence other, bigger countries. That depends on the action we take locally and bringing ourselves down to significantly below the global average *per capita* in terms of emissions. Only then can we start talking about the leakage argument and make the argument to countries that they are taking advantage of our good behaviour by increasing their emissions. At the moment, however, when we are above average, we are basically operating the leakage in reverse. We are the ones who are free riding on and hoping for greater ambition from other countries. That will not play well in international negotiations.

Dr. Joeri Rogelj: I fully agree with the intervention made by Professor McMullin. I just want to respond to the question on the different purpose of emissions and whether that is taken into account. The answer is a resounding "Yes". In these modelling exercises for how we estimate where emissions can be reduced, we are not necessarily interested in emissions, but we are interested in services that we, as a society, require such as energy - calories and nutrition. Others we need are, for example, wood products for building and so on. In the modelling, the question of how these necessary services can be delivered or supplied with as few emissions as possible is then asked. You get a very strong differentiation because the answer depends on, for example, how essential a service is and which opportunities and alternatives exist. That is why, looking at just methane, reductions in fossil methane are much deeper and go even to zero compared to the suggested reductions of methane in the agricultural sector. They also reduce, but to a lesser degree, and they do not go to zero. That is because there is a fundamental service, which is providing food to the global population, that needs to be guaranteed. As long as we do not have alternatives to, for example, providing calories via rice or rice paddy production, that kind of floor of methane emissions will not disappear, even if we produce rice in the best and most efficient way possible. There is a clear differentiation and this is taken into account in these calculations as well.

Deputy Martin Browne: I just have a couple of quick questions for each witness. There is a school of thought that a near 0.3% per annum reduction in methane emissions would stabilise its presence in the atmosphere and slowly reduce the level of methane in the atmosphere. Professor McMullin and Mr. Price stated that these calculations, which have been checked, are misleading. What does Professor McMullin say to the argument by Mr. Hourigan earlier that the production of methane in agriculture requires the removal of carbon from the atmosphere, while methane emitted during the mining process involves no such removals, yet in the calculations relating to methane emissions from agriculture take no account of direct removals or of what occurs during the production of that methane? Is this screwing the figures relating to and demands that are being made in respect of the agricultural sector?

Professor Barry McMullin: If I understand the question correctly, the argument that was made earlier was that the residual CO2 that methane breaks down into, in the case of methane from biogenic sources, effectively was already in the atmosphere before it was absorbed into grass, eaten by the cattle and then turned into methane. Therefore, there is no net increase in CO2. That is absolutely correct. In contrast, when it comes to fossil methane, natural gas being released into the atmosphere or emissions from coal mining or whatever, that is not the case. When fossil methane gets into the atmosphere and eventually breaks down into CO2, that CO2 represents a net increase. However, the mass of CO2 resulting from the degradation of methane

emissions from fossil sources is tiny compared with the CO2 being produced from the direct combustion of fossil fuels.

In terms of the distinction between methane from biogenic sources and methane from non-biogenic or fossil sources, there is a difference in long-term impact in terms of CO2 lingering in the atmosphere, but that difference is tiny compared with the CO2 impact of burning fossil fuels. The major impact of methane is not due to the residual CO2 in the atmosphere. It is due to the warming impact while the methane is in the atmosphere. That is what we need to be concerned about. It is what will affect the peak temperature over the next three to six decades. It is that time while the carbon is trapped in methane molecules in the atmosphere that it is increasing the global temperature or contributing to maintaining increased global temperature over the next several decades. That is the critical question in the context of methane emissions, not the residual destination of those carbon atoms in CO2. I apologise because that is scientifically complex and I do not know that I can simplify it any better than that.

Chairman: I apologise to Deputy Browne. Professor Thorne wishes to come in.

Professor Peter Thorne: I wish to address to address the Deputy's reference to a 3% reduction. Methane is a flow. It is like turning on and off a tap in a bath with the plughole open. If we reduce methane by 3% per decade, the methane concentrations will decrease by 3% per decade. The reason we need to do that is that the long-term warming of the impact of the methane on the oceans increases over time. That is why you cannot keep methane absolutely stable and keep global warming from increasing. We need slight reductions in methane. However, it is not that it accumulates in the atmosphere forever.

Deputy Martin Browne: On removing these gases from our atmosphere, are results more immediate from the reductions in the methane emissions? As such, in order to address the temperature limit most immediately, is methane reduction the key factor in it all?

Professor Peter Thorne: I think Dr. Rogelj is best to answer this.

Dr. Joeri Rogelj: This builds on some of the responses that were given earlier. If we had started in 1990, there would have been a lot of room to play with and possibility to make trade-offs between methane reductions, CO2 reductions and so on. However, today we are above 1.1°C of warming, and probably already closer to 1.2°C. It is moving towards 1.5°C., which is level that governments have decided is a safe level. We want to halt warming at that level, or at least well below 2°C. This means that all greenhouse gases need to be reduced, but they need to be reduced in different ways. CO2 to net zero is the minimum that is required. Methane levels should be reduced as steeply as possible. If we do not reduce methane, then the 0.5°C of warming that it is currently causing will be even greater by mid-century, where we are, in the best of worlds, reaching our maximum level of warming. This means that despite there being opportunities to limit the warming that the world as a whole experiences and that is causing the extremes and the damage we are seeing, we decide to keep it higher than we can possibly reduce it. That is the real discussion that needs to be held. As I said in response to the previous question, some of those methane emissions from rice paddy fields provide a really important service to society and are not eliminated fully. This is taken into account when determining what is possible to achieve in methane reduction.

Deputy Martin Browne: Does Professor Thorne have anything to say about the role technology can play in limiting biogenetic methane emissions? To what extent can technology coupled with a more focused and intuitive context play here? We are speaking here as discus-

sions on herd numbers intensify. How far has the technology come at this stage?

Professor Peter Thorne: It is really important to make key that scientifically the aim is to reduce the emissions. We should be chasing a reduction in emissions. There are many promising technologies and approaches produced by Teagasc that can and should be deployed widely across agriculture. They will get us a considerable distance. There are also promising approaches, including feed additives and others. There may be opportunities down the road but we cannot wait. If we are interested in limiting climate harm, we cannot wait on future promises of a solution that gets us zero methane emissions and promises that we can emit CO2. An even bigger one is that lots of people are saying that we can emit CO2 and do massive carbon capture and storage down the line. It is unproven at scale and it is uncertain whether it would be economical to do. We need to look at the technological solutions but we also need to get real about the fact that we cannot wait. Nuclear fusion has always been 30 years in the future and it is still 30 years in the future. We cannot wait on magic bullets. We have to get real about the fact that climate action is required. If we want to keep warming to below 2°C and strive to go below 1.5°C, we have really difficult choices to make in the immediate term but we should keep developing and trying to find solutions that enable some of the very hard choices to be avoided.

Deputy Martin Browne: At the end of his statement, Professor Thorne said that he believes in how adaptable our agriculture sector is and that if it is enabled properly to address mitigation challenges it can do so. Could he elaborate on this?

Professor Peter Thorne: I believe fundamentally in the ingenuity of the Irish people and the Irish farming community given the right conditions, opportunities and stability of policy at EU and national levels to diversify. Coming back to an earlier question, food shortages and food inflation this year will not just be down to the Ukraine conflict. That will be a large part of it but if you think about some of the extremes we have seen this year in the Indian subcontinent, China, Europe, North America and the major bread baskets of the world simultaneously, we can produce more of the food we eat, and I am not saying every farmer should grow broccoli - far from it - but we have opportunities to diversify putting in place the right policy and making the right market opportunities for the farming community to have a rich and diversified rural economy. That is what I want to see. It does not work through scientists saying it should happen. It works through the farming community, politicians and policymakers working together to make it happen. We have had major changes in agriculture over centuries. We have the ability to change how we produce our food but we should produce food.

Deputy Martin Browne: Dr. Rogelj spoke about other methods or proposals that in his view would merely stabilise global warming but not lead to a decline in emissions. Could he comment on the historic methane emissions and explain the level to which those emissions contributed to today's levels?

Dr. Joeri Rogelj: Ultimately, as Professor Thorne and several others highlighted, methane has a relatively short atmospheric lifetime of 12 years meaning that what is currently in the atmosphere is basically the result of what has been emitted over the past 30 years. This means that the emissions that were emitted over the past 20 or 30 years are the key contributors to the current rise in concentrations or heightened concentrations in the atmosphere. We have a net zero target. Call it the climate neutrality target or as in Article 4 of the Paris Agreement, a balance between sinks and sources. It is basically a net zero greenhouse gas target. If you measure or calculate what net zero means in a different way, it will have a different implication for the global climate and the global temperature. Scientifically, that is very simple and clear. Politically, it is something one needs to confront and talk about honestly. Just saying that we are

going to define the net zero target with GWP* would result in a weakening of the EU climate ambition.

The other point I wanted to make was about how using GWP* without accounting for the starting point would basically reward historically high emitters. If you start calculating GWP* from today, you basically calculate how much you start reducing from the recent past, for example, 20 years ago. It really depends on how much you were emitting 20 years ago whether you will be getting an emissions target or whether you will be punished in the eyes of GWP*. In terms of physics, there is no controversy there. We all understand that but in terms of fairness and equity, there is a big discussion to be had. That is the point I wanted to highlight.

Deputy Marian Harkin: I am not a member of this committee and, therefore, I appreciate the opportunity to contribute. I listened to the speakers from Mullingar so some of my questions will relate to the issues raised earlier. Professor McMullin said that temperature limit is the overriding goal but this is not exactly what is being measured. Why does he think that the European Commission is not actively looking towards the most accurate and up-to-date scientifically-based warming measurements? I suppose I am asking him a political question in this sense. Ireland's grass-based system is quite different from that of many other European countries. My instinct is that if this was the system in France or Poland, the Commission would be much quicker to look at the more up-to-date science for measuring. Professor McMullin does not have to answer that but if he could, I would appreciate it.

Professor Thorne made a really important point. He said that he despairs that agriculture is being disproportionately blamed. I listened earlier to the colleague from California who said that most of the methane produced here is entering. That gives us good opportunities to minimise and reduce methane emissions, much more so than they have done in California. In California, they have managed to reduce emissions by 30%. Dr. Mitloehner said that feed additives, etc., make a huge difference. What struck me most about his comments was that he said the state engages with farmers. It works with farmers to find market solutions. We do not seem to be doing that here. There seems to be a lot of finger-pointing but no engagement with farmers to look at the situation and see how we can improve it.

I have listened carefully to the points made on the two types of methane, biogenic and fossil. The witnesses can correct me if I am wrong, but it seems to me that the timeframe is what is crucial here. We have behaved very badly up to now. The methane that we are producing now, because of the level we are at, is in a way much more dangerous because it will take 24 years for the half-life to begin to convert into CO2. I ask the witnesses to comment on that. It is said that if we cut CH4 emissions by 3% per decade, there would be no additional warming impact. I ask the witnesses to estimate the reduction in global temperatures that would result if we were to cut CH4 emissions by the 30% that they have managed to achieve in California with its dairy herd, and the timeframe required to achieve that.

Finally, I want to raise the issue of carbon leakage. I disagree with Professor McMullin on a point he made. He said that our ability to influence bigger countries depends on our good behaviour. I spent 15 years in the European Parliament, and watched and participated in some of the debates on trade deals. The only thing that matters is proper scientific measurement, rules and regulations that can be enforced. Good behaviour counts for virtually nothing. That is my view.

Chairman: I ask the witnesses to provide brief responses. We are under time pressure.

Professor Barry McMullin: I defer to the Deputy's expertise on the political difficulties involved. In terms of the potential changes to EU accounting, as she will be well aware, changes to governance at EU level are very difficult to bring about. It is a process that unfolds very slowly. I completely agree with her that there are good arguments for Ireland to press and use its influence in the EU, in the manner that Professor Allen explained in an earlier session, to augment the accounting to better reflect to contribution to warming of different gases. That would be very beneficial. Ireland could certainly take a lead on that EU policy. On the question of international influence, I agree to an extent that what works, in the trade situation, is rules, standards and scientific measurements. However, when bringing those forward and in seeking to get other countries to buy into them, they are going to ask why we are bringing forward particular rules or changes. We will set out the argument for doing so, on the basis of the climate impact. They will point out that new rules and changes will affect them and us in various ways, and will ask why they should go along with that as part of the collective effort, if we are not playing proportionate effort in that collective effort. That is the point I was making. In terms of carbon leakage at the moment, if anything, we are on the wrong side of that equation because we are not playing our proportionate part.

The fossil versus biogenic methane timescale question is a complicated one. The only answer that I can give the Deputy is that, unfortunately, to do it properly we have to feed trajectories of all the different gases into a form of model. The GWP* methodology, which Professor Allen has explained, is effectively a simplified model for assessing the impact. One way or another, we have to feed the disaggregated gases into a model, look at scenarios for different combinations of the gases, and see what the aggregate temperature contribution would be. That is the only way to get a good answer. In the submission I made to the committee there is link to a paper that we presented just last month at an international conference in Gothenburg, in which we did exactly that in the Irish context. Using exactly the methodology explained by Professor Allen, we looked at the trade-off between reductions in Irish methane flow, doing more and less than that, and the consequence for having to do more or less CO_2 removals

Professor Peter Thorne: Just to give an idea of timescales of international processes, in the past year they have just adopted the GWP100 numbers from the IPCC assessment report 5, despite assessment report 6 coming out in the past year. I do not expect things to change very quickly at international or EU reporting level, which is a fundamental level.

On the Deputy's question on calculations of GWP, an individual cow or even the herd of a single farm has an absolutely negligible effect. It is when we aggregate it that we see the effect. However, as we have repeatedly stated, there is a difference between fossil methane and biogenic methane. The biogenic methane picks up the carbon from the active component of the carbon cycle, so it does not do very long-term harm. It does harm, relative to not having that emission, for the timeframe that the methane is in the atmosphere, but it does no additional harm afterwards. Fossil methane does harm.

The Deputy made the point that we need to get away from the "them and us" approach and stop finger-pointing at farmers. I absolutely agree. I do not believe for a moment that the agricultural community is deliberately trying to do harm to the environment. Why would they? They rely upon the environment for their jobs. They do not want to leave their farms in a worse state. It is not all down to methane emissions. The vast bulk of the warming to date is down to the burning and extraction of fossil fuels. That is doing harm. That is why we need to look at all sectors and everybody needs to play their part. I will go back to my opening remark. To paraphrase Douglas Adams, the real risk is that for 97% of the population who are not farmers,

we are making this somebody else's problem. It is not somebody else's problem; it is all of our problem. We need to fundamentally get to net-zero CO2 emissions. Otherwise, it is game over. We are not going to stop the warming at any warming level unless and until we get to net-zero CO2. I ask members and anyone watching the debate not to let a discussion on methane emissions disabuse them of the notion that we must reduce CO2 to net-zero. That is the absolute imperative.

Dr. Joeri Rogelj: I will make a short comment on which metrics are being used to report emissions. It is important to highlight that under the UNFCCC, countries are mandated to report their individual emissions, which, scientifically, is the most accurate way to understand what the climate outcomes of these emissions are. It is not that the EU and the UN do not want to know the climate outcomes. The information is readily available to do that. The question is how one sets targets and whether those targets, and the metrics in which those targets are set, reflect the highest possible ambition. That is basically a different discussion.

Chairman: I thank the witnesses for a very enlightening discussion. I appreciate them taking the time out to attend, either physically or remotely. We greatly appreciate their input into the discussion and our understanding of the challenges that we face going forward. I propose to suspend the meeting for 30 minutes to allow members to get a break. When we reconvene, we will be joined by witnesses from the Departments of Agriculture, Food and the Marine and the Environment, Climate and Communications to discuss emissions ceilings.

Sitting suspended at 2.50 p.m. and resumed at 3.20 p.m.

Chairman: In this session we will hear from officials from the Department of Agriculture, Food and the Marine and the Department of the Environment, Climate and Communications in relation to emission ceilings.

Witnesses giving evidence from within the parliamentary precincts are protected by absolute privilege in respect of the evidence they give to the committee. This means that witnesses have full defence in any defamation action for anything said at a committee meeting. However, witnesses are expected not to abuse this privilege and may be directed by the Chair to cease giving evidence on an issue. Witnesses should follow the direction of the Chair in this regard and are reminded of the long-standing parliamentary practice to the effect that, as is reasonable, no adverse commentary should be made against an identifiable third person or entity.

Witnesses who are giving evidence from a location outside the parliamentary precincts are asked to note they may not benefit from the same level of immunity from legal proceedings as witnesses giving evidence from within the parliamentary precincts and may consider it appropriate to take legal advice on this matter. Privilege against defamation does not apply to the publication by witnesses, outside the proceedings held by the committee, of any matter arising from the proceedings.

Members are reminded of the long-standing parliamentary practice to the effect that they should not comment on, criticise or make charges against any person outside the Houses or an official, either by name or in such a way as to make him or her identifiable. Parliamentary privilege is considered to apply to utterances of members participating online in this committee meeting when their participation is from within the parliamentary precincts. There can be no assurance in relation to participation online from outside the parliamentary precincts and members should be mindful of this when they are contributing.

We are joined from the Department of Agriculture, Food and the Marine by Ms Edwina Love, principal officer, Mr. Fergus Moore, senior inspector, Mr. Dale Crammond, agricultural inspector, and Mr. Philip Blackwell, agricultural inspector. From the Department of the Environment, Climate and Communications, we are joined by Mr. Marc Kierans, principal officer, Mr. Neil Gannon, assistant principal officer, Ms Niamh Gibbons, assistant principal officer, and Mr. Rob Barnes, assistant principal officer.

I call on the officials to make their opening statements, commencing with those from the Department of Agriculture, Food and the Marine.

Ms Edwina Love: We are pleased to be here today and have the opportunity to address the committee on the matter of sectoral emissions ceilings. As members of the committee will be aware, the achievement of a 51% reduction in greenhouse gas emissions on an economy-wide basis by 2030 is extremely ambitious. That said, as the Department has stated previously, I wish to re-emphasise once again that the agriculture and land-use sectors will do all that is possible to play their part in meeting Ireland's climate ambition while maintaining food production. Farming has long been an important and integral facet of Ireland's economic, social and cultural history, and this is referenced in the Climate Action and Low Carbon Development (Amendment) Act. Climate change is having an effect on the context in which agriculture operates, and the sector fully appreciates the need to address emissions from agriculture and land use and to build resilience into future development. The policy approach is structured around three pillars. First, we must continue to reduce emissions, using the best science and best agricultural practices. Second, we must continue to sequester carbon and increase our avoidance of emissions through increased afforestation and better land-management practices. Third, we must make a contribution to sustainable energy and displacement of fossil fuels and energy intensive materials.

In terms of mitigation, the Climate Action Plan 2021 sets the target of a 22% to 30% reduction in agricultural greenhouse gas emissions by 2030. This means that agriculture emissions need to reduce to between 16 to 18 Mt CO2 eq. in 2030 - an absolute reduction of between 5 to 7 Mt CO2 eq. It is worth noting that to even achieve the reductions at the lower end of the target range over the decade will require a significant transformational change in the sector on a scale that has not been seen before for Irish agriculture. Measures such as reducing and changing fertiliser type, earlier finishing age of prime beef animals and increased organics will get us perhaps 70% of the way there, but further measures, including the technological development of methane reducing feed additives and incentivising diversification opportunities for farmers such as growing grass for an expanding anaerobic digestion industry will be needed. Unfortunately, an unhelpful narrative may have developed that a 5 Mt reduction in the sector is somehow business is usual. I wish to state for the public record that this is clearly not the case. Regulation, public supports and incentives, in conjunction with private industry supports, will all play an important role. In terms of regulation, the Department has committed to the development of a national fertiliser register of compliance, requiring primary legislation, and reductions in chemical nitrogen allowances under the nitrates regulations. Enhanced training and advisory services will also be essential to underpin this transition. In terms of public supports, the CAP strategic plan, which is currently going through the approval process in Brussels, will undoubtedly be a key pillar of the State's climate action support. The CAP strategic plan will provide €9.8 billion to support the economic, environmental and social sustainability of farmers and rural communities. Key elements of the plan include a new eco-scheme, which has a number of climate- and environment-focused farming practices, which will be open to all farmers. These include practices aimed at reducing chemical nitrogen usage, increasing tree

planting, increasing nature- and biodiversity-rich land areas and encouraging extensive livestock production. There is also an ambitious new Pillar 2 environmental scheme, targeted at 50,000 participants. This will be underpinned by a greater focus on results-based actions and on collective actions aimed at achieving landscape-scale benefits. An organic farming scheme will be aimed at more than tripling the area of agricultural land that is farmed organically. A suckler carbon efficiency scheme will contribute to the objective of earlier finishing times for prime beef cattle and a revised targeted agricultural modernisation scheme, TAMS will provide more capital funding for on-farm investment than the preceding scheme and will have increased incentives for environmental investments including renewable energy. In addition, two Food Vision 2030 working groups on dairy, beef and sheep meat have been established, which will set out a clear roadmap to enable the sectors to reduce emissions.

I would like to speak specifically about the distinct characteristics of biogenic methane as referenced in the climate Act. The EPA has confirmed that methane emissions may need to reduce by up to 30% to even reach the 5 Mt CO2 eq. cut in agriculture emissions. This is very much at the upper end of international ambition and will make Ireland a leader in this space. We will do everything we can to achieve this level of reduction. A 30% reduction in methane was also referenced as a likely required pathway by the Climate Change Advisory Council. This must be benchmarked against the fact that a 3% reduction in methane emissions from the Irish livestock herd over the decade would ensure no additional global warming arises from the methane produced by it. This is due to the short-lived nature of the gas in the atmosphere.

I will now turn to LULUCF, which is the other area where the sector can make a difference. The crops, trees, hedgerows and soils that can sequester and store vast amounts of carbon can also be a source of carbon. It is, therefore, imperative that we reduce the volume of CO2 emitted from soils while maximising carbon sequestration as we aim to reach climate neutrality by 2050. We have committed already to a number of targets around land use and forestry. Again, these will not be easy measures to implement. We are placing increasing demands on farmers and landowners around improving the management of soils. The numbers here are significant and include reducing the management intensity of up to 80,000 ha of organic soils by 2030; better management of 450,000 ha of mineral grasslands; increasing cover crops and straw incorporation as carbon storing measures; and increasing afforestation rates to enhance carbon sinks. The reduced management intensity of organic soils is an entirely new area of work with much uncertainty and complexity, to which Ireland will pioneer an approach. Similarly, we need to address the downward trend in afforestation, and grasp the opportunities that existing forests provide in producing timber and wood products to contribute to a green economy and increase the use of wood in the built environment. Implementing these measures will be challenging and even more so given the increases in the gaps to target as a result of the 2022 LULUCF inventory refinement. We have commenced a programme of work to fill the existing knowledge and data gaps and to understand the potential contributions towards climate ambition from land-use improvements and set in train the development of a land-use plan, based on these findings. A new national forestry strategy and forestry programme are also in development and are currently the subject of detailed consultation. The focus will be grounded in the principles of the right tree in the right place for the right reasons, including the right management. Our aim is to have these concluded and in place for the start of 2023 with a new vision and incentives to attract farmers and landowners to consider planting trees, which is a key part of our climate actions.

I will now deal with sustainable energy. We are doing what we can to meet the 51% economy-wide target set by the Government. This includes making a positive and important contribution towards the decarbonisation of the energy system. We will achieve that through applying

the energy efficiency principle first and reducing energy use at farm level; deploying renewable energy technology at farm level for self-consumption but also a contribution to renewable energy generation through export of electricity to the grid; and providing forest biomass and agriculture feedstocks to the generation of renewable energy, such as biomass for heat, agriculture feedstocks for production of biogas and biomethane from anaerobic digestion. Through these actions, the agriculture and land-use sector is in effect contributing a total of 3.4 Mt CO2 eq. to the decarbonisation of the energy system, which is often overlooked.

There has been considerable commentary in recent times on what the sector is or is not doing to address the climate challenge, but our consistent approach has been to reduce all emissions. While reducing emissions in the agriculture sector specifically is a priority, there are opportunities for the sector to contribute elsewhere and these actions are just as important in the context of an economy-wide target.

As identified in Food Vision 2030, there is a critical need to consider the three pillars of social, economic and environmental sustainability as we move forward. Let us not forget that agriculture is about the production of food. At a global level, our competitive advantage is in the production of pasture-based animal proteins. There are significant challenges with the reduction of methane within our pasture-based livestock production system, but we believe solutions will emerge over the decade, along with the significant contribution early finishing ages will make here. On the land-use side, reducing the volume of CO2 emitted from soils is critically important. Notwithstanding, Ireland will only achieve climate-neutral status by 2050 through land-use removals provided from trees and soils and these removals will be delivered by the agriculture and land-use sector. Similarly, on the energy side, I have outlined the significant contribution that the sector will make to decarbonising the energy system. Accordingly, the targets assigned to the sector must be proportionate and reflective of the overall contribution. Unlike in other sectors where technologies or lifestyle choices can be utilised, there are no silver bullet solutions to reducing emissions from agriculture and land use. It will require a sustained effort for change to happen. We are happy to take any questions members may have.

Chairman: I thank Ms Love. I call Mr. Kierans from the Department of the Environment, Climate and Communications to make his opening statement.

Mr. Marc Kierans: I am the principal officer in the land use and sectoral policy division. I am part of a team responsible for the preparation of the sectoral emissions ceilings. I am accompanied by Mr. Robert Barnes and Dr. Niamh Gibbons from the land-use and sectoral policy division, and by Mr. Neil Gannon from the environment and climate action plan delivery division.

I will use my opening remarks to outline the process that the Department has undertaken for the preparation of sectoral emissions ceilings in accordance with the Climate Action and Low Carbon Development (Amendment) Act 2021, which commits Ireland to a legally-binding target of a climate-neutral economy not later than 2050 and a reduction in emissions of 51% by 2030, that is compared to 2018 levels. Following the process set out in the Act, the carbon budget programme proposed by the Climate Change Advisory Council was approved by the Government on 21 February 2022, and subsequently adopted by the Oireachtas on 6 April 2022. This carbon budget programme consists of three successive five-year carbon budgets. The first budget, from 2021 to 2025 is 295 Mt CO2 eq., which is an average reduction of 4.8% per annum for the first budget period. The second budget period is from 2026 to 2030 involves a 200 Mt CO2 eq. which is an average reduction of 8.3% per annum. The third budget period is from 2031 to 2035 and involves a 151 Mt CO2 eq., which is an average reduction of 3.5% per

annum. The upper ends of the emission reduction ranges in the Climate Action Plan 2021 are consistent with a 51% reduction in emissions by 2030 compared against 2018 levels. That is on the basis of full implementation of core measures and further measures, as well as allowing for unallocated savings. The plan leaves savings of roughly 4 Mt CO2 eq unallocated in 2030 on an economy-wide basis, pending the identification of additional abatement measures. The Climate Action and Low Carbon Development (Amendment) Act 2021 requires that the Government approve an annual update to the climate action plan that is consistent with the carbon budget programme. Once the programme and associated sectoral emissions ceilings have been adopted, the climate action plan for 2023 will be prepared and published before the end of the year to ensure such consistency.

Under the Act, the Minister for the Environment, Climate and Communications must prepare, within the limits of the agreed carbon budget programme, the maximum amount of greenhouse gas emissions that are permitted in different sectors of the economy during a budget period, also known as sectoral emissions ceilings. Different ceilings may apply to different sectors. These sectoral emissions ceilings shall be determined by the Government and are not subject to an Oireachtas process. The Act requires the Minister to submit sectoral emissions ceilings to the Government for approval "as soon as may be after a carbon budget takes effect". The Minister intends to take a proposal to Government on sectoral emissions ceilings shortly. The Department has looked at a number of scenarios to support the preparation of these sectoral emissions ceilings. The Department is being supported in this work principally by McKinsey and Company and the centre for marine and renewable energy, MaREI, in University College Cork. Key inputs have also been received from the EPA, the SEAI, Teagasc, EirGrid, the ESRI, University College Dublin and others.

The Act provides that the Minister shall, when preparing a sectoral emissions ceiling, consult with such Ministers of the Government as he considers appropriate. Over the past four months, extensive consultation with relevant stakeholders has taken place. In the engagement to date, the Department has been sharing analysis, including through bilateral meetings and workshops with key Departments. There has also been a series of meetings at Secretary General and ministerial level.

As part of the proposal, the Minister will recommend to Government the sectors of the economy to which each sectoral emissions ceiling will apply based on the EPA emissions inventory, which breaks down emissions into a range of categories across the economy. A Minister must be assigned responsibility for each sector to meet the obligations under the Act. Section 6C of the Act gives a legislative underpinning to whole-of-government climate action by making responsibility for adherence to the carbon budgets and sectoral ceilings more diffuse across Government. Ministers will be required, insofar as is practicable in the performance their functions, to comply with the sectoral emissions ceiling for the sector for which they have responsibility.

I thank the committee for inviting myself and my colleagues here today. I am happy to answer any questions.

Chairman: I thank both Departments for their opening statements. I will now open the floor to questions from members.

Deputy Matt Carthy: Over the weekend, journalists were critiquing Opposition Deputies because some of us would not specify a specific percentage figure for the sectoral ceiling for agriculture. I hope those journalists are watching today and understand that the information Mr. Kierans has been talking about, which is being used by his Department, has not been

made available. We have sought copies of the reports that have been used, information on the consultants that have been availed of and publication of the modelling and economic analysis the Department has. It has not provided that at all. I had hoped today would be an opportunity for us to get additional information. Instead, we have a two-page opening statement from the Department of the Environment, Climate and Communications that provides precisely zero additional information and makes it impossible for us as a committee to have a considered opinion on what could be the defining issue of the sector we are charged with monitoring. All of that needs to be taken in the context of the challenges ahead.

In all the consultations Mr. Kierans referred to, he missed an important one, namely, the Oireachtas, Members of which are elected by the people of this State who will be impacted by this. They have been watching on their TV screens as the extreme weather across the globe has made it very clear that climate action measures are required now. Alongside that, the war in Ukraine and other global events have crystallised the need for this debate to be taken in the context of food security. The ability to produce food sustainably is also going to be a crucial issue facing humanity in the time ahead. We need a sea change in how we address this because this State has never met any of the climate action targets that have been in place to date. We are now facing into an even more ambitious scenario with no roadmap as to how to achieve it. Ireland will become the best country in the world at setting ambitious targets but the worst country at actually reaching them because the targets are being set without a baseline plan.

I have a few questions for the Department of the Environment, Climate and Communications and then I will come back to the Department of Agriculture, Food and the Marine. Does the Department accept that if we are going to make progress in our climate action measures, we need to work collectively? In that vein, does the Department accept that it was a mistake for the Government to reject the proposal that the sectoral ceilings be brought back to the Oireachtas for consideration? That is the approach in the North and in many other EU member states where there is a full collaborative political approach to dealing with these issues.

I ask the Department to comment on the failures to date in respect of forestry. It is very likely that this year will see the lowest level of afforestation in this State since the 1940s, in the middle of the Second World War. That is going to impact across a raft of areas. This is happening under a Green Party Minister. What implications will that and the failure to reach other targets, which have been in place for a number of years now, have for our long-term ambitions?

What consideration is the Department giving to the potential for carbon leakage in its proposals for the sectoral ceilings? What if we take measures in this State that reduce our national emissions but actually increase global emissions? Is that a factor? What consideration is the Department giving to food security? What measures does the Department consider necessary, on a point-by-point basis from 22% to 30%, for agriculture to reach those targets if they were set?

Mr. Marc Kierans: The Deputy will forgive me if I did not catch all his questions; he can tell me if I miss any. With regard to the consultation, the Department is following the process as set out in the Act. I recognise that there are concerns but that is the process the Department and the Minister are following. The Department has engaged extensively with all Ministers and all Departments in that regard and it has had extensive consultations, as I laid out in my opening statement.

The Deputy asked about the situation with forestry. I would have to defer to my colleagues in the Department of Agriculture, Food and the Marine on that. There is a low level of affores-

tation at the moment. It is lower than we would like it to be and there are a number of factors involved in that. It puts pressure on future removals and actions.

We are looking at all-of-economy activity. We are not focusing on one or two sectors. That is how the plan has been established. There are provisions in the Act to look at the social and economic imperative of the early cost of effective action in relation to climate change. The special economic and social role of agriculture is included in that. There is also a need to deliver the best value for money, consistent with the sustainable management of the public finances to maximise as far as possible the net emissions across the economy.

I am afraid I missed the last question so I ask the Deputy to repeat it, if he does not mind.

Deputy Matt Carthy: It is an easy one. There is a range of 22% to 30% for the sectoral ceiling for agriculture. What measures would be required for each point along that scale?

Mr. Marc Kierans: The Climate Action Plan 2021 sets out the ambition, the actions, the core measures and further measures for agriculture, as well as all other sectors. The further measures involve looking at greater intensification of anaerobic digestion and greater rates of afforestation. I do not have the data to say at what points along that scale that ambition arises. At the moment these are measures that would take place in certain scenarios. Again, I will defer to my colleagues in the Department of Agriculture, Food and the Marine to explain how they see themselves achieving these targets.

Deputy Matt Carthy: Would it not be fair to say that measures taken on afforestation and anaerobic digestion should be assigned, in terms of credits, to LULUCF as opposed to agriculture? They are the only two specific areas raised and are not actually related to agricultural emissions.

Mr. Marc Kierans: Again, as I said, the sectorial emissions ceilings have not been settled nor has ministerial responsibility but it is an all-encompassing sector. The direction of travel at the international level is for a combined agricultural and forestry land use sector. The increased intensification of competing land uses displaces other activities. Displacing those activities benefits the sectorial emission reductions for the agricultural sector. I should stress that they are looking at alternative income streams for the agricultural sector to displace the space of current activities.

Deputy Matt Carthy: That makes no sense whatsoever. Does the Department of Agriculture, Food and the Marine consider a scenario where it would be appropriate or necessary for the State to apply linear cuts in respect of a particular type of agriculture, for example to state across the board that every farm or every farm within a region would be required to reduce its production by a certain number of percentage points? Does the Department consider that may be an appropriate or possible response?

Mr. Marc Kierans: Every farm is unique. I do not think we can categorically point to a homogenous agricultural sector. Different farms at different periods will have different carrying capacities in terms of actions on their climate action capacity. A linear activity cut needs to be looked at in terms of the capacity of the curbs farms follow. I do not have that information and I am not suggesting that is a policy measure being considered.

Deputy Matt Carthy: Moving on to the Department of Agriculture, Food and the Marine officials, the one point that is indisputable is that every farm is unique, but does the Department accept we are at a disadvantage in that we do not have any mechanism to assess on a farm-by-

farm basis the sequestration, storage and emissions that are currently happening on each unique farm?

Ms Edwina Love: That goes to the point of the whole issue around carbon farming and the need to be able to monitor, report and verify what is happening on farms. We need to have the data in respect of the baselines and work is ongoing in that regard. Generally in terms of the actions sets out in the climate action plan on agriculture we have set out a series of actions that will focus initially on nitrous oxide in the first carbon budget period. The success of the actions there will determine future actions that roll out from there.

Mr. Dale Crammond: The Deputy made a good point. We need to understand emissions on farm. As part of the food vision dairy group that the Minister, Deputy McConalogue, set up earlier this year, the interim report of that is in the public domain. One of the measures in that was looking specifically at emissions of every farm in the country.

Deputy Matt Carthy: How will that be measured?

Mr. Dale Crammond: We will have to establish a protocol to do that.

Deputy Matt Carthy: Are there no measures in place and no proposals?

Chairman: Let the witness finish, Deputy.

Mr. Dale Crammond: That is relatively simple to do. It is around how much livestock is on a farm, and how much and what type of nitrogen is applied to the farm. The sequestration will also be looked at in terms of how much sequestration is taking place on that individual farm. This absolutely needs to be done in the context of the carbon farming initiative. It will be done over the coming period.

Deputy Matt Carthy: Here is my difficulty. I have seen no proposal to do that at a practical level. What I saw was more general, baseline studies that say "This is what the average farm with 15 cows emits". My fear is that you could have a situation where a farmer is actually engaging in forestry, ensuring the hedgerows are protected and expanded, planting mixed species swards, engaging in anaerobic digestion and installing solar panels on the sheds and reducing fertiliser use but when it comes down to brass tacks, that farmer will be treated exactly the same as another farmer who has done none of those things unless there is a farm-by-farm audit. Are there proposals to carry out a farm-by-farm audit throughout the State to include every one of our farms?

Ms Edwina Love: The solutions are under development. That is answer we can provide-----

Deputy Matt Carthy: We could have our sectorial ceilings imposed next week.

Chairman: Let the witness answer the question, Deputy.

Ms Edwina Love: The solutions are under development, as Mr. Crammond mentioned. This is being picked up through the food vision groups. We need to address this area. In terms of the research that has been done we have the Signpost Farms from Teagasc which is a network of farms that are looking at different methodologies. The learnings from that will feed into subsequent audits that will need to be carried out to assess where farms are at.

Deputy Matt Carthy: The difficulty is that we are going to have sectorial ceilings next week. According to the opening statement there is little information. It is very clear that it is

not subject to the Oireachtas process and that the Minister for Agriculture, Food and the Marine has a very minimal role. He is consulted in all of this. We heard from the Department of the Environment, Climate and Communications that it will find a number that it can politically get through Cabinet without a single notion as to how it will be reached. We are at the point where we are depending on the Department of Agriculture, Food and the Marine to have a plan. From its opening statement, if I am correct, it essentially says that the Department cannot see a way of reaching beyond 22%.

Mr. Dale Crammond: No, Deputy, that is not what we are saying.

Deputy Matt Carthy: What number can the Department of Agriculture, Food and the Marine reach?

Mr. Dale Crammond: The climate action plan sets out very clearly a series of core measures ranging from 3.7 to 4.2 Mt. It was very clear when we published those figures in the plan that a series of additional measures would be needed to bring us into the required range. We have already heard a little bit about anaerobic digestion. That will undoubtedly play a role. We can manage the manure from our cattle and take the methane from that manure through the anaerobic digestion process and get a direct benefit into the agricultural inventory. We are also putting a great deal of effort into the area of feed additives, which will play a role. Teagasc is working on this. There is a particular product called 3-NOP that is showing promise. It has been approved by the European Food Safety Authority. Teagasc has starting trialling it. We know it works and delivers a 30% methane reduction over indoor house systems through total mixed ration diets. The challenge now is to develop a slow-release bolus to add that feed additive to dairy cows and potentially to beef animals at pasture to give us the mitigation wins we need to bring us to our final target.

Deputy Matt Carthy: All of those things combined, reading Ms Love's opening statement, would suggest that even that and a little bit more would be required to bring the sector to 22%. Mr. Crammond is not saying that is the minimum. What is the maximum he feels agriculture can go to in a realistic sense without undermining our agrifood sector?

Mr. Dale Crammond: It is very difficult to say at the moment. It is probably too early to make that assumption.

Deputy Matt Carthy: Surely the Minister is coming into negotiations with a figure in his head, that this is as far as he can go?

Mr. Dale Crammond: The Minister is in negotiations. It is a matter for Government finally to set the final sectoral ceilings. We obviously are talking to our Minister. He knows the level of the challenge here but it is impossible for anyone at this point in time to determine where exactly in 2030 the agriculture sector will be in terms of its emissions reductions because there are so many uncertainties.

Deputy Matt Carthy: Sectorial ceilings we are told are going to be set next week. Is that the timeframe the Department is working to?

Ms Edwina Love: Yes, we understand that is the timeframe that the Minister for the Environment, Climate and Communications is pursuing.

Deputy Matt Carthy: Okay. The figure is going to be between 22% and 30%.

Mr. Dale Crammond: That is our understanding.

Deputy Matt Carthy: The Department indicates that it does not know what the Minister is advocating for in the discussions. I am going to walk out onto the plinth and someone will stick a microphone in my face and ask, "What should the sectorial emissions be?" I will be accused of being a climate change denier if I cannot answer that question but I have nothing from the information from both relevant Departments that will give me any capacity to answer that question. Do the witnesses accept that?

Mr. Dale Crammond: I do not. We have set out very clearly the measures that are in the climate action plan. We have also clearly explained the sort of additional measures that the sector is going to need to take to bring us into that range. However, it is impossible to say just at the moment where ultimately the level of mitigation will be because there is so much uncertainty. We do not know whether we will get the 30% reduction in methane from developing that feed additive; it may be only 20%. There is still a lot of uncertainty.

Deputy Matt Carthy: If the sectoral target set next week is 30%, will the Department be able to work towards that?

Mr. Dale Crammond: If that is what the Government decides is the final sectoral emissions ceiling that is allocated, then, obviously, we will have to put in place the policies to deliver that over time.

Deputy Matt Carthy: What would those policies be?

Mr. Dale Crammond: As I stated, there are many things we will consider in the food vision group. It is looking at the policy in respect of a retirement or exit scheme for dairy producers who may wish to retire. Obviously, that would have an impact. That is clearly set out in the interim report. There are many things we will be able to consider.

Deputy Matt Carthy: In the context of the areas for which the Department currently has targets, afforestation was mentioned. The programme for Government has a target of 8,000 ha per year. The Department just about hit 2,000 ha last year and might not even get to that figure this year. The position in respect of organic targets is similar. The Government is wildly missing all its targets in a number of areas. Do the witnesses consider that putting a target in place first and following that up with a plan to achieve it, rather than putting in place a plan that will allow us to set an ambitious target that is actually going to be met, may not be the best approach?

Ms Edwina Love: We are engaged in a constructive process to fulfil the Government's ambitions in this area. The targets we have put forward are very challenging. We set that out clearly in our opening statement. Whether it is afforestation or the measures we are seeking to implement on-farm, these are not easy things to do. We are not pretending that they are easy. In terms of organics, the Minister of State, Senator Hackett, announced this morning that the new Common Agricultural Policy strategic plan will have increased rates with the objective of increasing organic farming. These are all very challenging things, however. The fundamental point the Deputy is making is that the window for doing this is closing. We accept that. Unfortunately, the solutions are still in development across the board. As my colleague, Mr. Crammond, mentioned, these are things that are in train in terms of the research. We do not have them yet. If there were silver bullets available now, we would implement them. They are not available.

Chairman: Before I go to the next speaker, there has been serious focus on forestry in recent years. It has been stated that the amount planted this year will be the lowest since the Second World War. I do not know from where the transformation will come to meet our afforestation targets.

In her opening statement, Ms Love mentioned finishing cattle earlier. To finish cattle earlier will require more concentrates. I do not know how that circle can be squared. If more concentrates are used, it will have a larger carbon footprint. Producing cattle off grass, our natural way of doing it, is the most carbon-efficient way of producing beef. I am a farmer and I know that proposing that cattle be finished earlier and expecting that to have a transformative effect on our emission targets will not work.

Senator Paul Daly: Deputy Carthy has covered the majority of what I was going to say. From the answers the Departments have given, they have no idea at the moment how they can achieve 22%. How in God's name can they justify 22.01% at the end of negotiations when they do not know how they will achieve 22%? They are depending on emerging sciences and technologies and tests that are only at inception stage. As has been said, we are years away from carbon footprint audits on individual farms. From what I have heard so far from both Departments, they cannot tell us how they will achieve 22%. Going by what we are hearing from media outlets and other commentary, there is horse trading going on between two Ministers regarding it being between 22% and 30%. How can the two Departments involved in that horse trading, for want of a better phrase, justify 22.01% when they cannot explain how we are going to achieve 22%? In fairness to them, the farming community and the farm representative bodies - the people who are the custodians of the land and will ultimately deliver on this, with or without the science we are all hoping will emerge - have bought in and accepted 22%. If the Department goes to 22.01%, it will lose them as well. That would be a backward step. My basic question for both Departments is how can they justify an announcement of anything over the 22% that is going to be so difficult to achieve, especially when they have farmers with them for 22%? If they sell the farmers out now, they will be on the back foot.

Mr. Marc Kierans: The climate action plan has set out a number of scenarios to reach those various targets. I emphasise that no sector in the climate action plan or across the economy is happy with its ranges of ambition. It is, and will be, a challenge for all sectors. All sectors have to step up and meet those targets. It is not about singling out one sector over another. That is an important point. It is not something the climate action plan or any other sector has done. We have not singled out one sector over another. We have said that all sectors must deliver-----

Senator Paul Daly: Through the Chair, I never mentioned anything about individual sectors or singling out sectors. I asked a simple question regarding to how the Departments propose reaching or can justify more than 22%. I am totally opposed to this sector versus sector thing that Mr. Kierans is bringing up but it was not mentioned in my contribution. This is the Oireachtas Joint Committee on Agriculture, Food and the Marine. We are specifically discussing the agriculture sector and the 22% to 30% window. I do not know where Mr. Kierans is going with his different sectors and sector versus sector. I am trying to avoid that argument at all costs because I think it is detrimental.

Mr. Marc Kierans: I thank the Senator. As I said, the climate action plan set out a number of possible scenarios towards a pathway for the agricultural sector. They were outlined in the opening statement of my colleagues from the Department of Agriculture, Food and the Marine. Those scenarios will be a challenge. They will have to deliver. Some of them will deliver; others will not deliver as much ambition as we hope. That is the point of the plan, however. The

climate action plan will revise them and we and those responsible will have to increase ambition in certain sectors. It will be a challenge but we have to set a target. From the discussion in the earlier sessions, it is clear that we have to act now, set ambitious targets and cut emissions across all greenhouse gases. That is the purpose of the sectoral emissions ceilings in the climate action plan.

Ms Edwina Love: The actions that the agricultural sector is being asked to adopt were identified initially by Teagasc in the marginal abatement cost curve that was done in the analysis. Many of the actions are cost-effective on the ground. To reach within the range that we are setting out, we are looking to mobilise as many of those actions as possible, as quickly as possible. Once that process is under way, it will be about getting better, not bigger, and focusing on margins rather than the numbers. The scale of this transformation is not to be underestimated. We have clearly stated on record that reaching that 22% reduction will be extraordinarily challenging and, going beyond that, we are looking to future developments in technology to get us there. We do not have those solutions yet. As my colleague, Mr. Crammond, has outlined, we intend and hope, as the research suggests, that the feed additives piece will deliver benefits on a considerable scale. We just do not have that certainty right now, however.

Senator Paul Daly: Mr. Kierans keeps going on about the importance of setting ambitious targets. My point is that it is far more important to set achievable targets than to be the top kid in the class who always has his or her hand up but does not know the answer. His narrative is so obvious in terms of ambitious targets. An ambitious target is useless if it is not achievable. We need to change that narrative to one of setting achievable targets.

Deputy Michael Fitzmaurice: We had three professors before the committee during an earlier session who spoke about methane and the different types of methane - methane from gases and methane from cattle. One third of the methane produced in the world comes from cattle. To put it simply, they gave figures to show that if we got rid of every animal in the world, that would only change the temperature by one third of 0.1%. The professors were concerned about the reporting in each country in relation to agriculture, its accuracy and the way everything is being lumped together, rather than a breakdown being given of the methane that basically disappears in ten or 12 years. What has the Department done with whoever it reports to in respect of targets and emissions to ensure these changes come about? What has it done with the EU or the people who keep the climate figures to try to resolve that issue, or has it done anything?

Mr. Marc Kierans: I thank the Deputy. One point to stress on this is that the GWP100 is the default emission used in the international process. I accept the Deputy's point. On what the Department has done and continues to do, the Department has worked within the UN international process and the EU process at various levels. It has engaged with the likes of Professor Allen to understand this process and has put forward in those negotiations on the changes. It is a slow, tortuous process, as Professor Thorne pointed out, but we do work towards that. It is just that it takes time and the science has to be settled. It is, necessarily, a very rigorous process to adopt new changes to the UN inventory figures.

Deputy Michael Fitzmaurice: I am sorry for interrupting Mr. Kierans. The future of Irish farming is at stake in the next week or two and he says it is slow for these people to do X, Y and Z. Someone could lose their livelihood because someone in some other country is slow or the people who collate the figures or make the decisions and are dressed up in suits are slow and it does not matter to them. Is that the way we should be operating? When we talk to Teagasc, which is doing research on wetlands, the figures are coming out totally different. We are using

default figures for most of the areas we are reporting on because we have not done the research. We are given what I would call falsified figures because we are using by default what other countries said were the figures. Those are the figures we are given and farmers around Ireland are at the mercy of them at the moment. Is Mr. Kierans comfortable doing that?

Mr. Marc Kierans: Again, I suggest the Department has invested through the EPA in the environmental research programme and it has-----

Deputy Michael Fitzmaurice: Hold on, they are default figures. Let us be clear on that.

Chairman: I ask the Deputy to let Mr. Kierans answer.

Mr. Marc Kierans: The Department, along with the Department of Agriculture, Food and the Marine, responded with research that is increasing our sensitivity on those tiers and that again is fed into the process. That is the method by which we make those changes.

Deputy Michael Fitzmaurice: We have default figures. It is now recognised and can no longer be questioned that we had default figures and that the new figures are totally different. In the meantime, we are going to set targets that will be detrimental, one way or the other, for the family farms around this country. It is like building a house. You either put in a proper foundation and it stays up or you put in a bad foundation and it falls. Why have we gone down that road?

Farmers ask me daily, as I am sure they ask every other public representative, what a reduction of 22% means and what a reduction of 28% means. All I can say to them is it is like Santa coming for Christmas except this is a bad one and we do not know what toys he is going to bring. When are we going to hear? All I hear is there is a row over 30%, 28%, 27%, 25% or 22% but what is this? What must the average farmer do? Will they have to stay under the nitrates threshold of 170 kg per hectare for the next seven or eight years? Some public representatives who never farmed land in their lives have spoken of a need to have a cull. What are the guidelines or where are we with this? Can the officials give us some information? We have to talk to the ordinary people on the ground. As Deputy Carthy outlined, we need to have information that the Departments did not give us if we are to know what everything means.

Mr. Marc Kierans: To go back to my original point, the Deputy questioned us on the foundations and we have made those investments in the research and they are bearing fruit. They are the figures he is discussing.

As to the specifics of the actions required of the agricultural sector, I must defer to my colleagues in the Department of the Environment, Climate and Communications. These are laid out in the climate action plan. They have obviously stressed that there are some that will deliver notable amounts and others that have greater and less potential as time evolves.

Deputy Michael Fitzmaurice: Mr. Kierans may have listened to the contributions of the representatives of the Department of Agriculture, Food and the Marine. Does he accept that for the next three or four years, we will have to wait on new technologies? We heard from Dr. Mitloehner this morning. In California, a new additive given to dairy cows has reduced methane emissions by 30%. It has been approved by the government there. As the Department of Agriculture, Food and the Marine outlined, there is also a new additive in the EU. It is like baking a cake in that we have already put it in the oven. There is a lot of stuff starting but we will not have the results or proof required to know how successful this will be for another three or four years. What work will the Department do with the Department of Agriculture, Food and

the Marine to ensure we do not impose draconian measures on farmers when the cure that will resolve a lot of issues could be just down the road?

Mr. Marc Kierans: Again, the task of the Department of the Environment, Climate and Communications is to implement the carbon budgets as set out by the Climate Change Advisory Council and voted for by both Houses of the Oireachtas. The task of delivering on that once the sectoral ceilings are set-----

Deputy Michael Fitzmaurice: It was not voted for by both Houses of the Oireachtas. It was voted for by some Members of the Houses of the Oireachtas.

Chairman: We are past that. I ask Mr. Kierans to continue.

Mr. Marc Kierans: We will work with all Departments to help them deliver their plan but our objective is to set the sectoral emissions ceilings and to work with them in that prospect. I will go back again to the point made in this morning's discussions that the longer we leave the setting of the sectoral targets, the fewer options we have as times passes and we need to act now.

Deputy Michael Fitzmaurice: Mr. Kierans does not think we may have more options when we see the proof of the different technologies being looked at. Is he not hopeful about those?

Mr. Marc Kierans: As I said, the message that was clear this morning was that sectoral targets and action are needed now. The scientific stuff that is emerging is very hopeful and very promising and if it does deliver, we will be able to readjust the actions required elsewhere in those sectors.

Deputy Michael Fitzmaurice: Mr. Kierans referred-----

Mr. Marc Kierans: Part of the reason we have the annual review process is to reassess how we are getting on and whether we need to make changes.

Deputy Michael Fitzmaurice: Mr. Kierans referred to the two Ministers talking. No Minister suffers divine inspiration. They have teams of civil servants, including Mr. Kierans, and the Minister for Agriculture, Food and the Marine has the officials in his Department. These civil servants advise the Ministers and look at this, that and the other scenario. I assume Mr. Kierans is one of the people who are doing that. What figures or types of cuts, or otherwise, are being looked at?

Mr. Marc Kierans: The discussions are currently taking place with the Ministers and I am not party to those discussions.

Deputy Michael Fitzmaurice: Mr. Kierans will have a good idea of what is on the table in the papers.

Mr. Marc Kierans: I beg the Deputy's pardon.

Deputy Michael Fitzmaurice: The Civil Service puts the stuff together for the Minister. A Minister does not sit down and write everything up and give all the alternatives over and back. I have a good idea how government works. I am asking Mr. Kierans what is laid out for the different scenarios between the 22% and 30% figures.

Mr. Marc Kierans: As I said, the role of the Civil Service is to advise the Ministers. That advice has been given. The Ministers are taking that advice on board in their discussions. That

is all I am prepared to say at this stage.

Deputy Michael Fitzmaurice: Yes, so we are going to hear nothing.

The Department of Agriculture, Food and the Marine has looked at different scenarios. I spoke to some of the officials early in this debate and my understanding at the time was that we were going down the road where the ordinary farmer would keep under the 170 kg per hectare nitrates limit, there would be different allowances on fertiliser and that basically farmers who were not overstocked would not be coming in for much of a shudder. Has that changed?

Mr. Dale Crammond: I do not think so. There are a number of measures. The targets for agriculture are very ambitious and no one is going to say otherwise. It is going to require every farmer in the country to make a contribution to those targets. Every farmer is different so the contribution each individual farmer will make to the process will be different.

Deputy Michael Fitzmaurice: What is Mr. Crammond's opinion, though? I want to get this clear. In everything we heard earlier, which was painted a bit rosy, there was no talk of a forced cull. Is that the scenario all the time?

Mr. Dale Crammond: As far as I know, no one in the Department of Agriculture, Food and the Marine is talking about a forced cull. As I said, we have set out a series of measures in the climate action plan and we need to implement them fast. As for your point, Chair, about earlier slaughter, that is exactly the sort of issue we need to bottom out and look at. A lot of Aberdeen Angus cattle are being finished at 22 and 23 months off grass in the second summer. We need to look at that and to see how the genetics of those animals that can be finished at two years are allowing for them to be killed at those weights. With earlier slaughter, moving from 27 months to 24 months, there is potentially between 0.7 Mt and 1 Mt of emissions abatement that will have a real, meaningful impact on reducing methane emissions. That is exactly the sort of measure we need to look at.

Deputy Michael Fitzmaurice: The following was spoken about earlier. We had, I think, the OPW and the Department of Agriculture, Food and the Marine at one of our committee meetings, at which it was stated that a contract would be put out to get LiDAR done on all of the country to know what we have and what we do not have. My understanding was that the tender was to go out last October. That was the timeline we were talking about. That related to forestry, I think. This was the time we were at Devenish and so on. My understanding was that the contract was to go out to tender. Devenish told us that when LiDAR work is being done, it needs to be at 15 sq. m and that any longer does not produce accurate results. It will count all the sequestering and so on. My understanding was that the contract was to go out last spring. Has anything been done in that regard? Does the Department have any tie-up with the OPW to make sure that will be done? The simple reason I ask that question, which is for Mr. Kierans, is that nearly every day I come to Dublin I drive about 120 miles and there are bushes and trees everywhere I go and not one of them is accounted for within our carbon mitigation plans. Why have they not been put in as mitigation? It seems the Department of Agriculture, Food and the Marine set a target in 2016, as Deputy Carthy pointed out earlier, of 8,000 ha. All we have reached is 50% of that, and in 2045 we will see the knock-on effect of that, with the Department, not the farmers, having actually caused the problem. "Forestry" is now a dirty word among the farming community. Farmers do not want even to hear about it. The only thing that might tick the box is the legislation we are bringing in that allows for a hectare to be planted. It might cover a farmer in the eco scheme and whatever other measures and ensure that the civil servants are covered and will be able to tick the box that we have done the 8,000 ha. In fact,

however, nothing will have been contributed to the commercial side, although it might do a bit for our sequestration. We have failed in that. Where are we on the LiDAR system? That is what I want to know.

Mr. Marc Kierans: If those questions are directed at me, I know there is a colleague in forestry-----

Deputy Michael Fitzmaurice: They were directed at Mr. Blackwell.

Mr. Philip Blackwell: I can comment on that. We had engagement with Ordnance Survey Ireland, which stated earlier in the year that it will run a full LiDAR run for the whole country. We are very interested in that. As the Deputy said, in terms of-----

Deputy Michael Fitzmaurice: When?

Mr. Philip Blackwell: Later in the year was the timeline given at the time. I do not have an update, unfortunately-----

Deputy Michael Fitzmaurice: We heard in October that it would be in spring. Now we hear that it will be later in the year. Someone needs to get a grip of this. Does the Department of Agriculture, Food and the Marine have a scenario in this regard? This is what we need to know as politicians. We need to be able to tell the people out there what the scenario would be with a reduction of 22%. Would it be that you would farm away and maybe sow a hundred trees and that would be the end of it - happy days? What would the scenario be with a 28% reduction? We are working blindfolded at the moment. When we talk to people out there, they are worried. The next thing coming down the line - I am being quite frank about this with all the witnesses - is that if the figure ends up being over 22%, we will see many people outside the gates here. That is what I see on the ground because farmers are sick of what is going on. The farmer is being put forward as the bad person. Everyone must understand that if people in the cities can do sweet damn all about sorting out the climate problem then it is the farmers we would want to be nice to because it is they who will be the solution to the problem. That message needs to go out there rather than what is heard in the media about the farmer, which is just propaganda. It is not acceptable, and we will not accept it. Rural Ireland has to be stood up for. It is our land, our private property, in our country that will help the person who is able to do nothing about the climate problem. Farmers should be treated with respect, not like criminals.

Deputy Martin Browne: I have just a couple of questions for the Department of Agriculture, Food and the Marine. Is the Department engaging with the Department of Enterprise, Trade and Employment and the Department of the Environment, Climate and Communications in addressing the ability of ESB Networks to connect larger businesses to the grid? I refer to getting the company's solar operations up and running. I have been made aware of significant delays which are costing businesses large amounts of money every day. If businesses are willing to use these technologies and they are big consumers, should there not be pathways for them to continue to do so in a more timely manner?

Ms Edwina Love: Yes, the Department is engaging with our colleagues across the board. Energy-led policy is not a matter for our Department but we are advocating for increased opportunities at farm level.

Deputy Martin Browne: A comment was made earlier about the categorisation of emissions and removals across disciplines that is leaving agriculture particularly exposed to carry the can for other sectors. The point was made that the carbon removals by forestry, grassland

and other lands were accounted for in the forestry ledger of land use, while emissions from grass-fed cattle are counted in the agriculture ledger. Is it not reasonable for farmers to have concerns that the shortfall in CO2 that would result from poor afforestation levels will have to be picked up by them and that there will be other mitigation measures later?

Ms Edwina Love: Generally, the approach to dealing with sequestration is twofold. There is the forestry on one side and there is how we are using the land and dealing with our soils on the other side. I will defer to my colleagues, Mr. Blackwell and Mr. Moore.

Mr. Fergus Moore: As for the forestry side, Deputy Martin Browne is correct to say that low afforestation rates over recent years will have a significant impact post 2030. It is a major concern for us in the Department. Another Deputy mentioned afforestation rates being the lowest they have been for some time. There are a number of factors contributing to that. We planted approximately 2,000 ha last year. Our target is 8,000 ha. All of us in the Department are aware that that figure has to increase dramatically over the coming years. As we mentioned, in the climate action plan we have an 8,000 ha reference as our target. It is an ambitious target, as the committee will know, because we are struggling to get there. We are revising the afforestry programme at the moment. We are examining all the grants and premiums and looking at how those schemes are structured. On 1 January 2023, we will have a new forestry programme. We have a new forestry strategy as well. From the extensive public consultation we carried over recent months, with over 3,000 submissions received, generally speaking, people want to see more trees planted in the landscape. We have to try to see if we can marry that level of ambition with a new and energised forestry programme. Certainly, the ambition is to try to get to 8,000 ha. Every hectare we do not plant will have a significant impact post 2030.

With the calculations we have done in respect of the climate action plan, the contribution forestry will make between now and 2030 will not be very large because those trees are quite small and are not sequestering very much carbon. That does not mean we have to step up our planting now because, post 2030, as those trees get larger, they will start really sucking in significant amounts of carbon dioxide. We will have the 2050 target to comply with as well. Therefore, getting more trees in the ground now, in excess of what we are currently planting, is of paramount importance. The focus of the Department and the Minister in recent months has been to look at the forestry programme. We have engaged quite extensively on the forest strategy preparation. We had a very encouraging workshop involving the forestry stakeholders last week at which we received a lot of good feedback. We looked at grants and the schemes, and giving support to our existing forest owners. Ash dieback was also referenced.

We need to have schemes that are fit for purpose. That applies to all our forestry schemes, because we need to start building confidence again. The licensing issue has been discussed regularly at this committee. We will not get into the stats of that, but the trends are certainly improving on the licence turnaround times. We need to ramp that up over the coming months.

Deputy Martin Browne: Is Mr. Moore sure that the 8,000 ha target will not be reached by August, regardless of what the Department or the Ministers keep telling us?

Mr. Fergus Moore: The planting targets drop at the end of every forestry programme because people are anticipating a better programme for the next period. In saying that, the targets are quite low. In the past, we planted very large areas - in excess of 20,000 ha - much of it on peatland soil, which gives rise to many issues with emissions. The land use review is ongoing across various Departments. That will say much about what we do with the land of Ireland. Forestry is a key measure. The Department has recognised that it is essential that we plant

more tress, in conjunction with all the other agriculture measures that have been proposed by my colleagues here.

Deputy Martin Browne: Will decisions be based on charts that are on the office walls of the Department rather than the actual reality on the ground for farmers? There are real concerns that the Department may overshoot the mark. We heard earlier that sectors need to be assisted to make that transition. We hear complaints that the Department's ambitions trumps what can be achieved, and that comes back to the 8,000 ha target. Some of the figures that are being thrown out there are not achievable, and Deputies Carthy and Fitzmaurice raised these issues earlier. Is it a case that even the sector and the stakeholders involved know that the target figures being thrown out there will not be achieved?

Ms Edwina Love: In terms of emission reductions generally, and picking up on the point Deputy Fitzmaurice made earlier, we have tried to communicate the actions we expect farmers to take. The roadmap process that we published a number of years ago, Ag Climatise, was designed to be understandable to farmers, to make the swaps they need to make in terms of fertiliser use and the activities they need to undertake on a farm level very clear. If there is any lack of clarity it is in terms of the impact those measures will collectively have within the period. That is where we look to the future measures that are provided for in Climate Action Plan 2021 and point to those technological solutions that we hope will come on stream and make further emission reductions.

This is a biological system that is very challenging to work with. We have seen that through the inventory refinement process, both on the agricultural side and the LULUCF side. It is very difficult to say at any one point because the science and our understanding of what is happening keep improving. We are trying to tread that path where we need to act soon, implement those changes, make them understandable and implementable for individuals in their farm businesses and, at the same time, keep an eye on the longer-term objectives, the targets that have been set by Government, and achieve them.

Deputy Martin Browne: Was a risk analysis ever carried out when deciding the levels referred to? Did it take into account the risk to farmers when a set level is being determined? Was an analysis carried out on the risk to farmers?

Ms Edwina Love: The target that was set - the 22% to 30% range - was informed by Teagasc analysis in terms of what was achievable within the sector on the basis of the technologies that we know exist.

Deputy Martin Browne: We heard that if methane was managed properly, it could be part of the solution. At the same time, however, we also heard that the IFA accused the Government of doing little to make anaerobic digestion feasible at farm level and that this fact puts us behind the curve. We seem to be lacking a proactive response - for the want of a better phrase - to the issue which committee members are concerned about. I appreciate that it may be said that this is for the Department of Agriculture, Food and the Marine to address but that is not the case anymore because we keep hearing that this is an issue across the Departments. Does the Department of the Environment, Climate and Communications have any views on that?

Mr. Marc Kierans: The Deputy is right. Anaerobic digestion came up this morning and has long been discussed as a possible solution, and there has not been sufficient support, direction and policy drive for that. One of the ways to achieve this is by setting the sectoral emission targets and making them a key deliverable within the delivery of those sectoral emissions

targets and to drive the policy to make the relevant Ministers responsible for delivering that. That is key. We hope that the various stakeholders involved in that process will come together to deliver those targets, which has not been the case before.

Deputy Marian Harkin: I thank the witnesses and appreciate them giving of their time. While I am not a member of this committee, I represent a rural constituency. I have a huge interest in this matter and have a background in CAP negotiations over the years. I came here today to listen and learn. I got a lot of good information in the earlier sessions. While I have received some information here today, as somebody who wants to listen and to learn, I am not getting enough back. I am not blaming any of the witnesses as individuals. They are here representing their Departments and Ministers. They are experts in their own right but, in a way, I am the connection between them and the farmers I will meet tomorrow or the next day.

Ms Love mentioned that the Department has laid out pathways and solutions and provided detail. Yes, there have been some of this but there is no real clarity. Much of this revolves around using less fertiliser, slaughtering early and using multispecies swards. They are all positive actions but what I have not heard today, and which I heard from speakers in earlier sessions, was about market incentives. We heard about what happened in California where they managed to achieve a 30% decrease in methane emissions. The committee was told that market incentives were put in place. We know that farmers are businesspeople - that is what they do - and would respond to that. I hear a lot of negative stuff in the media and what is wrong, although this has nothing to do with today's discussion. What I do not hear are the positive steps that will engage farmers, so that when I go to a meeting they will sit down and ask me what the details are and what they can do. Farmers are people, the same as the rest of us. They have families. They see the world burning around them. They are not stupid people. They know they can make a contribution. I am hearing far too much about cutting this and cutting that, but not about what we can do. That is just a general comment and if anyone wants to comment on that, that is fine.

I have a number of specific questions. Mr. Kierans said that we are measuring the decrease in greenhouse gas emissions. To be precise on this - I am looking for clarity here - are we measuring CO2 equivalents and not CO2 warming equivalents of each of the gasses, nitric oxide, carbon dioxide and methane? If not, as Deputy Fitzmaurice said earlier, what we are really looking at are default figures. The witnesses are not responsible for that personally and I am not asking them to defend it. I am asking them because farmers will ask me this question.

We have also been told that we need to establish a protocol to measure emissions and sequestration on individual farms, and that is being planned. If I meet some farmers in Drumkeeran tomorrow night, can I say to them that this will be done and that if they sit down, plan and work to sequester the greatest amount of CO2 they can to limit their methane emissions, in a year or two those efforts will be taken into account? Can I tell them that in order that they can plan for it?

I do not see anything wrong with ambition in the context of targets. We need to be ambitious, but I agree with Senator Daly that we need to be realistic because, otherwise, it is pie in the sky and people will just ignore it. The last thing we want is farmers ignoring what is happening. The witnesses may or may not be able to answer my question because it is partly political but I will leave it with them. We know it is going to be somewhere between 22% and 30% so what is the need today, tomorrow or next week to fix that as a definite target? Why can we not leave flexibility there while saying we want to be ambitious? Why can we not leave it flexible in order that farmers do not feel that what is being asked of them will not be achievable?

We have listed a number of actions. To be fair to the witnesses, they have done that and have given us some detail. I have great belief that innovations will come on stream, but they may not do so in time. That is the big issue. If it does not happen in time, farmers will be left wondering whether we will be looking at a cut in the herd. I heard somebody mention a retirement scheme, which is basically the same thing. That is the danger when you set your target at a point that may be achieved but not within the timeframe in which it is expected to be achieved. If you allow flexibility, you get people to work with you.

Ms Edwina Love: Any changes that we are asking farmers to make need to be economically viable. This is a cornerstone. To go back to an earlier question about anaerobic digestion, that is a key part of it. We do not want to ask farmers to move into different activities or diversify in a way that will cost them. We continually need to improve in communicating that message and pointing to the pathways.

Deputy Harkin asked about the industry incentive. From a consumer perspective, there is definitely a growing awareness - and there needs to be a growing awareness - of the real cost of producing food and paying for it accordingly. I mentioned the announcement this morning by the Minister of State, Senator Hackett, regarding organics. Organics should be a premium product. I will defer to Mr. Crammond on the question about industry support.

Mr. Dale Crammond: It is a valid point. As Ms Love stated earlier, we are only going to achieve this through a combination of measures. These involve financial supports for farmers. Regulation will also be part of the solution. There is no getting away from that. Private industry incentives will also play a role. We have raised the issue of the early finishing of our beef animals. This will not happen unless the pricing structures change to encourage and incentivise that. If we look at what some processors have done recently in terms of their sustainability programmes, we can see that they are offering milk price bonuses to farmers who take on a particular suite of actions, be they around the use of protected urea or biodiversity initiatives. This is going to be crucial. A whole-of-government, whole-of-industry and whole-of-sector approach is needed. It is not just us in the Department sitting in our ivory towers and stating that this is how it must be. We need to bring everyone with us. The industry will be crucial. To be fair to the industry, it is up for this. We have discussed the matter with it, and it wants to be part of this transition and journey. It is selling these products all over the world, so it wants to be the most sustainable it can possibly be in respect of it.

Metrics were mentioned by Mr. Kierans. It is not realistic to say that we can change the metrics at the moment. We can engage internationally. It is part of a process. The climate legislation contains a very special reference to the distinct characteristics of biogenic methane. That has to be taken on board by Government when it is considering establishing these sectoral ceilings because methane is really the only gas that behaves differently in the atmosphere *vis-à-vis* the other two greenhouse gases that make up the majority of the inventory, namely, carbon dioxide and nitrous oxide. That clause is there to cover this. The Minister was very aware of that, the Government is clearly aware of it and they will have to take it into consideration as they have done to date at all stages in the process.

Deputy Marian Harkin: Does the Chairman have any questions?

Chairman: No. We have had a long day. I thank the witnesses from both Departments for coming before us. Our concern for the agrifood sector does need amplifying. We are extremely concerned. Food security must be part of the equation. While none of us are denying climate change in any way, we must ensure we put a target in place that is achievable and that

will not hinder our ability to produce sustainable food. We see Germany reopening a fossil fuel-powered power plant today. If we put obstacles in place that will hinder food production on this island, that production will happen somewhere else and in a less sustainable manner. This is the reality. I thank the witnesses for their contributions. Deputy Fitzmaurice wants to ask a question.

Deputy Michael Fitzmaurice: Can a commitment be given that we will drive the reporting of methane emissions from the agricultural sector agenda in order to ensure that it is recognised in a different status by other countries? Can the Department of Agriculture, Food and the Marine give an undertaking here before there is any announcement of 5%, 8% or whatever percentage will be talked about? Will the Department give an undertaking that there will be a document showing a pathway with consequences or ways of resolving how we get there that every Deputy, Senator and farmer has the opportunity to look at? Can this undertaking be given? At the moment, we are being asked the questions. In fairness, the Department of Agriculture, Food and the Marine does not yet know. The danger is that this could explode if the Government does not do it right. What it needs following an announcement are all the ways of reaching the target. It is like typing how to get from my house to Dublin into Google and it will show you. The Department went around the country with regard to the CAP. The biggest problem we are seeing is that the media seems to have all the information before we have anything, which is not acceptable nowadays. I am asking that this comes out, that we know what we are looking at and that it is accurate reporting and not someone adding 40 times more to it than what is on it. We can decide then if it is acceptable or if there is a different story to it. Can we be given that undertaking?

Chairman: I wish to make a final point before the witnesses answer Deputy Fitzmaurice's question. What is extremely annoying for people is that our unique landscape is not getting any recognition. If one travels across Europe, one will not see a ditch for miles. Our unique landscape has the ability to sequester carbon. We are being told we have to do X and Y with our ditches, but no credit is being given for carbon sequestration. Each individual farm has a serious number of ditches. Farmers cannot comprehend why that landscape is not being recognised in the calculations. That is something that will not go away. It has to be addressed if we are going to be fair. We have discussed forestry today. If we are going to be fair in the calculations at farm level, we have to give recognition to the unique landscape we have compared with the rest of the world. When one travels in North America or wherever else, one will not see the landscape we have in this country. There is no recognition of that in the entire emissions debate.

Deputy Marian Harkin: I wish to add to that, and to back up what the Chair said. In some of the CAP programmes there is recognition, perhaps, of our unique landscape features and our hedgerows and trees. They are across the country but especially in the part of the country I come from. However, that is no longer enough. At one time there was a recognition of that. It has to be from the perspective of sequestering carbon. If it is not, it will be impossible to bring farmers on board, certainly in the part of the country I come from where there are suckler farmers, sheep farmers and the like. They are all part of the greater whole of agricultural production. Saying to farmers that their emissions will be counted without counting the sequestration of carbon on farms is essentially unfair. If our guests were asked to operate that system in their jobs, they would say they could not do it, that it is not fair and that it is not a system that will work. It is the very same for farmers if our guests are going to talk about doing this at farm level. I want to add my voice to that very strong argument.

Chairman: Does Ms Love have final comments?

Ms Edwina Love: The concept of carbon creation, measuring carbon and trading it is still in its infancy across Europe. The European Commission is moving ahead. It published a communication in December. An expert group is being formed. That group intends to meet at the end of the year. From a departmental perspective, we see tremendous opportunity here. We are issuing a call for evidence in the next couple of weeks so that interested stakeholders will be able to engage with that process. As I said at the outset, the measurement, reporting and verification side of that is critical. We need to be able to say exactly what we have, where we have it and have a baseline from which we can then measure improvement. Mr. Blackwell might wish to speak on that, but I will answer the other question first.

Regarding the engagement with the farming community, the process for announcing the sectoral emissions ceilings is entirely a matter for the Minister for the Environment, Climate and Communications. From a departmental perspective, it is our intention to revise the Ag Climatise document on foot of the ceiling that is allocated to the sector. Again, it is to go back out and talk to people about the concrete actions they need to take on their farms to contribute. There are no secrets about most of the actions. They are all well known and are in the public domain, but it is to try to communicate them. Obviously, we will be relying heavily on the advisory services, both private and in Teagasc, for providing that knowledge and knowledge transfer on the ground. That is our intention.

Mr. Philip Blackwell: Just to add to that, the monitoring, reporting and verification are very important. To garner industry funding in that regard to actually sell a product, which it would be in terms of carbon sequestration, one needs to be quite certain of what that is in the actual certificate of carbon one is selling. There are many elements to the land and how it is used and to the biological processes which influence what is sequestered in a year. For example, a hectare of grass or a grassland area in mineral soils has approximately 200 tonnes of carbon within it. To measure the change within that, it is approximately half a tonne per year in terms of the sequestration or even lower than that depending on how wet it is, the climate and so forth. That is an approximately 0.25% change from year to year.

The research that is needed to get to that point of having a carbon balance for the entire farm is something we need to strive for and something we need. There is a body of work that we have started to invest in, and that needs to be done. That is going back to the LiDAR we mentioned earlier, the national land cover map, the soils, the research projects we have started this year, such as RePEAT, improving our soils maps and then going back to our national agricultural soil carbon observatory, which there is investment in and which will have probably the largest amount of flux towers in Europe. There is work starting there and it is hoped we will get a flood of data coming through which will all feed into this process, but it is just slow in terms of the biological processes around land use and sequestration.

On the hedgerows, the sequestration is measured in the EPA inventory in terms of mineral grassland and also in terms of our organic soils that are farmed, which have higher emissions. On balance, our grasslands are in an emission overall on a national basis. We need to get down to the granular level on a farm-by-farm basis where we would know whether it is having a positive impact, but there will be difficulties where farms with organic soils may have issues with that.

Deputy Michael Fitzmaurice: My understanding is that we are using figures on default and that Teagasc - and I went to Sligo to see where it was setting up on what we call peaty soil - is only now getting the figures together. That is going to take a while. Many of the figures we are using at present are worst case scenario that we have no research on. That is not good. It is

the same for climate action. We are using the figures the EPA is using and we are shafting our own people. We are saying this is putting out this and that is putting out that and we are using figures from other countries that could have totally different landscapes, and which are starting to evolve now with some of the information that is filtering through. We are making decisions for the future of farming without having the knowledge of where we are going. That is what I worry about, that we will do an injustice to these people because we do not have the research done. Are the officials worried about that?

Mr. Philip Blackwell: I recognise that there are default figures of tier 1 in the inventory for land use and that needs to be improved.

Chairman: I thank the witnesses from the two Departments.

The joint committee adjourned at 4.59 p.m. *sine die*.