



**OFFICIAL REPORT**  
AITHISG OIFIGEIL

# Environment, Climate Change and Land Reform Committee

**Tuesday 30 October 2018**

**Session 5**



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**Tuesday 30 October 2018**

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**ENVIRONMENT, CLIMATE CHANGE AND LAND REFORM COMMITTEE**  
**30<sup>th</sup> Meeting 2018, Session 5**

**CONVENER**

\*Gillian Martin (Aberdeenshire East) (SNP)

**DEPUTY CONVENER**

\*John Scott (Ayr) (Con)

**COMMITTEE MEMBERS**

\*Claudia Beamish (South Scotland) (Lab)  
\*Finlay Carson (Galloway and West Dumfries) (Con)  
\*Richard Lyle (Uddingston and Bellshill) (SNP)  
\*Angus MacDonald (Falkirk East) (SNP)  
\*Alex Rowley (Mid Scotland and Fife) (Lab)  
\*Mark Ruskell (Mid Scotland and Fife) (Green)  
\*Stewart Stevenson (Banffshire and Buchan Coast) (SNP)

\*attended

**THE FOLLOWING ALSO PARTICIPATED:**

Stefan Nyström (Swedish Environmental Protection Agency)  
Anders Wijkman (EIT Climate-KIC)

**CLERK TO THE COMMITTEE**

Lynn Tullis

**LOCATION**

The Robert Burns Room (CR1)



**Scottish Parliament**  
**Environment, Climate Change**  
**and Land Reform Committee**

*Tuesday 30 October 2018*

*[The Convener opened the meeting at 09:00]*

**Decision on Taking Business in**  
**Private**

**The Convener (Gillian Martin):** Welcome to the 30th meeting in 2018 of the Environment, Climate Change and Land Reform Committee.

We have an updated agenda to include correspondence from the Government on the United Kingdom Ivory Bill.

I remind everyone present to switch off their mobile phones, because they might affect the broadcasting system.

The first item on the agenda is to consider whether to take agenda item 5 in private. Do members agree to do so?

**Members indicated agreement.**

**Climate Change (Emissions**  
**Reduction Targets) (Scotland)**  
**Bill: Stage 1**

09:00

**The Convener:** Agenda item 2 is to take evidence on the Climate Change (Emissions Reduction Targets) (Scotland) Bill. This is our second evidence session with stakeholders.

I am delighted to welcome our two witnesses, who are joining us via videoconference from Sweden. Stefan Nyström is the director of the department for climate change and air quality at the Swedish Environmental Protection Agency, and Anders Wijkman is the chair of EIT Climate-KIC.

We will start with questions about how climate change is currently being tackled in Sweden. Scotland and Sweden have similar topography and land uses—densely packed urban centres and significant agricultural, forestry and other rural land uses. What have been the key challenges in developing and implementing Sweden's environmental objectives and integrated climate and energy policy?

**Stefan Nyström (Swedish Environmental Protection Agency):** That is a good question. Obviously, there are several challenges. One of the main challenges is that Sweden is a small country whose prosperity depends on international trade, and there is the issue of competitiveness in relation to how to maintain or increase standards in Sweden while facing competition from other countries that might not do the same. Will our doing that hurt our country's competitiveness, or will we gain an advantage from it? Will it be costly? How can we protect ourselves and gain advantage in competitiveness? The pace of increasing environmental standards affecting competitiveness is one of the main issues.

**Anders Wijkman (EIT Climate-KIC):** I agree. One climate policy advantage that Sweden has over many other countries is that we have a more or less CO<sub>2</sub>-free electric power system. We have a combination of hydro power and nuclear power, and nuclear power is now gradually being phased out and replaced by increased renewable energy production. That is due to peak around 2040, which makes us a bit special in the European context. Over the years, we have had discussions about whether we could be a much larger net exporter of electricity and help countries including Poland and Germany to close down some of their coal-powered stations. That is the advantage for us.

The convener asked about environmental objectives in general. The main challenge is to move away from the more or less silo-based approach in which we have tried to target each environmental goal in its own right. We are, increasingly, realising that we have to do much more in an integrated fashion. That goes for our environmental objectives and for the United Nations sustainable development goals. The vertical approach that has dominated so far, with each ministry focusing on its particular concerns, will not really work.

**The Convener:** Has buy-in been needed from all sectors working together in order for you to have achieved what you have achieved?

**Stefan Nyström:** Exactly.

**The Convener:** That buy-in has obviously happened.

**Stefan Nyström:** Yes, it has happened. The main difficulty, other than the things that we have spoken about, has been politics. We need to make sure that environmental policy is not treated as a right or left issue, because it is not: it is, for obvious reasons, a matter of the planet's survival. We can see that technology can help us because it will be cheaper and more competitive to use better technology in the future. The main challenge has been to manage the political context, in which short-term squabbling is the main agenda of the day. However, 87 per cent of the Swedish Parliament now stands firmly behind the goals.

We also have a long-term energy remit that aims to create an electricity production system that is free from CO<sub>2</sub> emissions by 2040. We can see that that will happen before then, because the wind energy industry is increasing extremely quickly in Sweden—so much so that it no longer needs any subsidies.

**The Convener:** Was the Paris agreement the catalyst for the wider agreement, or was that agreement already happening?

**Anders Wijkman:** The answer is yes and no. The Government set up a climate task force in 2015. Our goal was to reach net zero emissions by 2050, but the Paris agreement influenced the task force, so we moved the target date closer—we now have a target of reaching net zero emissions by 2045.

The convener asked about the challenges and difficulties: I will mention two, specifically. First, we have agreed on the targets and goals, which is the first step, but we will experience a lot of difficulties with implementation, simply because there is a tendency in our country—as there is in other countries—for our Ministry of Finance often to use a discount rate, which delays action because the

assumption is that we will be much richer in the future. That relates to the old debate between Nordhaus and Stern, from 2006. The finance ministry is often wrong; we should do things much more quickly. The most recent Intergovernmental Panel on Climate Change report speaks in favour of that approach; if people read the report carefully, they will know that the whole world has to reduce emissions by 50 per cent by 2030 in order to have a chance of meeting the Paris agreement. We cannot continue to delay action. That is one difficulty.

The other difficulty is in distinguishing between incremental change—which we have done so far by cutting fuel emissions year by year, for example—and the transformation that we now need. We will not get close to zero emissions with incremental change; we need transformation in several of the major sectors. We need transformation not only in the energy sectors, but in sectors including cement, steel, aluminium, plastics, textiles—which is a horror story—electronics and agriculture. We need to do things in totally different ways in all those sectors. Most people do not realise what that transformation means.

**John Scott (Ayr) (Con):** Gillian Martin touched on this point. I note that Sweden has a long history of environmental protection, with strong public support and buy-in. How have politicians and Governments managed to achieve such a high level of support for decarbonisation and other environmental objectives? How did you manage to persuade your public and electorate that those are good ideas?

**Stefan Nyström:** That was done through a combination of means.

**Anders Wijkman:** Luck!

**Stefan Nyström:** As always, luck had something to do with it. The Paris agreement offered a window of opportunity for taking long-term rather than short-term action, which for obvious reasons often dominates the political agenda. We also saw that technology that was not currently available and which would help Sweden to decrease emissions from large sources was around the corner.

The mining and minerals industry, for example, has now put before us an action plan to become fossil free by 2035. That industry accounts for a large proportion of emissions in Sweden; the steel sector alone accounts for 10 per cent of our emissions, or more than 5 million tonnes.

The list is long, so the general understanding of the fact that climate change will harm our economy and will hurt us all badly if we do not take action is widespread in Swedish society, spurred by the climate agreement in Paris and

then translated into action both in terms of political goals and in terms of action plans from the commercial side, which has helped a lot. As has been stated before, there is a long tradition of awareness in Swedish society, so the whole process has been shared, so to speak, and it has been spurred on and helped by the non-governmental organisations that wanted us to go further. There has been a movement in general since the window of opportunity opened up, thanks to a combination of the Paris agreement and technological change. That has facilitated transition.

**Anders Wijkman:** I interpreted your question a bit more widely—you asked about historical development. Sweden is in a rather special situation, as I said before. We are a small population in a very large land area. We have lots of forests, so we can use biomass cleverly if we need to, and we also have hydro capacity.

For a number of reasons that are not related to climate change mitigation, Sweden took a decision in the 1960s to develop nuclear energy. If we had not done that, we would have been 40 to 50 per cent dependent on fossil fuels for our electricity production. That decision was made mostly because of concerns about energy security at that time. You may recall the oil crisis at the beginning of the 1970s. At that time, I was a member of the Swedish Parliament and the question of how we could be less dependent on outside sources of energy dominated the energy policy debate. Nuclear energy was also seen by industry as a cheap way to produce electricity. In retrospect, you could say that for a period it was, but now, when we include the costs of waste disposal and long-term management of nuclear waste, that is no longer true, because the fee that reactor owners have to pay per kilowatt hour for disposal is increasing as we speak. Things have changed a lot, but that background is important.

**John Scott:** Sweden's integrated climate change and energy policy has set testing interim and final targets for greenhouse gas emission reductions. What process was followed to pass that legislation? You spoke earlier about the beginning of the process and setting the targets. What key factors did you consider when deciding on the targets?

**Stefan Nyström:** Are you asking about the targets in the energy sector for 2040 and the climate change goals?

**John Scott:** Both or either—whichever you prefer to talk about.

**Stefan Nyström:** They are connected, in a way. There is a tremendous amount of academic work being done through close relations between the Government policy side and industry. Behind the

system of energy goals was a job that was carried out by the Royal Swedish Academy of Engineering Sciences. For about three years it looked at various businesses and the possibility of their becoming fossil-fuel free by 2040.

09:15

At the same time, we had a group of politicians closely following the work. That opened up a common understanding that becoming fossil-fuel free is possible, and that, rather than being costly, it will quickly serve our country well. For instance, wind power is going to increase tremendously quickly in our country because we now have a more market-based incentive system that is part of the whole equation. It was launched in 2003.

Generally, Sweden produces about 160 terawatt hours of power a year and consumes about 140 to 145 terawatt hours. In 2006, we produced our first terawatt hour of wind energy. Today, it is more, and we think that we will produce 30 terawatt hours by 2021, based on the decisions that have been made. The transition is very fast, and costs have come down to below what it would cost to introduce new coal-powered or nuclear plants. Wind power will dominate our energy system by 2040—it will be the new nuclear, so to speak. That was an important part of getting the politicians to agree on the energy goals for 2040.

Of course, that was done in parallel with the process that Anders Wijkman and I have worked on in setting the climate goals. The two aspects are very interconnected. If a country cannot at least get a CO<sub>2</sub>-free electricity production system, it will be difficult to reach the goals for transition in the transport sector, which needs zero-emitting electricity production systems.

That is the situation with regard to the energy system. Anders Wijkman will speak about the climate process.

**Anders Wijkman:** The first decision that we took in leading the task force was to ensure that each member of the committee, on which seven political parties were represented, had more or less the same understanding of the challenges. We spent about half a year listening to experts, travelling around Sweden, talking to people and doing deep dives into particular sectors to try to understand the challenges and the opportunities in terms of technology, substitution and so on.

As Stefan Nyström said, the energy system was a critically important area. Electricity is now more or less under control, and we look forward to rather rapid electrification of private vehicles. There is still a big question mark over heavy traffic, because we do not know whether the solution will involve electricity, hydrogen or

synthetic biofuels. We have to have an open mind in that regard.

Other sectors are also of particular importance. I already referred to basic materials manufacture—cement, steel and so on. Most people do not talk about it, but basic materials manufacture makes up about 20 per cent of global emissions, and demand for basic materials is rising sharply, especially in developing countries. Unless we address that issue and consider it to be the responsibility of countries such as Sweden to provide the world with new technologies, the requirements of the Paris agreement will never be met. It is not just an energy-system issue—it is very much an issue that concerns infrastructure and basic materials. We have some policies in place in Sweden to try to incentivise change in that regard.

Of course, the agriculture sector is critically important. We talk a lot about meat and meat consumption, but I point out that every time you put a plough into the soil, you release a lot of carbon. We have more and more evidence from different parts of the world—in particular, the USA and Australia, but also west Africa—that a combination of rotation of crops and no-till agriculture is preferable, because that enables soil fertility to be built up, soil erosion to be halted and soil to absorb carbon from the atmosphere. We have not been able to convince the agricultural sector about that yet, never mind those who are preparing the next phase of the common agricultural policy.

I single that out as a very important issue. If Sweden, Scotland and some other countries, in particular France, could co-operate, there could be a breakthrough, with Brussels starting to incentivise farmers to do the right things and to stop building up carbon. That will be critical.

Those are areas of importance. City planning is another issue, and moving from a situation in which cars are all over the place to one in which public transport, biking and walking are the primary transportation modes is a major issue for the long term.

**John Scott:** Thank you for that. I declare an interest as a farmer. I am interested to hear you say that you have identified something similar to what we have identified in Scotland. Although those in our agricultural industry are prepared to shoulder their share of the burden, it has yet to be demonstrated to them by those who have the technology, or the ability to tell them, how it should be done. There is a lack of knowledge transfer here. Is it the same in Sweden?

**Anders Wijkman:** I do not want to sound condescending, but the agricultural sector is a bit conservative. There has been a rather slow uptake

of the ideas. I suggest that you invite Professor David Montgomery from the US to give evidence. He recently wrote a fascinating book called “Growing a Revolution: Bringing Our Soil Back to Life” in which he uses a lot of examples from the midwest to show the benefits of what he calls regenerative or conservation agriculture.

We need to pilot schemes and pilot demonstration projects for farmers to see it work with their own eyes, because it is a risk to move from something that they are doing today to something that is totally different. The benefits are crucial. Of course, soil is different in different parts of the world, so the new approach would have to be applied differently. It is a very interesting area.

**Mark Ruskell (Mid Scotland and Fife) (Green):** I return to the questions about energy. You have a very ambitious target to remove fossil fuels from your heating system by 2020. That is an area that we have particularly struggled with in Scotland. What do you deploy? Is it biomass? Is it electrical heating? Is it district heating? How will you get to that target?

**Stefan Nyström:** It is a combination of all the measures that you have mentioned. We already have little fossil fuel use left in that sector. During the oil crisis in the 1970s, a conscious policy decision was made to decrease the use of fossil fuels tremendously. The target is ambitious, but I think that we will be able to reach it—if not by 2020, at least by 2021.

**Anders Wijkman:** We use district heating to a larger extent than most of Europe—about 55 per cent of households are connected to district heating, which has helped, because it is an efficient system. In parts of the country we have combined heat and power, which means that we use biomass—or whatever the energy source is—much more efficiently.

Over the years, we have used an increasing number of heat pumps. They have taken over. In some parts of Sweden, district heating faces difficulties, because energy demand is being reduced. Consequently, new business models for that energy source will need to be developed.

Those are the main responses.

**Stewart Stevenson (Banffshire and Buchan Coast) (SNP):** I want to come back to farming, which impacts three of the seven greenhouse gases that are internationally recognised. We have talked about carbon dioxide and tilling. Methane mainly comes from bovine sources, but it is not particularly persistent. However, the gas that I want to ask about and seek an answer to is nitrous oxide, which persists for more than 100 years. It comes from transport and other sources, but a large source of it is the production of artificial fertilisers for farming. Has Sweden done any work



to identify alternative sources of fertilisers to help farmers and perhaps, in addition to securing the climate change benefits, to reduce farmers' dependence on artificial fertilisers as well as their costs?

**Anders Wijkman:** I do not think that either of us is an expert on this matter. Incidentally, though, the other week I met Hans Herren, the Swiss expert on this matter and head of the Millennium Institute, which is active all over the world advising farmers. In a talk that he gave at a conference, he basically said that he looked forward to the phasing out of conventional fertilisers through a change in farming practices, although perhaps not in parts of Africa where there has been tremendous soil erosion and loss of nutrients. There are some new developments, but I cannot say that we in Sweden have championed them. I am sorry about that.

The other day, I ran into an interesting article that suggested that methane from cattle can be reduced by mixing seaweed into fodder. There is obviously quite a lot of technological development going on.

**Angus MacDonald (Falkirk East) (SNP):** You might be aware that, in Scotland, we publish a climate change plan every five years, setting out how emissions will be reduced in seven key sectors over the following 15 years. How does Sweden approach and report on sectoral greenhouse gas emissions reductions?

**Stefan Nyström:** Under new Swedish climate legislation that was launched on 1 January and which was the result of work that Anders Wijkman and I carried out, the Government must produce such a plan every fourth year. If year zero is an election year—in Sweden, the Government that wins the election has a four-year mandate—the Government will receive the relevant statistics from all the authorities at the beginning of the first year of that mandate period, which gives it as much time as possible to produce an action plan for the next four years. The Swedish Environmental Protection Agency gathers all the materials from the various sectors, produces that statistical analysis and hands the information over to the Government.

We also do the same thing annually, which allows us to see how emissions are developing in the various sectors each year. However, the Government has to present an action plan to Parliament every four years.

**Anders Wijkman:** As in the UK, we have a climate change committee that provides an independent voice and is supposed to provide both positive and negative comments on the Government's plan. I assume that it will also come up with its own proposal if it thinks that the

Government is not doing its job. However, that is a relatively new development, and we do not know how it will work yet.

We were inspired to a large extent by the British legislation. In November 2015, we visited London to meet Lord Deben—John Gummer—and that visit was instrumental in convincing some of the members that the idea of a special law or legislation was a good one.

09:30

**The Convener:** I want to go back to some of the areas where progress has been a little sticky—the difficult sectors. In Scotland, we have a similar situation to the one that you have described. We have been reducing our emissions, but a lot of that has been down to closing a coal-fired power station. Anders Wijkman mentioned construction and agriculture, but what other sticky and difficult-to-change sectors are there? More importantly, what strategies have been put in place to facilitate change in those sectors?

**Stefan Nyström:** I think that we can share a picture with the committee. *[Interruption.]* No, it does not want to work.

**The Convener:** I am seeing something that says "Policy instruments". Is that what we should be seeing?

**Stefan Nyström:** No. It is supposed to be a picture showing the largest emitting sectors in Sweden.

**The Convener:** Do not worry—you can send it on and we can put it into our evidence as supplementary evidence. Perhaps you could just talk us through it.

**Anders Wijkman:** Let us start with steel which, as Stefan Nyström indicated, is the source of roughly 10 to 15 per cent of our yearly emissions. The Government has offered a special package to the steel industry, which now has a major project to try to go from today's steel production technology to using hydrogen for oxygen reduction. The industry is quite optimistic that that can happen before 2035. I met industry representatives a couple of weeks ago and said, "Couldn't we speed it up?" They said, "Of course—if you provide us with more capital and financial resources, we could probably do it within 10 years."

The cement industry is another challenge. I am a little bit at a loss on that. I do not know whether you saw the Chatham House report that came out about a month ago that basically said that, with present knowledge, we can cut emissions from cement production by 45 to 50 per cent over the next 10 to 15 years. However, when I meet senior officials in companies such as LafargeHolcim, they

indicate that they already know how to produce cement in a way that is CO<sub>2</sub> free but that the technology is too expensive and does not fit in their business model. We have to try to understand what we could do in the economy to incentivise that.

Steel and cement are two very important areas. The third one is of course plastics. On that, we depend a lot on what goes on in the European Union, where the Commission has taken on an ambitious role in that area.

Some consumption sectors, such as textiles and electronics, are also very problematic. We talk about the circular economy, but we should remember that less than 1 per cent of fibres from textiles are being recycled. The textiles sector alone accounts for 6 to 7 per cent of the direct and indirect carbon emissions in the world, so that is a huge challenge. The way that fashion is being offered, where people buy new stuff all the time, is definitely not sustainable. Consumers have to play their part, but the industry has to do a lot.

It is the same with electronics. I cannot even change the battery of the telephone beside me, because the plastics that are used are glued together. It is very difficult to recycle high-quality plastics. Today, the only materials used in the sector that are recycled and reused are copper and gold—the rest are incinerated. We have a huge problem because the sector is increasing so quickly, and there are areas in which we do not yet have any effective policy instruments.

**Stefan Nyström:** Those issues are obviously very difficult. I will complement Anders Wijkman's answer by looking at territorial emissions. Can you see the picture that I am sharing with you that says "Transformational change needed"?

**The Convener:** Yes, we can.

**Stefan Nyström:** Excellent. The lower line shows industry, the red one shows transport and the green one shows agriculture. If you look at 2045, you can see that what will be left in relation to our aims and the goals that we have set will be emissions from agriculture and industry. We can see that it will be difficult, primarily in the agricultural sector, to reduce emissions with our current knowledge. Around the corner, we have technologies that might be efficient, but we do not know whether they will be able to be deployed.

Unfortunately, carbon capture and storage will be necessary to achieve our goals. Anders Wijkman mentioned the cement industry, which accounts for 5 per cent of Swedish territorial emissions—the emissions that are produced in Sweden. We cannot take emissions lower than 50 per cent without transformational change and that change is not possible at the moment, except through the use of carbon capture and storage.

The Swedish Environmental Protection Agency believes that we need to develop CCS infrastructure—not alone, for obvious reasons, but in a European context. Norway claims to own 30 to 40 per cent of the total known storage possibilities, and Norway and Sweden, as neighbouring countries, co-operate very closely.

For the years 2050 and beyond, which are not shown on the graph, we need negative emissions. Sweden is well endowed with forests, and we have 30 million tonnes of biogenic emissions from the forest industry. If we could store those emissions in proper bio-energy with carbon capture and storage facilities, we could produce negative emissions, but such facilities have not materialised yet. They are waiting around the corner and everybody is speaking about them, but they have not been created yet. We need them by 2035 in order to meet the goals for the cement industry and to achieve the goals of negative emissions in the latter end of this century that are needed but which have not yet been set.

**Stewart Stevenson:** I have a couple of relatively technical questions that have come from what you have said. The use of carbon capture and storage in the cement industry is being discussed to a limited extent in Scotland. However, that would require post-processing extraction of carbon dioxide from the emissions from the cement industry, which would be done largely through washing the gases with a nitric acid bath. That takes us back to the point about nitrous oxide being the precursor chemical for producing nitric acid.

Are other carbon capture and storage technologies being looked at? I know of seven different technologies, a number of which involve precombustion, which means using the right amount of oxygen and so on. Unless I am mistaken, the cement industry uses a post-processing extraction process that relies on nitric acid. Has Sweden done anything that might help with that issue?

**Anders Wijkman:** I do not think so. The Norwegians are running a project for the cement industry, and the Swedish cement industry is partnering with that project, but neither of us has visited the installation.

**Stefan Nyström:** I am going there in December but, unfortunately, I am unable to answer that question just now.

**Stewart Stevenson:** That is fine. I recognise that it was quite a technical question. My other question is also quite technical. We touched on the electronics sector, where the most recent gas added to the portfolio, nitrogen trifluoride, is a key part of the process of producing microchips, and most of it comes from the electronics industry. Is

there any understanding of how we might eliminate nitrogen trifluoride from production in that industry? I make a small caveat because, as the gap between components in silicon-based chips has now reached the limits of what works, we may well be moving to a base material other than silicon, which may result in other issues, but I know so little about it that I will not make much comment on it. Has Sweden done anything about that?

**Anders Wijkman:** I do not think so, basically because we do not have an industry in that field, so it is not part of our territorial emissions, as we import all that stuff. Your question is very important and it is something for the Americans, the Chinese and the Koreans to address, but it is not something that we have any particular knowledge about. I am sorry.

**Stewart Stevenson:** That is fine. We should move on.

**The Convener:** I would like to return to some of the information that you gave in response to my earlier question about the difficult-to-reach sectors. Your graphic mentioned transport, which is obviously a difficult sector, and a lot depends on a change in the behaviour of people—in Sweden and in Scotland—in order for us to reach those goals. What is being done to effect those behavioural changes, particularly with regard to people's lifestyles?

**Stefan Nyström:** Going into behavioural issues from a political point of view is extremely tricky. We live in a free world, so politicians are hesitant to go for that, although they can incentivise actions in order to facilitate people doing the right thing. For instance, there is a subsidy of 60,000 Swedish crowns, or approximately £5,000, for buying a new zero-emitting car. That effects a behavioural change through an incentive rather than through information or punishment.

We have the same for fuels. People generally do not have to worry about that, because we have a law demanding—through a market incentive-based system that is difficult to explain—that suppliers of fuels for private vehicles increase the bio element of fuels in the market. It is set to increase from 20 per cent to 30, 40 and 50 per cent over the years to come in order to facilitate a transition. We also have incentive programmes to facilitate the charging of electric vehicles all over the country. They cover both public charging facilities and the provision of cheaper private charging facilities in people's homes and at their work.

You asked about transport, and there is a sticky issue with international transport, with the most difficult part of all being international aviation. Sweden's public consumption emissions and

territorial emissions, together with the exports, are about 11 tonnes per Swede today. Territorial emissions are around 5 to 6 tonnes, so the total is almost double. A large part of that comes from international aviation, and it is increasing tremendously fast. Just one journey from Stockholm to Thailand, for instance, which is a popular route at Christmas and new year, emits 2 tonnes of CO<sub>2</sub> per person.

**Anders Wijkman:** That is in economy; it is three times more in business class.

09:45

**Stefan Nyström:** That is a really tricky issue that we need to tackle together. The authorities in Sweden feel that the answer that the airline companies have come up with—namely the carbon offsetting scheme for international aviation, or CORSIA, which is the international system for reducing increases in emissions from 2027—addresses only between 15 and 20 per cent of overall emissions, because of all the exemptions and loopholes in the system. We are really worried about that and have no real solution to it, other than to suggest deeper international co-operation by all countries.

**Anders Wijkman:** Behaviour is changing; for example, people are changing to cleaner types of cars, which is a positive move. I would also say that, over the past five to 10 years, an increasing number of cities have been offering much more efficient public transport opportunities. Smart mobility is catching on. I do not think that there is any Swedish city in the lead in that respect—Helsinki and Lyon are the two European cities with the most efficient systems—but the idea is to make using public transport very easy. For example, you can purchase tickets on your mobile phone through an interface with the payment system. I also see a lot of new car-pooling systems in which you can use an app to order a car. You do not need to own a car if you live in the city, because you can use a combination of cycling, public transport and cars on demand. Those sorts of systems, which are developing quite nicely, will help to bring about behaviour change.

**The Convener:** However, as you said earlier, Sweden, like Scotland, has a massive rural population. The things that you have talked about can be done in cities, but what are you doing to give people in rural areas access to the public transport that will make it easier for them to change their behaviour with regard to car use? Is that a big issue in Sweden?

**Stefan Nyström:** Yes, it is. There is, for understandable reasons, a very clear divide between people who live in rural areas and people

who live in cities, but that is not just a transport issue. It is also about education and, indeed, about jobs, with people moving to the cities and the central parts of countries where the jobs are.

With regard to the ways in which people transport themselves in rural areas, our analysis is that the introduction of electric vehicles will give those areas an advantage. Sweden is vast—it is 2,000km long and 600km at its widest—and it is sparsely populated in, for example, the north-west. If the gas station in an area closes down along with the school and the store, it is just not possible for people to stay there. However, everyone has those two holes in the wall that allow them to charge their electric vehicles, so the infrastructure is already there. In that sense, we believe that the rural areas will be the winners in the transition to electric cars. We will see whether that comes about, but at least it will mean that in, I think, five years, we will not need to have a discussion about whether this or that gas station can be closed or whether it will need to be subsidised by the Government.

**Anders Wijkman:** You should also bear in mind that 80 per cent of car travel in Sweden takes place in city environments. Although the divide between rural areas and cities is a political issue, it is, from an emissions point of view, a minor problem.

**Claudia Beamish (South Scotland) (Lab):** I want to turn to the emissions trading schemes. For the purposes of the *Official Report*, I point out—I hope that I am correct—that, as you will know, Sweden has put in place targets for reducing non-ETS emissions to 63 per cent below 1990 levels by 2030, to 75 per cent below by 2040 and to 100 per cent below by 2045. Why do those targets differentiate between European Union ETS and non-EU ETS sectors? If possible, can you give us a simple explanation of which sectors are covered under each target? Are any flexibility measures available to help you achieve those targets?

**Anders Wijkman:** Around 40 to 45 per cent of our emissions are covered by the ETS—that is heavy industry. One of the suggestions made by the task force that Stefan Nyström and I were involved in was to make the ETS much more ambitious than it was at the time that the report was launched. We are not leaving the ETS sector all alone, but we cannot really influence it, apart from being part of the decision-making process in Brussels. We can, by and large, control all the other emissions through policy measures.

The 63 per cent target happens to be a compromise—some people wanted 70 per cent and some people wanted 55 per cent, so we ended up at 63 per cent. It is not easy to explain why it is that particular percentage. We wanted to move towards zero in 2045 and we made the

calculation that 63 per cent for 2030 was appropriate. Of that 63 per cent, 70 per cent of the reduction is from the transportation sector, which is major.

**Stefan Nyström:** There is intricate arithmetic behind that 63 per cent, which we will not go into. The simple explanation is that we rely on the ETS delivering the reductions that it set out to deliver, and we do not want to be double steering, so to speak. We have confidence in the ETS delivering. If the ETS does not deliver, we will need to work via Brussels, or together with like-minded countries, to ensure that it will deliver.

**Anders Wijkman:** I referred to the Government scheme to incentivise technology change in the steel sector. That is an example of an area where we do not believe that the ETS alone will bring about the necessary technological change. That is because the price has been so low. There need to be complementary measures.

Over the past couple of years, we have seen that the ETS seems to be working better. The price has gone up, so that should be more of an incentive for companies to look for innovation—that was not happening when the price was about €7 or €8 per tonne.

**Stefan Nyström:** To elaborate a little on that, when it comes to the steel industry, which has always been very important for Sweden—the steel industry accounts for about £6 billion in net exports, which is a fair amount for us as a small country—the ETS is not enough. We need a complementary innovation policy. Even if the price in the ETS sector was high, the pockets of our large steel producers would empty, because it takes such a long time to innovate and put in place new, innovative, zero-emitting steel production methods. When it comes to those large transformational changes, we need the participation of the public together with industry in order to share risk; we need the public to contribute to the finances.

We have a special company that is made up of three companies working together: a steel company, an electricity production company and a mining company—two of those companies are publicly owned and the other is a private company. That approach will probably be needed in other areas, too, although we do not yet know which ones. Then again, competition in the international market is fierce. If change takes more than a quarter of a year and stock markets want a return, countries may need to share risk and contribute to the finances with public funds.

**Anders Wijkman:** As a policy maker, I find it interesting that when we compare the price at the point of sale of a tonne of conventional steel with a tonne of steel that is CO<sub>2</sub> free, the difference is

something like 40 to 50 per cent. That is not competitive. However, if you buy a car and the steel in the car is CO<sub>2</sub> free, that car will cost £100 or £200 more. The difference at the consumer level is minor. I would hope that we could do something in the economic system so that the differential does not play out in that way.

**Stefan Nyström:** As Anders Wijkman indicated, preliminary research shows that although net-zero cement and steel are about 50 per cent more expensive—I think that the figures are 60 per cent and 40 per cent—the additional cost of using that cement and steel in rail and house construction is 0.5 per cent. For example, the price of constructing an apartment in central Stockholm would be around £500,000, and the incremental cost of using net-zero cement and steel would be £2,500, which is nothing. We are asking ourselves how we can use public procurement to incentivise our industries to provide us with net-zero cement and steel.

**Claudia Beamish:** How would public procurement help in those sectors?

**Stefan Nyström:** One of the largest buyers of cement in Sweden is the authority that is responsible for building new highways, bridges and railroads—that agency's demand for cement and steel is very high. If demand for zero-CO<sub>2</sub> cement was introduced, either gradually, directly or in close co-operation with companies, that is an equation that could work out. It would incentivise a large company that has about 96 per cent of the Swedish market.

**Anders Wijkman:** Fifty per cent of new apartment buildings are built by municipalities. One of our proposals was that we should build high-rise buildings out of wood. We have a lot of wood in Sweden, and houses that are built from wood are cheaper and quicker to erect. I would also say that they are more beautiful—I do not like concrete buildings very much.

There are many opportunities in public procurement. The EU's public procurement legislation allows for such demands to be made. The critical issue is competence among public procurement officials. They have to be aware not only of the legislation and the legal aspects but of technology, carbon emissions and a lot of other issues. It is crucial that their competence is enhanced or brought up to speed.

**Stewart Stevenson:** The subject has come up of the competitiveness of steel production companies if they start to eliminate greenhouse gases from the process. To what extent has Sweden considered the potential advantage of being an early adopter of new methods of producing steel? That would apply to other industries, too. Whatever shortcomings there may

be in the Paris agreement, it creates an international market in the longer term for new methods of production. The early developers, adopters and owners of intellectual property associated with that have a huge commercial opportunity if they choose to take it. Arguably, on the other hand, it may be one of those cases in which, because of the huge start-up costs, those who are first to be second have the advantage. Is that part of the discussion in Sweden?

10:00

**Anders Wijkman:** Definitely. That is one of the arguments that a small country must give priority to. Our share of global emissions is very small, but we can make a difference by demonstrating good solutions. That would also allow us to benefit from future trade.

Sweden produces about 5 million tonnes of steel a year. It is mostly special steel. The world produces 1.6 billion tonnes of steel a year, half of which is produced in China. We have a long way to go until all the old steel-producing facilities are closed down and replaced by modern technology, but we have to start somewhere. The Swedish hydrogen project—there are similar projects in Austria and Germany—is very promising. We hope that that will benefit us in the future.

**Stefan Nyström:** I will add to what Anders Wijkman has said. After the oil crisis, the shipyard crisis followed in the late 1970s. At the time, we were a large ship producer and we produced lots of steel for the ship industry—neither China nor India were as large a producer as we were. There was an enormous cost crisis in the Swedish steel industry and we had to close down lots of facilities. The ones that are still in the market asked themselves at that time what they could do to continue to be in the market in 10, 20 or 30 years' time. They moved to producing only special, hard steel and specialised products. They produced light steel for the car industry and the mobile industry, which includes Anders Wijkman's iPhone. They managed to stay in the market, and they are not as sensitive to price issues.

We see that others are following the Swedish example—we are no longer alone in that segment of the market. Innovation is a natural step in taking the steel industry further.

We cannot be sure that the first to innovate will be the winner. We do not know how the Porter hypothesis works in reality—it works differently in different sectors—but we know that innovation is the key to our continued wellbeing and economic prosperity in Sweden. Nobody doubts that any longer, which is why we are going into the hydrogen project.

**John Scott:** In developing the theme of innovation, you mentioned the hydrogen projects in Sweden and Germany. On the development of fuel sources for trains—that is, electric versus hydrogen—I understand that Alstom has introduced hydrogen trains. Is that the future? How do you see hydrogen versus electric developing as a fuel source for large vehicles, or even cars?

**Anders Wijkman:** The Japanese would be the best people to ask about that, because they place a huge emphasis on hydrogen in parts of their industry. They believe that hydrogen will be as good an alternative as electricity is for private vehicles and for dealing with heavy traffic.

On trains, we will rely on the electric grid. We get 60 to 70 terawatt hours a year from hydrogen and, as Stefan Nyström said, energy increasingly comes from wind, so I do not see any reason why we should go for hydrogen there. However, heavy traffic is a bit special; it is still an open question.

**Stefan Nyström:** It is very open. I will elaborate a little bit on the issue. The industry, and especially Vattenfall, which is our largest energy producer by far, has started to discuss power to X instead of only power to gas.

We see that hydrogen is the future, because there are so many possible ways to use it. It can be used in trains. In the northern inland parts of Sweden, some trains cannot be electrified because there are no facilities there, and it would be much too expensive to construct them, so hydrogen could be an alternative to continuing running trains on diesel up there. That is not a very big part of emissions, but it could be done.

Hydrogen can also be used for cars and heavy vehicles, and we can produce methanol for shipping using hydrogen. There are also possibilities to use bio CO<sub>2</sub> emissions that come from the forestry industry. There is already a project between the forestry industry and Vattenfall to produce methanol for shipping on the Swedish west coast, and we will see how that works out.

We are going into a situation with more weather-dependent electricity production. Windmills are now becoming around 250m high, so they tend to produce much more electricity than they did previously, because there is always some kind of wind up there, but we are still getting into a situation with more weather-dependent electricity. If we produce hydrogen as a back-up gas for power stations, that could be used to balance the power supply when there is no wind and the sun is not shining.

There is an increasing discussion on power to X in Sweden, but not too much of it has materialised yet.

**Finlay Carson (Galloway and West Dumfries) (Con):** I want to briefly take us back to targets. It is a simple question. Why was a domestic effort target considered necessary alongside an overall target?

**Anders Wijkman:** Do you mean the overall target in Europe?

**Finlay Carson:** I mean in Sweden.

**Stefan Nyström:** So you mean the division between the ETS sector and the rest of the economy.

**Finlay Carson:** Yes. Why did you include a domestic target?

**Anders Wijkman:** The ETS covers 45 per cent of emissions, but we have to deal with the rest in Sweden. We need policies and a combination of regulation and incentives, because we believe that emissions would not come down otherwise. We need to address the ETS sector and the non-ETS sector. That is a given. Every country in the world has to do that.

**Stefan Nyström:** There is no escape there.

**Richard Lyle (Uddingston and Bellshill) (SNP):** Your targets are of course for the future, so let us look to the future. Do you expect Sweden to use international carbon trading or other measures to achieve its net zero 2045 target? What are the consequences of not meeting the net zero 2045 target or of using carbon trading to meet the targets?

**Stefan Nyström:** There has been intense discussion between the various blocs in Swedish policy making on international trading and offset mechanisms. Before the agreement that we now have on the 2045 goals, the reds and greens were not in favour of using credits, whereas the blue parties more or less wanted to use credits a bit more. We now have a very clear-cut distinction, which is that only 15 per cent of the reductions by 2045 can be achieved through credits. However, it is not necessarily the case that credits will be used to achieve that 15 per cent, as it could also be done through land use change, such as a large increase in forests. It depends on what is decided through the mechanisms of the Paris agreement, as the Kyoto protocol definitions of what is accepted as a credit will run out in a couple of years. We will see what happens.

I think that you asked what the consequences will be if we do not reach the target.

**Richard Lyle:** Yes. What will really happen? At the end of the day, we are all setting targets. In 20-odd years' time, I will be about 93. It is great for politicians to set targets that they will not have to meet because they will possibly not be here. Is it a cop-out—I am sorry to use that word—to say that,

if we do not meet the target, we will just buy credits and offset it? Does that debase your belief in what you will be able to do?

**Stefan Nyström:** The year 2045 is a long time from now.

**Richard Lyle:** Exactly.

**Stefan Nyström:** That is as far as Anders Wijkman and I went during the investigation that we led. What is currently happening is that the Government with the Opposition—everybody wants this—has launched an investigation into the 15 per cent and how we can best create a road map for how to use the credits. A certain amount can be used for reaching the target in 2030, as well, and we have to elaborate on that.

We did not count further than that in our investigation. That is now being done in another investigation, and we will see what people come up with.

**Anders Wijkman:** We know very little about the next 20 to 25 years, so we have to maintain flexibility. Five years from now, we might have breakthroughs in certain technology areas that will make the picture and the challenge look very different.

Offsetting can play a very important role. I know, as I have been involved in discussions about this, that the German Government is going to launch a major initiative in Katowice in which it will try to incentivise offsetting in many developing countries and help civil society organisations and Governments to restore degraded lands and grow forests, for example—to literally build carbon in the soil. The potential to do that is enormous. We do not talk much about that potential, because we have been so focused on the energy system, but there are hundreds of millions of hectares of degraded land that could be brought into fertility again and could store carbon. Offsetting is therefore an interesting area.

**Richard Lyle:** I remember the 1970s oil crisis. I was in Holland at the time.

It would be wrong of me not to ask the question that I am about to ask, although some people might think that I should not do so. You spoke about recycling. Does your deposit return scheme contribute to meeting your carbon targets?

**Anders Wijkman:** We have a chapter in the climate strategy, which we submitted, that focuses on basic materials. There is a combination of innovation, substitution, recycling and reuse and, of those, recycling is the least positive alternative. The reuse of components is, of course, the main target.

The problem is that most products are now designed in a way that means that recycling and

reuse are very difficult. I chaired the Swedish Recycling Industries Association for six years. One of the main problems was that things were put on the market upstream that were very difficult to do much about downstream. When ministers went to Brussels and enhanced recycling rates, I often said that that was meaningless as long as the design issue was not addressed as well. Normally, there should be a principle that, when products are put on the market, it should be relatively easy to reuse and recycle their components.

We need a revolution. I was party to a recent study by a company called Material Economics, which we can share with the committee. Its estimate for the European Union was that, by adopting a circular economy approach, we could cut away roughly 70 per cent of the emissions relating to basic materials and infrastructure leading up to 2050 compared with a business-as-usual case. That is a huge amount, but that is not happening as long as the European Commission is not implementing the right measures. Unfortunately, Mr Juncker is not the right man for the job, because he is blocking the effective use of the ecodesign directive. I could elaborate on that.

10:15

**Richard Lyle:** Thank you very much.

**Anders Wijkman:** Do you know why? In the Brexit campaign, Nigel Farage was travelling round Britain with a toaster in his hand, saying, “These bureaucrats in Brussels even have views on how we should design our toasters—such rubbish!” That argument was obviously quite effective. When Juncker heard that, he said, “Okay, let’s focus on the big things, not the small things.” What he obviously does not understand is that, if 500 million Europeans use a toaster that demands less electricity, that is a big thing, not a small thing, so the ecodesign directive is very important and we should broaden it to take into account design and materials.

Sorry for being so political.

**Mark Ruskell:** No, let us have more of it, please. You have one of the world’s most ambitious climate targets—net zero by 2045. There is some uncertainty, as we sit here in 2018, about exactly how you get there, and about the types of technological change that will be needed. How have you dealt with that question? It is a big question here as we look at our own climate targets and ask whether we have a precise thought-out pathway to whatever target we put into our bill or whether, to a certain extent, we can take a leap of faith and try to lean into the technology that might be coming and develop it over time. How has that debate played out in Sweden?

**Anders Wijkman:** The first necessary step is to set the targets, then the devil will be in the implementation. We have seen over the past couple of years, both at national level and at city or municipality level, quite a lot of initiatives to get closer to the targets: so far, so good. Emissions are still increasing—they went up last year—but they should start to go down as many measures have been implemented. However, we have to do much more. Having seen the Intergovernmental Panel on Climate Change report the other week, I think that we should increase our ambition.

**Stefan Nyström:** It is a good question. In the graphic that I am showing you, the yellow curve represents actual emissions, which do not perform as nicely as the projections do. They go up and down and we have no idea where they will go next year, for obvious reasons. The graphic shows that so far we have managed a reduction of 2 per cent per year, until 2017, but last year we had a cold and rough winter, so emissions went up. Industry is also running at a high percentage of its capacity, which is another explanation. We can see that we need to come down by between 5 and 8 per cent until 2045—by 8 per cent a year if we want to reach zero emissions and use none of the extra flexibility that is allowed, or otherwise by 5 per cent a year.

If we do not make calculations, we cannot make progress. We need to set targets, then evaluate, then maybe put in more measures if we do not reach the targets. When we set the targets, we saw that the technology was around the corner, or was perhaps already there, even if it was not yet on the market. You need to be a little bit bold and to stretch things a little bit, but not by too much. We can see that a reduction of between 5 and 8 per cent by 2045 is within reach. It will not come easily, and we will need to take more measures and supply more incentives to get there, and we will need to discuss how to create low-carbon alternatives to fossil fuels for the transport sector after 2030. Should we put a very high tax on them in order for them not to return when electricity has become the main fuel, or should we simply forbid their being on the market? We do not know.

We know very little about the future, but we can set the targets, evaluate and use more measures as evaluations come to hand. That is how we do it.

**Anders Wijkman:** I will make two additional comments. First, I do not think that any European country has cut its emissions by more than 1.5 per cent to 2 per cent from one year to the next, historically. Therefore, regardless of whether we are talking about 5 or 8 per cent a year, there is a huge difference. I stress that we are talking for many sectors about transformational change being needed in order for them to do things differently.

Secondly, we will, of course, face stranded assets along the road, and we have to put in place policies—not only in Sweden but also in central Europe—to help the regions that are very stuck in the coal-based economy to transform. I do not think that we have discussed that enough yet at European or national levels. That discussion has to come.

**Mark Ruskell:** I read about Sweden's 15 sector action plans, and we have heard a bit about cement and steel this morning. How focused on the gaps are those sector action plans? We have heard about the transformation in renewable heating, which is obviously an easier target for you, given the progress that you have made with renewable electricity. However, in terms of the harder-to-reach gaps, is innovation coming from the sector action plans that gives you and the public confidence that the gaps can be closed, or are there still many unanswered questions?

**Anders Wijkman:** One of my tasks is to chair the European Institute of Innovation and Technology's climate knowledge and innovation community—EIT Climate-KIC—which is one of the instruments that was set up by the European Commission some years ago. After seven or eight years of experience, we have come to the conclusion that to bring about transformation, we need what we call systems design, not vertical or silo-based design. We are no longer interested primarily in specific technologies; we look at the system and try to understand what is required in that system to make change really happen. Of course, there are areas where a particular technology can make a significant change, but with regard to transportation, infrastructure, farming and so on, you need to look at a number of components in order to make change happen. We need to be much more ambitious in that regard and to put in place public funding and support for that.

**Stefan Nyström:** I shared a couple of the action plans with the committee. If you do not have access to them all, I would be happy to share them with you.

Mark Ruskell asked whether the action plans are focused on the gap. I would say that they are not necessarily so. People have shown initiative in coming up with action plans for their own sectors and trying to see how fast they can translate from today's emissions to a situation in which they are fossil-fuel free. As it happens, the fossil-fuel free co-ordinator who was appointed by the Swedish Government has worked with the sectors that need to be focused on if we are to close the gap. For example, members can see that the list of sectors contains the mining and minerals industry. The aim is to make mining operations, which are large emitters, fossil-fuel free by 2035. There are



machines down the mines that emit lots of CO<sub>2</sub> that are often forgotten about in the discussion. Those are about to become electrified—work on that will happen from next year. I think that the sector will reach its goal much sooner than 2035.

The steel industry accounts for 10 per cent of Swedish emissions. The aviation industry is obviously also a sticky issue, to use the phrase that was used before. There are a lot of other sectors on which there is focus and where Sweden needs to take action to close the gap.

The answer to Mark Ruskell's question is yes and no. It is no because the plans focus on their own sectors, but it is yes because those sectors happen to be the ones that were chosen by the co-ordinator who was appointed by the Government, who has been in close contact with us as they have carried out the analytical work for the Government.

**The Convener:** The Swedish Government's strategy of not including certain sectors when it is producing its targets and measuring its achievements in relation to those targets appears to be quite different from the approach of the Scottish Government, which sets a target that does not exclude any sector. Can you see a situation in which Sweden would adopt that bolder approach? Would that be politically possible, and might it be necessary?

**Stefan Nyström:** Could you repeat the question? I did not quite understand what you said.

**The Convener:** At the moment, when your Government sets its targets, it does not include emissions from aviation and certain land-use emissions, for example. The Scottish Government's approach is different, in that it does not exclude any sectors. Can you envisage there being a political change in Sweden that would mean that those sectors were not excluded and 100 per cent of sectors were covered?

**Anders Wijkman:** The two sectors that are not included are aviation and shipping, but we will have to include them sooner or later. They were seen as being in the domain of the international agreement. I agree that we need to tackle the emissions from those sectors. We must undertake initiatives: if every country waited for the others to join it, nothing would happen. Some countries need to stick their necks out and be a bit more ambitious. I very much applaud the Scottish approach. We have not yet come that far, but I think that we will get there.

**Stewart Stevenson:** A slide that has disappeared from the screen said that aviation aims to make domestic flights emissions free by 2030, and international flights that originate in Sweden emissions free by 2045. I read those as

being the industry's aims. What status do those aims have? How will the industry sanction itself if it does not meet them? Do those aims mean much, if they are not part of the legislative framework?

**Stefan Nyström:** All aviation within Europe falls within the ETS, so the domestic part of our flying system is within that system, but international flights are outside it. All sectors are covered by the Swedish goals, except the two that have been mentioned. The haulage industry, the retail sector, the steel sector and the mining and minerals sector are covered by the 85 per cent target, so the status of their goals is that they are more or less a statement on their behalf to their owners, their consumers and society in general, but they are not connected in any particular way to the goals that the Government has set out. When it comes to what the Government can do, my answer is that, more than anything, it can incentivise.

We do not count CO<sub>2</sub> uptake by our forests. In Sweden, we emit about 55 million tonnes of CO<sub>2</sub> each year, and the net uptake by our forests is about 45 million to 50 million tonnes. We do not count that at all, but we could do. I was not sure from reading the committee's papers what Scotland does with such information. We might begin to count the uptake by our forests in the future, but at the moment we look on it as a free service to the world, so to speak.

**Claudia Beamish:** I want to develop an issue that we have already touched on. In his article in *The Scotsman*, Stefan Nyström indicated that the setting of a net zero target had been a strong driver for business and local government. You will probably know that in Scotland there are mandatory duties not just on local government but on all public bodies. It is expected that those duties will be met, although there are support methods. What support—beyond the support that we have already discussed—is provided by central Government in Sweden for the public sector and business to achieve climate change targets?

**Anders Wijkman:** We alluded to the steel sector, for which the Government puts in some €30 million or €40 million a year to the hydrogen project. There are many similar examples. There are also particular incentives in the transportation sector—as Stefan Nyström mentioned—to incentivise consumers to do certain things and to oblige the petroleum providers to increase gradually the mix of synthetic fuels in conventional fuels and so on. There is a wide array of measures. We cannot give an exhaustive list here and now, but we could send that list to the committee.

10:30

**Claudia Beamish:** That would be very helpful. The public sector is also very important. There are local government arrangements as well as the police and the health service. Is the Swedish Government able to support such bodies to effect change?

**Anders Wijkman:** There is a provision in the law that each and every Government sector—each ministry—has to take account of climate law in all that it does. Climate mitigation and adaptation concerns have to be taken into account in all policy making. That is one of the strongest parts of the legislation and has led to much more integration than was previously the case.

As I said, at municipality level, we have many examples of rather ambitious policies that engage the private sector and various parts of municipality services and so on. There is a sense of competition—not just domestically, but internationally. We have the C40 cities and the ICLEI, which is now called Local Governments for Sustainability, so there are many organisations at city level that co-operate and share experiences and so on. That does not need much input at national level.

**Stefan Nyström:** As Anders Wijkman has said, there are a lot of support programmes and we cannot go into them all—you probably would not want us to—but we can send a document over for the committee to read and ask questions about later.

Three Swedish cities have introduced their own climate change committees. Things are developing at a very fast pace.

One of the big challenges is that we traditionally work in silos—that is the case in all countries—both within Government and in policies. One example of the challenge that that presents is our statutory investment programme, which is financed by the Government—*[Interruption.]* There seems to be some background sound—a scraping sound—where you are, which is making it difficult to hear.

**The Convener:** I do not think that the sound is coming from here. Please just carry on.

**Stefan Nyström:** The scraping sound has stopped now.

The investment programme was launched last year. It is a 10-year programme for Swedish investment in new roads, railroads, surveillance and maintenance. The programme comprises, in Swedish crowns, some SEK690 billion, which is about £75 billion—a lot of money. However, so far, the authorities that are responsible for deciding exactly where to put the money have not even considered climate issues.

That shows that Sweden has a way to go, too. We have to find a way for co-operation between the silos. We are not there yet. As Anders Wijkman said, there is an important provision in the law on co-operating to consider climate concerns, but that is, largely, yet to materialise.

**Alex Rowley (Mid Scotland and Fife) (Lab):** My experience is that many more people are now aware of climate change but there is sometimes a tendency for people to see it as someone else's problem to solve. What is your experience of engaging the wider public in the discussion and debate so that people can see that we all have a responsibility?

To return to the question of setting a net zero target, there is a debate in Scotland about whether that is achievable and the right thing to do. What do you see as the main advantage of setting a net zero target, given that the technology that we might need to achieve it has not yet been invented?

**Anders Wijkman:** On your first question, there are of course groups in Sweden and in other countries who are either climate deniers—we have those people—or very sceptical about a small country such as Sweden taking on such an ambitious goal. If I may try to categorise those people, most of them live in rural areas and they have a tendency nowadays to vote for the ultra right party that has emerged in the past 10 or 15 years. We have to convince them or show them that, if we do the transformation in an intelligent way, they should not become losers and that, rather, the opposite is the case, because we would do a lot of things in the context of a bio-based economy that would probably be beneficial to them. It is important to establish a dialogue with people and not to look on anyone as a hopeless case. Rather, we should engage everybody because, otherwise, we will not succeed.

That is the only way to address the issue, which I would say is an existential one. If you read carefully the IPCC report that came out on 8 October—not only the summary for policy makers, but some of the other chapters—you will see that between 1.5° and 2°, there are very serious tipping points that may turn life as we know it into something very difficult and challenging only a few decades from now. Therefore, we need to have very ambitious goals. So far, we have evidence that, when we do that, we can achieve it. I am not saying that it will be easy, but it is possible and in most areas we have the technologies.

We then need to add in behavioural change. It is not a God-given right to travel to Thailand every Christmas on vacation. People could start to reconsider some of their habits, and I think that that is needed.

**Stefan Nyström:** This is one of the most important issues because, if the general public are not aware and do not support the approach, it will be difficult for politicians to put in place measures to achieve the goals. There is a very strong consciousness of the issue since last summer, as I wrote in the article that was mentioned earlier. After that, discussions became very intense. We have never had such a hot summer—it was extraordinary, and harvests were halved. In spite of that, we had a very cold winter, with lots of rain and floods. At the same time in Sweden, we had flooding in five or 10 places and a severe drought. That served no one. Everybody understood that, if this is the beginning, we really need to put in place a strategy.

You asked about the advantage of having a net zero target. I would say that a net zero target or a fossil-free target is much easier to communicate to anyone than a target of 86 per cent, 93 per cent or whatever percentage, because what is that a percentage of? A net zero target is something to stand behind. It is like the Apollo project to launch a man to the moon—it is something that is needed in this period of transition.

A philosophy that is discussed in some leading newspapers in Sweden today is Kant's moral imperative, which is that we need to do the right things because they are the right things to do.

**The Convener:** We have one final question.

**Anders Wijkman:** I had calculated that we would end at 11.30, or 10.30 your time, so I will have to start to fade out of the discussion, but please ask a final question.

**Richard Lyle:** I believe that we all wish to be green to secure the future. I turn to the costs of implementation on society. In Scotland, a figure of £13 billion has been given for the cost of implementing our proposed target, but there are several unknown factors in the methodology and analysis. What analysis has been done of the costs and benefits of Sweden's net zero target? How robust do you believe that it is?

**Anders Wijkman:** The economic models that we have are not very good at calculating that, especially over the long term. That was one of the findings of the strategic work. Most of the economic modelling looks at the costs rather than the benefits. The models do not really have the capacity to anticipate the innovation that will probably take place as a consequence of the measures that have been taken. New companies will be started and new jobs will come into force.

My general answer is that we must take all such calculations with a pinch of salt. Of course implementation will cost money, but the benefits will be colossal. The health-related benefits that

we will see in most countries as a result of less air pollution will be hugely beneficial to society.

**Stefan Nyström:** I am with Anders Wijkman. As an economist who has done a lot of modelling, I know that it is difficult to properly include innovation in models, which means that they always overestimate the cost and the difficulty. Given that the whole scheme of becoming fossil free or climate neutral by 2045 depends on innovation, which we cannot include in the models, it is extremely difficult to calculate any numbers for it.

However, we can see what the benefits of no-regrets policies such as electrification are when 1,100 people die 12 years before they should because of air pollution. We will have cleaner, less noisy cities. When we have electric cars instead of fossil-fuelled cars, we will be able to construct buildings in areas where there is too much noise at the moment, which will make it possible to brighten up the cities. Land is very scarce in such central areas. There are many no-regrets policies that we can identify.

Big emitters such as the cement industry think that they will have a competitive advantage in the future if we can find proper ways of sharing the risk and the finance with the public. That is what triggered the possibility of setting the goals. Everybody understood that it is not really possible to calculate the costs of taking measures or, for that matter, the costs of inaction, and that we must evaluate those costs in relation to reality as it develops.

**Anders Wijkman:** I will add two points. First, nobody knows the extent of stranded assets out there. The financial sector has only recently started to be aware that some of the things that it has invested in might lose value because of technological change.

Secondly, we did not have time to delve into the area of exponential technology. One of the most fascinating opportunities lies in trying to align climate policy with some of the exponential technologies that are emerging. I am thinking, in particular, of digital technologies and artificial intelligence. Most of those technologies are not really aimed at addressing climate mitigation goals—they have other objectives—but if we could align the two sets of goals, we would have some opportunities that are not available at the moment. As we have indicated, there is so much that is unknown, which we must explore.

**Richard Lyle:** Thank you very much.

**The Convener:** I thank Stefan Nyström and Anders Wijkman very much for their time. We have kept them a lot longer than we thought we would. Their evidence has been extremely interesting and they have answered our questions

fully. I thank them for staying on, as their evidence will be tremendously useful to us.

At our next meeting on 6 November, the committee will continue its consideration of the Climate Change (Emissions Reduction Targets) (Scotland) Bill by looking at the behaviour changes and governance structures that will be required to achieve more challenging climate change targets.

The committee will now move into private session, and I request that the public gallery be vacated.

10:46

*Meeting continued in private until 12:01.*

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