

# DÁIL ÉIREANN

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## AN COMHCHOISTE UM CHOMHSHAOL AGUS GHNÍOMHÚ AR SON NA HAERÁIDE

## JOINT COMMITTEE ON ENVIRONMENT AND CLIMATE ACTION

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*Dé Céadaoin, 12 Eanáir 2022*

*Wednesday, 12 January 2022*

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Tháinig an Comhchoiste le chéile ag 1.30 p.m.

The Joint Committee met at 1.30 p.m.

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Comhaltaí a bhí i láthair / Members present:

Teachtaí Dála / Deputies	Seanadóirí / Senators
Richard Bruton,	Lynn Boylan,
Réada Cronin,	Timmy Dooley,
Cormac Devlin,	Alice-Mary Higgins,
Darren O'Rourke,	Pauline O'Reilly.
Christopher O'Sullivan,	
Bríd Smith,	
Jennifer Whitmore.	

Teachta / Deputy Brian Leddin sa Chathaoir / in the Chair.

## Carbon Budgets: Discussion (Resumed)

**Chairman:** I have received apologies from Deputy Alan Farrell. I welcome: Professor Barry McMullin and Mr. Paul Price from Dublin City University, DCU; Professor John Sweeney of Maynooth University; and Professor Kevin Anderson of University of Manchester. On behalf of this committee, I thank them for coming before us today. The purpose of this series of meetings is to consider the carbon budgets. The carbon budget was referred to this committee on 7 December and we are required to report back to the Houses by 7 February. In order for the committee to consider the carbon budgets, we are holding a series of meetings this week and a final session next Tuesday in which we are hearing from all relevant stakeholders to inform our work.

Yesterday, we heard from representatives of the Climate Change Advisory Council's climate budgets committee and had a very informative discussion. This is a very important piece of work being undertaken by this committee as it is the first in a series of carbon budgets to be agreed in order to ensure that Ireland meets its ambitious target of being a carbon-neutral economy by 2050. It is one that this committee is taking very seriously.

Before we begin, I will read the note on privilege. I remind witnesses of the long-standing parliamentary practice that they should not criticise and make charges against any person or entity by name, or in such a way as to make him, her or it identifiable, or otherwise engage in speech that may be regarded as damaging to the good name of the person or entity. Therefore, if a witness's statement is potentially defamatory in relation to an identifiable person or entity, they will be directed to discontinue their remarks. It is imperative they comply with any such direction. For witnesses who are attending remotely from outside of the Leinster House campus, there are some limitations to parliamentary privilege. As such, they may not benefit from the same level of immunity from legal proceedings as a witness who is physically present on the campus does.

Members are reminded of the long-standing parliamentary practice to the effect that they should not comment on, criticise or make charges against a person outside of the Houses, or an official, either by name or in such a way as to make him or her identifiable. I also remind members that they are only allowed to participate if they are physically located on the Leinster House complex. In this regard, I ask all members of the committee to confirm, prior to making their contributions, that they are on the grounds of the Leinster House campus.

I call Professor McMullin to make his opening statement.

**Professor Barry McMullin:** I thank the committee for the opportunity to provide evidence on this crucial subject of Ireland's first statutory carbon budget programme, under the Climate Action and Low Carbon Development (Amendment) Act 2021. I am a professor in the faculty of engineering and computing at DCU, researching national energy system decarbonisation. I am joined by Mr. Paul Price who is a research fellow in the faculty funded by the Climate Change Advisory Council to undertake research in the domain of carbon budgets. For the record, Mr. Price and I are appearing today in our individual academic capacities and are not representing or speaking on behalf of the Climate Change Advisory Council in any way.

My comments will focus primarily on the statutory requirement for the carbon budget programme to be consistent, in both design and execution, with the Paris Agreement and, specifically, the commitment to quantitative limits on global temperature rise, to be achieved on a

basis of equity and informed by the best available science. Under the Act, the Climate Change Advisory Council has proposed the initial programme of three five-year carbon budgets, with the third on a provisional basis. It is now up to the Oireachtas, informed by the views of this committee, to adopt these budgets as proposed or to revise them on some specified grounds. My view is that the candidate budgets proposed by the council should be regarded as absolute maxima and that the committee should give serious consideration to revising them downward significantly, by which I mean more stringent budgets. This is based on multiple lines of argument, which I will outline as briefly as possible.

The current programme for Government committed explicitly to an average reduction in total emissions of 7% per annum over the period 2021-30. Using the baseline of 2018 emissions specified in the Act, this would allow a cumulative ten-year total to 2030 of 468 Mt CO<sub>2</sub> eq, whereas the council's proposal is for 495 Mt CO<sub>2</sub> eq, cumulatively equivalent to a reduction rate of just under 6% per annum. While the programme for Government properly fell outside the formal legal scope of the council process, it is surely still relevant to the deliberations of this committee and of the Oireachtas. Accordingly, I suggest that the committee should consider revising down the first two proposed budgets by a combined amount of, at least, 27 Mt CO<sub>2</sub> eq, to align them with the programme for Government. The committee should resist deflection into a narrow focus on the projected annual emissions level in 2030. This is simply not equivalent to the original programme for Government commitment on any good faith basis of best available science.

Separately, as explicitly required by the Act, the council has assessed its proposed budget programme for consistency with the Paris Agreement. It has emphasised that this assessment depends not just on the budgets, but on how they are allocated between sectors, which strongly affects the relative mitigation of different greenhouse gases, and on unavoidable value judgments required to interpret the obligations of the agreement. While it concluded that its proposed budget programme is broadly consistent, at least with the temperature goals of the agreement, it was also clear that its assessment represented only a minimal test of Paris consistency and took the position that the judgments involved ultimately go beyond the remit of the council. It is, therefore, proper that this committee should now make its own assessment and determination on all these issues.

A key aspect of this is relative historical responsibility for climate change and the need to treat this on an equitable basis between countries. Those with greater historical responsibility have a correspondingly greater obligation to act. This is a complex issue, but it directly affects the assessment of carbon budget consistency with the Paris Agreement through the choice of a reference year for temperature increase. In effect, differentiated historical responsibility between countries is waived for all emissions before this reference year. In its assessment, the council adopted a reference year of 2020, but without offering any explicit rationale for this. In previous work with colleagues at DCU and Trinity College Dublin I have argued that 2015 should be regarded as the latest defensible reference year for this purpose, it being the year when the Paris Agreement was adopted. Indeed, there is a good case for extending further back, even to 1992, when the UN Framework Convention on Climate Change was agreed. Since the council published its budget proposals, I have initiated with DCU colleagues, including Mr. Price, independent analysis of the effect of varying the reference year. Preliminary results indicate that using the council's methodology, but with a reference year of 2015, all but one of the scenarios considered by the council would then fail the council's own test for Paris Agreement consistency, strongly indicating a need for further reduction in the proposed budgets to adequately align with the intentions of the Act.

Regulations issued under the Act direct that certain emissions should be omitted from the carbon budget framework, that is, those arising from international aviation and shipping. These are significant for Ireland, amounting annually to just under 4 Mt CO<sub>2</sub> eq, in 2018, primarily in aviation. However, the fact that accounting for such emissions falls outside the budget framework does not mean they can simply be ignored in the setting of the budgets. On the contrary, as already noted, the budget process is required to operate on a basis consistent with the Paris Agreement. Recent independent legal analysis, commissioned by the Brussels-based Transport & Environment NGO, is unequivocal that such emissions fall within the scope of the Paris Agreement. Accordingly, they must still be provided for in some way in the national budget process prescribed by the Act. The council appears to have taken the view that this particular aspect of Paris consistently fell outside the scope of its assessment. On that basis, therefore, it falls to this committee to make such provision. Again, this indicates that the proposed budgets should be reduced, at least, by the projected national share of such international aviation and shipping emissions. A minimum estimate of this would be 40 Mt CO<sub>2</sub> eq, over the period 2021-30, which is the first two carbon budgets.

A further critical consideration is prudence, as explicitly expressed in the framework convention through the precautionary principle. The council's Paris test focused on the lower temperature goal of the Paris Agreement, that is, limiting to no more than a 1.5oC increase compared with pre-industrial conditions. This was very proper in light of the Intergovernmental Panel on Climate Change, IPCC, special report on warming of 1.5oC, indicating rapidly escalating risks of severe global disruption as this threshold is exceeded. However, the relationship between that temperature limit and the permissible global greenhouse gas budget is still subject to very significant scientific uncertainty. It appears that, in effect, the council adopted a budget based on just a 50% probability of meeting this temperature goal, that is, no better than a coin toss.

I urge the committee to explicitly consider whether this represents an adequately prudential approach. If not, then the Irish budgets should be further reduced to reflect this. It should be noted that the equity requirements of the Paris Agreement extend to at least the further dimensions of differentiated vulnerability and capacity to act and, arguably, to reparation for ongoing, severe and highly unjust impacts of climate change. While the national claim on the global carbon budget is not the sole, or indeed the main, potential mechanism for responding to these issues, I would nonetheless urge the committee to still bear them in mind in assessing overall consistency with the Paris obligations.

Moving on from the immediate adoption of the carbon budgets, the next key step under the Act will be the division of these budgets across sectors, that is, setting the sectoral emissions ceilings. As this is explicitly a Government responsibility, the council properly refrained from prescribing any single sectoral breakdown, but did provide a set of five illustrative scenarios specifically exploring different potential divisions between the two largest emissions sectors, namely, agriculture and energy, including electricity, transport and heating. This was essential to inform its assessment of consistency with the Paris temperature goal. Even though all these scenarios are designed to correspond, essentially, to the same aggregate carbon budget programme, as expressed in carbon dioxide equivalent emissions, they differ very significantly in their ultimate contribution to global warming. While the detailed interactions are complex and will benefit from further scientific analysis, it is clear that the scenarios allocating relatively larger budget shares, or lesser emissions reduction, to the agriculture sector also correspond to greater absolute levels of warming and, therefore, greater risk of failing the requirement of consistency with the Paris Agreement. I would urge the committee to give early consideration to

this issue and to offer relevant advice to the Government in advance of the setting of the sectoral emissions ceilings.

While adopting the national carbon budgets and corresponding sectoral ceilings are essential steps in Ireland's climate action, their effectiveness will hinge on actual delivery. It is critical to recognise that under the 2021 Act carbon budgets are no longer mere targets to be aspired to; they are self-imposed, quantitative statutory constraints, legally binding upon the State. This is a radically new and extremely challenging framework for our political and policy institutions. This is entirely justified by the scale and urgency of the climate emergency, but it demands an urgent re-evaluation of our governance mechanisms to ensure that they are commensurate with this task. It is no longer a question of merely doing our best, we must do what is necessary. In particular, there is a very strong case for the early establishment of mechanisms to dynamically regulate, as and when necessary, the upstream inputs to Irish societal activities, such as fossil fuels, that ultimately give rise to greenhouse gas emissions. This would effectively create a backstop, ensuring that carbon budget constraints would be reliably met, regardless of shortfalls in the effectiveness of other less direct measures. Given the overriding need for justice, equity and national solidarity in these actions, this should be in the form of a system of equitable rationing. I have previously advocated for the deployment of one particular such system, known as tradeable emissions quotas, TEQs, but whether through that approach or some other, I urge the committee to consider this need for much stronger, transparent and societally inclusive, national carbon budget governance at the earliest possible opportunity.

My final comment is in regard to the international dimension of climate action. Through the 2021 Act, and the implementation of its voluntary, nationally-determined carbon budget process, explicitly bound by the Paris Agreement goals, Ireland has sought to take a leadership role in modelling how the agreement can be effectively delivered on. However, the harsh reality remains that unless those countries responsible for the great bulk of emissions adopt similarly ambitious measures, the agreement will still fail with devastating consequences for current and future generations in all countries across the globe, including Ireland. As we celebrate the centenary of the establishment of the State, we can take some justified pride in our record as a small independent nation in advancing progressive multilateral action through active diplomacy. This was most recently manifested through our rapid mobilisation of diplomatic support from other EU member states during the ongoing Brexit process, and through our success in being elected to the UN Security Council for the 2021-22 term. I suggest that this committee now initiates an urgent collaborative activity with the Joint Committee on European Union Affairs and the Joint Committee on Foreign Affairs and Defence to consider how we can collectively upscale and prioritise Ireland's diplomatic effort on climate action so that our newly ambitious local efforts can make the maximum possible contribution to catalysing the required emergency global response.

I make these remarks on behalf of both myself and Mr. Price.

**Chairman:** I thank Professor McMullin and Mr. Price. I invite Professor Sweeney to make his opening statement.

**Professor John Sweeney:** I thank the Chairman for inviting me to attend this meeting. I am emeritus professor at Maynooth University and I am a climatologist. I did a lot of the early work on scenario modelling for Ireland and the modelling of climate impacts in areas such as agriculture, biodiversity and hydrology. I have also done some work with the IPCC on the fourth assessment report or AR4. It is AR5 and AR6 that have really given rise to the change in approach, which is evidenced by the climate Bill in Ireland, for example, in terms of carbon

budgets.

Members can see from the diagram I have provided that we now have a very strong linear relationship between cumulative emissions of greenhouse gasses and the resulting temperature change. We can now say what the finite budget remaining is, how that should be allocated among countries and what the consequences will be if we stop or reduce our emissions at certain points. We are dealing with very real-world consequences because we are dealing with tipping points of 1.5°C and 2°C where we may change the global climate system in a way that may not be recoverable. We know, for example, that there is a high risk that once we breach those points we may alter the circulation of the Atlantic, which Ireland is so dependent on, we may lose the Arctic summer sea ice and we may start the irrevocable melting of Greenland. All of those mean that it is imperative that we take very seriously the task that we have been entrusted with and reduce our emissions accordingly.

Professor McMullin has dealt with Article 2 of the Paris Agreement so I will not dwell on it. The Climate Change Advisory Committee handled its test of the Paris Agreement in a rather complicated way. I can see some of the arguments behind that but there is a much more simple way and that is to look at what the United Nations has said is the test of the Paris Agreement. It is a reduction of at least 7.6% on a global scale ongoing until 2030. For countries like Ireland, which has an historic responsibility, I think that figure is low and should probably be nearer 11%.

The question of compliance with our EU obligations also arises. I have heard a lot of comments that this is the second most ambitious reduction figure in the world. That is not necessarily a fair description because if one drags one's feet for 20 years and has huge *per capita* emissions, it is quite easy to set a high target. Many countries have achieved similar figures and ongoing reductions that Ireland has not achieved so I do not think we should pat ourselves on the back prematurely. In fact, if one does the calculations for emissions between 1990 and 2030, one sees that for Ireland's projections the reduction is likely to be about 44% based on the current carbon budgets being allocated. It is not the Fit for 55 package that people might otherwise suggest.

In terms of the actual budgets themselves, and to add to what Professor McMullin has said, my main concerns would be the questions of slippage and timing. We have seen slippage and timing being the deathbed of many climate policies over the years. I am long enough in the tooth to remember our first national climate change strategy in 2000, which is 22 years ago. At that time, we had sectoral targets and tonnages for each of the sectors but that is now lost in the depths of history.

I would like to address the question of backloading. The budgets are backloaded as it is 4.8% in the first five-year period and 8.3% in the second five-year period. That is very risky because of slippage. If we do not get that up and running in the first five-year period, it will place an intolerable burden on the period 2026 to 2030. In particular, the fact that we will not incorporate the national and sectoral budgets finally in the plan until the fourth quarter of this year creates at least a two-year loss in the first carbon budget.

Another aspect is the reporting schedule for the Climate Change Advisory Council, which is obliged to report by 30 October each year. The Ministers who have been flagged with not taking sufficient corrective action have a whole three months to respond to those comments but that takes the whole procedure into early 2023 and beyond the time for which the 2022 climate action plan will have been formulated. There is a real administrative difficulty here. It may not

be possible to take corrective action to keep us within budget in a timely fashion.

I am very concerned that, as Professor McMullin has said, these are not targets but legally required limit values. If we do not meet them by the end of 2022 or early 2023, we will be required to make savage reductions in sectors to achieve them by 2025. Let us make no mistake about that because this is a legally enforceable requirement.

I am concerned about the time lag in terms of when the data becomes available because we know it takes some time for the emissions data to become public. We have provisional data for emissions in 2020 that were published in September of last year so there is a lag of almost of a year in the data becoming available. It is going to be very important that if we are to inform the CCAC in a timely fashion, the council will have to have access to provisional data much earlier than the nine-month lag that currently exists. I think the CCAC has sent a memorandum of understanding to the Government that addresses this point to some extent. It is an essential requirement for the CCAC to be able to work efficiently.

The sum total of all of that is that there is a great deal of uncertainty in terms of the first carbon budget period. On that basis the precautionary principle, which Professor McMullin mentioned, would seem to indicate that preliminary action should be taken in advance. We should not use the excuse that we do not have the technical infrastructure and administrative capabilities, or that all sorts of obstacles are stopping us from making the necessary requirements in the first carbon budget, and therefore it should be a relatively relaxed budget. I think that the opposite applies. We have moved beyond the economics and the infrastructure. We must act in a manner that is commensurate with a problem that was described in just one way yesterday and that is the climate emergency. We have seen how the organs of the State have effectively responded to an emergency over the past two years. This is an emergency to which an equal response capability also should be given. The issue of timeliness is important.

I have concerns in respect of some of the assumptions on which the CCAC modelling was based. In particular, I have concerns regarding the credibility of the land use, land-use change, and forestry, LULUCF, arguments that were put forward. There is so much uncertainty in respect of those arguments that there is a case for using the precautionary principle there. I will be happy to explore that further if members have questions on it.

I have given indications in my written statement in respect of the exposed population in many of the sectors with which we are concerned. They are indicative and overlapping. I do not stand over them as being mutually exclusive. However, members can see where the big problem areas are in the two sectors that are not showing adequate signs of reduction and parts of which are showing signs of increase. They can see that the 93,244 farms are responsible for 37% of emissions and the 1.39 million households with cars are responsible for almost 18% of our emissions. These are the two sectors that we have to address very effectively in the sectoral allocation in any budget to make carbon budgets viable and credible at a national level. I refer to the remaining three areas identified in the statement, namely, residential, energy and manufacturing. Energy is the success story, as the committee heard yesterday, and may continue to be the baseline from which we draw most progress in the next few years.

My conclusions are, perhaps, more fundamental because if carbon budgets at a national level are to be credible, that requires commitment and credibility at a sectoral level. I wish to look briefly at some of the choices we need to make in that regard and whether they are being made in terms of national policy at the moment. I fear they are not being made. First, the allocation of sectoral budgets will require, as has often been stated, major changes in how society

is organised and, in particular, major changes in how agriculture and transport are organised. I have provided in the statement figures relating to the choices available. They are not my figures; they were produced and published by a former director of Teagasc. Of course, he is also a former member of the CCAC. Members can see that if we go for 51% across the board, there is equity. Let us be honest - this is very unlikely in agriculture. However, if we go for a 33% reduction in agriculture, for example, it means that the rest of society - those millions of households referred to in the previous table - will be expected to bear a heavier burden of approximately 60% reduction. That is quite a considerable reduction to anticipate in the course of ten years. If we get a 15% reduction in agriculture, the rest of society will have to burden itself with an 80% reduction. These figures are not theoretical; they are legally enforceable carbon limit values to which we must face up. If we went down to 10%, which is quite close to what we are seeing in some of the Food Vision 2030-type documents at the moment, the burden becomes very heavy and really impractical for the rest of society.

I wish to consider some of the more recent developments that have emerged from the COP26 meeting, which I had the pleasure of attending. They are relevant to the credibility of our carbon budget. The first such development, and one that I welcome, is that Ireland very proudly signed up to a proposed reduction of 30% in methane emissions by 2030. Some 70% of the world's economy is now committed to this reduction. We have not heard Ireland state this is what it is going to do. I wonder why that may be the case. Do we really expect the rest of the world to carry our burden once again? If we were to reduce agricultural emissions by 33% and if, as part of that, we were to reduce methane emissions only by 10%, a figure that corresponds to what is being offered in Food Vision 2030, the reality is that the rest of agriculture - and that is a very significant amount of agriculture - would have to face a 77% reduction. There are intrasectoral divisions and issues of just transition that will be significant if we are not willing to bite the bullet on a larger scale. The conclusion one may draw is that only an immediate policy change, rather than waiting for the next carbon budget, to ensure significant near-term and on-going reductions in methane can protect livestock agriculture in the first instance and, second, the rest of agriculture, from far more onerous and less planned mandatory and very rapid emissions reductions that will be required to meet those budgets.

The second point I wish to make in respect of COP26 relates to the infamous paragraph that members probably read *ad nauseam* at the end of November when the final meeting of the UN Framework Convention on Climate Change resulted in last-minute changes to the agreed communiqué and the rejection of that communiqué by large countries and large emitters. The paragraph, which is before the committee, states that it:

*Calls upon Parties* to accelerate the development, deployment and dissemination of technologies [we can do that], and the adoption of policies, to transition towards low-emission energy systems [we are doing that], including by rapidly scaling up the deployment of clean power generation and energy efficiency measures, including accelerating efforts towards the phasedown of unabated coal power [we are doing all of that, but then it states] and phase-out of inefficient fossil fuel subsidies, while providing targeted support to the poorest and most vulnerable in line with national circumstances and recognizing the need for support towards a just transition.

I refer to the section calling for the phasing out of inefficient fossil fuel subsidies. If we ask the Central Statistics Office, CSO, what is being done about that, we will find that in 2019 the CSO estimated that we were raising €3 billion on energy taxes, spending €0.4 billion on environmental subsidies related to energy and emissions, and subsidising fossil fuels to the

amount of €2.4 billion. Those subsidies are partly direct subsidies, but they are also taxes foregone as a form of subsidy. We are now in the rather strange situation of trying to form a carbon budget that discourages and fosters incentives to reduce fossil fuel consumption but we are still throwing €2.4 billion of taxpayers' money at subsidising fossil fuels.

On the issue of slippage, I am disappointed that the Climate Action Plan 2021 only targets the production of a roadmap to transition away from fossil fuel subsidies by the first quarter of 2024. That smacks a little of the issue in respect of the National Climate Change Strategy 2000 all over again. We really should recommend that this is an overly lengthy delay and that fossil fuel subsidies and actions should take place in 2022 with a view to being incorporated in the financial budget at the end of this year and commencing in 2023.

**Chairman:** I ask Professor Sweeney to finish up in the next minute or so.

**Professor John Sweeney:** I refer to the key aspect of nitrogen. I would like to explore that further with members. We were going very nicely in 2010, when we were consuming 300,000 tonnes. We are now consuming 400,000 tonnes per year and that is driving our greenhouse gas emissions.

Finally, there is the aspect of firms. Firms are becoming more sustainable and more amenable to including their scope 3 emissions or supply chain emissions. We should be fostering that a lot more because they will also have budgets that they have to meet. We can do a lot more in terms of procurement and encouraging them to count more of their downstream emissions, and this will possibly also help our hard-pressed agricultural community.

**Professor Kevin Anderson:** I thank the committee for inviting me to this hearing. I am a professor in energy and climate change at the University of Manchester and I have worked on climate issues for some 30 years. Prior to that, I spent ten years working in the petrochemical industry as a design engineer for offshore oil and gas platforms.

I will start with a bit of political background so we can remind ourselves what we have committed to. In Glasgow at the COP26 in November, the Taoiseach made a very clear statement:

Unless we act now, we will not keep the possibility of limiting warming to 1.5 degrees alive. ... As political leaders, it is our responsibility to put the necessary policies in place. Ireland is ready to play its part.

That is the context of the commitment Ireland has made and it is similar for all wealthy countries.

I want to provide a bit of flavour on the quantitative background which it is important to consider when developing analysis for Ireland. If we look at Ireland's emissions and if we consider we have had the global banking crisis and the Covid pandemic, Ireland's emissions in 2020 were the same as they were in 1990. In fact, if we factor in a slight increase in aviation and shipping emissions, they are higher, and if we factor in the rise in emissions in agriculture, they are higher again. Therefore, Ireland has fundamentally failed to reduce its emissions since 1990. Ireland has territorial emissions of carbon dioxide *per capita* that are around 17% higher than the average for the EU-27. A typical Irish citizen has a total carbon footprint 27% higher than a Chinese citizen, 75% above the global norm and ten times that of a typical African person. Ireland's GDP *per capita*, measured in purchasing power parity, PPP, puts it as the world's third richest nation. It has a PPP *per capita* value over twice that for the average EU person, more than five times the global average and 16 times that of a typical African. The population density of Ireland is very low at about 70 people per square kilometre, which is considerably

lower than the EU average. It has a very long coastline, an extremely favourable wind regime and high tidal ranges. Overall, Ireland is disproportionately well served for developing renewable energy.

Against that background, I have made my analysis, which is more detailed than the text I sent to the committee but I will summarise it now. First, I want to make clear that my analysis takes the Taoiseach's and Ireland's commitments towards 1.5°C but also 2°C at face value. My analysis is based on the science and the numbers. I eschew political sensibilities and legal niceties and I am not constrained by some ephemeral tenets of the current economic *status quo*. All of that gets parked and I do the analysis based on the commitments, the numbers and the science.

I focus here on energy use and supply, which is my area of expertise. I recognise that agricultural emissions are particularly important for Ireland and other countries such as New Zealand. Agricultural emissions are a key part of understanding how much space we have for energy. They are not my area of expertise and others have spoken about them, but they are key. I will focus here on energy and the carbon budgets only, and I am using the numbers for the carbon budgets based on the IPCC's sixth assessment report, AR6, which is the latest set of data that we have from the IPCC. I am using two headline budgets for the submission I made to this hearing. To simplify, one is for a good chance of 1.5°C of warming and the other is for a good chance of 2°C of warming, and the details are in the text. It is also worth pointing out that there is a huge difference between 1.5°C and 2°C. Both of these are disastrous for many people but, at 2°C, the impacts are considerably greater than they are at 1.5°C, and they will be felt initially by poor and climate vulnerable communities around the world, typically low emitters and typically people of colour. It will also, of course, be felt within a decade or so by our own children and grandchildren. I then updated the AR6 budgets, which are from 2020, to 2022, which is where we are now, and I estimate from that, as a simple bit of arithmetic using the latest emissions, that the global carbon budget we have now is for a good chance of about 270 billion tonnes of carbon dioxide at 1.5°C or a good chance of about 680 billion tonnes at 2°C, which is much less onerous.

I take at face value Ireland being a signatory to the United Nations Framework Convention on Climate Change, UNFCCC, and the international protocols since the UNFCCC in 1992, and the whole concept of common but differentiated responsibility. I assume that Ireland was being honest when it said it wanted to give some additional emissions space for the development of poorer parts of the world. If it does that, then the repercussions for the wealthy parts of the world, Ireland included, are severe. If Ireland has taken this into account, then the carbon budget for Ireland from now, the start of 2022, and across this century is about 120 million tonnes of carbon dioxide for a good chance of 1.5°C to about 300 million tonnes for a good chance of 2°C. Let us just think of some of the numbers we heard earlier in the context of this 120 million tonnes to 300 million tonnes. This covers, say, 2022 to the end of the century and is for all energy carbon dioxide, including aviation and shipping. If Ireland does not want to include aviation and shipping, it has to take an additional amount of that budget away.

If Ireland was to carry on at its current level of emissions, which, from an energy point of view, is roughly 33 million tonnes of carbon dioxide equivalent plus, as Professor McMullin pointed out earlier, about 4 million tonnes of aviation and shipping on top of that, then that is somewhere between three and eight years of current emissions before it exceeds the fair budget for Ireland for 1.5°C to 2°C. To repeat, that is three to eight years of current emissions, and Ireland shows no sign of its emissions coming down at the moment. If, after this meeting, Ireland

goes away and implements policies immediately and it is a straight line to zero emissions, that means Ireland has to be at zero emissions by 2029 for a good chance of 1.5°C and by 2038 for a good chance of 2°C.

Another way of thinking of it is by looking at the reduction rates. If Ireland was to start now at a set reduction rate, for 1.5°C it would have to reduce emissions at about 30% every single year. It sounds impossible but it should have started in 1990 and we have failed for 30 years. For 2°C, the rate is much lower - about 12% per annum - but we have to remember that includes aviation and shipping. All of this, of course, requires fundamental change in agricultural practices in Ireland, in particular given the current requirements for beef and dairy.

There is no easy way out of this dilemma that rich countries are now facing and that we have got ourselves into. We are here precisely because, for 30 years, we have been unprepared to face the climate challenge with honesty and integrity. That brings us to the point we are at now because physics does not care about our political niceties; it only cares about molecules and greenhouse gas emissions. Wealthy nations now have a choice whether to succeed or fail but that depends on this idea of honesty and integrity.

This analysis is different to some of the others the committee will hear, principally for two reasons. The first is that virtually all other analyses rely on future generations removing huge quantities of carbon dioxide from the atmosphere, using carbon dioxide removal techniques and technologies that are highly speculative. There are a few pilot schemes, most of them still in the imagination of academics, yet we are relying on these in virtually all analyses and passing the burden to future generations to suck our carbon dioxide out of the atmosphere. I argue that is irresponsible and it passes a huge burden onto future generations in terms of the risks of much larger levels of climate impact. While we should research those technologies and deploy them if they meet stringent sustainability criteria, we should not rely on them, which we are currently doing in all of our analyses because we want to make something that is more politically palatable.

The second part is that we are completely ignoring our commitments on international equity. Even under the scenarios I am showing the committee, the cumulative emissions per person per year are still greater for rich countries than they are for poor countries. There is no fair way of dividing the budget any more; there is just the least unfair way of doing it. Even this disproportionately affects the poor parts of the world. Those are the two reasons my analysis is different because it does not include any political expediency. In summary, Ireland is an extremely wealthy nation, with a highly educated population and very favourable renewable energy potential. Moreover, it has a low population density. It should be siting renewable supply with ease because that is very unproblematic for Ireland compared with most other nations. Despite Ireland's unique financial and geographical position - it also incredibly wealthy - to lead the world in renewable energy development, according to the Sustainable Energy Authority of Ireland, only 11% of its gross energy consumption is actually renewable. This means, to put it more simply, that 90% of Ireland's total energy consumption is unsustainable, according to 2020 data. It is worth reiterating that Ireland's failure to deliver any reduction in net emissions since 1990, despite its favourable financial position and geography, suggests that climate change has received no serious political attention thus far.

The unprecedented carbon budget challenges Ireland faces today stem, in part, from its own choice to, in effect, ignore three decades of clear scientific analysis and advice. Each year, this failure to heed the science continues, so the mitigation challenges will increase. Ultimately, the physics of climate change will always beat any ephemeral economics or political niceties that

ignore it, with the subsequent climate impacts we are knowingly bequeathing to Ireland's future and to more vulnerable communities elsewhere. We have to remember that we are a world behind this. It is about impacts. People are living today with the impacts of Ireland's and the UK's choices. We are passing that burden on to our children. I thank committee members for listening.

**Chairman:** I thank Professor Anderson for his statement. A number of members have indicated they wish to ask questions. Is it agreed that questions will be limited to two minutes each? Agreed. We will have a second and third round, if we have time. I ask members to direct their questions to particular witnesses.

**Deputy Christopher O'Sullivan:** I thank the witnesses for their contributions. There are always incredibly interesting contributions when academics and scientists appear before the committee. There is so much to learn.

I will pick up on something Professor Sweeney said on the fact that the climate emergency was only referenced once. I assure him that everybody on this committee and, I am sure, the CCAC realises that we are in the midst of a climate emergency. There is absolutely no doubt about that. That is reflected in the speed with which we have introduced the climate action Bill and are trying to agree these carbon budgets. We are well aware that we are in the middle of a climate emergency. I just wanted to point that out.

I ask for clarification from the witnesses on whether they are saying that they disagree with the 4.8% figure for the first budget period, in particular, and the 8.3% figure, in addition to the assessment of the carbon budget committee of the Climate Change Advisory Council? I imagine that they tuned in to yesterday's session of this committee when members of the CCAC discussed the deliberations and debate they had in coming to that figure of 4.8% for the first period. We had contributions from the likes of Professor Brian Ó Gallachóir, Dr. Hannah Daly, Dr. David Styles, Mr. Trevor Donnellan, Dr. Kevin Hanrahan, Professor Lisa Ryan, Ms Patricia King, Professor Peter Thorne and Ms Marie Donnelly, among others. They stressed that there were deliberations and debate back and forth, but they believed this was the best route and trajectory to take. They referenced issues such as the social, economic and just transition factors. The fact that in the second half of the budget period-----

**Chairman:** The Deputy's two minutes are up.

**Deputy Christopher O'Sullivan:** I will wrap up on that. The witnesses yesterday referenced that the second budget period reduction of 8.3% could possibly be adjusted upwards to achieve greater reductions in that period because of developments in areas such as wind energy.

Professor Sweeney referenced a 33% figure for agriculture, which would leave a 60% "burden" for the rest of society. When we talk about 80% reductions in areas like energy, through the use of renewable energy, that is not necessarily always a burden. Will Professor Sweeney comment on the opportunities for renewable energies, which are cheaper forms of energy, that will possibly lead to a situation where households have less of a burden in the energy sector? I would not mind if he commented on that. I have other questions but I will leave them until the second round.

**Chairman:** The Deputy's first question was directed to all four witnesses.

**Deputy Christopher O'Sullivan:** Yes.

**Chairman:** They probably have addressed it, to a certain degree, in their opening statements but I will give them another cut at it. There is then a question for Professor Sweeney.

**Professor Barry McMullin:** I will very quickly say that by explicitly advocating that the committee consider reducing the budgets proposed by the council for the first two periods through to 2030, I am implicitly saying that there should be faster reductions, probably in both periods, than those proposed by the council. In doing so, I am drawing attention to some matters that lay outside the scope of what the council considered was legitimately its concern. One can argue back and forth about that, but I certainly disagree with the position of the council where it implicitly adopted 2020 as the basis for historical responsibility. The council did not provide its motivations. It is hard to know what the basis of the disagreement was, but I disagree with that position.

**Deputy Christopher O’Sullivan:** Does Professor McMullin disagree with the council basing that 4.8% on social, economic and just transition factors? This was the question we put to Professor Brian Ó Gallachóir yesterday. Those factors are what it based that first trajectory period on.

**Professor Barry McMullin:** Committee members will know that they also have a written submission from Dr. Andrew Jackson of University College Dublin on the legal implications of the climate Act, in particular, that Act’s clear stipulation that the budgets have to be consistent with the Paris Agreement, in effect, above all. Looking at the Act, the other things are “to the extent feasible” but consistency with the Paris Agreement comes above that in the Act. That is the first test for me. In reading the council’s technical report and, again, I am not a member of the council and I am not speaking on its behalf, it seems it did it the other way around. It used other considerations and then assessed consistency with the Paris Agreement. As I said, the council’s Paris test falls short in paying attention to historical responsibility, but it has not elaborated on that so I am not sure where the grounds of the disagreement would be. It did not make any adjustment for emissions from international aviation and shipping, which, again, is legally problematic in terms of Paris consistency.

If the budgets are reduced further, what does that translate into when it comes to societal impact? There is no doubt that the disruption to society would be greater. I will make no pretence that the level of challenge on the council’s budgets is already very significant. If the budgets are reduced further, that will represent a higher level of challenge, but it will be nothing compared with the challenge faced by poor and vulnerable people around the world today, who are exposed to greater climate risks due to our disproportionate emissions, and our own children in future years. We have to grasp this nettle of reconciling our own immediate preferences for an easier transition locally in Ireland, given our comfortable lifestyle at present. We would all like an easier transition but, as against that, we just do not have the time. We have responsibilities to our children, future generations and poor and vulnerable people all over the world who are directly affected by our actions. We recoil from this here in Ireland because of our history but it is a form of tacit neocolonialism. We are exploiting an atmospheric commons, a global commons, that belongs to all people of the earth equally but we are exploiting it disproportionately just because we can. I do not think that is defensible.

**Deputy Christopher O’Sullivan:** I do not think that anyone is suggesting that a transition will be easy. I think we all appreciate that it will be incredibly difficult.

**Chairman:** Do the other witnesses wish to come in on that?

**Professor John Sweeney:** I can answer the question on the burden. There are huge advantages in being an early mover in changing to the low carbon economy or lifestyle that countries are now doing and benefitting from internationally. Yes, enforced reductions may well accelerate that transition. Maybe the word I used was not appropriate but the burden presumably works both ways. Maybe 33% is not a burden either for agriculture. I would not want to imply that the committee has not taken the climate emergency seriously. I have very much listened in awe to the activities of the committee over the past two years around its pre-legislative scrutiny of the Climate Action Bill and the insight that it has shown. The big problem, as the council's chair, Ms Donnelly said yesterday, is leadership. It is leadership that we now need so urgently to put these policies and this legal requirement into practice. That is where I would have most concern.

On the budget the Deputy mentioned, am I suggesting that the first budget should be higher? Yes, I am. The reason or excuse - and I use the word "excuse" not wisely but loosely - is that we have not got the infrastructure and technical aspects ready yet. However, there are short-term contingencies that we can do in responding to an emergency. One of the Deputies raised the notion of stopping artificial insemination for a couple of years. That is something we could have looked at. We could look at restricting car movements in city centres. We could tax some of the less beneficial environmental practices more than we do now. There are short-term things that we can do over the next 18 months. I am rather old and in a hurry now. I am not going to wait for ten years for another carbon budget to come along. Having seen what happened in 2000 and onwards I think the time for implementation is now. We should not wait for something coming around the corner whether it is infrastructure, a magic bullet or whatever. We have to grasp this by the horns in the next 18 months. For that reason, I think the provisions of the climate plan really need to be toughened up very considerably.

**Professor Kevin Anderson:** It is interesting looking at the budgets that we are talking about here. I just do not recognise them. I recognise that it is politically appropriate. Every country claims that there is a climate emergency, we must do something and comes up with a budget, then the budget blows away any reasonable budget that comes out of the science. Ireland's budgets look like that to me. The budgets in the first period are way above the total budget that Ireland should be having to deliver the 1.5°C or 2°C reduction. They are tougher than business as usual but they are completely out of touch with the science unless one wants to rely on future generations sucking the CO<sub>2</sub> out of the atmosphere. Just look at the aviation emissions alone. They are 4 million tonnes a year, roughly. Say the committee on climate change pathway for the UK was followed, if it stayed roughly constant for the next 30 years, with a growth in efficiency improvements, it would still take out the total 1.5°C budget for Ireland. Aviation alone would blow the complete budget for 1.5°C for Ireland. The rest of society would have nothing to spend on budgets from today. In fact, since 1 January this year. We are working in the realm of political niceties and the physics does not care. Once one starts to play that out, one ends up with a completely different world.

I bring the question of equity back to equity within our country. We talk about what we can deliver but we never think about the distribution within our societies. Some 70% of aviation in the UK is carried out by 15% of the population. Most emissions do not come from most people. Most people in Ireland will, by definition, be below-average emitters. What we have to do, if we are serious about these issues, is to recognise that emissions align very closely to income and therefore one's policies have to be tailored towards people on higher incomes. Once one does that, it opens up a whole portfolio of policies behind the ones that we are prepared to think about. However, in no country are we taking equity seriously either internationally or within

our own countries. Hence our policies are all -----

**Deputy Christopher O’Sullivan:** I take it then that Professor Anderson’s issue is not just with the budgets but also with the interim target of 51% and the target of carbon neutrality by 2050.

**Professor Kevin Anderson:** I do not have an issue with them. They have nothing to do with the commitments the Taoiseach made. They are political numbers that are pulled out of the air with a whole lot of assumptions around them to make them look legitimate. Just take the IPCC scenarios and do some very clear science and numerical analysis with explicit assumptions. How much is one relying on future generations sucking the CO<sub>2</sub> out of the air? How much of the carbon budget of poor countries is one prepared to take away from them when they are already struggling as it is? What we are doing with the budgets at the moment is either forcing future generations to put up with more climate change or poor parts of the world to have their development cut even further. There is no easy way out of this. We should have started 30 years ago. At some point we have to draw a line and from that moment, be honest to our commitments and to the science. We are still not prepared to do that because it is politically too challenging.

**Mr. Paul Price:** We are signed up to the entire Paris Agreement. That says that every party’s successive nationally determined contribution will represent a progression and also has to represent highest possible ambition. That is what one has to look at. If the science takes politics at face value that is what we have to look at then that is what we have to address.

Similar to what Professor Anderson has done, Professor McMullin and I have looked at the global situation. We take a slightly different approach but effectively we are, again, following the physics. Therefore one has to distribute a climate budget which in our case included all the three gases, not just CO<sub>2</sub>, and did that at a global level and at Ireland’s level. One sees that one really has to reduce emissions of all those gases very seriously and that most of all, early action is what counts.

When one thinks about making a transition, the thing that is really important for lower costs is to deliver that early because that helps everybody. If one has to make real sudden changes later on, that is a shock to the economy and in every way. In the physics, what matters is cumulative CO<sub>2</sub> emissions and that means that early action counts most of all. If one is at a high level of emissions right now, one needs to get them down very quickly, very soon. That is what counts most of all. The serious challenge we have is that the physics is not forgiving. When it comes to really severe, stringent climate targets that are in the Paris Agreement, and this is true at global level and certainly for Ireland, at this stage one really has to cut methane which particularly has a big effect. One has to cut CO<sub>2</sub> very quickly which is the energy side but in agriculture and fossil fuel methane, and whatever methane a country has going out, one has to cut that pretty substantially, very quickly. The earlier one does that the bigger effect it has on 2050. Again, it is the same for methane as it is for CO<sub>2</sub> and nitrous oxide. Cutting those early really helps. Addressing those early actually helps economically because then we are not faced with sudden changes that we have to address too. These things all go together, and the longer we hold off, the higher will be the costs and the shock, potentially.

**Deputy Christopher O’Sullivan:** I thank the witnesses.

**Chairman:** I thank Mr. Price and Deputy Christopher O’Sullivan. I call Deputy Whitmore.

**Deputy Jennifer Whitmore:** I thank the guests for coming in today. Their contributions have been interesting. This has been the reality check that we need, and it has given us a great deal to digest over the coming weeks. Much of what has been said today echoes concerns I have that not enough is being done up front, with the result that we are backloading the targets. I have specific concerns about our ability to implement the required measures. We are good at setting targets, but we are not so good at enacting the policies to enable us to meet those targets. How we have failed to meet the 2019 cap has demonstrated that. It has been the same with the targets set in the last year for retrofitting, heat pumps, electric vehicle infrastructure, apprenticeships and everything of this kind across the entire gamut in this regard. I do not think the Government has met one target yet. Indeed, I think it was Professor McMullin who mentioned that the reductions do not even meet the 7% target specified in the programme for Government. It is actually 6%. There is a real risk therefore that we could wake up in 2025 and realise that not enough is being done and that it is not being done quickly enough for us to ever attain the targets for 2030.

Returning to the differential between the 4.8% and the 8.3% targets for reductions, for the sake of simplicity, and assuming agreement with the overall target of 51%, which I know there is not, will the witnesses tell us how they would divvy up that percentage? Would they have it at 7.6% to meet the Paris Agreement commitments, or at 8.3% for the first five years and then 4.3% later? What figures would they recommend adopting? When this topic was raised yesterday, what Professor Ó Gallachóir said regarding this split was that he challenged anyone to come up with a way that it would be possible to meet higher targets in the first period. I put that challenge now to the witnesses. If they could do one thing to meet these targets, what would that be?

**Chairman:** I call Professor McMullin first.

**Professor Barry McMullin:** I thank Deputy Whitmore for her excellent questions. We are already one year into this period, because 2021 is over. That is an immediate issue. Over the remaining nine years to 2030, I would prefer to see us achieving something more like 8% in reductions annually, rather than starting with a lower percentage and then ramping up to a higher rate in the last few years. I understand the logic of the argument made yesterday that some of the reductions would be easier to do if there is a longer lead-in time that allows for the building out of infrastructure and similar developments. That would be lovely. It would be great, if we had the time for it, and we do need to build out infrastructure as fast as we can.

In the meantime, however, we must reduce our emissions anyway. The only way to do that is to do less to cause emissions, and the only way to do that fairly is to ration the opportunity to do things.

Professor Ó Gallachóir rightly posed the challenge regarding how we could do this. My answer is focused mostly on the energy side, and on achieving our targets by placing an upstream limit on the entry of fossil fuels into the Irish economy. They can then be rationed out in a way that protects fairness and justice in the short term. It would mean that all of us, people, households, companies, enterprises and State agencies, would have to figure out how we can best pursue our normal goals. We would not tell people how to do it. We would leave it up to people themselves to have the freedom to figure out how to best pursue their goals, but in a scenario where there was a framework of stringent annual reductions in the available fossil fuel energy sources in the economy. That would mean doing less of certain kinds of activities. Returning to the earlier point made by Professor Anderson, it would mean wealthier people doing proportionately less of things that are proportionately more intensive in producing energy emissions.

If we build out our infrastructure, especially for renewable energy, as rapidly as we can in parallel with that approach by adopting a Marshall Plan-type scale of prioritisation of societal resources and devoting them to accomplishing our emissions reduction objective above all our other priorities, including building roads, for example, by focusing our resources relentlessly on the capital programme over the next ten to 15 years, then the restriction on people's use of energy could ease. If we want to be confident that we will meet stringent carbon budget targets, and to start early - and I agree with Professor Ó Gallachóir that it will be extremely difficult, while not agreeing that it is impossible - it will be a question of sharing the details of the predicament we are in with wider society, and doing so honestly, and then appealing for solidarity across our society. A system to fairly distribute the resultant burden across society would then have to be designed.

It would, essentially, be the same type of experience as we have been going through with Covid-19. The restrictions we had to put in place in the early stages of the pandemic were unthinkable previously. Yet we thought those thoughts and put them into action, because the alternatives were unthinkable. As the American journalist David Roberts said - and it is nearly ten years since he said it - we are trapped between what we think is impossible and what is unthinkable. The problem we are all collectively faced with is how to make the impossible possible, including, as I said, rationing fossil fuel energy in the short term and being honest and blunt about that requirement. I am blunt and honest about it. Achieving the early reductions in the time it will take to build out infrastructure means rationing. We have said, however, that we are going to stop the sale of new internal combustion vehicles from 2030. Why not make it 2028 or even 2025? We must absolutely think outside our previous, self-imposed restrictions on what is thinkable in this context.

**Deputy Jennifer Whitmore:** I thank Professor McMullin.

**Chairman:** Would Professor Sweeney, Professor Anderson or Mr. Price like to comment?

**Professor John Sweeney:** It is a difficult question to answer. Much of it goes back to what Professor McMullin was saying about society having set the budgets. It is now up to individuals, led by the Government, to implement the necessary carrot-and-stick approach to achieve them. Professor McMullin spoke about energy, and it will be one of the easier areas to tackle over the next ten years. I suspect that rationing will be needed even in that area, and that Professor McMullin is correct on that point. Equally, however, we must also tackle agriculture. In the short term, we need a commitment that we will reduce our national herd and make an ongoing reduction in our methane emissions of at least 3% annually. That is an important figure. If we can reduce these emissions by 3% per year, we will not then add too much in the long term to the burden of climate warming due to methane emissions. We must, however, put that aim into practice, perhaps using the ban on artificial insemination idea floated yesterday as one possibility. There should certainly be no question of an increase in our cattle numbers, and a reduction is imperative if we are to realise any of these carbon budgets.

We also need a limit on nitrogen use. It is the driver. As I said, we have targets for nitrogen use by 2030 of 325,000 tonnes. Why not bring that date forward to 2022 or 2023? Why not limit and throttle the overuse of fertilisers, which is now causing so much damage to the quality of our lakes and rivers in many parts of the country? If we listen to the director of the EPA on this topic, we begin to understand that there are two semi-State organisations in Ireland on very different trajectories. Teagasc's roadmap for 2027 envisages something like 200,000 more cows, which sees an increase of 19% and an increase in the average herd size to 100. That is not compatible with any of our carbon budget targets. That has to be tackled at source. We

have to do that.

Beyond agriculture, we need urgent changes to our planning system. We are not building houses or apartments where there is a mandatory requirement for a home charger, for example. We are not making the procurement policies that recognise companies that are really counting their emissions properly. These are short-term measures that would help. We need not just the stick but also the carrot; we need incentives. As Professor Anderson said, we need to tax the 10% of people who cause 50% of the emissions. That is an equitable thing to do. We can perhaps consider tackling the likes of SUVs and city centre parking privileges. In the short term, doing so would hopefully force more people to use public transport, once it becomes more acceptable to use it and the pandemic is over.

Many small steps can be taken. They will add up, but they will have to be taken according to the precautionary principle in the next 18 months, not in 2025. As Deputy Whitmore stated, if we are not meeting our targets by 2025, we will face litigation. We will face litigation long before that. We will face it if we are not meeting our targets by 2023 because we will be obliged to meet them one way or another. It will be by hardship that we will meet them if we have not already done so by 2024 and 2025. It is urgent to do, in the next 18 months, what we envisage in the budget.

**Chairman:** I thank Professor McMullin. That was a very comprehensive answer, which we appreciate. I am going to push things along because time is running out.

**Deputy Jennifer Whitmore:** Professor Anderson wanted to contribute.

**Chairman:** I want to bring in Professor Anderson and Mr. Price on this question. For subsequent questions, I will ask witnesses to be as succinct as possible.

**Professor Kevin Anderson:** By definition, we may not like the language of rationing. In the UK, it is not the kind of language people like to use, but a carbon budget is a ration. One has to live within that ration; there is no neat way out of it. We can change the word to “fair share” but it is still a ration. You have got to live within the ration whatever you do. We can use the sorts of things that Professor McMullin referred to, such as technology, personal carbon allowances and stringent frequent flyer levies, not levies that allow people to pay just a few pence to fly more regularly but levies that stop people from flying more than twice, three, four or five times per year.

If there is a climate emergency — let us assume we are honest about that — why are we selling any SUVs? There should be no SUVs in any forecourts. If they are in forecourts, they should go back to the producer to be dismantled and converted into something much smaller. If there is a climate emergency, SUVs should not be sold. If we are selling SUVs, we are not acknowledging a climate emergency. There is a nice logic there. A climate emergency can be defined by whether there are SUVs in forecourts or in front of people’s houses. That is the sort of change we are talking about. No car should be sold that emits over 100 g of carbon dioxide per kilometre, starting from now. It should be tightened by 10% every single year. That would get us out of all internal combustion engine cars by 2025.

If there is a climate emergency, let us take Covid as an example and learn from what we did in that regard. In Ireland last year, transport emissions alone reduced by 15.7%. This was driven not by climate policy but by Covid policy. It is true that Covid policy was not particularly successful in driving emissions down elsewhere. Housing emissions went up by about 9%

and agriculture emissions went up again in Ireland, but we should examine what was successful and ask why it was the case and what the equity implications were.

On the points raised on issues of burden, we should rethink some of the economics. If a low discount rate is applied to the likes of power generation, fossil fuels will be much more expensive than renewables. As soon as there are discount rates of 5% or lower, renewable power is cheaper than fossil fuel power every time. The only reason fossil fuels ever look cheap is that we apply a high discount rate. We should use the tools of economics to drive these things but ultimately we have to live within our carbon ration. That ration is determined by the fact that we have a certain carbon budget at global level that we have to allocate fairly.

**Chairman:** I thank Professor Anderson. Does Mr. Price want to contribute?

**Mr. Paul Price:** Deputy Whitmore was pointing to Government failure. We see that in transport. I have correlated Irish transport emissions with the Irish economy and noted they follow each other very well. That is a problem because it indicates no policy has been effective in Ireland in reducing transport emissions. Therefore, one has to do something along the lines of what Dr. Hannah Daly was talking about yesterday in respect of a low-energy demand scenario. That was really pointing at the fact that we have to focus on limiting fossil fuel vehicles. We must not just say we are going to have electric vehicles because we must target fossil fuel vehicles.

We actually have a really good example of how a limit drives efficiency. We assume that efficiency measures somehow result in emissions reductions, but that is the wrong way around. Most of the good examples we have show that the imposition of a limit effectively creates a rationing situation that the market can sort out. In Ireland, we had this until the end of the milk quota. The milk quota went in 2010 but up until then we had a milk quota that was effectively a quota on nitrogen. As Professor Sweeney pointed out, having that quota is important because that is what is driving agricultural emissions. What we saw over the period in question is that the number of cattle reduced because we had the quota. Efficiency was rewarded in the agriculture sector and we produced the same amount of milk with lower emissions and fewer cows. This is a good example of what really works. A Government imposed limit really works in rewarding efficiency. There were social paybacks, as members know. The efficient farmers paid for quota and there was a redistribution. There was a distributive system. Unfortunately, of course, getting rid of the milk quota made all of this disappear, and purely economic considerations came into play. What we have had is massive growth in milk production and massive growth in methane, nitrous oxide and nitrogen pollution. It is really about setting limits.

**Chairman:** I thank Mr. Price and Deputy Whitmore. Deputy O'Rourke is next. He has two minutes. I am going to try to drive the discussion on. I do not want us covering old ground so I ask witnesses to be as brief as they can be.

**Deputy Darren O'Rourke:** I thank the witnesses for their contributions. Yesterday, when we heard from the Climate Change Advisory Council, or a subgroup of the council, it said the most significant factor underpinning the proposed carbon budgets was the commitment to a reduction of 51%, the interim target in the Climate Action and Low Carbon Development (Amendment) Act 2021. Do the witnesses believe this target is achievable based on the carbon budgets? Professor McMullin made a point on the area under the curve but the text in the Act is quite specific. Will the carbon budgets achieve a reduction of 51%?

Are the witnesses of the opinion that there is a contradiction in the Climate Action and Low

Carbon Development (Amendment) Act 2021 between the target of 51% and our commitments under the Paris Agreement?

On a related point, what would it take by way of carbon budgets to live up to our commitment under the Paris Agreement? The commitment in the carbon budgets, as presented by the Climate Change Advisory Council, is 495 Mt CO<sub>2</sub> eq in the first decade. Professor McMullin and Mr. Price have mentioned 468 Mt CO<sub>2</sub> eq. Is 300 Mt CO<sub>2</sub> eq the figure Professor Anderson is indicating? What does he believe to be a Paris Agreement-compliant carbon budget for the first ten years? Professor Sweeney mentioned concerns about assumptions in respect of LULUCF. Will he expand on that point?

**Chairman:** The Deputy stayed just within the two minutes. I appreciate that.

**Professor Kevin Anderson:** The budget I am using is for energy only. I would argue that the budget for Ireland is somewhere between 120 and 300 million tonnes. If you are more committed to 1.5°C and care more about our own children's future and the impacts on poor parts of the world that are already being felt, you would go for 120 million tonnes. If you are more gung-ho about our children's future and less concerned about people outside Ireland, you would go for 300 million tonnes. There is a moral choice to make when choosing between those budgets.

However, let us also be clear that the Paris Agreement is not a nice coherent document. It is a political document. The agreement says that we will cut emissions in line with what is necessary to stay well below 2°C warming and that we will pursue 1.5°C. It then has a commitment framework that is based on nationally determined contributions and the highest possible ambition, which does not necessarily fit with the commitments in respect of temperature. It asks everyone to give a voluntary agreement. Every country underplays the amount of effort it is going to make so the emissions exceed the budget required for the temperature everyone has committed to. There is an innate incompatibility in the two framings within the Paris Agreement. That was done deliberately because it was thought to be the only way to bring people together politically. The Copenhagen Accord showed more scientific integrity but no one committed to it. Something was made that was so weak that everyone could say they had committed to it but, when everything is added up, it aims for 3°C to 5°C of warming. You should be careful in how you read the Paris Agreement. I take it based on the temperature commitments and the physics. That is different from the politics and the short-term economics.

**Professor John Sweeney:** I welcome the opportunity to talk a little about LULUCF because it is one of the underpinning assumptions that gives rise to most concern in the CCAC. The chairperson, Ms Marie Donnelly, said yesterday that meeting targets in this regard would be challenging. I would go further and say that its feasibility is highly questionable. The most recent projections in respect of LULUCF show that Irish land use produces net emissions of approximately 4.5 million tonnes per year and that this will increase to 7.1 million tonnes per year. As we know, we face a problem in respect of falling afforestation rates and the continuing draining of grassland soils. The assumption made by the CCAC is that these emissions would fall by 51% in line with the overall budget. That would mean that it would fall to 2.4 million tonnes per year by 2030. That is a very unrealistic assumption.

Over the past 30 years, we have not managed to achieve the kind of land use changes that would imply. It would imply huge swathes of forestry. We have to ask where these huge swathes of forestry will go. We can be sure they will not go on the very rich farms of southern and eastern Ireland. Some of those farms are making €500,000 and more in profit per year. In a

30-year cycle, forestry will not provide a return those farmers would welcome. These swathes will also not go on peaty soils west of the Shannon because that would undermine the carbon budget in our wetland areas. There are therefore very limited areas where this forestry can go. I would hate to see it go on drier soils west of the Shannon, where many farmers are dependent on Pillar 2 aspects of the Common Agricultural Policy, that is, environmental management aspects, for their income. There is a big question as to the feasibility of that.

Even if we assume that we will not achieve that 51% and will maintain the *status quo* in respect of land use for the next ten years, that means adding 45 million tonnes to our carbon budgets for the next ten years. That again brings into question the viability of the kind of division we have seen in respect of our carbon budgets. It also raises biodiversity issues, which we have not really taken on board. The CCAC has run three models, one each in agriculture, forestry and energy, but they have not joined up. Integrated modelling strategies have been available in Europe for the past ten years through which you can look at the trade-offs between different models in these areas and build in social and economic aspects. That has not been done here. That would have been very welcome had it been done. It would have enabled us to take on board issues of biodiversity, which has been largely left out of the equation thus far. There are many aspects which give cause for concern in the way the budget has been formulated and in the strength of those divisions between the first and second five-year periods.

**Professor Barry McMullin:** I will try to be very brief. The questions were very well put. With regard to the legal provision in the Act and the 51%, as members of the committee will be aware, it is on the record that Professor Sweeney, Professor Jackson and I wrote to the Government of the time suggesting that the way this was framed in the Act was unsound and should be revised in certain ways which we suggested. In that Government's wisdom, it decided not to accept our suggestion. The way it was put into the Act was unfortunate and caused unnecessary difficulties for the council. I sympathise with it on how it had to try to deal with those difficulties. I cannot speak on behalf of the council and I am not sure of the nature of its discussions on this matter but it is possible that this provision had the effect of limiting the scale of ambition the council could consider over the ten years to 2030. As I have said, I do not know whether that was the case but, because of the poor legal language of that particular section of the Act, that is a possibility.

However, it is important for the committee to be aware that it is not bound by that legally. That provision in the Act applied only to the council. The process the committee is now engaged in is quite separate from that. It is not bound by that provision in any way, shape or form. As I said in my submission, at a minimum, the committee should consider a further reduction in the budgets proposed by the council to align with the original programme for Government. This would represent a reduction of approximately 27 Mt CO<sub>2</sub> eq across the two periods. I recommend that the committee take aviation into account. It is unclear why the council left that out. That would take away another 40 Mt or so. In round numbers, that would bring it back to something like 400 Mt CO<sub>2</sub> eq over the ten years.

Deputy O'Rourke rightly queries why that figure is so different from that suggested by Professor Anderson, because my position is very different. It is a much bigger number than the numbers he has suggested. It must be remembered that Professor Anderson's budget is not for up to 2030, but forever. There is a discrepancy there but it is only an apparent discrepancy. It primarily reflects the fact that Professor Anderson is presenting a budget exclusively for carbon dioxide whereas the budget I am talking about, the 400 Mt to 2030, is for the big three gases: carbon dioxide, nitrous oxide and methane. A relatively large proportion of Ireland's emissions

are in the form of methane and nitrous oxide, which skews matters. For other countries, that discrepancy would not be so big. It makes it appear much bigger in Ireland. I will refer to something that will really only come into play as we move to the sectoral emissions ceilings part of the debate. I have suggested a budget of 400 Mt to 2030, as opposed to the 490 Mt the council has suggested. Whether even that is adequate or consistent with the Paris Agreement temperature goals still hinges on how it is broken down by gas. If, for example, there is comparatively little reduction in methane by 2030, say 10% or 15%, and there is more of a reduction in nitrous oxide and CO<sub>2</sub>, that would not be enough. It would still exceed what would be prudent. The science is complex, and I apologise for that, but the discrepancies hinge on the things the council omitted, including the way it treated historical responsibility and aviation emissions, the constraints on reflecting the full force of the programme for Government targets and the way the Act was framed. Certain discrepancies arise on that basis. The interactions between the different gases give rise to a superficial discrepancy, though it is only a superficial discrepancy. If we make deep reductions in methane emissions, that would resolve those discrepancies.

**Mr. Paul Price:** I will follow up on what Professor Sweeney was talking about. On the land use side of things, we have to realise that land carbon storage is not simply exchangeable, 1 tonne for 1 tonne, with fossil carbon storage. They are very different things. Fossil carbon is geologically stored for millions of years until we take it out. Land carbon storage, if we increase it across the world or in Ireland, is very vulnerable carbon storage. If we get a lot of climate change, all that carbon might go back into the atmosphere as it burns or as soil carbon is lost, etc. It is important to understand that those two types of storage are not fungible. The accounting might say they are but that is not the case. It is important we understand that in the physics because it affects how we think about these things.

When we are talking about our immediate action, one thing that is important to understand about carbon in land is that it is taken in very slowly but can be released very quickly. There can be a forest fire or a field can be ploughed and so forth, and the carbon can be released quickly. That type of storage is, therefore, hugely vulnerable and uncertain. Once it has been stored, it must be kept there, on a landscape scale. The level of carbon stored must be increased. A strong land use policy is required to ensure that happens. Accounting for it is not easy at all. If we are going to put public money towards it, we must be certain of what we are getting. That is important.

On the slow in-fast out element of carbon storage, we have a big focus on afforestation at the moment but it has not happened. Therefore, we must think about what we are going to do to make sure fast losses do not occur right now. To think the unthinkable, it would mean restricting forest harvest, which is planned to increase because the level of past planting was quite high. We could restrict that to avoid fast loss. We can also considerably lower peat extraction. There may be a horticultural sector but the volume of carbon being extracted and lost is far bigger than that in terms of exports. We have serious choices to make. They could be made right now and could reduce those fast losses. Perhaps slow afforestation, re-wetting and soil carbon sequestration then come into the equation, but they are slower. We must make sure those measures are taken.

**Deputy Bríd Smith:** I confirm I am on the Leinster House campus. I thank all our guests for coming to the meeting and giving us an interesting session. I found today's discussion much more about the urgency of the situation we are facing than the discussion yesterday, which I was unable to participate in. I do not criticise the committee for a lack of urgency yesterday. The

problem is the framework under which the committee is acting. It is an even deeper problem when one thinks about the fact that we have a Green Party Minister. If we cannot get it right now, we could be facing into the second half of our carbon budgets without the commitment of a Green Party Minister. It is important that this committee acts to get it right. I take all of the contributions very seriously. They give us a lot of food for thought.

I have a couple of questions and matters on which I would like our guests to elaborate. Perhaps Professor Anderson can answer my first question. To what extent do carbon budgets depend on future technologies for carbon capture and storage, CCS? What does the professor think is the danger of that? My understanding is that the development of future technologies is not anywhere near a place where they could help to deal with the requirements of these budgets.

I do not know who can answer my next question, which is about the omission of aviation and shipping. I think Professor McMullin said it is unclear why aviation and shipping were omitted. Is it unusual for a country to do that? Is it avoidance? It is quite shocking that aviation was left out of the budgets, given the role that Irish aviation plays in the whole European outfit.

Somebody mentioned equity within countries. This is all, of course, to do with just transition. Most emissions do not come from most people. That is an important point for us to keep in mind. It relates to the question of transport. There is a high dependency on private car ownership in this country because we have an appalling public transport infrastructure.

**Chairman:** The Deputy has gone beyond her allotted two minutes. She can finish her question.

**Deputy Bríd Smith:** I will wind up shortly. Despite the Covid restrictions, public transport should be an absolute priority.

My final question is for Professor Sweeney. He mentioned the €2.4 billion in subsidies to the fossil fuel industry. Most people would be quite shocked to learn that figure. Will he quickly explain to us how that figure breaks down? I do not want a big mathematical explanation but how do we subsidise the fossil fuel industry to that extent?

**Chairman:** The Deputy asked about the reliance on future technologies. Which of our guests would like to take that?

**Professor Kevin Anderson:** I am happy to discuss that. I will try to keep my answer as simple as possible. We are relying on a number of technologies, one of which, as the Deputy mentioned, is CCS. The standard interpretation is that CSS is used with fossil fuels. Coal, oil or gas are burned. It is usually gas in modern power stations. The CO<sub>2</sub> is captured thereafter and buried under the ground somewhere. That technology is part of CCS. In that way, in theory, no CO<sub>2</sub> is released into the atmosphere. It can also be done by splitting the gas into oxygen and hydrogen beforehand. There are different ways of doing this. One of the concerns is the full life cycle emissions. Many people who work in this area do not look at the full life cycle. There was a very good method study report in 2017 that looked at the different technologies. The life cycle emissions for CCS from power stations are still very high - approximately 150 g to 300 g of CO<sub>2</sub> equivalent per kWh. To give a feel for what those numbers mean, the emissions from renewables and nuclear energy sources are approximately 5 g to 15 g of CO<sub>2</sub> per kWh. Emissions from coal on its own are approximately 900 g of CO<sub>2</sub> per kWh. Emissions from gas on its own are approximately 450 g of CO<sub>2</sub> per kWh. Emissions from carbon capture storage are approximately 150 g to 300 g of CO<sub>2</sub> per kWh. Those are still very high

levels of emissions. It is inappropriate for energy. It cannot deliver at the life cycle level. Of course, the oil industry loves it. Fossil fuel companies love it because it means they can carry on producing fossil fuels. Academics, if they are paid by fossil fuel companies, merrily say how wonderful CCS is.

CCS can, however, be used on cement. Cement produces approximately 8% of all emissions globally. Some 4% of emissions are what are called process emissions from the chemical process. CCS can be used to remove those emissions. There is some work going on in that regard at the moment. The other technologies people think about in this area are negative emission technologies. These are technologies that are either very small pilot schemes, such as the recent one in Iceland of which people will be aware, or that are still just ideas. These are technologies to remove CO<sub>2</sub> from the atmosphere in the future. The primary option considered in almost all the models is the burning of biomass. Trees or other forms of biomass are grown and burned. As those trees or other forms of biomass grow, they suck in CO<sub>2</sub>. They are then burned to get energy and the CO<sub>2</sub> is buried. It is incredibly inefficient and requires, according to the models, an area somewhere between two and three times the size of India to be planted out. It allows wealthy countries to carry on with business as usual under the guise that there will be this technology in the future that our children will apply but, increasingly, from an ecological perspective, from a land rights perspective and from a simple technology perspective, people say that is not the right way forward. There are other technologies such as direct air capture, which is when you use a chemical process to suck CO<sub>2</sub> out of the air using a catalyst and then bury the CO<sub>2</sub>, but that requires lots of energy - ideally, low- or zero-carbon renewable energy, which we do not have at present. All of these things effectively are relying on technologies in the future which may or may not work on different levels.

In the various models and in all the assumptions we make, the problem that arises relates to the level of uptake. To get a feel for it, in almost all the models the level of reduction of CO<sub>2</sub> from the atmosphere is roughly equivalent to the net reduction by global photosynthesis today. All of global photosynthesis for all the plants on the planet is roughly what we think, in the context of the models, we will have from these technologies that do not exist other than at pilot scale. It is not as if it is a small adjustment. This is an industry that is roughly the same size as the current oil and gas industry. It does not yet exist. That is fine if it is in one out of ten models, but when it is in 99 out of 100 models, it has become a systemic bias that allows us to have a nice world in terms of politics now because we are passing the burden on to future generations. It is absolutely massive.

International aviation and shipping are not included in the submissions from every country to the UNFCCC, annually except as a memorandum. That is because in the Kyoto Agreement in 1997, there was an agreement that they were international emissions and should be the responsibility of the International Maritime Organization, IMO, for shipping and the International Civil Aviation Organization, ICAO. However, both of those organisations have fundamentally failed to grapple with the emissions from their sectors. As a result, the EU, for instance, has included aviation in its emissions trading scheme - certainly, in the context of EU flights, and there has been some discussion about international flights also. The EU is also threatening to include shipping in the emissions trading scheme. That is why aviation and shipping have not been included. In the UK, the Climate Change Committee has stated that we should include it because the IMO and ICAO have not done their jobs and that it is the responsibility of the Government to take action.

**Chairman:** I thank Professor Anderson. Which of the witnesses wants to come in on the

questions relating to transport equity and fossil fuel subsidies.

**Professor John Sweeney:** I can tackle fossil fuel subsidies. I thank Deputy Bríd Smith. The CSO estimates fossil fuel subsidies largely on the basis of revenue forgone. It uses a benchmark as a standard for what the average person pays in excise tax on petrol for driving a private car. On that basis, the CSO estimates that, for example, the revenue forgone on jet kerosene is €634 million per year and the revenue forgone on auto diesel, because diesel is taxed at a slightly lower rate than petrol, is €400 million per year. There is also a rate, which is very much lower, for green diesel for agriculture, forestry and fishing. This is effectively a subsidy and there is also a VAT refund on auto diesel, which amounts to €281 million a year. Those are the issues as regards revenue forgone.

I stress that there is a strong case for some subsidies, such as the heating allowance for winter that is currently allowed. That is a very legitimate efficient subsidy, and I would hate to see it being reduced as well.

There is also an issue in terms of things that we do not tax. I have been very surprised that I cannot find any other EU country that does not tax nitrogen fertilisers. Ireland is the only country in Europe that does not tax nitrogen fertilisers. That would have a significant effect on making more efficient use of fertilisers. The latter are a strong driver of greenhouse emissions in Ireland and of what is going wrong with our lakes and rivers. Those are the kind of areas in respect of which there is scope.

If you had an extra €2.4 billion a year, I am sure you could think of many ways to spend it in order to ease the transition to a post-carbon society. That would be a good start.

**Chairman:** I thank Professor Sweeney. There was a question on transport equity, was there not?

**Deputy Bríd Smith:** Yes, if anybody wants to take that. It was in respect of what Professor Anderson said about how most people do not create most emissions and how we deal with that. The committee has discussed this. Even in Covid times, we could start planning for proper, frequent and, ultimately, free public transport across this tiny island.

**Professor Kevin Anderson:** If you look at the emissions across different income groups, there are certain areas where the emissions differences are not so great. They are often called Lorenz curves. Housing is a good example because poor people often live in much more inefficient homes that are often rented. Such homes are very inefficient and hard to heat. Actually, there is quite high energy use in poorer homes, and the emissions from them are often not much less than the average or slightly wealthier home. There is not a huge difference. That is because, of course, they are living in poor quality houses. In transport, there is a huge difference between wealthy and poorer people, and even average people in society. In some areas of society, there were significant differences in the emissions. In other areas, there were fewer differences. In particular, transport is dominated by people who fly a lot, drive larger cars and drive further. We say it is not good because the poor people are driving around in inefficient cars, but they do not drive very far. There are clear distinctions in the income groups for how far people drive, what vehicles they drive and also, of course, how often they fly. There is a big difference in emissions from transport, but the difference is less when it comes to housing.

**Chairman:** I thank Professor Anderson and Deputy Bríd Smith.

**Deputy Bríd Smith:** I thank Professor Anderson.

**Chairman:** Senator Higgins is next.

**Senator Alice-Mary Higgins:** I thank all of the witnesses. I will jump right in.

One of the main concerns I have relates to climate justice. As the witnesses will be aware, there is an obligation in the Climate Action and Low Carbon Development (Amendment) Act 2021 to have regard to climate justice but there is also an obligation in terms of equity. I was concerned at this attempt to strip that out and say that there is an attempt to seek a kind of value neutrality in the approach. Mr. Price had some input on the question of equity. Perhaps he could address this aspect. Equity is, of course, specific to the Paris test in the context of climate justice and the test that has been developed by the CCAC. I am concerned that this test does not involve the best available science when it comes to the important task of comparing the temperature impact of carbon budgets with the 1.5°C Paris goal. It is also concerning because it involves two assumptions. It assumes that all countries are starting at the same point and have the same emissions and would be reducing at the same rate. Of course, that is the exact opposite of differentiated responsibilities and respective capacities. I would be interested in our guests comments on that. While there is much in the Paris Agreement, as Professor Anderson said. Articles 2 and 4.1 of the agreement are referenced in the 2021 Act. They relate to the 1.5°C rise in temperature and they do impose responsibility in the context of equity and comparisons.

Professor McMullin mentioned that he thinks 2015 was a better year, but I am wondering about 2020. Even at a minimum, would 2018 not have been a more appropriate year given that it is the year applied to the 51% reduction provided for in the 2021 Act? I am a little concerned about taking 2020 - which was the first year of the Covid pandemic and which saw a global dip in emissions - as a baseline year, not only because it is out of sync with Paris, which uses 2015, but also because it is out of sync with the 2021 Act and the reduction of 51% in the carbon emissions figure that obtained at the end of 2018. If our guests have thoughts on that, I would appreciate hearing them.

**Chairman:** That is two and a half minutes now, Senator.

**Senator Alice-Mary Higgins:** It was a well-made point of the United Nations Environment Programme, UNEP, that a reduction of 7.6% on a global scale ongoing until 2030 might be the test. That is what was used in developing the target of 51%. If our guests could comment on that being a more appropriate measure of compliance than 1.5°C, I would appreciate it.

**Chairman:** I thank the Senator.

**Senator Alice-Mary Higgins:** In terms of future removals-----

**Chairman:** The Senator is away over on time.

**Senator Alice-Mary Higgins:** I seek a comment only. Professor Anderson and others have spoken about how that 7.6% is based on removals. Is it the case that future risks, such as tipping points, have a higher probability of occurring than some of the future removals? As a result, should the precautionary principle be pushing us much higher?

**Chairman:** Who would like to respond first?

**Mr. Paul Price:** I will go first. The first question from the Senator was about equity. As Professor McMullin said, we are facing these carbon budgets and, as Professor Anderson said, this is something we have to confront. What we have to confront is the physics of it. We have

not faced up to it so far, so it is really good that Ireland is doing this. It is not an easy thing to go through. The Act says “consistent with”, and that is really what we are about, which is consistent with temperature targets and with equity. It seems one could start from there. If one starts from there, then one must look at the quantities. That is what Professor Anderson is doing and it is what we have done. That is what feeds into the economics. Therefore, one must have an economics of that quantity that actually hits that target.

One of the difficulties we have now with the modelling, and there were many good questions yesterday from members of the committee about modelling, modelling gaps and so forth, is that when we look at the energy modelling it is very good on the technology and so forth, but it is based on prices. It is also based on economic assumptions that assume constant future growth and equilibrium correction. These are doubtful assumptions. We have to grapple with the fact that they are doubtful and we must be thinking about what economics we can fit. We have to be thinking, therefore, in terms of what Professor Sweeney and Professor McMullin were talking about, which is how much carbon and how much reactive nitrogen can come into the country per year, because a carbon budget in emissions terms is pretty much equivalent to a forever fossil fuel budget. One must ration that in some way. There might be a little amount of CO<sub>2</sub> removal and there might be methane reduction that can somewhat make up for that, but one has to make it all add up. The real challenge for our society is how to have an equitable transition within Ireland that works in the global sense too and adds up. The economics of the prices we put into models now do not necessarily reflect that at all. They just reflect our current needs or wants rather than the reality. If economics do not join up with the physics, we are in trouble.

**Professor Barry McMullin:** The Senator raised a number of questions, and I do not want to respond at length. In terms of the Paris test that the council formulated, I sympathise with the council. It was operating in a difficult timeframe. The mix of gases of emissions in Ireland is unusual globally, so the nature of the scientific question in Ireland is quite special. It is not easy to copy examples from other countries and apply them directly. The concept of a temperature-based test downscaled to a national level is relatively new in the literature. I am basically saying that I sympathise with the council. What it has presented at this point should be regarded as a work in progress. There is certainly scope for, and I expect we will see, significant improvements in the scientific basis of that particular test. Some of the work we are doing in DCU will hopefully contribute to that.

However, I refer members to the written submission from Dr. Jackson on the legal implications of the Act and the role of Paris consistency. While the council to an extent excused certain things on the basis that it felt that it was being invited to make value judgments that it was not appropriate for it to make, Dr. Jackson’s legal analysis suggests that it was an obligation on the council. There is a difference of opinion, or at least there is a difference of legal opinion, on what the obligations of the council are in that respect if one takes those value judgments into account. I highlighted historical responsibility. The Senator has queried whether 2018 might make more sense in the context of the Act, but 2018 plays a very special role in the Act. It is not to do with historical responsibility. I would not conflate those at all. The choice of an appropriate reference year for historical responsibility should not be tied to 2018 in the Act at all. In fact, now that the council has made the recommendations, that section in the Act is moot and has no effect. It should be set aside so we can have a proper discussion about what the appropriate criteria are for historical responsibility. My opinion, and I refer members to the publications relating to this, is that 2015 marks the very latest defensible reference year for that. As the council did not elaborate on its reasoning, I do not know where the discrepancy between its

reasoning and my reasoning-----

**Senator Alice-Mary Higgins:** To clarify, I was not suggesting 2018 for historical responsibility. The Paris test has no historical responsibility in it, and that is one of the issues with it. My question was about whether 2020 was appropriate as the base year for the volume of emissions in the world at that point. It was an unusual dip.

**Professor John Sweeney:** The point made by the Senator about shocks is very valid. It is imperative, based on the precautionary principle, that we do not rely on a continuation of the *status quo* into the future and that we do not attempt to borrow from the future on the basis of those assumptions. For example, we have seen throughout the world in the past year the type of shocks that can destroy forests and the type of shocks that can ruin some carefully cultivated investments over 20, 30 or 40 years. We have to be very cautious about assuming that what we plant today will be there 30 or 40 years hence. We have to be extremely cautious about attempting, in any shape or form, to bring the benefits forward into previous carbon budgets. There was a hint about that yesterday, which is something we must be ultra cautious about.

On the point about the future, a very passionate speech was made in Glasgow. A very passionate individual said that the future is a bourgeois concept. The individual was saying that we have to think very seriously about the welfare and well-being of people today as well as what we are bequeathing to the next generation. On those two grounds, the precautionary principle is one that should alert us to the fact that we should be taking action sooner rather than later on these carbon budgets.

**Professor Kevin Anderson:** This is the headline quantitative framing. Ireland's emissions per person from energy, and Ireland also has very high emissions per person from agriculture so this is taking the easier end of the story, are approximately 8.4 tonnes per person on a consumption basis. In the case of Africa as a whole, they are approximately 0.8 tonnes. One immediately sees a huge difference in those. The concept of common but differentiated responsibilities has remained in place since 1992, when it was first coined and put into place and which we all signed up to in virtually every international agreement, despite the fact that wealthy companies have repeatedly tried to weaken it. It is still there in Paris and in Glasgow. That requires us to make serious allowance for the fact that we must not impose restrictions or reductions in emissions on poorer countries that will affect their development - certainly, they should be moving to and developing renewables as quickly as possible rather than fossil fuels - and assume they can simply do that overnight. They still do not have all those options for their transport where they are using lots of petrol and diesel.

We have to think about that. However, we have left it very late, and I would argue deliberately so much of the time. That is not helped by policymakers and academics, not including people here, who have underplayed the challenge for years. We have left it so late now that we cannot fairly divide the budget. For example, Dr. Sivan Kartha has done some really interesting work on equity. He is now based in the United States but he is at the Stockholm Environment Institute. He has done much interesting work on equity. The work of Dr. Kartha, among others - Professor Julia Steinberger and others have made similar points - indicates that we have left it so late, we are in emissions debt. It is not that we have any emissions budget as actually, wealthy parts of the world do not have any carbon budget because we squandered that carbon budget quite a long time ago. We cannot live with that because it is not practically deliverable. We cannot switch off the lights now. We must recognise this and it is a good starting point to recognise that we are already taking away the emissions budget from the poorer parts of the world.

We can think about this in the context of the United Kingdom, although it would be slightly different for Ireland. We misused Ireland as well. The United Kingdom has taken people as slaves and taken these countries' minerals, often causing wars in countries because of boundaries being drawn. Now we are stealing their carbon budget. As Professor McMullin has stated, this is colonialism going on in a healthily well state in 2022. We do not like it and we like to think of ourselves as modern individuals in this respect but that is what we are still planning when it comes to our carbon budget. We are adding to our abuse of minerals, of which lithium is a good example, of course, and what we have done with their people in the past.

The concept of equity is absolutely key and it is not embedded well, as I understand it, within Ireland or other parts of the world. The latest data I can find are from 1992. We should not have signed those agreements and our policymakers signed them. We can go further back and look at the Brundtland report from 1987. That is the starting point but if you do that, as Sivan Kartha points out, we have no budget left.

The Senator made an absolutely key and really insightful comment on tipping points. This annoys me repeatedly. I do not like the language of "tipping points" but it is the common language for these sorts of non-linearities in the system. We are prepared to accept the risk of tipping points but when it comes to negative emission technologies and their risks, we embed them in models merrily. We will do anything we can in the models to increase the budget to make it easier for policymakers today but we will ignore the elements that make it harder. The IPCC has been party to this as well. The IPCC reports speak about tipping points in a paragraph somewhere behind the budgets but within its analysis, it will merrily include many negative emissions. In the academic realm we have been party to the making of things more politically palatable. The point is we should really be having much tighter budgets and we cannot even live with the budgets we have.

To put some brief perspective on this, I recently spoke with two of the leading scientists on Greenland. Greenland's melt is not in the IPCC report for sea level rise. The expansion is there but not the actual melt. In Greenland, there is empirical evidence of levels of melt that it was thought would occur under what is called a high emissions scenario, a representative concentration pathway, RCP, of 8.5. That is a very high emission future for decades to come and there is empirical evidence of that level of melt happening today. I spoke to two experts on Greenland, Dr. Jason Box and Dr. Twila Moon, and they and their colleagues think it very unlikely we will not see more than 1 m of sea level rise by the end of the century. It is possible it will be up to 2 m, and that will almost all be from Greenland. After the century we will see the melt coming from the Antarctic. This peer-reviewed science is not embedded in the IPCC reports. There is a suite of such tipping point matters that we are not taking account of because they make the question too politically challenging.

**Deputy Richard Bruton:** I welcome the insights we have received from various contributors. I certainly do not envy any Minister listening to this. The portrayal of the climate advisory council as wimps would not be very widely held by voters, on whom all of us in this room depend. It struck a chord with me that the Climate Change Advisory Council is putting forward something that is legally binding on Ministers and is the second-most ambitious target in the world. It certainly suggests we are stretching what we can achieve.

As I understand it, Professor McMullin is talking about an approximately 20% lower budget and Professor Anderson speaks about a budget that is 36% to 75% lower than what the climate advisory council has advocated. That is a pretty aggressive change. Both the Climate Change Advisory Council and the witnesses are presenting politicians with a task that, in Professor

McMullin's words, is thought to be impossible. Professor Anderson is saying we should assume away any political constraints. Is that approach not a bit of a cop-out for people who are advising us as politicians on how to go about this? We do not have an unfettered capacity to introduce changes or rationing as it was described. One must be conscious of the reaction of the *gilets jaunes* to much more modest proposals. Even governments with extraordinary powers that may not be given to governments like ours are the laggards in signing up to a Paris Agreement context.

We must try to work on the climate advisory council's proposals and the framework it has given us rather than seeking to throw it out. We should work to help Ministers to achieve these and get us on this path. That is instead of prolonging the process by saying something is not adequate and we should wait longer for a credible approach. I worry about that. Like Professor Sweeney, I am old and in a hurry. I believe the Climate Change Advisory Council is giving us the best shot at making real inroads into the change.

How credible is it for a small, open, trading economy like our own to do what Professor McMullin is saying in having top-down rationing of fossil fuel to every enterprise we are seeking to operate and in every home that is looking to carve out a future? That is just not practical politics and we need to see eminent scientists like those before us finding some middle ground with people like us who are trying to get momentum going.

**Professor Kevin Anderson:** I would completely turn that statement on its head. We must start with some self-reflection, which often is quite challenging for us. I am not blaming anybody here more than myself but we are where we are because of 30 years of collective lies and delusion. It is 31 years since the first IPCC report and 29 years since the UNFCCC. We have a choice. We can make that 32 years since the first IPCC report, or 33 years, and carry on with lies and delusion, or we can start to say that we should look at the challenge we are actually facing. That concerns the impact of climate change; it is not about temperatures or reduction rates. We are interested in impact because that is what will hurt us. We can be honest about that. We can say it is fine to have the other budgets and aim for an increases of 3°C to 5°C. We can tell our children that and explain to them at breakfast that it is what we are doing because it is the best we can achieve politically. That is an honest position and it has integrity.

We would have to live by that, however, and cannot pretend we are delivering a target of an increase of 1.5°C or 2°C when the budgets are more aligned with increases of 3°C to 5°C. Let us have integrity on the matter and say we cannot deliver if that is the case, and people will have to live with increases of 3°C to 5°C. It is an honest position and I have no problem with that as long as you do it honestly.

I disagree about rationing, as we are already rationing. I do not know Ireland so well and obviously it is much wealthier than the UK. I am thinking of the UK experience. People in the UK are rationed by salary. There are 20% of homes in the UK in fuel poverty. They are not in fuel poverty because people are not bothered by buying more fossil fuels; they are rationed by their access to fossil fuels. We all live in a rationed system.

Unpicking the "we", there is no "we" in society. There are very different groups. It may be different in Ireland but it does not appear so from some of my experience. The Deputy spoke about how to deal with this politically. If we are serious about our commitments, we should consider what this looks like. There is a massive jobs agenda and there is a possibility to secure long-term and quality jobs rather than short-term zero-hour contract jobs like we have in the United Kingdom. That would mean we would not have fuel poverty. We eliminate fuel

poverty because people can afford to heat their homes. We improve air quality in our cities so people's kids can cycle around without having to breathe in low-quality air. It also means that the streets are much safer for people. There is a whole suite of real win-wins. Although those win-wins are for the majority, sadly the majority are not the people who shape the debate. The people who shape the debate are us, the high emitters. It is we, the high emitters, who will have to make profound changes to our lifestyles. Rationing is better for most people but not for the professors, policymakers, entrepreneurs, business people or for those of us who shape the policy realm. We have been shaping the policy realm in the way that we like it for too long but it is not a universal "we". If we separate out the "we", most people do a lot better under climate change, not least of course, poor people who are dying today. The fact is that Ireland produces 8.5 tonnes per person and the UK produces 7 tonnes per person. We generate high emissions per person, as an average. The problem is not about the future but, as someone said in Glasgow, about the present. It is not just a question of thinking about the future. In communities in Mozambique and Madagascar, people are dying today from the climate change we have knowingly imposed upon them. I would turn all of that around and say that we must have more political integrity and reflection on why we are where we are. Then we must put our shoulders back and get on with the job. We can paint this as a much more positive political story and narrative if we split the "we" into those of us responsible for the lion's share of emissions and those who will benefit from the changes.

**Professor Barry McMullin:** I thank the Deputy for his question, to which I have a couple of responses. First, I am not a politician but I do not remotely underestimate the difficulties and challenges of that role in society and I commend all members of this committee on their engagement with these issues. I cannot do their job because I do not have the requisite skills and do not pretend to have them. Nothing that I am saying here is intended to suggest that I have the answer to these political challenges and members are just not taking it up.

On the climate council, I want to emphasise that for my part, while I have presented certain points of disagreement with what the council has done, that is in part because the council was bound by things that the committee is not bound by and in part because I agree with Dr. Jackson that it may have been mistaken in its understanding or reading of the legal requirements on its actions. Those are honest, scientific disagreements; they are not me suggesting that the council was derelict in its duty or that the individual members of the carbon budgets committee, who had a very difficult job, were derelict in their duty in any way. Those are honest, scientific disagreements about the appropriate approach but it is my responsibility to share my views with this committee. That is the question I was asked to comment on and it is my responsibility to be honest about that and to present those points to this committee accordingly.

The question about realism is really important. The Deputy asked, perhaps rhetorically, whether the suggestion that we might need to ration fossil fuel use or nitrogen use to reliably deliver on the carbon budgets proposed by the council, never mind the lower carbon budgets that I have advocated, was realistic for a small, open economy. Where is the realism here? I am an engineer. What is real to me is the physics of the climate system and it does not bend. It just does not bend. It does not care about what we regard as realism. It does not care about what we regard as our hard-earned status of high living standards relative to other people in the world today. It does not care about any of that. It does not care about whether politics is hard; it just does not care. It is completely independent of all of those things. That, to me, is what is real.

While I absolutely do not underestimate the difficulty in this whatsoever, what is fungible or potentially changeable is societal understanding of these issues. As I said, we have the example

of the pandemic, or one could go back to the so-called Emergency in the 1940s, or the Second World War as the rest of the world refers to it. In an emergency situation, if it is explained and communicated appropriately and if the response is handled in a way that is as fair as possible to all concerned, then it is possible for societies to rally around that, to engage with the measures and look forward to the time when they get through it successfully, having undertaken those measures sooner rather than later. It is important for people to understand that delaying the measures does not make the challenge go away but just delays things and exacerbates the scale of the challenge to be faced later on. This is not solely the responsibility of politicians, by any means, but they do have a particular role to play. Neither is it solely the responsibility of academics but they also have a role to play. We all have a role to play in this but ultimately it requires societal commitment to bring it about. The first step in gaining societal commitment is to communicate the physical reality and the physical scale of the challenge. Downplaying it does not help. Downplaying the urgency does not help. Pretending that we have a choice between making emissions reductions now and making the same reductions in five years is not helpful because that is not the same thing. Making the same emissions reductions in five years will not have the same effect as making them today. It has much more effect to make those emissions reductions today. The first step is communicating honestly the scale and urgency of our predicament. That requires political leadership. Of course it is politically risky but the times in which we now find ourselves call for that scale of political leadership. It may fail, of course, but the people of Ireland deserve to be asked the questions, at least. They deserve a conversation that talks about hard choices like rationing, about the significant and unpalatable economic effects in the short term and about the fact that our future is completely tied up with the actions of much bigger countries. Our ability to influence those much bigger countries is absolutely critical to our future. If we, as a small country that is not even a fossil fuel extractor cannot take this on, with the relative wealth that we have in a global sense - albeit that such wealth is not evenly distributed within our society - then the idea that we are going to persuade the bigger countries on whom we are completely reliant to take comparable action, is clearly unrealistic, to use the Deputy's word. None of this is easy or palatable. I have concrete disagreements with the council's recommendations, which I have given the academic grounds for and that is the best I can do. I am only trying to offer this committee the benefit of that but members will have to assess what they do with it themselves.

**Chairman:** I am going to give time to Professor Sweeney and Mr. Price to respond because this is a critically important question.

**Professor John Sweeney:** The Deputy is slightly misrepresenting our view of the council. We have the highest respect for the council, which is composed of highly-qualified, really good individuals who have been given a very difficult task to perform and have done the best job possible. We would see some areas where there is room for improvement but that is not, in any way, to characterise the council members as wimps. They have done a splendid job within the remit they have been given of producing carbon budgets. If we want to go looking for wimps, we need to look elsewhere, such as at the decisions that have not been taken in the past 20 years; the promises that have been broken and the political commitments made that were not carried through. Those are much more serious in terms of critique.

However, I accept Deputy Bruton's point about political pragmatism. I exclude him from any criticism in this regard because his climate change plan from 2019 represented a step forward in this area and fundamental progress, which had been missing up to that point, on budgets, tonnage and labelling where progress could be made. That was a pragmatic step forward, but the reality is we are now three years on and need even more commitment and drastic changes.

That is a sad state of affairs to be in, but let us not be too pessimistic about political pragmatism.

One can sell the idea that we are entering a post-carbon world which will have opportunities, better health and air quality, and better and more efficient use of energy and food. These are aspects we should not necessarily think of as barriers for the future to be sold by the political system. We can go out and trumpet them, rather than looking at the negative aspects which we may have focused on too much today.

Yes, there is a need for pragmatism and giving politicians scope, but there is also a need for leadership and decisive action, which, as Professor McMullin was saying, overrides many of those issues at present. I urge the committee to grasp the nettle in the opportunities being offered by the climate change situation we are now entering.

**Mr. Paul Price:** I will add to that by saying we all have huge respect for what the council has done. It did not have an easy job. What Professor McMullin and I are pointing to, and what Professor Anderson just mentioned, is about clarity. Let us be honest about the value judgments we are making because they are unavoidable. In any carbon budget one comes up with, there are unavoidable value judgments to be made about the start year, the prudence, the temperature target and the percentage chance of meeting that target. These are value judgments and it is very important that we make them plainly. If we do that, we will have something to talk about.

How much clarity is there in what is laid out in the Paris test? If we had more clarity, we would be talking about what that means in terms of our portion of the carbon budget, but it is very difficult right now to say exactly what that is and to be honest in the terms Professor Anderson talked about.

Neither I nor any climate scientist is in any way saying that there should be a delay. Certainly, there should not be a delay in getting carbon budgets. It is the responsibility now of the Government to take on and accept carbon budgets and then divvy them up between sectors. That is a huge responsibility and very difficult to do, but there is no idea of delaying in any way.

We should remind ourselves that climate scientists went to Lyndon B. Johnson in 1967 and said there was a problem. Climate scientists have been saying this for all this time, as loudly as we possibly can. I am not a physical climate scientist, but climate researchers in general are saying that. In no way are any of us saying that there should be a delay. We are saying there is a need to act now and possibly act a bit harder, but whatever we do is about acting now without delay.

**Senator Pauline O'Reilly:** I thank the witnesses for their contributions. I will bring it into a more positive frame of mind and go back to what Professor Sweeney said. It is very important that we frame it in a way that is honest about the challenge, but also honest about the opportunities for people within that. That means we bring people along with us. There is an opportunity to start to make changes that will have a benefit for people's lives. We could go beyond what the council is saying.

Regardless of whether we are to be more ambitious, as the witnesses seem to be saying here today, or as highly ambitious as the CCAC is already being in its proposed budget, action still needs to be taken. My question will be same as that I posed to the members of the committee yesterday. Do the witnesses see a place for an ongoing modelling approach that could support politicians and policy makers in making the decisions that are made day to day around which direction we go in?

We do not know all of the technology we will be faced with. I know the witnesses talked about the precautionary principle, but we can make iterative changes along the way. I would like to see more collaboration between scientists, policy makers and politicians in order that on an ongoing basis, we do not find a compromise, but science that backs up which policy direction to go in on a day-to-day basis. Will the witnesses comment on that?

I am glad Deputy Bruton brought up the concerns, because some people listening to the meeting might think we are talking about going back on the carbon budgets and redoing the whole thing, which is not what the witnesses are talking about, or going back on the Climate Action and Low Carbon Development (Amendment) Act 2021. I know Professor Anderson has a difference of opinion on the targets that are set there.

It is internationally recognised that the Climate Action and Low Carbon Development (Amendment) Act 2021 is very ambitious. It is also accepted that the carbon budget, as laid before us by the council, is similarly ambitious. Let us start to act on that. If we can make more progress, let us make it. I would love to hear the witnesses' view on the other issue to which I pointed. Can scientists help with the modelling? The council said there were gaps. Professor McMullin has said there were gaps, especially around social justice. Those gaps are there because the data simply are not. That can be built on over time, but we are where we are and we have to act on it.

**Professor Barry McMullin:** I thank the Senator for her comments. They are very helpful. Yes, there definitely is a role for better integration of research and knowledge in our institutions, universities, agencies and so forth to help to inform and have some sort of more clear prioritisation of that. In the Irish framework, much of academic research is funded through Science Foundation Ireland, which updates its research priorities from time to time and has increasingly attached more priority to research in the domain of sustainability, climate and energy. That is positive. There is scope to go further with that but - to speak to the point that is being made here - there is also scope to emphasise more the integration of social and physical science with political activity. While we have had a long-term focus on better integration and collaboration between academic researchers and enterprises, we have not had the same focus on integration between academic researchers and the political realm. It would be very helpful to explicitly add engagement and integration with policy as an output our academic funding agencies look for from relevant academic research activities. The EPA already does this and is very good at doing so. It is a role model that some of the other agencies could learn from.

There is a particular issue about which I am concerned, which Professor Sweeney also raised, and that is the timeliness of information. In this new carbon budget system, we need to know where we are at in a very timely way. The current system of reporting on our emissions has quite a long delay before we get definitive numbers. That is completely understandable as it is a complex process. However, in our financial budget management, we benefit from earlier, albeit less reliable, almost real-time information on the economy, what is happening with financial flows, the price index, salaries and so forth. We get those sorts of data quarterly, if not monthly, from the CSO. There is scope for similar preliminary data for carbon budgets. The outlook for our performance against carbon budgets should be made available in a systematic way, at a political level in particular, in order that course corrections, to which Professor Sweeney referred, can be made in a much more timely way. If we have to wait a year until we know what the emissions were, and we are already one year gone and it will be another year on from our first budget period before we have definitive numbers on the emissions for 2021, that does not put politicians or the political realm in a good space for actively and dynamically managing

that. I agree and endorse the views expressed in that regard.

**Professor John Sweeney:** Politics is about the allocation of scarce resources and we are talking about one of the scarcest resources around at the moment. Ultimately, the decision has to be made on the basis of democratically elected politicians rather than scientists. Nonetheless, it is very useful for scientific input to inform policy. Unfortunately, scientific input has not informed policy on this topic effectively over the years. That is something about which I have a great deal of regret. If we had a better funnel of scientific information going to politicians over the years it would have been better because scientists by their nature are not particularly good communicators. We write our papers, go to conferences and exist in our own bubbles but we do not necessarily get trained in the articulate skills politicians have. We are at a disadvantage, especially in comparison with other very powerful vested interest groups that have very different experiences in the debating halls, literature and societies that scientists generally do not access.

It is very important that we improve science communication in this area. Those of us who have laboured for many years trying to do that recognise the difficulties there are but, nevertheless, there are possibilities here. I mentioned already that modellers get bad press in climate science. In fact, the models in climate science are much more certain and closer to the mark than those we find in the economist's world, for example. There are opportunities here for looking in a more integrated way at trade-offs between different models. As I mentioned already, the European Commission has been very active in promoting integrated climate models that take into account mitigation, adaptation and socioeconomic models. I have been a little involved in some of that. There is scope for looking at things in more detail, in that kind of integrated way, rather than the silo approach of sectors that has characterised our look at this operation so far. Perhaps that is a way in which the scientific community might also bring the options to the decision-makers. Ultimately, it has to be the political system that decides. We can improve from a scientific point of view by gaining access to the political decision-making system and there is a willingness to do that among most of the academics I encounter. However, we will not usurp or take away the ultimate choice that has to be made and the leadership that has to be provided by the political system.

**Professor Kevin Anderson:** I have to disagree slightly with Professor Sweeney's final comments. From a modelling point of view, the scientists have done a fantastic job. The models are remarkably robust. Let us draw a very clear distinction between the modelling that the scientists do, which is basically lots of physics, and the modelling that goes on in these other huge models that use integrated assessment models, which is where we shoehorn in anything that can be quantified. There is a whole load of economics in it and right at the core is always a general equilibrium, which is basically a market economic growth model. One cannot question that so everything has to fit around it.

There is a simple climate model into which are plugged in theories on transitions and how technologies change. These things are really uncertain. One thing that is always missing is behaviour, and equity is almost completely ignored in these models. These models are part of the problem. Adding more data to them will not make them better. It just makes them worse. This is a deeply political problem that needs to be informed by science, including the excellent climate models. The voices we are missing in this, from an academic point of view, are less those of the scientists.

I heard the term "mitigation denial" used. I know climate scientists who are mitigation deniers. They deny the levels of mitigation that are necessary because they are not politically palatable. The funding we have requires us to do research that fits with the politics of the day.

Look at how quickly net-zero has become a new term. Going back five years, it was not in the IPCC's AR4 or even AR5 reports but now it is everywhere. One cannot talk about climate change without talking about net-zero but most people do not even know what it means, although they use it.

We have to be careful about assuming that scientific expertise is what we need to guide good policymaking. Maybe we need to bring in more people from the social sciences and the humanities. I am an engineer. There are other people out there who have a useful contribution to make, as does wider civil society. Some of the work and ideas embedded in the Climate and Ecological Emergency Bill that is being developed in the UK at the moment, across parties, is looking at ongoing citizens' assemblies informed by experts as an ongoing process of thinking about these issues. It would be a bit like the House of Lords but rather than just being comprised of select elites it would be a much more random choice of people. That might help inform the policymaking process.

I am cautious about adding more quantitative expertise into models because all we will get from that is more high-tech options for the future and less understanding of the potential for major political change today. That is what we are talking about here. We are talking about political leadership akin to the big shifts we have seen in society from time to time, not about the incremental change that we see in between. It is not managerial politics we are after now but political leadership. There is no way that can be usurped by quantitative models so I would be cautious about that route.

**Mr. Paul Price:** With regard to the initial framing of the question I totally understand that some people might be listening to this and thinking this is all very grim. It is grim looking backwards but that does not mean it has to be grim looking forwards. Over the last three or four years we have had the Fridays for Future protests and some other big protests and awareness has been raised. On the physical side, we have seen impacts playing out around the world quite badly in the last couple of years and there has been a real waking up to this issue. Positivity comes from action and facing up to reality. If we can face up to reality and be positive about doing this then we can do it. The point being made is that we have not tried. We have not really tried, certainly in the richer countries. It is about trying and achieving. Senator Pauline O'Reilly mentioned iterative achievement. That is clearly important but the iterative changes in policy and policy-science interactions have to be fast enough to meet the physical challenge. Otherwise, even for the budgets that have been set, that is-----

**Senator Pauline O'Reilly:** I was not referring to iterative changes. I was talking about iterative conversations between scientists and policymakers in order to make policy decisions. I do not want that to be misconstrued.

**Mr. Paul Price:** I did not mean to misconstrue it. That is absolutely essential. We saw it play out really well yesterday between the committee and the Climate Change Advisory Council regarding the carbon budget committee. There was a brilliant back and forth about that. It was a brilliant example of what can happen and what needs to happen more often. We also saw this with the Citizens' Assembly, which was leading edge.

The issue of model types came up a lot yesterday, and it has been raised here. We have models for economic optimisation, but really we need modelling. Professor McMullin and I have talked about this. One really needs to play out scenarios in order to ask what is the worst case, to look at the worst-case scenario and to plan to avoid that. One of the worst-case scenarios is not meeting the Paris Agreement quantity budgets. We must look to see how we can do that.

That would create positivity and show that we are really thinking about this. It is important.

At yesterday's meeting, Dr. Hannah Daly referred to openness of models. This is extremely important. If we are going to talk between us, between policymakers and scientists, and between scientists looking at what other scientists are doing, then things must be open. We need open data and open modelling. Professor McMullin has been pushing for this for years. It is super important. I was a bit alarmed when there was talk yesterday of agricultural modelling being too difficult for us to look at. That is not good. We must have open modelling, which is essential to these discussions.

**Chairman:** I thank Mr. Price and Senator O'Reilly. Finally, Deputy Cronin has been waiting patiently.

**Deputy Réada Cronin:** I do not believe I am the final speaker. Senator Higgins is coming up after me again.

I thank the witnesses for their very sobering and realistic presentations. We all became involved in the climate change emergency because it is stark and in your face. One then becomes bogged down with committee work. I very much welcome this meeting. I do not want to sound frivolous, and certainly not in front of the eminent professors and professor emeritus, but many of us watched the movie "Don't Look Up" over Christmas. It is a satire on the deadly serious future we face with this climate emergency. My question is political, but it is not party political. The emergency is global. Globally, politics functions on the basis of reassuring people and offering them safe care plans, if not outright mollifying them, and trying to give them certainty. It has functioned almost as a brand or a product. It is useless for what we are facing with this raw science. Physics does not care if politics is hard. Do the witnesses believe that we will find the leadership necessary to finally look at this and face it, since we are constantly pushing the responsibility to the next generation? We did this with the bank debt. Do the witnesses believe we will do what is necessary and that we will do it on time?

I thank the witnesses for highlighting the scale of the problem and the urgency required, and for giving us a good cold bucket of water in the face to remind us of that urgency. Just transition and equity are critical, and I am glad they have been raised. Ireland should be pushing its diplomatic role internationally. That is an opportunity for us.

Professors Sweeney and Anderson referred to the carbon budgets. The IPCC's carbon budgets, which dictate what the Climate Change Advisory Council puts forward, were drawn up on the basis that the permafrost under Siberia and Greenland will melt slowly. Recent events, however, such as the forest fire in Siberia last year, indicate that this may happen more abruptly and that there could be a faster thaw. What would that mean for us, as a society, and for humanity globally?

We really must challenge the economic model of constant growth. I am always saying this because the two just cannot balance. We cannot keep expanding and expect growth all the time. It just will not work.

I thank the witnesses for the presentations. They provided the sobering start to the year that I needed.

**Chairman:** I thank Deputy Cronin. They were indeed sobering.

**Professor Kevin Anderson:** The Deputy's comments about leadership are absolutely key.

This is something that I bang on about too. If we are looking for top-down leadership, then we are going to fail. Leadership is not about top-down, and it probably never has been, although it is a convenient model for us. It is much more of a messy relationship between bottom-up and top-down. There is nothing tidy about this. Ideas can multiply from an individual to a local club, to a local institution and to a local policymaker, and then, maybe, to a national policymaker, and this can then inform the development of some policies and an umbrella framework, which then changes how society operates. This has happened across the world for years, and it is a much more emergent process. When we see it like that it gives us a lot more hope that rather than thinking leadership is about a handful of, usually, wealthy white men around the world, it is actually approximately 8 billion of us in various ways demonstrating leadership in our homes, in our institutions and with our friends down the pub and then engaging with the local policymakers who can demonstrate leadership, and in wealthy countries in particular we have more chance of doing that. It is a much more messy partnership across all tiers of governance, from our homes right the way through to national and international government.

If one can see it like that, and recognise it as a much more emergent process, then it gives us much more hope because there are many more people that can feed into that debate. The key issue is about discussing it, not necessarily about agreeing. It is about trying to make changes and talking about how easy or how hard it was, what the problems were or whether it was much easier than expected. One starts the dialogue. It is from this dialogue that leadership emerges in a way that we cannot predict. If we go back three years to the spring of 2018, and thought who would be the real person to drive this forward, one might have come up with one of the great and the good, such as Obama or someone else. One would not have thought that it might be a 15-year-old Swedish schoolgirl. That probably would not have been a person's first thought. While she may not save us from climate change by herself, she is the catalyst for change that has emerged across a youth movement that has gone across much of the world

. We have now seen that engagement with other generations through the extinction rebellion movement and many other civil society movements. There is now a wider discussion on climate change than before. This is really very hopeful. Once we open the dialogue into wider civil society, we recognise that we get much more scope for change. That is where I really see us as policy makers trying to get that dialogue as an option, and not just that we would pass good ideas down, and that we would also try to learn bottom-up what those ideas might look like. Of course, climate change is ultimately culturally derived. The responses in China will be very different from the responses in Ireland. The responses in wealthy parts of Ireland will be different to the responses in the poorer parts. It is very cultural, and we must recognise that there is no simple answer that we can just play out across countries or even within countries. It is much more localised than necessarily top-down.

**Chairman:** I thank Professor Anderson. As we have nearly reached our three allocated hours, we shall conclude shortly. Do Professor Sweeney or Professor McMullin wish to come back in?

**Professor John Sweeney:** With regard to leadership, I am reminded of a comment made by the late Desmond Tutu when he said he was a "prisoner of hope". We all have to be prisoners of hope in this problem. There is a lot of doom and gloom about it but we cannot give up hope. On leadership, since I retired from academia and left the ivory tower, I have worked more with NGOs and civil society groups such as An Taisce and with young people. I have found a much greater awareness and sensibility about the problem from those sectors of society. They see through the fog much more clearly than somebody who is beset and pestered by vested interest

groups, and with various contradictory pressures coming on them. I am much more hopeful of finding in our young people the leadership qualities necessary. Professor Anderson referred to the 15-year-old Swedish girl. Perhaps we could add to that a 90-year-old broadcaster. We see, therefore, that a range of society is actually stepping up to the mark on this. Let us hope that they continue.

**Professor Barry McMullin:** I endorse everything said by Professors Sweeney and Anderson. We have seen the emergence of this much greater civil society awareness and engagement in the past few years, and that is hugely encouraging. Here in Ireland, the experience of the Citizens' Assembly was extremely positive. We should not sit on our laurels in that respect. I recall that Professor Sweeney and I and a number of other academics, as long ago as the 2016 general election, were involved in an academic group promoting the idea of, essentially, a citizens' assembly on steroids, that it should be a standing assembly and that what was done on the Citizens' Assembly at a national level should be happening in every county and parish in Ireland. Compared with the amounts of money we are talking about, real money we will have to spend, what does it cost to facilitate communities and local groups to get access and to debate, discuss and review their local situations? The Sustainable Energy Authority Of Ireland does Trojan work through the sustainable energy communities, but this is about allowing communities to be much more politically engaged. We have pieces of that jigsaw already in place in Ireland, but there is huge potential to ramp this up to a much greater opportunity for citizens to inform themselves, to engage with experts, to challenge one another, to challenge politicians and to organise. It is not all about top-down political leadership by any means whatsoever. I encourage the committee to engage with all the possibilities there are to provide support from the top down for civil society engagement on this issue that concerns us all.

**Mr. Paul Price:** What happened in the Citizens' Assembly was remarkable. Regular citizens really took on board what experts said. We should not underestimate the ability of citizens to do that, and that is hugely hopeful and helpful. Having that ongoing engagement, as Professor McMullin said, would engender hope and wider understanding. We cannot constrain things to the top-down. When I engaged with energy management in Dublin and looked at that side of things, it was only when the local community was facilitated to engage with the experts and take that on board directly, not filtered from the top down, that they made things happen. Things can be made to happen. What we are saying in carbon budget terms is that there are overall constraints and that reality lies within those constraints. That is what science is talking about. There are very difficult constraints, but if we face up to them, we can deal with them and have hope. However, that requires that early acting in all these ways, particularly in this engagement with people. As Deputy Cronin said, "Don't Look Up" provides some of those lessons, as we have all seen over the years.

**Chairman:** Senator Higgins, I will not have a chance to go back to you, I am afraid.

**Senator Alice-Mary Higgins:** That is fine.

**Chairman:** I will make my own comments. If the witnesses wish to respond briefly, they are welcome to do so. From my experience on the committee in the past 18 months or so, everyone at this meeting is very serious about the challenges we face. However, Professor Sweeney is correct when he says that we - not just us in politics, but all of us - exist perhaps in our own bubble. A major challenge we have is to move from these debates. The debate today and yesterday has been incredibly compelling. We have had climate scientists move from science and technical aspects of the carbon budgets to other considerations. While there may be disagreement as to what the carbon budget should be, the debate has moved to the very real

kinds of policies that are necessary and the kinds of opportunities that could be presented. That has been lacking in the debate on climate action up to now, in my experience. My sense is that we need more of this. We need more people with expertise such as today's witnesses and the witnesses we had before us yesterday. The more these debates happen the better. However, I have a fear that we are not communicating. We are operating in our own sphere and talking to one another and not communicating these vast and very real challenges, including the local and the immediate. It is very well and good to talk about the high-level and the abstract, and that is really important, but we do the movement a huge disservice if we do not talk about the real, the immediate and the local. If the political debate breaks down into the traditional Punch and Judy show of the Government versus the Opposition and accusations of "You are not doing enough", that is an absolute disservice to the challenge we face and, ultimately, we will fail. I invite the witnesses to respond. They do not have to do so, and we are out of time, but if anybody does wish to comment, please just indicate.

**Professor Barry McMullin:** I wish to express my appreciation for the opportunity and the kind words. The committee members' engagement both yesterday and today and from previous sessions has been amazing. It sends a signal. The signal is not quite getting through yet, but all these things will mutually reinforce one another.

Covid has masked this challenge. Covid has so dominated public discourse for the past two years that it has been very difficult to carve out the space for public discussion of other things. Fingers crossed, however, that space will open up over the coming short months. The debate on the sectoral emissions ceilings, on the one hand, will be technical but, on the other, will affect many people's lives in very real ways, regardless of whether the budgets, as proposed by the council, or the further reductions that some of us have advocated today are taken. Either way, in no way do I counsel delay on any of this. Members should get on with it, come to their conclusions, adopt budgets and move on to the sectoral emissions ceilings. We need much more action on facilitating citizens all over the country to engage with these discussions to understand that they are going on, to understand the implications they have for them and, particularly, to engage and give the space to younger people - from my perspective, that means anyone under 40, incidentally - to have their voices heard and to negotiate this very difficult and challenging future with solidarity, community and collaboration rather than all the other possibilities, which would be hugely damaging to everybody.

**Mr. Paul Price:** I will spread the net you mentioned wider, Chairman. This is not just about citizens within Ireland, of course; it is about citizens across the world. Perhaps we should have committees, the Oireachtas and scientists engaging with scientists in Africa. Gender inclusivity is a problem across climate science, climate research and climate action. All this inclusivity has to be addressed. We are laying out some physical constraints and trying to have equity and clarity. Ireland has 5 million people. There are African countries with 5 million people that are facing real problems right now. We could appreciate a country with the same size of population facing those damages, taking on board the lessons they have for us.

**Chairman:** We will leave the last word to you, Mr. Price. I thank all the witnesses for joining us online today. It was a fascinating session and a very sobering one, as Deputy Cronin said at the beginning of the year, but witnesses have alluded to hope as well. We have to hold on to that. Tomorrow we will have probably a very different kind of session when we will have a number of social partners before us. They will have their own take on the challenge we have. I thank Professor Sweeney, Professor Anderson, Professor McMullin and Mr. Price for coming in today. Their insights really are invaluable to us.

12 January 2022

The joint committee adjourned at 4.40 p.m. until 1.30 p.m. on Thursday, 13 January 2022.