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Catholics in Coalition for Justice and Peace
2017 Occasional Paper Series

Key Concerns, Signs of Hope

OUR CLIMATE FUTURE

Edited Transcript of Address given by

Professor Tim Flannery, AO

Sunday 16 July 2017

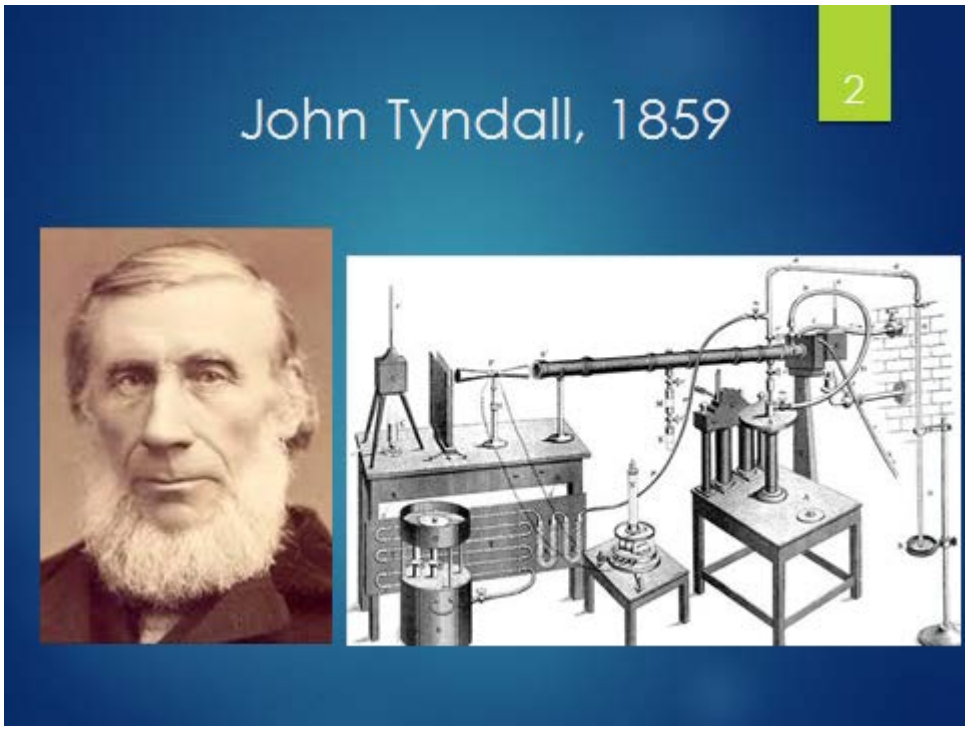
NOTE: The Question and Answer session that followed the address is provided in a separate document.

Professor Tim Flannery, AO

Thank you very much for the invitation to be here today and also for a really lovely introduction. If I could, for the Sisters who are here, I want to thank you for starting me off on my educational career. There are so many of us who went to a school taught by the nuns and spent my first few years really benefitting from that early education, so thank you.

What I want to do today is to give you a presentation that really encapsulates my latest thinking about climate change - where we are up to and what we need to do.

I will just start with the beginning. If anyone tells you that climate science is a new science or it is somehow some radical plot developed by the Left, don't believe it. John Tingle started Climate Science in 1859 with a demonstration using a machine that shows CO^2 captures heat in energy and it has all just gone on from there. It is well over a century old and very well attested science.



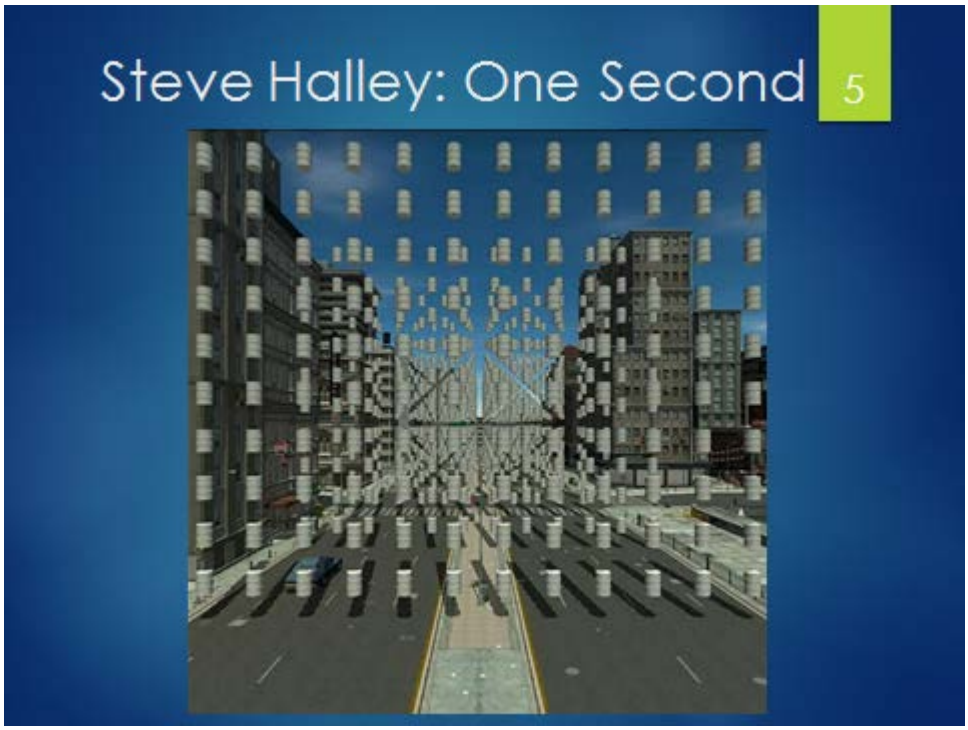
We know that humans are influencing our climate because of work done by researchers. The graphs on the map [below] show the temperature change over the 20th century. The real actual change in temperatures are reflected in the black line. This is computer modelling.

In the computer modelling - the purple line does not take account of human influence. The red area does take account of the human influence and you can see through all the area graphics that the only way you get a match with the real world data on temperature, is if you take into account the human influence. You have to add the greenhouse gases into the computer modelling to get a sensible answer out, so we know we are causing the warning.

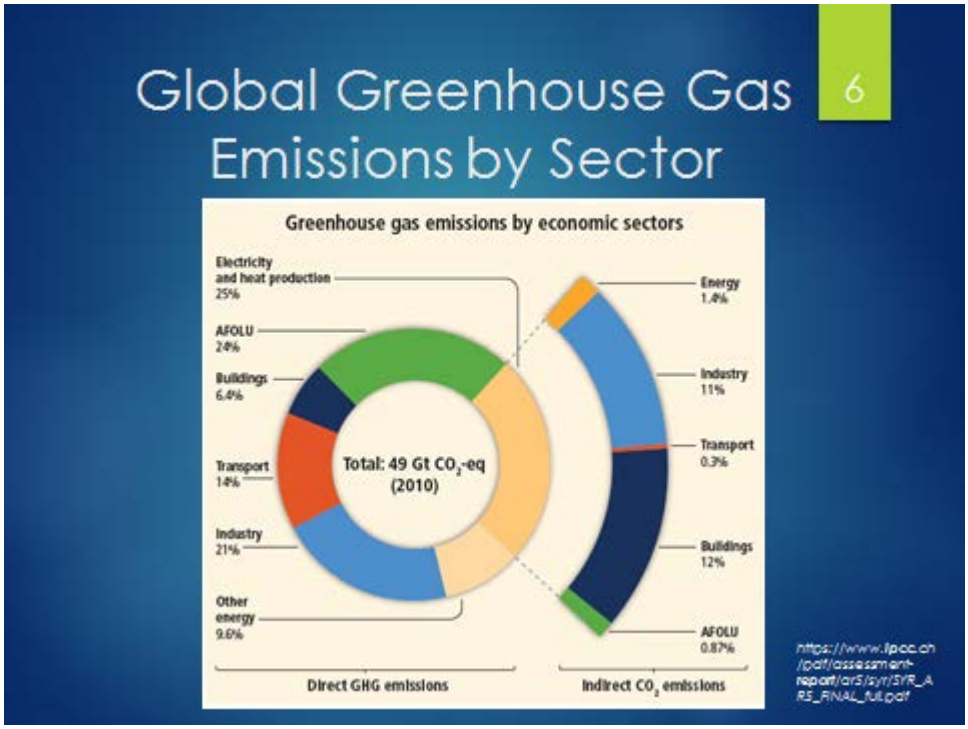
Just earlier this year, scientists developed something called the Anthropocene Equation. I won't go into the details but basically it demonstrates that the human impact now on the climate system is thriving and this is causing warming 170 times more rapidly than the natural forces that are changing the system. So we are much more influential now on the climate system than the natural factors such as sun spots and various celestial patterns.

How big is the impact? There is a lovely piece of artwork developed by a man called Steve Halley, an Australian artist, and what he has done is hook the

number of barrels of oil that we extract from the earth every second of every minute of every hour of every day in an image. It gives you some sense of the scale of the transfer of material from the earth's crust into the atmosphere. When you add to that the gas and then the coal, you can see that we are having a very big impact indeed.



We use fossil fuels of course for good things - for transport, for heating our buildings, for electricity.



The most important figure I want to really highlight is the total amount of CO^2 that we put into the atmosphere now every year. About 50 gigatons in round figures! How big is a gigaton? Well, it's enormous – one way of thinking about it is how many people are on the planet, how much do we all weigh, what proportion of us would we need to put into the atmosphere to create the same weight as that. The truth is that we would need to put all of humanity twice over into the atmosphere to make up 50 gigatons – it's a huge figure.

In terms of pulling some of that CO^2 out of the air by doing something sensible like planting forests, how much forest would we need to plant to just remove one tenth of that annual figure? You would need a current area of about the size of Australia in a forest to take one tenth of the CO^2 back out and capture it in trees. So we are talking about very big numbers indeed.

We often look at where CO^2 pollutions are coming from on a country by country basis. China is the largest emitter of greenhouse gases followed by the USA. People often point and scratch their head and say why should we bother in Australia if we are only a tiny bit of the problem. Why bother trying to fix it? Well, there are 193 countries on earth and all except 5 of them are a tiny bit of the problem.

Unless we all work together we are not going to get anywhere. We need to be able to all act on this. I think it's a little bit unfair to blame China for all that pollution as they produce things we all need and use. I suspect if we took away everything that was made in China in this room today, a few of us might find ourselves a bit embarrassed. We wouldn't have anywhere to sit, so I don't think we can blame other people as we have to assume responsibility ourselves.

Scientists have studied the impact of climate change on ecosystems around the Earth and have demonstrated that climate changing patterns have been documented across every ecosystem on our planet. Everywhere is feeling the impact of this warming. Coral reefs are really particularly in the frontline of this. I was very fortunate to have dived in the Great Barrier Reef in 1973 when I was a teenager, three years before the first coral bleaching event ever recorded. It was beautiful, a lovely place. Since then we have had one beaching event after the other. By 2012, half of the Great Barrier Reef was dead and we lost another 20-30% in the intervening years. It really is just barely hanging on.

The reason the impacts have been so great on the reef is that anything that lives in water and cannot get away, finds it hard to deal with the heat. Whilst on land, if we get hot we can sweat or we can find somewhere in the shade, somewhere to get out of it. On a coral reef or for anywhere in the ocean, if you get an underwater heatwave you can't sweat, you can't get away from it and fishes that live within very narrow limits are very badly affected.

Marie mentioned [in the Introduction] that I worked for many years in Papua New Guinea [PNG] looking for new species of mammals and documenting the rich diversity of the island. There are two species of tree kangaroos that I discovered while I was working in PNG. Both of them live on high mountains. One is in the north coast range and one is in the central range but right up in the Alpine zone.

What we have been able to demonstrate in PNG is that tree lines rise by 300 metres for every one-degree Celsius with temperature increase. We have already had one-degree Celsius of temperature increase since the Industrial Revolution and we are looking at another 3 degrees, in round figures, if we don't change by the end of the century. If we allow that to happen neither of the two species will have any habitat anymore. They are just on the tops of the mountains and as things warm up, they just get pushed off the mountain summits. It's not just wonderful creatures like [tree kangaroos], it's the whole environment of those mountain summits. Thousands and thousands of species unique to places like that will go. PNG is just one island full of tropical bio-diversities. The impacts are quite likely to be severe in environments that are very vulnerable such as the mountain environments of the world and the coral reefs.

Now, I sometimes speak to audiences where the people say ‘well I don't care too much about nature it's really we (humans) that count'. I need to make the point that climate change is having an impact on us through the food we eat. A study done just recently looking at the size of fish over 40 years shows the temperatures in the North Sea have increased by one to two degrees Celsius. The average overall catch size of fish, just as a result of that warming, has decreased by about quarter, but also the size of the fish has decreased by a quarter. That is because warmer waters have fewer nutrients, less food

available for fish and also the fish find it harder, metabolically, to get by in the warmer conditions with less oxygen in the water.

If you enjoy a glass of wine, it is the same sort of story sadly. Grape growers know how sensitive grapes are and what their ideal climatic conditions are. That's why one hillside somewhere in the north of France is worth much more than any other real estate on the planet. They are very local conditions. Those conditions are changing. I speak to grape growers in Australia quite often and they tell me about what is happening. They are harvesting now a full month earlier than they ever did previously. Some of them are selling up their land in the hotter areas of Australia and buying land in Tasmania because they just can't grow the grapes that they need, where they are at the moment. Some of them have had to develop sun screen for their grapes to stop the grapes being burnt. Can you imagine that, spraying your grapes with sun screen and then having to wash it off when you make your wine! Well, that's what is happening in parts of South Australia and other regions now.

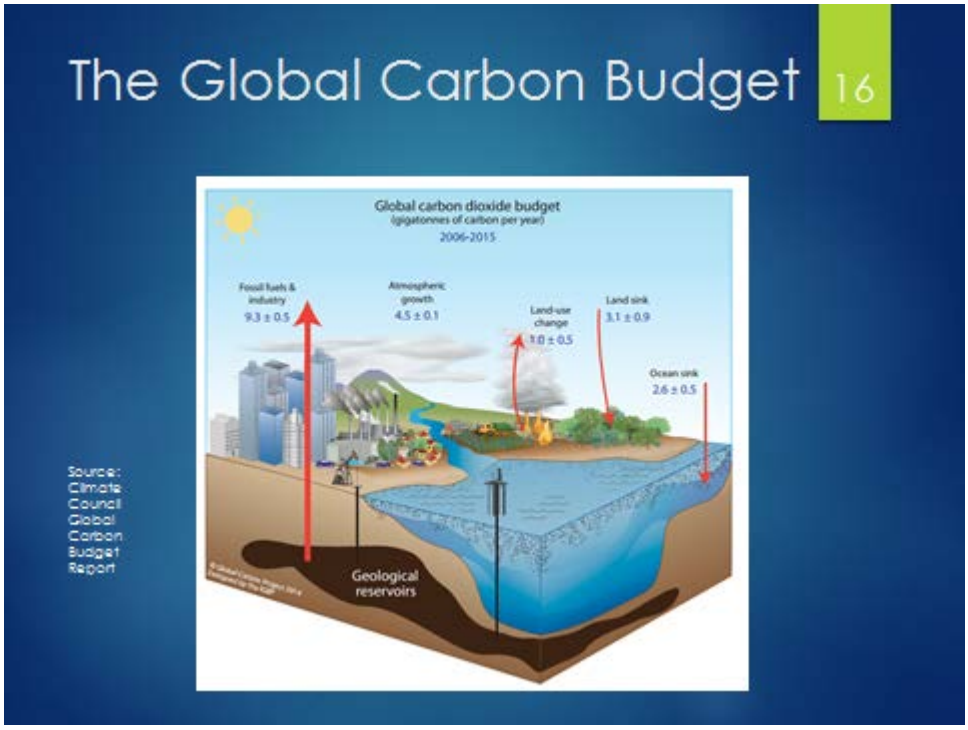
We are seeing major changes that are impacting many aspects of our lives. Perhaps most frightening of all relates to global food security. When Pope Francis talks about impacts of climate change on the least able to defend themselves, the poorest people, these are some of the things he had in mind. What we are seeing with common crops like wheat and rice is that CO^2 is acting like a fertiliser on them. You might think this is a good thing to get your wheat or rice plants growing fast. It's only partly true because what is happening is that these crops are growing faster but the food value of the grain produced by wheat and rice is controlled by other factors. They are becoming less nutritious as there is only a certain amount of protein that can be produced from minerals in the soil. So you are getting larger green leaf areas but less nutritious crops.

The Chinese government in particular is worried about this. A couple of years ago there was a headline in the China Daily saying that 'China's food security is threatened by climate change', a front page story, because of declining nutritional value of wheat across the country. So a very big collapse is potentially coming in future decades from climate change.

Thank heavens we have finally had a global agreement in Paris to deal with the issue. It's the first step in a long journey and a very important step. The Paris

Agreement gives people in business confidence that the world is heading in the right direction and allows them to make the right investments. It allows us to work together to reinforce the message. But it has come very, very late in the day. Why I say it has come late in the day is that we have already expended a great deal of our global carbon budget.

The carbon budget results from an exercise that scientists do which basically says that a certain amount of greenhouse gas will produce a certain temperature outcome in a certain amount of time. So if we want to stay below 2 degrees warming as the Paris Agreement suggests we should, and we can only emit a certain amount of greenhouse gas, we have run through the lion's share of that budget already.



The [above] equation shows how the [Global Carbon] budget works. There are barrels of oil coming out of the ground into the atmosphere; destruction of forests putting CO^2 into the atmosphere; land taking some CO^2 back; the oceans taking a little bit back as they absorb the CO^2 and what is left over just remains in the atmosphere taking away our carbon budget.

This is scientific work that has been done recently and it shows that the carbon sinks are weakening as the Earth warms. The land and ocean sinks are less able to take up more CO^2. As they weaken, we have even less carbon budget.

So it's a bit like having a bank account where you go to your bank manager and tell him you have $100 in the account and the bank manager says no, sorry you don't actually, bank fees and services will cost you $30 so you only have $70 left in your account. That is what has really happened to our carbon budget and scientists realise that the sinks are weakening. But even worse than that, the accounting is changing.

The current carbon budget does not take into account methane or nitrous oxide emissions because they are offset by particulate pollution in China and India. China and India are really cleaning up their atmospheres now because of the terrible health liability of having dirty air. That means that the warming potential of these other greenhouse gases are going to have to be taken into account, sooner rather than later. That's a bit like your bank manager saying well, we thought you had $70 in your bank account but actually, you don't have anything left, it's all gone now. That's where we are now. It looks like we might even be in a slight deficit.

This work has really focussed my mind and I hate nothing more than going to a group of enthusiastic young school kids or students and giving a message without hope. You can't do it. I have struggled long and hard on how we could find some hope in this rather grim scenario.

Really, the origins of my hope have come from two things. One has been the really rapid action that is now happening since the Paris Climate meeting [in 2016]. Since the Paris meeting we have had a really rapid uptake of wind and solar energy. China alone is putting in 70 gigawatts of wind and solar per year in place at an amazing rapid speed.

Overall, for the last three years, the amount of greenhouse gas emissions has stabilised year by year while the economy has grown. We have actually de-coupled economic growth from greenhouse gas emissions for the first time in history. We hope that the total volume of emissions starts going down quickly but at least we have stabilised it, so that is good news. We can see now with electric vehicles taking off, with wind and solar and other clean energy technologies that we really have a chance of getting emissions curbed and going down very quickly.

So that's one source of hope. Another source of hope came from the man on your left [below], Richard Branson.

I got a phone call from that man on your left in 2007, so 10 years ago now and he somehow had got my mobile number. I was walking along the street in Sydney and he said "*Hello, its Richard here*" (with an English accent), and I said oh! Who are you? He said, "*I am Richard Branson and I would like you to come and talk to my companies*". I went over and talked to all of his CEOs and so forth and at the end of the presentation on climate change, he said: *"You know, I don't think we are going to move on this fast enough"*. I said " Richard, I think we have a good chance, I am a natural optimist. The Copenhagen meeting is coming up and I think we are going to be ok". It turned out that he was right.

What Branson suggested was that he would like to put a prize up, a 25 million [Great Britain] Pound Sterling prize, for any technology that can take CO^2 out of the atmosphere at a scale that would make a difference. I became a judge on that prize, Al Gore is a judge and we have received 11,000 entries. It's extraordinary what is out there in the way of technologies. When I talk to people at schools or universities it is this sort of thing that I highlight because I think there are real opportunities to build new industries as well as to deal with climate problems.

There are two ways you can get rid of CO^2 out of the atmosphere. One is doing things like planting trees. It is very important but not at the scale that we really need. There is a three times bigger store of carbon in the soil than in the trees. It is a very important thing and if we do farming better and make sure we have rotational grazing, 'zero till' and so forth, we can produce food sustainably. Seaweed farming has huge potential and I will come back to that in a moment. So there are biological ways where we can take CO^2 out of the atmosphere.

The chemical ways sound terrible but actually, they are really interesting. One way you take CO^2 out of the air is by using silicate rocks that are very common rocks in the Earth's crust. As they weather they take in CO^2. Secondly you can make buildings out of carbon negative concrete. These concrete blocks already exist so here in Australia we can build cities and have a positive impact. Further, we can direct air capture of CO^2 to make plastics, carbon fibres and many other things. These approaches are in a fairly early stage but they are very exciting to young engineers and other people contemplating a future.

I talked about trees already and you need to cover all of North America with trees to be removing 10-20% of carbon emissions globally.

Seaweed farming has amazing potential. Seaweed grows 30-60 times faster than land based plants so it's a lot better than pulling CO^2 out of the atmosphere by trees for example. A study I read a couple of years ago suggested that if we could cover 9% of the world's oceans in seaweed farms, we could draw down more than our current annual emissions of CO^2. At the same time we could produce enough high quality protein to give 200kgs of fish and shellfish and prawns a year to every person in a population of 10 billion. This would be an amazing outcome. I thought, wow, this is a great solution. Then I started calculating how big 9% of the world's ocean was – about 4½ times the size of Australia unfortunately, so it's not going to happen quickly.

I have just done a big investigation of seaweed farming in a TV documentary for the [Australian Broadcasting Corporation] and it will be going to air next month I hope. The potential is enormous for many reasons and could be a very big industry.

As we think about seaweed farms on that scale we have to give care to our Earth. The mid-oceans are not just an empty environment as they are full of creatures in the deep sea that might be affected by what we do on the surface. We have to use due diligence as we go about doing seaweed farming.

Some scientists have talked about putting wind turbines in the Antarctic to freeze the CO^2 in the air and have it fall down as CO^2 snow. It's possible, and maybe we should investigate it, for the reason that by 2050 if we are getting very severe impacts of climate change, the people who are making decisions then will want all the information they can on how we can force CO^2 out of the atmosphere. I am not suggesting that we should do this using turbines and chiller boxes to force CO^2 out of the air, but I think we need to do due diligence because the problem is severe enough that we owe it to future generations.

James Hanson, one of the world's greatest climate scientists, has said that we could use silicate rock stores to lower atmospheric concentrations of CO^2 by putting in 300 parts per million by 2100. That is huge. There are only 400 parts per million CO^2 in the atmosphere. The trouble with this approach is that, when you think of how we quarry and grind up rocks today, we do it using fossil fuels. We can't just burn the fossil fuels and then hope that this will draw the same amount out. We need to clean up our transport and energy sectors before we can start using these approaches.

Direct air capture of CO^2 is quite extraordinary. This is a rapidly developing area of technology. I have seen one of the plants that do this and it's about the size of this room, and it pulls out about the same amount of CO^2 as a thousand hectares of forest. You can take that CO^2 and use it to make things. You can make plastics so we can replace fossil fuels for the manufacture of plastics. There are industries now in Canada that are using this technology to make liquid biofuels to compete with fossil fuels. Most excitingly we can produce carbon fibre from atmospheric CO^2. Carbon fibre is really the lightest, strongest materials we know about. As we start growing these sort of technologies we can start reducing our dependence on steel and aluminium which are very heavily polluting industries. It is very exciting for young engineers to have these options.

The reason I highlight these technologies to young people today is that we need to get the really smart people and investment capital interested in solving these problems now if we hope that by 2050 we can have viable industries working at scale to pull CO^2 out of the air. It takes a long time to develop any industry. We have seen it with wind and solar where it has been 40 years to go from the first experiments through to where we are today. The same will be true for these technologies. I must say when I think about it that way that the biggest problem I think we have got is a lack of imagination. Now when we think about 2050 we think about it as a sort of "*George Jetson*" world or something a bit like today but happening in 2050. It's going to be neither of those things, it's going to be different but in some very interesting ways.

How can we free up the imagined space to let ourselves think productively of 2050 so that we can make the right decisions now for that future? One way of doing that is to turn back a century and think about what life was like in 1917 then compare that with 1950.

Horse power was still really big in 1917 and for young men going off to war in 1917 some should have still been in school. If they were still in school they would have had a map that shows the British Empire on which the sun never sets. You would see the map and it hadn't changed for centuries and you would think it would be unchanging. Back at home, of course, everything was "*mum-powered*" in 1917 - cooking, washing, cleaning - the whole lot. By 1950 that would have changed.

What happened with transport in 1950 where that there were no more horses in the big cities but lots of cars, buses, trolley car and so forth. What would you have said to a child in 1917 who was looking at fighter planes in wonder as they flew over. Would you have told them that there would be jet aircraft in 1950 or that there was electrification in the home that was going to, to some extent, liberate mum at least from backbreaking physical labour. Unimaginable in 1917. Although I remember my mum in the 1950's still using the old copper for hot water for washing.

The one thing I know about the 21st century is that the pace of change is faster than last century and we have the potential to do so much good if we can

develop the right sort of clean approaches and technologies and do what Pope Francis said, "*Develop a more equitable and fair society*".

The great mistake we all make I think is to imagine that we are somehow insulated from the world and we do this despite the fact that our very skin is porous and that our lungs are intimately engaged with every other thing in the world. We draw in the air that a few weeks ago might have been coming out of a factory smoke stack in China. We don't live in a vacuum. We are all part of an integrated ecosystem and a society and an illness in any part of the ecosystem or society will affect the whole eventually. That is the great lesson I think that we have to learn as well as just keeping our imaginations alive to the possibilities of the future.

Thank you.

NOTE: The Question and Answer session that followed this address by Professor Tim Flannery, AO on 16 July 2017 is provided in a separate document.