Energising the Future - Challenge and Change

Welcome to this edition of encounters, which is focused on environmental issues. The first part (articles 1 to 4) includes expert information on the contemporary energy issues faced today, and the challenge of implementing the required changes in order to safeguard a sustainable future. Coincidentally, this editorial is written on the same day that the International Bulletin of Missionary Research publishes its latest online journal headed, “Mission and the Care of Creation”, re-emphasising the growing importance of responding missiologically to some of the greatest challenges we have ever faced. All the articles in this edition rest firmly within the scope of our engagement with God’s creation.

The first four articles are edited transcripts from the talks delivered at the annual Redcliffe/JRI (John Ray Initiative) Environment Conference held at Redcliffe College earlier this year. The theme of “Energising the Future”, was fleshed out with talks discussing key sources of energy; coal, nuclear, oil and renewables.

Andy Brown pleads the case for coal to be given a ‘stay of execution’. Rather than condemning the ‘black stuff’ to the annals of history, he maintains that coal still has a role to play in our energy needs, at least for the immediate and near future, whilst acknowledging that that same ‘future’ has a limited life-span. Ian Hore-Lacy argues that the future is ‘nuclear’, whilst also attempting to allay safety fears, as the Fukushima disaster has highlighted, once again. John Twidell contends that the future can be safeguarded by harnessing energy derived from natural sources, such as wind, sun and water-flows, and upholds that these natural elements can provide sufficient power to fuel the global needs of the future, without recourse to the continuing damaging extraction of minerals from the earth. Finally, Brendan Bowles seeks to add missional thinking to the energy debate, and presents the dilemmas facing the growing economies of fast-developing nations such as Ghana, and the huge environmental challenge posed by China, overall the world’s largest environmental polluter, although far less of an emitter of CO2 than the US and Europe on a per capita basis. He concludes with some ‘Kingdom’ thoughts.

The second part of this edition comprises thinking which challenges many traditional mission attitudes on the Environment. ‘Matter-matters matter’ might seem like an absurd tongue-twisting phrase, but issues of the material world are matters that do matter!! This view sets itself up as a direct challenge to the still-rife dualistic worldview, which seeks to separate the ‘spiritual’ from the ‘material’. I would strongly encourage patient and open-minded consideration of the challenges presented.

Article 5, by Carol Kingston-Smith, reflects on contemporary political developments in Bolivia, where the Environmental crisis is seen as one meriting spiritual/philosophical engagement and requiring protection, rather than simply being left to the scientific world for resolution. The question of whether Mother Earth has rights, might invite swift rebuttal from some circles, but Carol reflects on how a Kingdom-oriented missiology might affirm the intrinsic goodness of creation and offer support for legal mechanisms which recognise the need to actively preserve that goodness for the benefit of all. The final two articles are
written by current MA students, who have both studied the ‘Greening of Mission’ MA module at Redcliffe. Janet Parsons provides a helpful survey of eco-feminist and indigenous thought which has much to challenge dominant discourses of thinking and acting and, lastly, Benjamin Aldous provides an in-depth and critical examination of two biblical passages, focusing especially on the ‘contentious’ 2 Peter 3:10-13 text, which has resulted in polarised theologies concerning the fate of planet Earth. I trust these latter three articles will provoke personal responses, and maybe some of you will feel inclined to articulate the same on the message board!

Andy Kingston-Smith

Guest Editor and Lecturer in Mission, Redcliffe College.

- **Article 1**: Energy Overview; What is the Role for Coal and can it be Clean?  
  (Andy Brown, 4597 words)

- **Article 2**: Practical and Moral Outcomes with Renewable Energy  
  (John Twidell, 3419 words)

- **Article 3**: Nuclear Energy  
  (Ian Hore-Lacy, 4192 words)

- **Article 4**: The Energy to be Different; Can Developing Countries Model Low-carbon Prosperity  
  (Brendan Bowles, 4438 words)

- **Article 5**: Womb rights: a Reflection on Bolivia’s Proposed Law of Mother Earth  
  (Carol Kingston-Smith, 2316 words)

- **Article 6**: The Contribution of Eco-feminism and Indigenous Religions to a Theology of the Environment  
  (Janet Parsons, 5249 words)

- **Article 7**: Burning up or Being Renewed?: An Exegetical Study of 2 Peter 3:10-13 and Revelation 21:1-5 from an Environmental/Ecological Perspective  
  (Ben Aldous, 4640 words)

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Energy Overview;  
What is the Role for Coal and can it be Clean?  
Andy Brown, Engineering Director, Progressive Energy Ltd.

Introduction – Worldviews and Creation

Let’s have a quick look at world views on sustainability. Firstly, there are two humanistic views. The first one is the anthropocentric view that says the world is here for human use and enjoyment. Sustainability is simply our responsibility to provide enough for fellow humans and for future human generations. I don’t subscribe to that view. The second one is the eco-centric view that sees humans as simply one part of an interdependent biosphere with no greater rights than any other part, so we sustain for the greater good and have as much responsibility for the environment as my brother’s tortoise. I don’t subscribe to that view either. The third one, which I think makes a whole lot more sense, is the theocentric view which sees the world, human and non-human, as deriving its value from being created and sustained by God – now that warms my heart. The other two leave me feeling, frankly, nervous.

Stewardship and the Genesis Mandate

I would like to start with Genesis 1:26 when God says ‘Let us make man in our image according to our likeness and let them rule over the fish of the sea and the birds of the sky and cattle and over all the earth and over every other creeping thing that creeps on the earth.’ So there is a responsibility on us, as human beings, to rule over all the earth. Then look at Genesis 1:28, ‘God blessed them, God said to them: Be fruitful and multiply (we’ve managed that bit) and fill the earth (we’ve managed that bit) and subdue it (we’ve managed that bit) and rule over the fish of the sea and over the birds of the sky and over every living thing that moves on the earth.’ What is interesting, is that word subdue. It is a Hebrew word and it means to bring into shape. It is related to the noun for a pottery or lime kiln, the concept of taking something and making something different, even better out of it.

So, I have to ask myself the question, to whom did God give the responsibility of stewarding this planet on which we live? Us; well, let’s see how we’ve done, because I believe we have abdicated our environmental responsibilities.

Irresponsible ‘Stewardship’

Firstly, I believe we have essentially dug up the earth and thrown it away. 1987 was the first year in which the world used more than one year’s resources in a year. We started to live beyond our ecological means. By 2007 we needed 1.3 planets in order to fuel our consumption and by the end of 2010 we needed more than 1.5 planets worth of resources. This isn’t going up in a linear manner, this is going up exponentially. Obviously, I don’t have the figure for 2011 yet. We are also running out of raw materials at an alarming rate. This really bothers me and it wasn’t until I assembled this talk that I realised just how quickly we
are running out of things and, of course, the quicker we run out of things, the more they are going to cost. So, in 45 years, gold wedding rings are going to be difficult to get hold of. Those of you with grandchildren need to think “What on earth are they going to do?” In 29 years, we’ll have run out of silver, so your silver tea service is going to be worth a lot of money!

Well, not only have we failed to steward the natural resources, but we have damaged the earth’s atmosphere. We’ve got rising levels of CO2, of which everyone is aware, the thinning of the ozone layer and all these other effects. I am starting to feel guilty now. Look at over-population; it’s just growing and growing and growing. The Institution of Mechanical Engineers produced a paper recently that put a lot of the earth’s problems firmly at the feet of over-population. I think it has a lot going for it, but it does suggest that you are able to blame everybody else. And then we’ve got the imbalance of distribution of vital resources. At Redcliffe you had your ‘water-free Wednesday’, which is a good exercise. We should use less water because we use far more than our fair share here.

When you look at drought mortality, you realise that people are actually dying through lack of water. It is all frightening stuff. And then you consider the extinction of species. The more people there are on the planet, the less there is of everything else. So I think the impact of abdicating our environmental responsibilities is significant.

**Coal on Trial**

So, let’s put coal on trial. It is said that coal is the “Villain of the piece”. I’m not sure whether this presentation should be called “The role for coal”, or “The case for coal”. Let’s see how we get on. What makes coal unclean – apart from the fact that it is black and gets on your shirts and so on? Firstly, it contains mostly carbon and the only way to use coal is to convert the carbon into carbon dioxide. That has an impact. There seems to be quite a good correlation between the concentration of carbon dioxide in the atmosphere and the global temperature.

Looking towards the future, the temperature of the earth’s surface has risen remarkably since the Industrial Revolution, coincident with a rise of CO2 levels. And where we’ll end up at the end of the day depends on which scenario you choose, but the important thing is that we can’t keep going on as we are at the moment, because if we do, the rising temperature leads to rising sea levels, (because water expands when it is heated) and it is not just the ice melting into the water, it is the fact that you have a whole body of water and when it gets warmed it expands. Were we to be living in Bangladesh, instead of at Redcliffe, we would see the impact of sea water rising. It would have to rise a very long way before the lovely gardens outside here became water gardens, but in Bangladesh the problem is a bit more acute.

Secondly, coal contains sulphur, unfortunately particularly in UK coal, and sulphur, when one burns it, produces sulphur dioxide and that leads to acid rain and deforestation. Coal also
contains ash and that leads to particulate deposition, fine particles in the atmosphere. I used to be responsible for the coal, ash and dust plant at Didcot Power Station and they have got quite an efficient system there of taking all the particulates out of the coal. But once in a while something would go wrong, the system wouldn’t take the particulates out of the coal and we would end up with complainants at the gatehouse showing their washing covered in little black specks of grit.

Coal contains a lot of other materials as well, arsenic, nickel, lead, mercury, chlorine and uranium. Do you know coal has only got a very small amount of uranium in it, but if you take that small amount of uranium and multiply it by the amount of coal we burn in England, the amount of radiation that coal-fired power stations put into the atmosphere far exceeds what you get from nuclear power stations? Combustion of coal produces nitrogen oxides and nitrogen oxide has 200 – 300 times the global warming effect of CO2.

Coal; is it the villain of the piece? Yes, guilty as charged! But I am making the case for coal and would plead that it was “not acting on its own”. It is not coal’s fault; it is how we have used it and, if we are going to look to the future, it is sensible to look at how we are going to use coal in the future. So let’s have a look at that. Can we afford to lock up coal for ever, or can coal be ‘bound over to keep the peace’?

A ‘Coal-less’ future?

Let’s think what an energy system without coal would look like. On a typical day, the UK electricity supply system has a demand something like what we coal Load Shape 46. Now somebody may say what does Load Shape 45 look like, or Load Shape 47? I have failed to find an answer to that question, but everybody in the industry calls it Load Shape 46. That starts off with what we call a base load. We are talking generally about energy and we are focusing on how we can create a more sustainable future for ourselves and, as has already been pointed out, in the UK we have a mixture of fuels, a mixture of energy sources and by not putting numbers on the graph, I am hoping that we can avoid the situation where we get coal vs. windmills, vs. nuclear, vs. solar type arguments, because I think we need to look at the whole picture. I don’t want to get into debates about numbers because I could find you numbers that would prove any point that you want to.

So, Load Shape 46; we have this base load and then there is a variable load. The base load is provided by things that don’t shut down, like Tescos, and whereas street lights come on at night, we have other things like computers that come on during the day. There are things like water pumps that pump all the time, so there is what we call a base load. Then there is a variable load which starts about 6am in the morning when people get up and make a cup of tea. Every time you flush the toilet, pumps have got to cut in somewhere and supply more water. Then people get up and have a shower and they have breakfast and then at the end of the day’s work they would come home and do whatever people do in the evening, watch television or mark books or do some homework. Then, eventually, people go to bed and we settle down to the base load again. Our energy needs have been met, typically in this way.
There is a base load of nuclear because nuclear does not like being jolted up and down and so we just let that tick away at the bottom. Then one has the most efficient fuel power stations, and it is the most efficient ones because this is governed by accountants and not engineers, and so the power stations that earn the most money come in next, and finally one gets the less efficient ones doing the odd bits and pieces.

On a day-to-day basis, it is not quite as simple as that; it doesn’t go in nice straight lines. It would be lovely if it did, but it goes up and down. There are very early morning people, there are a lot of people who have breakfast and in the evening there are a lot of people who cook their tea and this is another peak. In between, there would be peaks at lunchtime and in the evenings there might be a peak when ‘Dancing on Ice’ finishes because everyone rushes out to make a cup of coffee and back to flushing the toilet and so on. The actual load of a day goes up and down quite a lot and provides a problem when one comes to planning the amount of energy required and to be distributed. So nuclear is left supplying the base load and the more efficient fossil burning plants, and then in between one has what is called “two-shifting” “three-shifting” and “peaking” plants; one has generating capacity that one brings on and switches off.

When we put wind power into this equation, it exacerbates the situation because, although there is some degree of control over windmills, basically when a windmill is turning it is exporting electricity into the system somewhere and that means that it will take a slice out of the sandwich, so that whatever is at the top end is having to be swung about more and more. As we increase the amount of wind, then for the fossil-burning plants, the scope for running very much of it all the time reduces and there is more and more of it to switch on and off quickly.

If we were to remove fossil-burning from the mix altogether, then it becomes more difficult to maintain the balance. I have taken an extreme situation here just to make the point that we have got nuclear supplying the base load, and we say everything else is supplied by wind, because the wind will blow wherever it wishes, as the Bible says.

I have talked about switching things on and off and swinging things up and down and this will give you an idea about how difficult it is suddenly to bring on more electricity generating plant. The quickest we can get something on is in two different units, which is a bit awkward, so one is in minutes and the other hours. In the case of a coal- or gas-fired power station, if it has only just been shut down, it is possible to bring it back in about an hour or two. If it is nuclear, it will take several hours to start it up again.

The best we can possibly manage to bring on, with a new piece of kit is 30 minutes, and people will do this. So if we have ‘Dancing on Ice’ just about to finish, in the half-an-hour beforehand they will start to bring this generating plant into the system and that is how it works. We think electricity comes out of a socket in the wall, but behind that there is so
much engineering, planning and technology, and in the UK we are blessed to have quite such a stable system.

What happens in the high-wind turbine scenario when we have an anti-cyclone as we had in January for about three days? If we are not going to have windmills generating a significant proportion of electricity, which is the Government's intention, then we have got to have something in the background to supply that electricity when the anti-cyclones happen.

This is where I think coal can come to the rescue. Many of the conventional power stations we have got at the moment have already had equipment fitted to reduce the sulphur emissions and I have given the example of five power stations. This is interesting because we have taken a power station that is 40 or 50 years old and have made a significant investment on the back end of that to clean up the emissions. The other power stations in the UK will close. In 2007 there was a rule that either one fits this flue-gas desulphurisation equipment on the back end, or that plant will close down, when it has operated for 20,000 hours, or by 31st December 2015. So plants have either opted in and started spending money on flue-gas desulphurisation, or have opted out. After 2015, this will leave the UK with a smaller fleet of plants fitted with such equipment reducing the amount of nitrogen oxides and combustion. It will also leave the UK short of 10,000 megawatts of generating capacity.

I struggle to put 10,000 megawatts of generating capacity into context. I suppose it would be what Manchester would use, so we are losing a significant chunk of electricity supply. We can't do anything about that, because the European Union has said so, and we always obey their rules.

So you have a conventional type of power station which produces steam and you put this equipment on the back, limestone in the top, (which is not particularly good for the earth's resources because that means digging up Buxton), and it produces gypsum at the back end, which is good because plaster board can be made out of gypsum. About 20% of the UK's plaster board comes from flue-gas desulphurisation gypsum. Making gypsum to the right standard for plaster board governs how one operates the power station, because if plaster board cannot be made out of it, it has to go to land fill which is also not environmentally a good idea, but for the accountants it is a bad idea because it costs money. So, Plan A would be to 'burn it dirty and clean it up'.

‘New Power’

That is the old power station; now let's look at the new ones. Using what they call supercritical steam conditions, the efficiency rises from about 36% at the moment, which is what we can expect from today's power station, up to about 45%. 45% is current best practice and that is at a plant in Finland, which benefits by taking its cooling water from the Arctic at only 2 degrees centigrade. That is an example of a very efficient modern power station. This will give a 20% reduction in the emissions of sulphur oxides, nitrogen oxides
and carbon dioxide compared with other power stations, just because it is burning things more efficiently. But with regard to nitrogen oxides which are 200 – 400 times more powerful, as greenhouse gases, than carbon dioxide, this is not enough. More equipment could be bolted on the back to reduce emissions further but, this reduces efficiency, makes it more expensive and gives the accountants a headache.

We in the UK are amongst those piloting the post-combustion capture of carbon dioxide; there is a scheme and the tax payer is paying for it. Plan B is to burn it and clean it at the same time. This is another technology and there is a power station of this sort on the Slough Trading Estate, but it has not taken off in the UK. Limestone is added to the coal in a chamber at the bottom and air is bubbled up through it allowing simultaneous combustion and desulphurisation.

The reason it hasn’t taken off in the UK is the ash from that has been designated as Special Waste, so it is a bit difficult to get rid of. But in other countries it has taken off, such as in the United States and China, because what they call carbon neutralisation is quite good. If you have got difficult coals, like the woody coals that are burned in Germany, it is good for that and, particularly good for biomass, and I think that is where it has got a niche. But the flue-gas isn’t suitable for carbon dioxide capture without a lot of treatment, which means a lot of kit and that upsets the accountants. So I don’t think Plan B is going to work.

Plan C is to ‘clean it and then burn it’ and this is something which rejoices in the name of Integrated Gasification Combined Cycle. What we do is firstly turn a coal into a gas, similar to the days of town gasworks. I say similar to because when I mention town gasworks, people think of this pungent odour that surrounded it, coal-tar soap and people leaving on their bicycles in the evening with filthy faces.

Now, of course, we have got the legacy of the land it contaminated. Technology has moved on a bit since then and we can take the gases out of coal without any of that stuff at all. The gas it turns into is mostly carbon monoxide and hydrogen, and then it is cleaned of mercury, sulphur and carbon dioxide. So one ends up with a gas that is mostly hydrogen and that is helpful. Because of its chemical processing, we can add to it and we can clean it of more stuff, if we discover that there is more stuff we need to clean it of, or we can clean it better of the stuff we are cleaning it from at the moment, so you have got some flexibility there. There are plants operating successfully in Spain, the Netherlands, Poland, Japan and the United States and there are at least two projects planned in the UK.

We start by taking fresh air and we separate that into oxygen and nitrogen; that is common technology. Then the oxygen is put into a reaction vessel under pressure with coal or coke or biomass and, because it is there with oxygen, it will react very quickly. We put steam in there to keep the reaction temperature down to about 1,600 degrees centigrade. At that temperature, all sorts of things happen. There isn’t enough oxygen for carbon dioxide to be formed so the first reaction is between the carbon and the oxygen and that produces carbon
monoxide. Carbon monoxide isn't a very nice gas, it replaces oxygen in the blood to form carboxy haemoglobin instead of haemoglobin and this can lead to death.

I mentioned steam is added to keep the temperature down to 1,600 degrees centigrade. At that sort of temperature water just falls apart and that releases hydrogen molecules and some oxygen molecules. The oxygen molecules quickly get sucked up by the carbon molecules to produce carbon monoxide, which leaves a lot of hydrogen gas. Coal contains sulphur, as we have noted previously, and the sulphur reacts with the hydrogen to form H2S which is poisonous. We then take the carbon monoxide and add it to water, shuffle the molecules about and make it produce hydrogen and carbon dioxide. At that point you have got a gas that is about 50% hydrogen and 50% carbon dioxide and this is ideal for chemical processing. The carbon dioxide and H2S is washed out, leaving a gas that is mostly hydrogen. Hydrogen can be burned in a gas turbine and generate electricity, where the emissions are mostly water vapour. So we have taken coal and we have produced an emission which is mostly water vapour, and that has got to be good news.

There is the carbon dioxide to deal with, but before we do that, consider the sulphur. The same process that washes out the carbon dioxide will wash out the H2S and then we can react that with oxygen and produce elemental sulphur. That is saleable into the fertilizer industry, for instance, so that is good. And the sulphur it replaces is the sulphur that is mined, particularly in Germany. This is good; we are digging up coal, we are using it responsibly and we are minimising an extractive industry.

So, what about the carbon dioxide? The UK is uniquely blessed in that we have got a lot of carbon dioxide storage capacity. What I didn't bring with me today is my piece of Bunter Sandstone which is sitting on the window sill in the study. You may have seen a lot of pictures of carbon dioxide being stored underground. What they normally have is a bit of sea, then sand, then rocks and then a black dome and that is where the carbon dioxide is stored and you have other rocks and things underneath. That leaves you with the impression that underneath the sea there are huge caves full of absolutely nothing where the carbon dioxide can be pumped. It is not like that. The carbon dioxide is stored in sandstone and, if I passed it round, it would be similar to Cotswold stone but just a bit grainier. The trick is to take a glass of water, pour it into the rock and the rock absorbs it! That is the mechanism by which our carbon dioxide is stored. What is in this rock at the moment? We can find natural gas in a rock, and you can find oil in there, held within the rock.

Some of these formations have got salt water in: they are called saline aquifers. Some of them have got fresh water in and we drink that stuff; a lot of our water comes from aquifers. The carbon dioxide is pumped down, typically two or three kilometres, and displaces some of the salt water in the aquifer, where the carbon dioxide stays. You can also put it into wells where you have taken out the natural gas and you can put it into wells where you have taken out the oil. The nice thing about the last one is that, when it goes into the rock where the oil was, it pushes more oil out, so that makes the accountants happy. You can argue that it doesn't make the environmentalists so happy because they would rather the oil stayed in the
ground, but as we will see in a minute, we need something to keep us going whilst we do other things.

**Clean Coal**

So we have taken a piece of coal, where we have acknowledged it has got problems and I have introduced to you a technology today whereby we can deal with the carbon dioxide problem, we can deal with the sulphur problem and we can deal with the nitrogen oxide problem by burning it in modern gas turbines. This is the technology that will enable coal to be used cleanly. It will not smell like a gas works; it is remarkably clean and if you were buying the technology from me I would circulate to you now a little lunch box that is filled with yellow sulphur that is produced in the plant, just to show that it really does produce real sulphur.

If we can say that we can make coal clean, how clean is clean? We have power stations like Didcot which are unabated (the ones that are going to close after 20,000 hours or on 31st December 2015). Then we have other power stations where they have fitted kit on the back, and finally you have the 'state of the art' modern power station.

By introducing modern technology we can deal with nitrogen oxides. With carbon dioxide emissions, when we put the kit on the back it reduces the efficiency of the power station. Even with the newest power stations it is not zero carbon dioxide emissions; you reduce it by 85% which is a step in the right direction. How much will it all cost? The impact of some of the emissions trading coming in at the moment has given the right signals to the market to do something about it.

**Conclusion**

In conclusion, I think that continued use of coal with yesterday’s technology is not environmentally responsible. I think that in the future emissions from coal-based electricity production can be much lower, and it can provide the flexibility needed to balance the variable or inflexible low CO2 alternatives. We need something to bridge the gap and I think today’s technology offers a role for coal in the future, as a bridge towards sustainability. I would not pretend that coal is a sustainable solution but I think we need something that is a lot better than what we have got at the moment to put in place until what is emerging and developing can come in and take its place. I would like you to consider that coal has a role in the future, provided that it is used responsibly using modern technology.

I rest my case.

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Title. Slide 1.

Introduction

Slide 2. I want to talk about the practical and moral outcomes of using renewable energy. Why is it practical? We have to remind ourselves that nothing lives, or moves, or communicates, is heated, or is made, without energy. Everything needs energy: the houses we live in, our own bodies, business, industry, transport and natural ecology. The need is so familiar that we tend to forget that without energy supply there is trouble.

Slide 3. Indeed, without energy supplies there is death in every sense. Economies collapse, commerce collapses, your life at home would collapse and biological organisms would cease. So it is incredibly important to keep energy supply going. Why is it that the bulk of us forget about energy and don’t think about it? It is because a continuing supply comes naturally from the Sun; it is there every day, it wakes us up every morning, we have hymns praising it and it continues without our intervention. It is there, it is part of our existence and we tend to forget about it. But nevertheless, for our economies we obviously need satisfactory forms of energy.

Slide 4. Energy is practically needed, but why do I say it is morally needed? It is because sustainability is a moral issue. It is not just that we seek to exist; society seeks to become richer in an economic, physical and health sense. ‘Sustainability’ is looking after future generations. We have to learn to live with ecology. We have a duty for minimum pollution and we want energy security. Governments are particularly conscious of this to have energy supplies for their country that they can rely on.

Slide 5. So energy supply is both practical and moral. It is for governments, institutions, commerce, schools, churches and for you in your home and in your life.

Defining ‘renewable’

Slide 6. We will consider renewable energy, which requires basic definition in talking about this, so I have a definition for renewable: it is a natural, persistent current of energy in the environment. What does that mean? It means the energy is already going by. We don’t have to worry about making it; it is passing us by all the time. If we don’t use it, it passes by.

Slide 7. That is how the world is sustained. So we take some of this energy, we use it and we put it back where it has come from. So these are the supplies of sunshine, wind and rain and others as we will see.

How much is there? Well, renewable energy is part of the natural environment. We divert it and we use it. That is in marked, fundamental contrast with the other supplies like nuclear and fossils. These we dig up; we take material which is under the ground, out of reach of ecology. It is not part of ecology; we bring it up, we use its energy and then we have a huge
problem dealing with the bits and pieces left after. I argue, why do we dig that hole in the first place? If the material is out of the way, under the ground in the first place, what on earth are we doing bringing it up when we have so much energy going by in the environment already? That is my fundamental case – why bring the stuff up, when we have such a problem in dealing with it once we have brought it up? Leave it out of the way underneath and live off the supplies from the renewable energy.

*Slide 8.* Is that possible? The first and obvious thing to say is, ‘is there enough’? So you get out and you take the measurements and you see how much energy is in the environment. The bulk of it is coming down from the Sun. From the Sun there is 20,000 kilowatts, per man, woman and child. In Britain we need 4 kilowatts each or less. There is 20,000 kilowatts coming from the Sun if we look at it on a global scale. Then as the sunshine arrives, it is absorbed as heat, water evaporates and comes down as rain and there are other processes as on the diagram. In addition, there is some heat coming out of the ground – geo-thermal heat – and there is some energy from the movement of the Sun, the Moon and the Earth by gravitation in tides. So those are the flows of the energy for the world as a whole; there is plenty there. It is a question of how we use it.

**Renewables and technology**

*Slide 9.* There is no shortage of renewable energy, but we obviously need technology to utilise it; electricity does not appear from the Sun! If you leave your car out in the car park in the Sun, it is not going to go. So we need technologies to transform the energy; there are three categories. We want heat, we want fuels and we want electricity. We need heat for this room, we need heat for processing, particularly for making metals. We need fuels (mainly we think of fuels for vehicles). We need electricity; that incredibly powerful technology for making machines work, for communication, for the lights and much else.

The good news about renewables is that they cover all those sectors; it is not just one of them. It is not a technology that is just for electricity, or a technology that the companies think of mainly for fuels; it covers the full amount. So let’s put those technologies in the same boxes that we had before. We looked at the way the energy comes through the environment, we looked at the numbers, now lets put the technologies in there.

*Slide 10.* We looked at the energy that is coming down from the Sun that is absorbed as heat. Consider each box on the diagram. So there are solar water heaters; we can have our buildings orientated towards the sun, carefully constructed to use the Sunshine more efficiently. We can concentrate the power of the Sun. If you live in a country with a lot of bright sunshine, this can be turned into electricity and process heat. We have the rainfall providing hydro-electricity; both large scale and small. We have the movement of the atmosphere making the winds and the winds make the waves; so we can put technology in there. We have photosynthesis for biomass, and it is very important to make our fuels there. The great thing about biomass is that it is storage. So when plants grow they basically trap the energy of the Sun into a store. This big problem that electricity has, energy storage, is a fundamental difficulty; but no so with photosynthesis where storage of energy is intrinsic. Once the plants grow and the crops are there as biomass, we can relax about when we use them.
The heat that is in the earth; if you are in the right place where it is accessible as geothermal heat you can make electricity. Separately, heat pumps extract heat energy from the earth as 'ground-sourced heat pumps', which is available in the ground from solar energy heating the ground. Also tidal energy can be used.

There is another aspect of the sun's radiation, it is not just the amount of energy, it is the fact that it is a quantum system and it can excite electrons as it does in photosynthesis, but in this particular case it can make electricity and photovoltaic cells. So we are not using just the energy as such from the Sun; we are using its radiation characteristics.

*Slide 11.* There you see a wealth of technologies possible with renewable energy. Of those different technologies, there are what I call the Big Three – solar, biomass and wind. They are the dominant energy fluxes that come. They are also dominant because wherever people live you always have at least two of those three available in relatively large amounts. One of my first jobs was in Khartoum University in the Sudan, where solar energy was strong, biomass was in the crops but there wasn't so much wind and the rainfall was more or less zero. So we had two of the 'big three'. Wherever you go in the world you are going to have two or more of the 'bug three' resources. If, however, you have a stream running down the back of your house and you can use that for hydro power, lucky you, that is tremendous. So most of the other forms of renewable energy are splendid if you have them, but it is not guaranteed that they will be available on the site that you have.

*Slide 12.* Now let's look at those technologies a bit more, though we won't go through them all in detail. You will see from the Slide that there are a lot of technologies, very comprehensive in skills and science and the ability to provide heat, fuels and electricity. That is a major thing that I want to say about renewables; it is incredibly comprehensive, not only in scale from large to small, but in terms of the skills in society. I have a vision that I can justify of a very comprehensive society satisfactorily supplied by renewable energy. Hence lifestyles and structures of society are formed to fit the energy resources. For instance, the sizes of the habitation; it is very difficult to supply large cities or minute villages. So somewhere in between, say 200,000 inhabitants, is probably the scale that fits total renewable energy supplies. This requires a very careful mix of agriculture and food production with other forms of technology. So a full set of renewable supplies becomes incredibly comprehensive in the way it works. Renewable energy is not a technology where you put fences round and police it, or you have to put signs up warning of extreme danger.

*Slide 11.* Another point I want to make is that in each of these technologies there is much very sophisticated science. In fact, I would argue that modern science, certainly post 1950 science, is most suitable for renewables technologies, which are leaving a lot of the other technologies behind.

Let's talk about photovoltaics for instance. The sophistication of taking the sunlight and turning it into electricity in an efficient manner is very, very advanced science. A lot of it is nano-technology; requiring the deposition of thin films, processing, making these materials rugged to withstand the weather; very sophisticated science.

Window glazing. If you want to orientate to the sun properly, you want to keep the infrared heat in. You want the glass to stay clean so it doesn't get dirty, self-cleaning glass and so on. So there is much sophistication all the way through.
Biofuels. The aim is to get the biofuels from lignin, the waste from wood that no one uses. There are signs that biofuels can be produced from algae at large scale. So there is a great deal of advanced science all through.

How much can renewables do?

*Slide 12.* Now how much can renewable energy supply of world need? I think it can do everything, but then I'm standing here, just me, saying it. I was delighted to find that the WWF, the World Wide Fund for Nature reported in June 2011, accessible on the web, arguing the case that there could be 100% world energy from renewables by 2050. The emphasis is that it can be. They are not saying it *will* be, because the 'will' depends on the political side. But if, as Jimmy Carter said, there was a moral equivalent of war and you really *had* to do it; 100% renewables could be implemented. The WWF Report explains how this can be done.

One of the most important aspects is becoming efficient in our energy use, so we reduce the total energy that is needed. That is absolutely crucial. Consider your house and the way you live; frankly, it is not difficult to have a 50% reduction. We've done it in our home. You work at it, it takes about 5 or 6 years and it changes your lifestyle; but you can succeed. Who has a car that does twice the distance on fuel compared with the first car they bought? Ours does. My first car was 10 miles to the gallon when I was a student. I can't believe it. Now 50 mpg and pushing out to 80 mpg is quite possible. So as many steps in energy efficiency as possible should happen.

*Slide 13.* WWF give their reasons for why 100% renewables supply is needed. First of all they point out, there are 1.4 billion people with no electricity supplies. Those people without electricity now are most likely to be getting it from renewables. Oil and gas are finite materials and are running out. Climate change is a reality. These are WWF's words. We need to dramatically reduce coal because of climate change. Nuclear, WWF says, is unethical and expensive. Those are the key things and then they go on to talk about the greater energy security with renewables, efficient use of energy and how the integrated package could be possible.

It does require changes in lifestyle; less eating of meat for instance. Energy going through the cattle to us is about 10 times less efficient than our eating plants directly. So WWF admit there would be big lifestyle changes for everyone in this.

*Slide 14.* There is a summary of how the world could move to renewables by 2050 and you can get the Report from the website. Certain aspects are noteworthy; vehicles would be much more dependent on electric power; not only passenger cars, but trade vehicles as well and trains. So the WWF Report predicts the greater use of electricity because it encompasses transport, as well as other needs.

Andy was talking about the need for fossil fuel to continue. WWF say that it will be necessary for certain metal processing. The heat consumption in making metal is so large that certain fossil fuels will be needed for that. But overall, because of the introduction of renewables and the reduction of demand, the totality is effectively 100% renewables by 2050.
What needs to be done?

*Slide 15.* Why should people do this, or are they doing it? There are two categories of looking at how it is happening now. First of all, top down; in other words the governments. The EU has taken the legal decision, which all our governments have agreed to and the UK was more than happy to sign up to, that there will be 20% of European Union energy from renewables by 2020. The British government has actually gone further and put into the law a 90% reduction in fossil fuels by 2050. Now that was very easy for the Labour government to do because they don’t know who is going to be the government in 2050 to pay the fine if it is not done! Nevertheless the legal requirement is there.

Carbon trading is starting. China gets so slated, it is really cruel; China is doing a huge amount in renewables. They realise the challenge, the environmental challenge, because of their lack of forests for instance. So basically, economies are changing. A bit slow, but all round the world they are changing.

Now what about bottom-up? Well, that’s you and me. What is happening for the ordinary person? A major step in the UK is, at last, we have a feed-in tariff, so that you can generate energy at your house and you can sell it in an easy way. That’s done with electricity with a feed-in tariff and there might be an equivalent for heat, though it might be a bit different. Another example is if you take any trade manual, for instance a plumbers’ magazine, or a building magazine, or farmers’ magazines, you will find a lot of training happening regarding renewables. There are courses on how you get the materials for doing the work and so on. There is a lot that is happening. So, not only are governments changing, but bottom-up individuals are changing.

*Slide 16.* There is another useful report that I would push you to look at. Ren 21 is a European organisation for renewables in the twenty-first century. A lot of details and facts are available in the REN21 World Status Report 2010. You see the dominant use of energy in the world is now from fossil fuels and from nuclear for a proportion of electricity. The Report looks at the renewables; what we immediately see is that the use of firewood, called ‘traditional use of biomass’, is a dominant use. Don’t disparage firewood; we heat our house with wood. We do not use open fires at home, but enclosed stoves. There is nothing wrong with using wood. Call it biomass and biofuel and everyone thinks it’s alright! So do not disparage people who cook with firewood. You will see that the supply of heat is a dominant need that is being met by renewables.

*Slide 17.* If you look at global electricity, fossil fuels are still dominant, nuclear obviously a large proportion, hydropower we know about and the other renewables. On the screen there is a graph that shows the breakdown for different countries and the world as a whole, as the different amounts of renewables.

*Slide 18.* Wind power has been mentioned. There is a rapid increase in wind power. The growth each year of wind is 30 to 40% more manufactured each year from the year before. That is new factories, news jobs, new employment, new standards, new transportations, new designs of turbines; a huge, rapid increase in the use of wind power. But when something grows exponentially, it takes some years before you suddenly notice it. I think of children growing up, suddenly when they get to 13 and 14 – oh, you’ve grown! – and they have appeared on the scene. So steadily, steadily, each year not much noticed about it and then in a year or two it suddenly happens and it has arrived. Wind power is about to get to that stage where it has arrived in that sense, with the growth being very strong.
Slide 19. The other technology that is following about six years behind wind power is photovoltaics - making electricity from the Sun. It should be absolutely standard that the roofs of houses are made of photovoltaic panels. Why on earth have a roof there doing nothing in terms of energy, when it can produce electricity? Such application will come and it will be standard for all buildings to have photovoltaic roofs. It is beginning now and with steady growth.

Slide 20. One technology we don’t think about much, but it really works, is solar water heating. China dominates in solar water heating. Good on China. We have one at home, they work well.

Slide 21. Vehicle fuels, bio-fuels, coming into vehicles. Again, this is growing.

Slide 22. What about the business side? The investment is happening and at last it is beginning to show.

Slide 23. The growth per year of renewables is extraordinary, some showing 150% increase in a year.

Slide 24. There is also a very significant increase in jobs in renewables.

Slide 25. The growth of renewables in electricity with the European standard presents quite a challenge, moving from about 1% up to 15% by 2020.

Slide 26. It is a tragedy the UK has not dome more, because the options for renewables in the UK are probably better than most countries because we are on the east side of the Atlantic and have so many opportunities.

Slide 27. What do we do in our house? Photovoltaics for electricity and solar heating for hot water. Slide 28: Heating systems, cookers and boilers, stoves in the house running entirely on bio-fuels. It is hard work. It is a distinctive life-style thing and not a trivial exercise.

Conclusion

Slide 29. I conclude then and argue that renewables are proven technologies. The vast majority are in the market place being traded by the many companies making them. The products are improving, of course, but already they are part of everyday life and the public is receiving the benefit. No one is against renewables; the only thing said is that they are insufficient. I think the WWF report and others show that renewables can be sufficient, but now there is a lot to do.

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Nuclear Energy

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**Introduction**

I'll introduce myself by way of saying that I am a Botanist by background focusing on nuclear energy. I was an inter-varsity staff worker for several years after graduation and working on rainforest ecology. I was a school teacher for three years, a senior biology teacher. I joined the mining industry as environmental scientist in 1974 and then moved into a number of other roles in the industry and got involved in writing the first edition of the book, *Nuclear Electricity* in 1978, which actually hooked me on nuclear power and I have progressively moved in that direction since. It is now in its ninth edition, although only the second edition under the title *Nuclear Energy in 21st Century*. It was published last year. And just to state my position with regard to coal and renewables: in respect to coal, I think there is no way we can or should do without it as a major resource, so roll on carbon capture and storage! With regard to renewables, I think we should use as much as practicable and economic, but I oppose the populist push.

**Two perspectives on nuclear**

So, let’s talk about nuclear. Two perspectives, first of all a world perspective with regard to population projections. This is from the World Energy Council a few years ago but still reasonably valid, showing a huge increase in GDP, primary energy use, CO2 emissions, mobility – which is interesting, with a huge increase projected. Another perspective is of God’s providence and there is a paper on this coming in *Science and Christian Belief* in mid year.

Firstly, there is abundant nuclear fuel, enough for centuries. It provides large-scale and continuous reliable power, *aka* base-load power. The physics of nuclear energy enables control of both moderated and fast neutron reactions and that is an extremely providential thing, maybe an anthropic principle and I can talk more about that if you are interested. It’s a mature technology with 14,000 reactor years just in the civil area and about the same in the nuclear navies. It represents a timely availability as a mature technology due to carbon constraints and a liberal provision by God, I believe, for human needs through this.

Electricity and human development – it is just very interesting to see that per capita electricity use correlates very strongly with the human development index, I think, on many different scales, and electricity use is a good way of getting people forward. Part of my theme, particularly in this paper, is related to people.

Let’s just talk about primary energy very briefly. The notable thing is the proportion of France, Germany, Japan and US primary energy which has to be imported and somebody else has made comments about energy security. Also of course, there are also economic aspects in the exports here.
World primary energy, the scenario with no change, you can see the pattern is much the same between now and 2030. Of course if you change the policy, those will change but I haven’t got time to go into that now.

Moving to electricity, consumption by region is increasing, but the OECD is relatively flat. Asia has a huge increase foreshadowed by 2030 in electricity.

There are currently 433 world nuclear power reactors operational, 62 under construction and 156 firmly planned. 14% of world electricity, concentrated in the eastern part of North America, in Europe and in East Asia. About half of the reactors under construction are in China.

At the moment, there is a lot of nuclear power providing electricity around the world that is carbon-free - the green portions. Secondly, coal-fired power (red) means approximately 1 kilogram per kilowatt hour of CO2 emissions. There is a great deal of scope for accelerating carbon capture. The third thing is gas. There has been a big dash to gas over the 1990s as you in Britain are aware more than most. It has cheap capital cost, but once you have built the plant you are at the mercy of energy prices and there is a good deal of scope for painting that one green too. Gas is a magnificent fuel and chemical feedstock in other respects as well.

**Drivers for nuclear expansion**

So what are the main drives for nuclear expansion in the world at the moment? First, just basic economics, including increased fossil fuel prices. Secondly, the prospect of carbon emission costs, although I should say that at least two-thirds of the reactors under constructions in the world are in areas where those prospects are rather more remote than here in UK. Thirdly, insurance against future fuel price increases, because if you double the fuel price for anything, with nuclear power that has very little effect. With gas it has a huge effect. Doubling the fuel price for gas would have the effect of increasing the cost of your electricity by 70%. Doubling the fuel cost for nuclear increases it by about 3 or 4% electricity price. Finally, energy security. This is a geo-political thing and it is becoming more and more important.

We have had a very helpful exposition of base load power and power profiles from a previous speaker, but the point I want to make is that this is a summer load profile – that’s a high winter demand profile, the base-load is about 55/60% of the total demand that you have got to allow for, but it is about three-quarters of the actual electricity supply. Base-load is supplied relatively cheaply, compared to peak load, which comes in later on. So the main point here is that most demand is for continuous, reliable supply and that is just a fact of life, a fact of modern economies like this.

Wind is low carbon, but it has got some problems. The Danish Wind Energy website shows a graph where each line is one day of one week in western Denmark with 650 megawatt installed capacity and that looks pretty pathetic. In fact, that works very well. The reason it works well is that they have got a 1,000 megawatt interconnector with Norway, so when the wind drops, they just turn on a tap, and that relationship between wind and hydro does in fact work well. Another example is wind farm output in south eastern Australia. All the wind farms, 830 megawatts – over one week in May last year. And that is over about 1,000
kilometres east/west of those wind farms and that is not something that matches very closely with the profile of actual energy demand.

So, where else do you look for low carbon electricity? Well, nuclear. France has had nuclear power for quite a while, before 1970, but in 1970 there was the oil crisis and they sat down and said 'listen, we have got to take a look at our energy imports'. They were importing a lot of fossil fuel and they said, 'we are going to go nuclear in a big way' and they did and they standardised their reactors. So the first of those new ones came on line in 1977, the last of that programme came on line in 1999 and you can see that they get about three-quarters of their electricity from nuclear, 58 units in operation on 19 sites and the cheapest kilowatt hours in Europe so they claim, and certainly that is a defensible claim, though you could nit-pick a little. The standardisation has helped them with that and they are also, of course, net energy exporters to this country. They are the largest net electricity exporters in the world.

The US picture, production costs for nuclear are very low but beware, any figures you see from the United States exclude capital. The capital is the big killer with nuclear as we will see.

Let's look at the costs of nuclear, gas and coal in Finland in 2003. The first thing to say is that the capital costs are hugely greater for nuclear, double coal and three times gas and that is a very big impediment to new nuclear investment. The operating costs are vaguely comparable, gas is certainly low. Fuel costs, however, very low for nuclear, very high for gas, medium for coal. If you double the fuel costs for each of these, you get a very different result. Then if you add emission trading at 20 Euros per ton of CO2 on coal and gas, that gives you a picture of 2.37 compared to 4/4.5 Euro cents per kilowatt hour, and that was the basis on which they made a major decision. It is pretty much the basis on which most other decisions have been made around the world today for new nuclear power.

Energy subsidies and taxes. From and to governments, US production tax credit is paid to generators and in other parts of the world, at the government level not the consumer level, you have got a levy on specified sources. Nuclear in Sweden, Belgium, Germany and Finland is so profitable in those countries that it is taxed uniquely. There are no subsidies for nuclear anywhere in the world at this point. There are some offered in the US and by subsidy I don't mean up front R&D expenditure in the last half of the last century. I am talking about subsidies in a per kilowatt hour sense. Subsidies from consumers, which are mandated by government of course, not a voluntary imposition, you have feed-in tariffs which is a set price paid by the grid company and passed on to consumers. You have got renewable obligations, the RET which is a set proportion paid by the grid company and passed on to consumers. You have various permutations and combinations on these which are expounded in the paper on the website.

In terms of cost of electricity generation, you also need to look at external costs; that is, costs which are quantifiable but not paid by the electricity consumer. They are paid by society at large in terms of health effects, environmental effects and so on. The coal cost can actually double the generation cost in real terms.

Energy accounting is another way at looking at electricity generation; that is, energy input versus energy output. A plant in Sweden has ordered a life-cycle assessment and there the input is 1.35% of output, taking output for 1 gigawatt over 40 years. The figures I use are
about 1.7%, a bit more conservative and if, as projected, you go to very low grade uranium 0.01% you get up to 2.9% of output. Still a good return on input.

Uranium resources (and this is where I pick a bone with a previous speaker, Andy). Since 1975 the known world uranium resources have expanded 2½ times. What has changed is knowledge, and knowledge changes whenever you spend money on exploration. Graphing cumulative exploration expenditure on uranium alone, you get quite a good correlation. As you go on spending money on exploration you find more. Not that you don't know vaguely that it is there somewhere, but the point is before you publish figures you have got to have very good data, otherwise if you are a mining company executive or director you can get chucked into prison in certain parts of the world. Those figures have got to be good, so any published figures on resources, whether they be copper, iron ore, lead, or uranium has to be backed up by pretty good data, and that costs money to get. So be sceptical of any numbers you see quoted and realise that they are always provisional and keep in mind ‘known’ even though that word is not always used.

The world picture of uranium mining is significant. A lot of mining was for weapons programmes. I have added to the figures for demand for nuclear electricity generation a little bit that for demands for nuclear navies; that is, demand for what propels 220 submarines around the world at high speed. There is a big deficit between the amount mined and the demand since late 1980s and a lot of this earlier surplus has gone into filling that deficit. That gap has to start closing pretty quickly, so the demand for mined uranium is going to increase in the next few years.

Greenhouse gas emissions from electricity production is around 1 kilogram per kilowatt hour directly if it is coal, plus whatever you like to factor in for moving it around the world and for other parts of the fuel cycle. Gas is about half that. With nuclear it is very much mining and, according to some figures, older technology enrichment. I generally use a figure of 20 grams per kilowatt hour. This means that every 26 tons of uranium oxides sold from an Australian or Canadian or Kazakh mine used, saved 1 million tons of CO2 relative to coal.

As well as nuclear power in the grid, you also have nuclear power used in shipping, the latest being powered by 270 megawatt thermal reactors, giving you 54 megawatts at the propellers and that will go through about 3 metres or 3.5 metres of ice and it keeps the northern shipping routes open. There are quite a few nuclear-powered submarines still in the world, though much less than the were, and they burn uranium.

The first Russian floating nuclear power plant is nearly ready for action. This is a basically a couple of 40 megawatt reactors from the previous ice-breaker, stuck on a barge and made to look pretty! That is being built at St Petersburg and will be deployed to east Asia. A second will be deployed and others are planned. The first floating nuclear power plant was in 1967 in the Panama Canal zone.

Another new concept which is echoing the off-shore wind farm, is off-shore nuclear farms and this is a recently announced concept from France with each pod having a 50-250 megawatt pressurised water reactor sitting on the seabed about 6 kilometres offshore. As well as that there is also the question of nuclear desalination. Water is going to become a major factor in world politics in the next few years. Two ways that nuclear power can be used: firstly reverse osmosis (RO) where you use electric pumps and, secondly, distillation where you use waste heat for co-generation.
Another way of using nuclear power is for electro-mobility with plug-in hybrid electric vehicles and electric vehicles which you charge off-peak. This then increases your proportion as base-load. If you take your charge off-peak you raise your base-load percentage by about 30% and this has the potential for decreasing the unit electricity cost for everybody because the base-load cost is cheaper than the peak load as a rule. So that is the picture then and you get a much larger base-load proportion, much cheaper electricity overall and that is a really win-win situation and a realistic scenario.

Nuclear process heat – for instance with synthetic crude oil from coal. If you have got a nuclear source of hydrogen and nuclear process heat, you can get double the liquid hydrocarbons from coal and eliminate most CO2 emissions. And you can also liberate oil from tar sands, just by making steam. So there are various things there in mind. In terms of the hydrogen economy (this is getting way out now, but it has already been mentioned by a previous speaker), today there is 50 million tons of hydrogen made, for oil production mostly, cracking long-chain hydro-carbons. In the future, if there is some sort of hydrogen economy with regard to whatever (motor cars, etc.), we can envisage about 1,000 million tons a year for use in fuel cells. Today, hydrogen comes from steam reforming of natural gas and we are on the threshold of improving on that to be able to use high temperature electrolysis of water, or actually of steam, because it is high temperature. But the holy grail in this respect technologically is thermo-chemical production from water using nuclear heat. But that needs 950 degrees Celsius, whereas most reactors today are operating at less than 350 degrees. Many UK ones are a little hotter, but they are about to go out of operation and no one is going to build any more of that type.

The sources of mined uranium (again there is this energy security issue). Kazakhstan is getting bigger but the point is, mined uranium is not all in the Middle East or in unstable political regions, therefore it does not impact the US defence budget, as I think John mentioned.

Nuclear fuel cycles: first the open cycle. Mining and milling is at the mine site wherever the uranium ore is, and mine tailings stay there. Uranium oxide is then sold to whoever runs the reactor as a rule. It is then converted on a toll basis and enriched on a toll basis. After fuel fabrication it then goes into the reactor for three years typically and is then stored and disposed of. That is the open fuel cycle in many parts of the world, including USA and Sweden. In the course of that about five-sixths is parked there as depleted uranium which may be viewed as a waste, or may be reviewed as a resource, but we will come to that.

So if you then close the fuel cycle, you instead re-process used fuel as has been done in this country for many years. Re-processed uranium can either go into storage or go round back to the conversion plant. Only 3% then is reported as waste to be vitrified and that is high level waste, a bit different from what comes out of the bottom of the coal plant. 96% is mainly stored uranium, 1% is plutonium which goes into mixed oxide fuel drawing on this depleted uranium and that goes into the reactors as fresh fuel. There is quite a bit used (about over 30 reactors in Europe using mixed oxide fuel, about 10 Japanese reactors are about to do so and a few others here and there). But that is the closed fuel cycle, as it was intended to be originally. A very small amount of high-level waste there.

And then you have got the fast breeder nuclear cycle. Fast breeder reactors, you have got about 300 reactor years of experience notched up, including some in this country. Russia is the only country with a major fast breeder reactor operating at the moment, with the Indians
going in that direction. So are the Chinese, Japanese, French, and US all anticipating fast reactors being a major deployment by the middle of this century. So here you have got about 1 ½ million tons of depleted uranium parked around the world today as a resource and there will be a whole lot more by the middle of the century of course. So fuel fabrication here from both reprocessed uranium and plutonium into the reactor as before and some wastes, probably in the same order of 3% or something like that, vitrified and disposed of. So that is what we will be looking at much more by mid-century.

Just looking at those various elements, uranium conversion is simply a chemical process, uranium enrichment is a purely physical process. Most enrichment capacity being installed today is centrifuge which uses about one-fiftieth of the amount of energy as the old diffusion enrichment process and, on the horizon, is a laser enrichment process invented in Australia and being development in the US.

At any rate, after all that, and the fuel fabrication, you get fuel pellets and each fuel pellet is worth nearly 1 ton of coal. So it is a very dense energy source, very concentrated. Those fuel pellets are put into tubes and the tubes are put into assemblies, ready to go into a nuclear reactor. The assemblies typically stay in the reactor for about three years. The reactor core is relatively small; the fuel assembly is about 4 metres long and there might be in a 1,000 megawatt reactor about 200 of those. All of that is in a pressure vessel because this is a pressurised water reactor so your primary loop is all water under very high pressure of about 320 degrees. You make steam in a secondary container, all of that is in a big concrete containment structure which was originally designed to contain it in any disaster that may happen and not spread radioactivity over the local community. These days, this is seen as an excessively conservative idea/notion but, on the other hand, with crashing planes and so forth, having 1.3 metres of reinforced concrete around things is a really great matter of peace of mind today. So that is serendipitous and no one was thinking that way when the original reactors were designed in the 1960s.

**Nuclear power and safety**

A lot of countries around the world are increasing their capacity in various ways, as well as building new capacity. The main thing to say about nuclear power is that it has a safety record unmatched, I suggest, by any major technology. Chernobyl was an outlier in terms of the whole thing. That was a reactor that could not have been licensed outside the Soviet Union and is essentially irrelevant to anything operating in the West or in Russia since then. The point is a matter of perspective; more people are killed every two days in the world’s coal mines than died as a result of the Chernobyl accident, so it was a disaster but it was essentially irrelevant to the mainstream of nuclear power in the world today. [1]

Generation III reactors were first built in the ‘90s in Japan, but there are now many more. Four are being built in China and they are steamming ahead with those. In Finland they are building one which is way over-budget and over-schedule but it is coming along. The French have EPR reactors and the first four built in this country will be EPRs. The third generation reactors, EPR I mentioned and a number of others, APWR are going to be built in America. All are very big, but the HTR-PM is 205 megawatt reactors driving one turbine in China and this is a modular type of thing. It is a high temperature reactor which will deliver about 950 degrees Celsius and this is probably the future of things nuclear in many respects. The whole small and medium reactor picture is interesting. You have increasing interest for most
progressively constructed large plants, so that you get a cash flow from the first unit, before you need to pay out for the third and fourth. For small grids for isolated sites many innovative designs, ranges in sizes up to 300 megawatts, which is what IAEA calls small, and 700 megawatts medium.

Fast neutron reactors I have talked about, many are and will be operated as breeder reactors which is why the uranium resource will last for centuries, not just a couple of decades. The BN600 and BN800 in Russia; the BN600 has been operating for 20 years very, very well. The BN800 design is about to come on line in Russia and two have been sold to China and you have got various other ones in other parts of the world.

Generation IV reactors are due to come on line in 2025/2030. Note that most of them are fast reactors or capable of being fast reactors, most of them are low pressure as distinct from today’s high pressure ones and they use a variety of interesting coolants other than water and the fuel is also fairly diverse.

There is a military provenance to civil nuclear power which is interesting. Naval experience coming across to civil employment, submarine PWRs becoming power reactors, and also the military high-enriched uranium which is being broken down to low-enriched. Half of the nuclear electricity in the US today is from Russian weapons uranium which has been diluted and exported to the USA, and also military plutonium is now coming into MOX fuel for civil use. There is no reverse flow in any country.

Conclusion

Regarding nuclear weapons, the 1960s expectation was that at the turn of the century there would be over 30 nuclear weapons countries, in fact there were only eight and this is testimony to the effectiveness of the nuclear non-proliferation treaty (NPT). There are proliferation concerns today in Iran via enrichment, North Korea via plutonium and they are real concerns but they are not related to any civil programme. You have controlled civil use in 28 countries plus Taiwan under the NPT, and India and Pakistan which are partly under the NPT. As for nuclear liability insurance, there are some strong international principles here whereby not only is the reactor insured, in the same way that your car is insured, but you also have third party liability cover under various conventions. So the nuclear future means that you have got a mature technology, electricity since 1956, increasingly competitive as fuel costs rise, environmental drivers – carbon emissions and clean air, energy security drivers, particularly in the EU and USA, and so nuclear power will be part of the future more widely.

Notes

[1] The major accident to three reactors at Fukushima Daiichi in March 2011 has cast doubt on the safety resilience of some older western reactors. While the reactors shut down safely as designed when the major earthquake hit, the huge tsunami an hour later disabled their cooling systems and back-up power provisions so that decay heat (about 1.5% of operating heat at that stage) could not be removed. The fuel apparently melted and volatile decay products in the fuel were vented with steam and hydrogen as internal pressure rose to about twice design levels. A large amount of radioactive iodine (with short half-life) and caesium (much longer) was deposited up to 50 km from the plant. Well before this the inhabitants had been evacuated, but there is massive inconvenience to some 100,000 people, in addition to the direct effects of the tsunami in the area (which killed over 25,000 people). After more than three months there have been no deaths or serious radiation exposures from the
accident, and hundreds of people working on the radioactively-polluted site are cleaning it up, restoring proper cooling (for ongoing decay heat removal) and treating a lot of contaminated water.

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The Energy to be Different: 
Can Developing Countries Model Low-Carbon Prosperity?


Introduction

We are talking about developing countries. Most of us do not come from developing countries and, therefore, they tend to be missed off our perspective of both energy and climate change. The key thing is that they are developing; they are changing very fast. If they become like us [in the UK], then there will be all kinds of sticking points, particularly around energy use and around climate change. So the question we are asking today is ‘Can developing countries model some kind of low carbon prosperity? Can you develop without going down the route of oil, coal, and all the things that we have used to develop?’

As part of my role with Climate Stewards, I produce the monthly blog ‘Climate Prayer’ and I also do the ‘Climate Prayer’ on Twitter which involves quite a lot of research just around what issues should we as Christians be praying about with regard to climate change, and that immediately brings in the whole world-wide perspective. It means that I spend quite a lot of time each day just looking at the impact of energy-related, climate change-related issues on people around the world.

Ghana and Oil

I am going to hold out a couple of examples and try and draw out a couple of principles. I don’t necessarily bring out any strong answers. Ghana is my example of a developing country. I have chosen it for a couple of reasons; one is that as Climate Stewards we support projects there and the second is that I’ve actually just come back from there looking at projects. It also illustrates quite a number of some of the most useful points. This is a traffic jam [photo on slide 3]. It is probably the most civilised traffic jam that I saw in my time in Ghana, but that’s not what it feels like to be in a traffic jam in Ghana. What it feels like to be in a traffic jam is that it is very fast moving and it is incredibly-skilfully driven. Ghana is a very Christian society and amazingly people invite each other in, but people are travelling fast, at small distances away from each other and it takes a long time to cross. It wasn’t like that five or ten years ago. It is changing and developing and one of the symptoms of that change is the increased use in petrol, in fuel.

This jam was down in the south of the country. If you go further north, it gradually gets drier and drier and then you end up in the arid lands up in the far north. It also turns Muslim as you go further north as well. You can see the banana sellers and the various salesmen and women talking to all the drivers in the traffic jam. It is an incredibly entrepreneurial society. Everyone, certainly in the south, is trying to make a living. They have incredible energy, finding ways to make a living. Selling bananas, selling balloons, whatever it is, everyone is trying to sell something to make a living and if people are stopped in a traffic jam you have a captive audience…it’s got to be great. They do tend to move out a little bit when the traffic starts moving!

That feeling of energy to get out of poverty is almost tangible in the south. It is very impressive and very different to the feeling you get in a Western society where we basically have got ourselves organised and we don’t rush around like that, being entrepreneurial. If
you go to India, or China, or Brazil, you feel the same kind of energy. What is driving that is an ambition to lift a country out of poverty. That is the background and, in that context, rules maybe matter, but they don’t matter as much as they matter here. Health & Safety doesn’t matter as much as it matters here. The drive to get out of poverty, the drive to make good of yourself is very, very strong and, as Christians, the drive to get of poverty is very important – love your neighbour.

I talk mainly about Climate Change these days, which is not really my background. I worked for a long time for Tearfund and my background has been in ‘love your neighbour’ type of Christianity. Love God, love your neighbour, it is important to look after and help the poor, not to be poor. That is where I have come from, so I am not really coming at this from an environmental perspective. But Climate Change has brought those two kinds of agendas together; the environmental and the ‘love your neighbour’. And you see it in a place like Ghana. It looks like a big drop in poverty doesn’t it? It’s gone from 31% to 28%, so it was a steep drop in one year, but it is not a very big drop – there is still a lot of poverty in Ghana and somehow they have got to find a way of getting those people out of poverty. That is their ambition and their GDP growth has gone from 4% in 2000 and it is now a little bit higher. It is growing but it is growing from a very low base, so there is a lot of poverty.

We can look at renewable and bio-energy, but in effect it is charcoal. As you drive along the main roads, you see stacks of sacks all along the way – it is charcoal; it is what people burn to cook on or boil water. Charcoal comes from trees, so you cut down the tree and you burn it. There appear to be lots of trees, but you see lots of scrubby land with small trees in it. Ghana has lost a third of its forest in 30 years. That is a lot and it’s still going down. The charcoal is really important socially, if you get richer in Ghana, and this is across most of Africa too. As you get richer, you maybe buy a car, you maybe have a nicer house, but by and large you still like to cook on charcoal. It is just an interesting social thing and that has implications for technological approaches to energy solutions, because people just still like to cook on charcoal, which has an impact on the forest.

This is another reason why Ghana is so interesting and so important. Ghana has struck oil, or at least an oil company has come to Ghana and has found oil. It is a very tangible feeling of hope in Ghana that the oil will make all the difference. The hope is, and the World Bank says this is possible, that they can move from being a poor country to a middle income country within maybe a decade, like Thailand or Morocco, not like a sub-Saharan African country; that is the hope. In an article on the BBC they said “Ghana is one of the most stable of the African countries, they hope that they are going to be able to harness the oil, without what we saw so graphically coming with the oil in Nigeria.”

It is a very common story that with oil comes corruption, because it is big money. It comes with conflict, because it is big money. It brings in inflation because there is more money around – big money. More money comes into the country and so things get more expensive and the people who get hurt are the people who don’t get access to the big money, just the ordinary poor. And environmental destruction often follows as well. This is such a common scenario associated with oil found in somewhere in African countries and the big challenge is how to get the benefit of the oil without the curse that comes with it. It was interesting, whilst I was there, that there were headlines saying that they were buying their first warship and the reason is to protect their oil supplies, because at the very least the oil is going to have to be shipped out and that is going to make their new-found wealth vulnerable to someone else with some weapons along the coast, so they have got to have a warship. So already the prospect of oil is disturbing, or at least changing the society.

Ghana also is very susceptible, along with the rest of West Africa, to extreme climate/weather events. Margot [Hodson] mentioned my background in maths, which means
that I am very interested in the whole area of probability and statistics, the difference between weather and climate and how you can describe one thing causing another. A metaphor that I am trying out at the moment is that I regard climate as a sort of statistical thing, much in the same way that your league position as a football team is a statistical measure of your success. Being top of the league does not win you matches, so being top of the league cannot cause you to win matches.

Having a particular climate can never cause a particular weather event. But, if you are top of the league, you are more likely to win matches. It is not a causal effect, but it happens at the same time. As climate changes more extreme weather effects are more likely. It is true, and certainly in 2010 we had a huge number of very extreme weather events, including in West Africa, with both floods and droughts, sometimes one coming quite soon after the other.

**Development and Energy**

Uganda has a very similar history. It has also discovered oil in West Uganda and yet around this time last year they suffered some horrendous mud slides, where the rainy season had come to an end, but the rain had continued. The land on the hillsides got water logged and, because they had cut down the trees on the hillside, the hillside just slid down. Whole villages, with hundreds of people in them, were wiped out and the picture that came out was one of the most stunning I have ever seen because there is nothing to see of the village left, it is just flat land, but underneath it is a village.

I wanted to highlight these aspects for these countries because it means you have got a very difficult ‘catch 22’. We have to emphasise, as Christians, the importance of lifting people out of poverty, of loving our neighbour. We need to care about those people and the governments of those countries need to care about those people. Now whether development is the right word for describing that I don’t know, but the normal way of development, as people become developed, is that they use more energy and that has always meant more fossil energy, more oil and more coal.

Here is this gift of oil that you have as a poor country. Not only can you use some of it, but you can sell it, but if you do that, the more oil and coal consumed, the more carbon dioxide goes into the air and that is the driver for more climate change, which means you are back to square one because all the development you have achieved is washed away by the floods, or just burned in the droughts. This is a very difficult question for any country in this position.

**The Chinese Challenge**

China is different. I call it an emerging country, like India is emerging, along with Brazil and South Africa. These are big economies with lots of people and growing at a phenomenal rate. China is now the biggest total emitter of carbon dioxide, of course nothing like the biggest emitter per person, which is not always mentioned. China gets 70% of its energy from coal, (just over two-thirds). Vice-President Lee, who is expected to be the next top man of China, says "We get 70% of our energy from coal and it is very difficult to alter that. It is going to be coal for the very foreseeable future that gives us our energy."

That is why, from a global perspective, it is so important that we get carbon capture from coal plants. You could argue that Britain might conceivably somehow manage to wean itself off coal completely and could then look virtuously at the rest of the world on the basis that it wasn’t using dirty coal. But that won’t actually make much difference to the future of the world because the biggest emitters are going to be China and India and other emerging
economies and they are going to be using coal, because they cannot leave their people in poverty and retain social stability. So for them, they have got to use their coal. We have got to have a go and make it work to have carbon capture storage.

Vice-President Lee listed a number of issues around their energy policy. He said ‘energy security’ and there are two aspects to that. Can we make sure that we have got it and no one can hold us to ransom? If your economy is growing like that, and you are importing energy, if someone interrupts that supply then you are in big trouble. And that is true for China, which is why they are going out into the world, into Africa, into Asia, and trying to get as much ‘right’ to as much raw material as they possibly can and, in particular, energy. Energy security for them is really important.

Vice-President Lee also seems to have no doubt that the carbon dioxide that they are emitting is changing the climate and is a threat to them and they see this as one of the biggest threats to China, but they are also trying to lift their people out of poverty since they still have a lot of people in poverty. It is not a democracy, it is nothing like a democracy, but the will of the people still matters. There is a bargain between, if you like, the ruling classes of China and the people of China. If you give us employment and a rapidly rising standard of living, we will put up – to some extent – with the lack of freedoms. But there comes a point at which, if you don’t deliver that growth and you don’t deliver the jobs and you don’t deliver the increasing comfort, then they won’t vote the government out but they will rebel and throw the government out. So from a Chinese point of view the democracy operates at a lower level; you don’t vote people out, but you do get a revolution if the fundamental bargain is broken. And they feel very vulnerable in that sense.

Somebody commented to the top Chinese leaders, “Every empire comes to an end because the empire was guarding against the wrong thing.” This is a very perceptive comment and the person asked the Chinese leader, “What is the thing you are ignoring; the thing you are not defending against which is actually going to bring you down?” And he said, “Well up until now it has been the environment.” So from the way I would see it, the Chinese leadership is very aware of the environmental constraints and the energy implications of those environmental constraints. It is heavy metal pollution, it is air pollution and it is climate change. The Chinese are talking about a tax on fossil fuels within China to address those issues and the likelihood is that it will be in the next five-year plan. If they don’t resolve environmental resourcing and environmental problems, domestic development will be difficult to sustain and, from the Chinese point of view, that also means domestic stability will be difficult to maintain.

If Ghana goes completely wrong, it is a tragedy for the people of Ghana and that is bad news. If it goes wrong for China, then it goes wrong for all of us, so we all have a stake in their actually dealing with this problem. But they realise they are walking this same tightrope as they know they are emitting large amounts of carbon dioxide. They are also investing massively in solar and renewables; the biggest of everything now is beginning to come out of China. They are building huge dams for hydro-electric power; we’ll talk about those in a minute.

The Energy Conundrum

So, do we have any kind of magic bullets that are particularly relevant to developing and emerging countries? Solar photo-voltaic? Yes, if you have a large bit of desert and companies like Munich Re, the biggest re-insurer in the world, is putting billions into photo-voltaic. That will sit across the Sahara, but it turns out not to be for the developing countries in which it is sitting, but to power Europe. Although that may still be a good thing for all kinds
of reasons, and it does raise some very interesting questions about energy security, nevertheless people are putting money into it. It doesn’t really look as though it is very appropriate for developing countries, because it is just too expensive and you don’t get enough energy out.

What about solar cooking? A friend of mine was involved in and sat on the Board of a charity that produced a million solar cookers for use in India. They were a brilliant design, they really worked. You put them in the sun and they would cook whatever you put in them and they really worked well. The only problem is, to stir the stuff you had to sit in the sun, which for anyone sitting in the sun in India is, of course, idiotic!; so nobody used a million solar cookers.

This is not just about technology, this is about the social implications of the technology which you bring about. In part of my time in Africa I came up with a wonderful design for a solar trough that would heat water very efficiently and I was just making the first prototype when I realised that during the main part of the day it would heat the water beautifully, but in the evening and the morning when the sun was low, it would fry anyone within 30 metres. It turned out to be not such a good idea, so I didn’t make it!

Wind power? Very good for some rural communities, for re-charging your batteries, for example, but it is difficult to do that on a base load and it is also difficult to distribute the energy you get from that into rural communities.

Hydro? Hydro-electric seems a good idea where you have got a waterfall, or where you can build a dam, but you need big dams to get a big impact. That may have impact in terms of water flow and silting up. It may be that there is not enough rainfall. Some of the South American countries, such as Chile and Peru, have lots of hydro and have lots of dams, but the glaciers that feed the water behind the dams are drying up. They are trying to work out how to avoid power shortages when there is nothing to go into the dam, because climate is having an impact even on something you think is sustainable, like Hydro. So they are turning to geo-thermal.

Geo-thermal is getting energy out of the ground; what can possibly be wrong with that? The problem is scale. At a small scale, burning fossil fuels is a good idea, the trouble is when it gets big. The problem is what happens when geo-thermal becomes the way the world gets heated. I got some calculations done that demonstrated that it works if you are rural, but if you are a big city and you are trying to get geo-thermal, it doesn’t work so well.

We heard a lot about nuclear this morning. I can see a lot of advantages to nuclear where there is the infrastructure to do it, but I find it really hard to see it working in Africa or some areas of South America; there just isn’t the social infrastructure to support it; at least it looks like that to me.

Bio-fuels seemed to be the magic bullet of a year or two ago, but you need a lot of ground to grow them on and it doesn’t do very much for your bio-diversity either.

President Obama's Energy Secretary, who has a Nobel Prize in Physics, says the answer is painting your roof white! The idea is that if you are in a hot country, why turn the air conditioning on when you can just have a white roof, because it will reflect the sun’s rays back. Or maybe the answer is geo-engineering? But every kind of geo-engineering I have seen is difficult to bring to scale. I’m sure the white roof concept is useful, but I can’t see it making a really big impact as it doesn’t cook your food or do all the things that people need and it doesn’t get you from A to B.
So in terms of developing countries, some of these need a lot of capital, and they haven't got capital to actually implement them. Then there is distribution. In India they can build the nuclear power station, but most people are not connected to the national grid, so they can't get the energy out to the people who need it. As for social impacts, it is very difficult to manage the social impacts of a lot of these issues such as the traffic jams. You are getting the energy in, but actually everyone is immobile for two hours every morning and evening, because the infrastructure just isn't there to manage it.

How important is it that the energy you use is of the same kind of energy that the people you are trying to be like are using? That is a fantastically important thing. Unintended consequences? This isn't energy, but it is such a good story. A friend of mine has a friend who is a very concerned environmentalist working in Madagascar. He is a Biologist but he saw the impact of world population, so as well as looking after some particular wildlife in the area, he also had a programme handing out condoms – tackling both issues at once. The local fishermen discovered that if you put a torch inside the condom and tie a knot in it, you have got a waterproof torch – and that wiped out the population of the local squids and octopuses, because they could hunt at night.

As soon as you start bringing any of these solutions to scale, to big scale, there will be unintended consequences, which richer countries can deal with, but poorer countries can't. This is the impasse; if you develop you get climate change and social instability because (as in the case of Egypt today), one of the major drivers of the changes in Tunisia and Egypt was food prices. Why did the food prices go up? The biggest market of Russian grain was Egypt. Why was Russia no longer selling grain? Because of the drought and the hot summer last year in Russia that wiped out a third of its harvests. So you get a drought in Russia, leading to no exports. You then get food prices going up in Egypt and you get riots in Egypt that turn out a government. That is not just me saying that, that's a guy with a Nobel Prize for economics. If you don't develop, then you have inequity and if you have that level of inequity, then you get mass migration and all kinds of social instability as well.

Theological Considerations – The ‘Energy’ of the Kingdom of God

Some theology now; love God. We are told to love God, and Jesus, in particular said “don’t love money”. Loving God and loving money don’t go together. Our basis of development is loving money, so there is a question of what do we mean by development and how do Christians model different kinds of development that aren’t based on loving money. What about loving your neighbour? I’ve talked about that a little bit and it seems to me that we have to think not just in terms of the big thing like climate change, or the big thing of overall energy policy, it has to be the people at the heart of it that we are talking about.

The Kingdom of God is something that Jesus talked about a fantastic amount and the metaphors he used are very interesting. He said the Kingdom of God is like a tiny seed that grows into a huge tree. It’s like a tiny pinch of salt that flavours or protects a whole meal. He says it is like a tiny candle seen from a long way away. He says it’s like a tiny bit of yeast that lifts the whole loaf. He even says it’s like being born again, from a tiny baby that then grows into someone else.

The whole thing about the Kingdom of God is how it starts tiny and affects everything; and that applies to you as an individual. God gets his grip on you and then it transforms your whole life, but it also applies to you within the church. That one person within the church, who manages to infect the whole church by their attitude. Or it is the church affecting the whole of its society. The Kingdom of God is about ‘small’ affecting and changing the whole ‘big’ thing.
Conclusion

Although we are small in number, our ambitions have to be large in terms of this new vision of development, not based necessarily wholly on money. You have to get out of poverty but not become rich. Zaccheus is an interesting character because his response was financial. He saw something was wrong and he gave money, and Jesus said “the Kingdom of God has come today.” That means that our generosity can be a part of our response to the Kingdom of God.

Please Note: The views expressed in this article are those of the author and do not necessarily reflect the position of Redcliffe College.

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Womb Rights: A Reflection on Bolivia’s Proposed Law of Mother Earth

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Climate justice march “Defending our Mother Earth” at Cancun, Mexico, December 2010

Introduction

On December 4th 2010 the work of 1,500 representatives of Bolivia’s active social movements representing the voices of the 36 indigenous groups, the membership of which accounts for 60% of the 10 million citizens of the Plurinational State of Bolivia, culminated in a radical and historic proposal.

This proposal, presented at the Cancun World Climate Summit, called for a law on “Mother Earth” founded on the indigenous principle of “vivir bien” (living well). It aims to establish harmony, balance and a communitarian economy based on the principles of solidarity, reciprocity and fairness. It is expected to pass into state legislature shortly and stands as a particularly evocative legal landmark in a region where the indigenous national consciousness never strays far from the memory of exploitative colonial mineral extraction.

The proposal is one of many signs of Bolivia’s explicit resistance to the Western capitalist economic model which has been tarnished as exploitative, destructive and irresponsible. It forms a significant plank in the Indigenous Movement’s own reassertion of agency as part of a decolonising project which has grown significantly in momentum since the country’s first
indigenous president, Evo Morales, came to power in 2006. The proposal claims that it is “time to stop Mother Earth’s agony and treat her wounds...reverse all the damage caused...and re-establish harmony and balance between all living beings.” It is based on the accord of intrinsic rights to Mother Earth as a living being who is “sacred, fertile and the source of life that feeds and cares for all living beings in her womb...she is the home of all living beings, ecosystems, biodiversity, natural societies and their individual components”.

Rights of Mother Earth

These thirteen new rights for nature are (Proposal for a Law on Mother Earth, 2010):

- Right to life and to exist
- Right to be respected
- Right to continue her vital cycles and processes free from human alteration
- Right to maintain her identity and integrity as a self-regulating, interrelated and differentiated being
- Right to pure water as a source of life
- Right to clean air
- Right to a healthy environment
- Right to not be polluted and contaminated with toxic and radioactive waste
- Right to not have her cellular structure modified or be genetically altered. This would threaten her vital and healthy functioning and integrity
- Right to full and immediate restoration and decontamination due to human activity
- Right to be reforested
- Right to ensure the responsible and sustainable management of nature’s blessings
- Right to not be affected by mega infrastructure and development projects that affect the balance of ecosystems and the local inhabitant communities

Speaking from almost 4000m above sea level, Vice-President Alvaro García Linera’s assertion that the proposed law “makes world history... establish(ing) a new relationship between man and nature, the harmony of which must be preserved as a guarantee of its regeneration” (Garcia Linera, 2011), can be set in contrast with the urgency of President Mohamed Nasheed of the Maldives. He asserts that, in the face of the reality that the Indian Ocean islands will be submerged by rising sea levels by the end of the Century, we “cannot cut a deal with Mother Nature” or “have negotiations with planetary boundaries” (President Mohamed Nasheed, 2009).

However, both leaders are addressing the urgency of a radical re-evaluation of the way in which humankind develops in relation to Mother Earth, noting both historical breaches, the consequences of which we are currently subject to, but also the present imbalances which threaten life on the planet and which will lead, according to the overwhelmingly consistent scientific view, to catastrophic future changes.

So how can we view the emergence of such a legal framework protecting the rights of Mother Earth? What can be said theologically and, importantly, missiologically in the face of such important civic and political processes?
Locating Theological Reflection Within a Socio-historical Context

Throughout much of human history there is record, through religious and cultural narratives, of ways in which man’s interface with his environment has been mediated; for example, through cultural (often very localised) myth-telling and religious belief systems, such as animism and, notably Hinduism. Implicit in these narratives were communitarian frameworks for life based on rules and regulations which influenced our engagement with the Environment.

Whilst we might rightly wish to re-evaluate these frameworks and discard some of the inherent (as opposed to inerrant!) “wisdom” as unsuitable for the modern context, there is little doubt that these narratives offered some protective function for the Environment. In contrast, Lynn White in his landmark essay on the history of the environmental movement, noted the distinct part played by later Western Christianity’s interpretation of the creation narrative in opening the door to a hierarchical relationship with nature which paved the way to the possibility of a more exploitative relationship (White, 1967). He does, however note the positive contribution of St. Francis of Assisi who demonstrated an alternative Christian engagement with fauna and flora which, though deemed heretical by the religious gatekeepers of his day, has greatly informed Christian theological reflection on environmental issues today.

With reference specifically to Bolivia’s proposed new laws it is important to understand them in a number of ways. Firstly, they are borne out of an Andean indigenous worldview which locates humanity in an explicitly interdependent, indeed even dependent, relationship with the rest of creation. Secondly, legislation could be regarded as a somewhat clumsy modern tool of largely Western-style democracy which inevitably fails to capture the interpretive nuances of this worldview.

This means that there is something of a mismatch between the spirit of the indigenous environmental narrative (or world-view), articulated and re-invigorated by this new proposal and its legalised wielding within the Westernised democratic processes of the modern plurinational state. Thirdly, the proposal has an explicitly political and external function to control and reform the relationship of Bolivian land (and the people who inhabit it) with those who seek to use the power of “imperial capitalism” within the nation's borders. It recognises the deep connection of people to the land and the Environment, and as such the accord of rights to Mother Nature may serve to emphasise both the rights and the responsibilities of humans.

As Christians we value and understand the biblical injunction to intercede and act on behalf of the vulnerable. The recent Micah statement to world leaders preceding the Copenhagen Summit enunciated the “moral, spiritual and economic imperative to tackle climate change” (Micah Statement, 2009) which is recognised to affect most adversely, and immediately, the poor. However, to support the accord of rights to Mother Earth may be for some a step too far. For many of us there is a disconnect between human rights and the accord of intrinsic rights to Mother Earth and yet, for most people living in the majority world today, the connection of people and their environment is very strong.

If the land becomes a desert, the people perish, and so on. We know only too well that the ones who suffer most (and hugely disproportionately) the effects of environmental
degradation and climate change are those whose resources do not provide viable alternatives if their connection to the land is discontinued, be it through flooding, dam-building displacement, mining or pollution. Thus, there is a need to locate the discussion first and foremost in the reality of all of humanity’s dependency on Mother Earth’s life-sustaining resources.

If we look at the biblical framework for humans’ location within, and relationship to the rest of creation, we see in the creation narrative, a strong connection with the land (Genesis 2:7). There is depicted, in addition, a mutuality and interdependency of man and the rest of creation (Genesis 1:26, 29 &19). We can accord creation intrinsic value because God created it and deemed it “good”. His word of commissioning to creation was one of letting life multiply. In the light of this, it is not absurd to suggest that creation has the intrinsic right to remain “good” in the same way that we humans have been accorded the right to retain “goodness” in dignity and worth.

Furthermore, God’s value of creation as being good and worthy of redemption is linked explicitly with the value of man made in his own image and worthy of redemption, as I will address below. It is against this backdrop that we are invited to regard the whole of creation as a participant in the shalom of the God of the Bible, shalom being the fullest expression of life and of “living well” within the Great Economy (Kingdom of God). Indeed, this Judeo-Christian concept of shalom resonates deeply with the Andean concept of “vivir bien” which also holds an eschatological dimension.

A Missiological Conclusion

Mother Illimani with Intis, Awichas and Children by Roberto Mamani Mamani, Bolivian Artist
Whether we can assert, theologically, that the earth should be accorded rights as part of a moral modus operandi may, in fact, be a secondary question, to the primary missiological one which asks whether in fact all of creation is part of the redemptive plan?

Romans 8 certainly does articulate a redemptive liberation from bondage and decay for all of creation (Romans 8:21), and the gospel of Mark 16:15 connects the whole of creation with the redemptive focus of The Great Commission. In addition, we read in prophetic scriptures of the alluding to a time when “the wolf will live with the lamb, the leopard will lie down with the goat, the calf and the lion and the yearling together; and a little child will lead them” (Isaiah 11:6).

This transcendentally sublime and non-coercive, non-predatory vision seems to surpass the necessity of legalised rights and obligations. In the spaces of hope between the present reality and the fullness of the new heavens and new earth, laws and rights may appear as inept mechanisms. However, it seems to me, that until we are truly free, we remain a risk and a liability to ourselves, to each other and to the rest of creation. The tension, which the apostle Paul perceived between freedom (permissibility) and responsibility (consequences) is one which has historically necessitated the intervention of law, to direct, guide, correct and mediate at many levels (1 Corinthians 10:23).

So then, missiologically, the redemption and renewal of all creation is an important and often downplayed part of the Grand Design of the Kingdom of God. As such we can view the attempts to cherish and steward creation in tension with the sustainability of human life as an important aspect of missiology. In actual fact, for those anthropocentric thinkers who remain entirely unconvinced by a vision of environmental missiology we need only consider our utter dependence on our life-sustaining environment to know that to fail to protect her, be it legally or in other ways is to fail to sustain hope for our own future.

If we consider further, using the Andean allegory that Mother Earth is indeed the womb of all life, then we can see that to accord her rights (specifically life-enhancing ones) can only benefit the life-fulfilling aspirations of those borne and sustained in her womb. For example, to accord a pregnant woman the right to a balanced diet or protection against violence, or overwork, consistently improves the life, both present and future, of the child borne in her womb. The Millennium Development Goals recognise maternal rights as crucial life-sustaining objectives (MDG 5: improving maternal health).

The womb of Bolivia must sustain first and foremost the people of Bolivia, not the multinational “extra-terrestrial” extraction companies which have historically siphoned off resources with payment of very low taxation revenue to the country. Christian Aid’s report (October 2010) on the Bolivian perspective of the World Bank energy strategy notes a “wrong vision of unlimited growth” and cites the following statement made at the 2010 World
People’s Conference on Climate Change and the Rights of Mother Earth in Cochabamba, Bolivia;

The development model we advocate is not destructive or unlimited development. Countries need to produce goods and provide services that satisfy the basic needs of their population, but under no circumstances can they continue a development path where the richest countries have left an ecological print five times bigger than the planet can support.

Maybe it is time to affirm that a legally-protected Environmental “womb” will enhance rather than limit the rights of all humanity to flourish?

References


Mohamed Nasheed (2009) We will not die quietly, speech delivered at the Climate Vulnerable Forum and published by Carnegie Council, accessed online 24/06/11 at http://www.policyinnovations.org/ideas/innovations/data/000152/pf_printable


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The Contribution of Eco-feminism and Indigenous Religions to a Theology of the Environment

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Introduction

In the mid-Twentieth Century in the West, the first warnings of an impending environmental crisis went unheeded. Rachel Carson published *Silent Spring*, and I remember finding the title so chilling that I avoided reading the book. Denial was rife, and denial increased as the Information Age [1] provided us with all that we did not want to know.

In this article, I will begin with another writer’s bid to sound a warning, Lynn White’s essay on the origins of environmental destruction, a thought-provoking indictment of Christian theology in relation to the natural world. I will discuss the ideas of two Christian thinkers who previously tried and failed to change the human-centeredness of Western Christianity and consider possible reasons that developed, showing that a male-centred, anti-God and anti-culture theology existed for many of the same reasons. I will describe the views of feminist environmentalists and their critical deconstruction of classical theology and examine their search for an alternative cosmology of creation and theology of justice.

Primal/indigenous creation traditions will be considered and I will attempt to relate them to eco-feminism, firstly to demonstrate that both seek justice, and secondly to show that eco-theology is liberationist. Finally, I will make the case for the potential of radical, holistic and populist movements to revitalise worldviews and create bridges where theology as a discipline has failed both in its premises and its capacity to respond to the environment and the marginalised.

White’s ‘Historical Roots’ of the Environmental Crisis

Lynn White, a professor of medieval history, shook the academic world in 1966 with his address, later published (1967), entitled ‘*The Historical Roots of Our Ecologic Crisis*’. His sweeping historical analysis of Christian thought attracted an enormous and sustained response that established a discourse on Christianity and the environment. Affirmations and rebuttals, in fact, never subsided because White, instead of presenting science to discuss ecology, called into question the very values and religious traditions upon which our society is based.

White argued that the central teachings of the church gave way in the Middle Ages to what became an unholy alliance between science and technology [2]. The biblical mandate of Genesis 1:28 (man’s dominion over creation) became an ethic of power and control over nature that replaced respect and protection. The human animal became ‘owner’ and exploiter, guilty of systematically dispatching the resources of the earth for his own selfish ends. Western Christianity *de-sacralised* and *instrumentalised* nature (Szerszynski, 1991 p
1) and bears a substantial ‘burden of guilt’ for the environmental crisis that resulted (White 1967, p 1206). White predicted a ‘worsening ecological crisis until we reject the Christian axiom that nature has no reason for existence save to serve man’ (White 1967 p 1207).

The conversation continues. White’s thesis is picked over, discussed, supported and rebutted. It is business as usual for creation, too, as the natural world continues to be degraded in spite of Carson’s data warnings, White’s reasoning and the alarming expositions of countless scientists, thinkers and writers. Nevertheless, instead of turning the juggernaut, we continue to equivocate. The half-century we had in hand is gone, but we have at least begun to look for solutions in a mood of collective concern. Even opponents of White have agreed that if there is any means of drawing back from the abyss, it will have to be through change in attitude and worldview. White himself says, that because the roots of the dilemma are religious, ‘the remedy must also be essentially religious’ (White 1967 p 1207).

Ecologist Mary Evelyn Tucker agrees that “the values that mold” our perspective of nature “come primarily from religious worldviews” (Gardner 2003 p 1, citing Tucker), but world religions are generally unready to meet the demands of a new ecological awareness, not least Christianity. John Grim, Tucker’s associate, takes the position that religion in our own culture retreated centuries ago from much consideration of nature and the universe; our cosmology needs to be checked for relevance and adjusted (Tucker and Grim 2009 pp 2,3). That there is little time for re-alignment simply increases the urgency.

Creation Theologians Unheeded

St Francis of Assisi, with his gift for communicating with wild creatures, encouraged the animals to glorify their Creator [3]. White recognised Francis as a radical environmentalist; the Church marked him out as a heretic. By the Twelfth Century, humans had already overstepped their rank in creation, so Francis tried to depose them from ‘monarchy’ and direct them toward a ‘democracy of all God’s creatures’ (White 1967, p 1207) [4]. He did not succeed. St. Mark’s parallel narrative, of Jesus in the wilderness with the wild creatures (Mark 1: 12, 13), was simultaneously ebbing from of our tradition.

There have been other voices that have spoken of our relationship with the earth. Pierre Teilhard de Chardin, theologian and palaeontologist, integrated a Christian worldview with evolutionary biology to correct the Christian assumption of separateness in the creation. But palaeontology never shook off the prejudices that grew around Darwin’s theory of evolution and de Chardin’s thesis was disregarded. Other disciplines prevailed, including the post-Enlightenment science that ‘enabled Western societies to exponentially amplify both their domination and its effects’ (Bonk 2008 p 1).

On this foundation, an ecological crisis grew, as described by Jürgen Moltmann, who focused his study of Christian theology on human history until the 1980s (Neal 2009 p 12, citing Moltmann 1985 31 pp 137-8). He then moved his effort into explaining God’s deep compulsion to create, out of love (Neal 2009 p 13, citing Moltmann 1985 p 75). The creation narrative in Gen. 1:26-28 (especially subdue and rule) had been wrongly interpreted, he believed, as having emphasised not God’s love for the order and stewardship He created, but the superiority of humans by virtue of their being made in His image. Like White, he
believed this caused a distortion that led to the human pursuit of power, material gain and an erroneous conception of ‘progress’.

‘God was increasingly excluded... displaced from the central goals and ethical values of the civilisation which succeeded medieval Christendom’ (Northcott 1996, p 85). The so-called Protestant work ethic (that had little to do with religion and more to do with wealth and the marginalisation of the destitute, landless and unskilled) legitimated profits at the expense of the poor, and industrialisation at the expense of the environment. Creation was seen as fallen, so human beings could disengage from the divine plan to create an ordered world through science and technology. Trust in God receded.

The world was being reduced to raw materials and people to agents in control of consumption. The ensuing crisis has set for Moltmann the most urgent task a theologian can adopt; to rediscover God’s intentions for His creation. His prophetic voice can be heard calling attention to pollution, extinctions, desertification, resource depletion, hunger, climate change, commodification of everything, and wealth for the already-wealthy. Moltmann’s indictment of the human impact on the natural world is devastating in itself, but he has added a further dimension, ‘Environmental problems are ... signs of the sickness of our whole culture and the human “sickness unto death”’ (Berry, 2000, p 109). Our Hebraic tradition, of a covenant with God and a Sabbath rest for the land, is endangered as the natural environment is endangered. Relentless destruction has become an allegorical lesson from which humanity does not learn, “when weak creatures die... the whole creation-community suffers” (Berry 2000 p 110).

Before turning to eco-feminism, I will consider Matthew Fox briefly; Catholic, modern, as much on the wrong side of Church authority as St. Francis and equally in the avant garde of creation spirituality as de Chardin. Fox calls attention to a particular dualism in Christian theology, ‘divorcing as it does God and humanity and reducing religion to a childish state of pleasing and pleading’ (Fox 1983 p 89). Fox appeals for rediscovery of a holistic, creation-centred spirituality, as expressed by Julian of Norwich who called attention to the *Motherhood of God* as a place of safety and enclosure, of Meister Eckhart, who also stressed the *enveloping of God*, and of Jesus, for whom a favourite theme was Luke 17:21: “‘The kingdom/queendom of God is within us all’” (Fox 1988 p 91, rendering Luke 17:21). Fox has called attention to a need in Christian theology to move from The Fall and Redemption to a panentheism in which we are part of the fabric of creation. He makes his point with urgency, ‘we are living in the best of times and the worst of times. We can run but not hide; so much has to change’ (Croucher 2003).

**Eco-feminist Voices**

The eco-feminist ‘movement’ is more a diverse association of feminists, environmentalists and theologians with concern for the effects of power, privilege and patriarchy on people and the environment. Specifically, ecological feminism ‘examines the interconnections between the domination of women and the domination of nature’ (Ruether 2000 in Hessel et al p 97).

In defending their position, eco-feminists may draw attention, for example, to the correlation
between the low socio-economic status of women and the misuse of the environment through male ownership and control.

Rosemary Ruether, a key thinker in feminism and the environment, says that eco-feminism is now so large a gathering of small gatherings, so diverse and global, that only the movement’s ethos and shared aims hold it together; to recognise and change the power dynamic of male-oriented privilege, highlight connections and work for liberation and the healing of theo-cultural distortions. For the last of these Ruether is well-prepared. With a background in Classics, Patristics and Theology, she has prepared a trenchant critique of the Christian creation narrative. In Genesis, the female was created out of the male and handed over to be a wife-servant, forever associated with ‘sin, seduction and the secondary nature of woman’ (Meyers et al 2000 p 79), blamed in ‘causing evil to come into the world’ (Ruether 1989 p 32; See also Ruether 2002 pp 94-99) and considered to be in perpetual need of subjugation lest her ‘evil’ break forth [5]. She was made a scapegoat [6].

In the New Covenant, there was new hope. Jesus said there was ‘neither Jew nor Greek… male nor female’ (Gal. 3:28). But his new ethic did not prevail. The Early Church moved swiftly to institutionalise and establish the Canon, a canon of vested interests regaining cultural ground against Jesus’ radical vision [7]. It did not take long to accomplish. Even in the teachings of 1 Timothy ‘women were created second and sinned first’ (Ruether 1988 p 2); they were to keep silent and have no authority over men.

Anthropology and the feminist movement, for all their achievements, have failed to correct an anthropocentrism of the environment and androcentrism of the human race. ‘It is only with the deepening of feminist theology that there has been a...recognition of the need to grapple with the whole structure of the Christian story’ (Johnson 2000 in Hessel et al p 13). ‘Since biblical times, men have been viewed as having “domain” over the earth’ (Johnson 2008 citing Knight). It is against perceived falsification of the biblical narrative that eco-feminism seeks to challenge Christian theology [8]. Ruether believes that Jesus the Liberator should now take precedence over Jesus the Messiah.

Eco-feminist literature often provides a poignant insight into the lives of women on the margins [9]. Some writers believe there is a mothering instinct in women that means they are more able than men to nurture and sustain the land and human needs. Others disparage gender-difference arguments [10]. Ivone Gebara, a Brazilian theologian, says ‘when it comes to gender, sex, and race, there are no immutable essences’ (Gebara 1999 p 11). Certainly, in my opinion, women with their experience of marginalisation and mistreatment can offer the greatest understanding, of marginalisation and mistreatment, but most gender differentiation is unjustified.

Gebara is aware of the pitfalls in treating women as ‘undifferentiated “victims” rather than people shaped by “a complex matrix” of influences (McClimin and McIlvaine-Newsad 1999). There are women, as well as men, who are rich and insensitive to the poor, female despilers of the environment and people of both genders who ignore the rights of others. Her solution is to be inclusive, and she welcomes men to the ecology effort. She has expanded on the ideas of Ruether, her teacher, and now leads a movement for justice in Latin America, the world’s poorest continent. It is not the poor, she says, who are ‘most
Gebara asserts that the primal sin committed by creation’s most advanced creature is not disobedience in Eden, but ‘an effort to escape from mortality’ (Ruether 2000 in Hassel et al, p 105). I suggest that this can be extended to incorporate the androcentrism associated with it; in assuming power not given by God, men typically choose to dominate women, the poor and vulnerable, animals and nature. In the process, they reduce their capacity to endure want and death because they have forgone reliance on the Creator. Gebara confirms this, in saying that men exert increasing control in order to achieve a sense of safety in their godless world. They engage in wanton destruction of resources as they ‘play God’, and the resulting wastage and imbalances threaten the earth and their lives. I question Ruether’s reasoning that the male impulse is to ‘transcend finite limitations’ (Ruether 1992, p 105), but I recognise greed as an impetus, which is linked with Gebara’s notion that the male makes a bid for control to create for himself a semblance of safety.

Gebara’s writing has the power to draw pictures of the plight of the earth, with women at the centre of the tragedy. She knows the barrios of Latin America. Those who live there are not the owners of the industries or power stations or the consumers of factory goods. They are poor people who endure the filth of garbage that is not theirs and the danger of industrial waste that is unregulated. She speaks not only of the people but the land beneath their feet, ‘the sacred body of the earth, which is bought and sold and prostituted for the sake of easy profit and the accumulation of wealth by a minority’ (Gebara 1999 p 18).

Men get things dirty; women clean them up [11]. It is women who clean the spaces called home between the garbage mountains. It is they who take the city’s low-paid jobs of clearing paths and roads [12]. It is they who leave the slums for a few hours of invisibility among the rich, where they clean their clothes, toilets, hair, children, pets, cars and swimming pools. The discourse of women and the environment has teased out the metaphors and imagery of domination: the rape of the earth; a violated landscape; the cutting of virgin forest (see for example Johnson 2000 in Hassel et al p 17).

Many environmental movements are led by women; the Chipko Movement to protect forests in India, in which women had only their bodies to put between the trees and machines driven by men (Samartha 1990 p 258) and the Green Belt Movement to reforest ruined land in Kenya, where women planted hundreds of thousands of trees by hand (Women Aid International). The healing of the land, in their view, is the healing of female bodies worn by work and misused and abused by men [13].

Gebara says that the Church appears to have distanced itself from power and oppression, giving a semblance of purity, goodness and freedom (Gebara 1999 p 6). It has originated injustice and then perpetuated an illusion. Power structures form a continuum that begins with male domination and extends to the commodification of all things. Humans, animals, minerals, trees, mountains and the seas, and their contents, are brought under control and
used, or used up, with the same justification given to both male supremacy and human *dominion*. A theology of eco-feminism offers an alternative continuity that is benign, extending from the individual, to the community, to the biosphere. Where there is no domination, a sustaining interdependency grows and healing begins; of the parts and the whole, of women and the natural world.

The most moral role humans can assume would appear to be that of *steward* over the non-human creation (Gen. 1:26-29). Liberation theologian Leonardo Boff agrees, saying ‘we are here to serve as shepherds’ (Boff 1995 pp 86, 87). Eco-feminists, however, reject the model outright; God is not a Sovereign overseeing a world in which humans act as vice-gerents because that god would be male, hierarchical and detached. Instead, Ruether and some others conceptualise Gaia, a female Earth Mother who gently guides humans to well-being. It is a relational and interactive base with many attractions. But re-interpretation and re-discovery are required in our theology, in my view, not re-invention. Acts 17:24-28, [14] for example, holds all the immanence and gentleness of a God who is mother as well as father and unwilling to relinquish the loved Creation to that of an incompetent steward.

Some eco-feminists (Gebara, McKinnon) and those who support them (Rasmussen) will try to re-balance theology. In the meantime, eco-feminist thinking is radical and, by its very nature, disparate. Some might conclude that it appears as quixotic as the Greenham Common Peace Camp in its early days (Guardian 05.09.2000); others, that one needs to focus on the outcome of both campaigns. I believe we need to look beyond the demand for movements to produce defined and quantifiable results. Awareness is being raised by eco-feminists on a set of inter-related justice issues. Stereotypes and dualisms are being eroded; confidence is returning to the marginalised. It remains to be seen whether improvement can be achieved for the beleaguered environment.

If anything is being lost, Ruether writes, it may be the poetry in the great creation myth. To regain it, ‘we need scientist-poets who can retell ... the story of the cosmos and the earth’s history in a way that can call us to wonder, to reverence for life, and to the vision of humanity living in community with all its sister and brother beings’ (Ruether 1992, p58).

**Indigenous Voices**

Aboriginal peoples, indigenes on every continent who retain their ancient traditions, have this same reverence for life and vision of humanity enclosed in nature. They often refer to their sisters and brothers among the wild creatures [15]. The needs and understandings of indigenous people groups and environmental concern go together. Paul Hawken gave credit to a Native American for helping him to understand that ‘the environment and social justice movements addressed two sides of a single, larger dilemma. How we treat one another is reflected in how we treat the earth (Hawken 2007 p 2).

Christian missionaries from the 17th Century suppressed primal beliefs. Few had the wisdom of missionary Marthinus Daneel who, in recent years, helped to create a coalition of traditional religious practitioners and African Initiated Churches (AICs) in Zimbabwe. As they
mounted a tree-sustainability project, they consulted the oracle of the *Mwari* rain shrine for her wisdom (Daneel 2001 p 79). African *Earthkeeping* Churches are expanding.

There is hope that the influence of indigenous groups, like that of eco-feminists, can reverse Christianity’s anthropocentrism. They apply ancient cosmologies, knowing better than most what results from a failure to respect the land. They have much in common with the impoverished and powerless women of Latin America. The Navajo in Western U.S.A. have high rates of cancer (Brown and Lambert 2010 *passim*) from uranium mining, and their forests have been cleared for profit (Gottlieb 2006 p 139). The Inuit, who have hunted on foot, are losing their way of life to climate change (Krause 2000) because millions of ‘modern’ people travel by car.

Stan McKay is an ecologist of Algonquian heritage who says that indigenous groups, in the Americas, Australasia, Africa and elsewhere, are like ‘Old Testament’ people with a profound oral tradition of the creation (McKay 1994 in Hallman ed p 214). ‘Land does not belong to the indigenous peoples, rather they belong to the land’ and it is sacred (Tapia 2002). ‘Advanced civilizations’ are the poorer for having lost this view [16]. But now, as human beings face suffering like the creatures whose habitats have been destroyed, there may be more willingness to learn from indigenous peoples; of biodiversity, sustainability, medicines, relationships, praise and thanksgiving, space and silence. What is needed, according to one writer, ‘is an American Indian theology coupled with an American Indian reading of the gospel’ (Tinker, G. 1994 in Hallman ed p 223). Elizabeth Tapia points out that indigenous worldviews also have things to teach us about communities and valuing and strengthening women. There are points at which the eco-feminist ethos and the indigenous one intersect, carrying the same themes, from the same human experience.

**Conclusion - Justice for the Earth and its People**

Naturalist R.J. Berry, in agreement with many eco-feminists, rejects the theology of human stewardship of the environment because he reasons that God cannot be the absentee landlord, transcendent and uninvolved. That view left nature de-sacralised and open to exploitation, as White demonstrated in his seminal essay. Instead, God is present and working *with* his people. Theologian Brigitte Kahl sees him as ‘taking the spade and planting the trees’ (Kahl 2001 in Hessel and Rasmussen p 55).

Eco-feminism, indigenous earth spiritualities and liberation theology naturally stand together in recognising that God suffers and works with his people and all of his loved creation. Those who struggle re-sacralise nature through daily lived experience that becomes the well-spring of a theology that can no longer be written from patriarchy [17]. For Moltmann, this is the ground of scripture and of hope, that it establishes a vector of God’s intentions for His new creation (Law, J. 2010 in Horrell *et al*, p 238) [18].

**References**


Notes


[2] Northcott added to the historical indictment against Christians in their relation to the environment by pointing out that Charlemagne destroyed the sacred groves of the Saxons, and European colonisers relentlessly extracted raw materials from their empires. See e.g., Northcott (1996 p 45).
[3] ‘Our sisters the birds are praising their Creator; so we should go in among them’ (Francis in a legend from the 13th Century.), Bonaventure, Cousins, E. (ed.) (1978), p. 258.


[5] Ruether writes that the human ‘lower nature demands that women be subordinated’ though assumed to be ‘prone to insubordination’; thus, ‘the male was seduced into sin in the beginning and paradise was lost’ (in Hessel et al 2000 p 99). She cites Augustine’s Fourth-Century commentaries on Genesis as shaping ‘theological rationale for women’s subordination’ (2000 p 101). Luther and Calvin reinforced the doctrine (2000 p 102).

[6] Manlove (1995 p 192, Note 55) writes that ‘according to Aristotle the woman, by nature, was “inferior in her capacity for thought, will, and physical activity.”’ Aristotle wrote that women were “natural slaves”; See Barnes, J. (ed.), The Complete Works of Aristotle 1.1-2.

[7] Ruether (2002 p 14) discusses the process of canonisation, involving acceptance, exclusion and inevitably suppression of ‘other ... texts and lines of interpretation’. She points to the ‘radical egalitarianism’ (2000, p 102) of early Christianity that was swept aside and recovered only centuries later with the Quakers.

[8] E.g., Ruether believes it necessary to ‘give up the presuppositions of an original paradise’ to look more closely at ‘distortion of our relation to one another and to the earth’ (in Hessel et al 2000 p 105). In the same article, she considers what she believes are misinterpretations of the Trinity, cosmology and the concept of sin.


[11] Gebara writes, ‘more and more often, it is women who are hired for certain public clean-up jobs, so they clean not only private space but also public space. At the same time, men are most adept at getting things dirty and failing to clean them up. This includes the production of nuclear waste’ (1999, p 2).

[12] The author saw this in ‘townships’ of the Northwest Province of South Africa. Rubbish collection was intended as paid work for men, but when there were no trucks but only brooms and burning to clear mountains of waste, women did the work on very low pay, saying they would maintain their communities.

[13] Tapia (2002) cites the poignant plea of the women of Mindanao:

The land is being ravished, and so are we as women.
The land is being overworked, and so are we as women.
...Let the land and women ... rest...

[14] ‘... in him we live and move and have our being’...‘we are his offspring.’ (New International Version).

[15] Mother earth, sister bear and brother eagle form a family in which man is a member (George, 1979).

[16] The primal religion of the Celts enhanced early Christianity with a panentheism that disappeared in the Medieval Period. E.g., Celtic tradition tells of a tree, with ‘white birds listening to the melodies of the ages. The tree is Jesus Christ ... who came forth from the earth... We implore God that we may dwell among the branches of the tree’. (Low 1996 pp 102, 103, abridged, citing Stokes, W. (1890), Lives of the Saints from the Book of Lismore, citing Ms Light of Bridget).

[17] Moltmann and Segundo agree on the value of women’s revelation through life experience; scriptural interpretation changes as the needs of humanity change. It is ‘the task of theology to “designate as the Word of God, that part of divine revelation which... is most useful for the liberation to which God summons us”’ (Law, J. 2010 citing Segunda, J. 1998 [1975] The Liberation of Theology, in Horrell et al, p 237).

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Burning up or Being Renewed?:
An Exegetical Study of 2 Peter 3:10-13 and Revelation 21:1-5 from an Environmental/Ecological Perspective

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Introduction

‘But the day of the Lord will come like a thief, in which the heavens will pass away with a roar and the elements will be destroyed with intense heat, and the earth and its works will be burned up.’ 2 Peter 3:10 [NASV]

The Christian faith is deeply eschatological yet there are myriad convictions held as to what will actually take place at the Parousia. Will the earth be destroyed in a final act of Godly wrath by Yahweh or does He have some other intention? Is heaven beyond Jupiter or will heaven be made here on earth? What seems absolutely clear is that our eschatological perspective will have profound implications on how we live and act now? The objective of this paper therefore is to ask how our biblical interpretations colour our praxis. The question might be asked ‘Would Jesus sign the Kyoto agreement?’ Whilst it has been argued that the American administration’s (under Bush) refusal to sign the Kyoto agreement was essentially political and economic, what scope is there for suggesting it is deeply theological too?

The religious right in the US make up a large voting block that simply cannot be ignored and with senators like James Inhofe [1] and fundamentalists like Jerry Falwell [2], a balanced theology of the environment seems some way off. Kuzmic (1999, p151) notes, ‘much of evangelical eschatology is very pessimistic about the world, thus marked by a withdrawal from the world.’ It emphasizes a radical break between the present earth and the awaited ‘new heaven and earth.’ Yet other Christian thinkers argue passionately that serious earth care is in fact a reflection of true worship. But the issue is not just contemporary politics; it reaches further back and unveils the development of the idea of heaven and where heaven is to be located spatially. It uncovers a doctrine of creation (whether creation was essentially good but has been corrupted beyond God’s redemption).

Perhaps, ultimately it uncovers a sense of what God's judgement really looks like. As Heide (1997, p39) points out ‘if this earth on which we live is going to be completely destroyed, as many evangelicals believe it is, then we have little more responsibility to it than to act as good stewards of the resources God has given us. But if this world has a future in God’s plan, being renewed rather than re-created ex nihilo, then perhaps we have a much greater responsibility than to merely act as good managers’.

A study of 2 Peter 3:10-13, homing in on verses 10 and 13 especially, and Revelation 21:1-5 will be made. 2 Peter 3:10 seems, on the surface at least, to be in direct opposition to Revelation 21:1-4. Questions regarding the nature and genre of material will be made taking seriously contemporary evangelical scholarship on the issues of authorship, context and influence from extra-biblical sources.
2 Peter 3: Questions of authorship, textual criticism and context

Rossing (2008, p363) believes that, ‘for Christians seeking biblical counsel on the environment, 2 Peter 3 poses particular problems because it consigns the earth to burning up by fire.’ Indeed Kuzmic (1999, p151) suggests that much evangelical eschatology reads passages like 2 Peter 3:10 literally, ‘whilst ignoring the implications of Revelation 21:24.’ Should Peter’s seemingly stark words be read and interpreted literally or can we find some other way of re-imagining them? The problems in this particular passage of 2 Peter are manifold. Firstly, Peter seems not only to be advocating the discontinuity of the present world with destructive fire but that believers should be involved in the ‘hastening’ [3] of the project in some form.

Authorship of 2 Peter

Authorship issues surrounding 2 Peter are important since generally it is considered to be pseudepigraphic. Bowman (1962, p159) says it is, ‘almost universally held’ that the Apostle Peter was not the author of 2 Peter. Reese (2007, p116) notes, ‘most modern commentators have not been accepting of Petrine authorship as the early church fathers have offered various reasons for pseudepigraphical authorship for the letter.’ Eusebius (275-339) listed it as non-canonical or at least placed it among the contested epistles [4]. Bauckham (2008, p144) believes that the ‘pseudepigraphical character of 2 Peter is at least extremely likely’ and Green (1987, p13) states it was, ‘considered second class by Luther, rejected by Erasmus and regarded hesitantly by Calvin.’ Rossing (2008, p365) indirectly asserts that 2 Peter is pseudepigraphical and written perhaps as late as 130AD.

What is clear is that, despite perhaps its canonical ‘illegitimacy’, or because of it, no other New Testament imagery reveals total world-destroying fire. To be sure Peter has a fondness for fire (Green 1987, p151); 1 Peter 1:7 uses the image of fire as a refining process for the faith which is more precious than gold. There may be some good reasons for holding this in mind when interpreting the 2 Peter passage, as we shall see later.

Textual criticism of 2 Peter 3:10

A key word in 2 Peter 3:10 is katakaisetai, which is generally translated as ‘shall be burned up.’ Overstreet (1980, p356), Wolters (1987, p405), Bishop (1991, p20) and Heide (1997, p53) all note that whilst the Textus Receptus has the verb katakaisetai, critical editions of the New Testament since Tischendorf (including Westcott, and Hort and Nestle) have adopted the use of heurethesetai. Overstreet (1980, p354) confirms that 2 Peter 3:10 uses the future passive indicative of the word heurisko (‘shall be found out’). Whilst there seems to be strong support for the use of heurethesetai, both Overstreet (1980, p356) and Wolters (1987, p405) believe it is problematic because the word appears to make little sense in the context of the verse. How does one account for the idea of ‘being found out’ in this context?
Many modern translations are returning to the *katakaisetai* of the *Textus Receptus*, whilst critical editions of the Greek all print another (Wolters 1987, p406). The idea of 'being found out' or 'being laid bare' gives more options in interpretation. Indeed, Wolters (1987, p406) argues that taking into consideration Peter’s worldview about the Day of the Lord or the Day of Judgement, rather than reading verse 10 as cosmic destruction, it should be read, ‘as a smelting process from which the world will emerge purified.’ This idea of purification, of cleansing or renewal and recreation is, obviously, for the Christian deeply concerned with the environment, a pleasing outcome. Both Wolters (1987, p412) and Bishop (1991, p20) argue that *heurethisetai* is related to *heureskesthai* and might be a metallurgical term denoting smelting and refining, meaning that the world emerges purified (from the crucible). This is something akin to ‘showing ones mettle’ in English.

Context of 2 Peter 3

Green (1987, p143) asks the question, ‘does Peter teach that the whole world will be destroyed by fire?’ and replies that ‘there is no a priori reason why he should not.’ Certainly the whole idea of cosmic conflagration belongs to apocalyptic imagery and since apocalyptic genre should not always be interpreted literally but symbolically we would do well to read both Peter’s alarming picture of world destruction in the context of the rest of 2 Peter 3 and within the context of the whole of Scripture. Green (1987, p144) notes that ‘judgement by fire is one of the great Old Testament pictures of the Day of YAHWEH.’

The Day of the Lord in 2 Peter 3 uses a host of verbs, according to Wolters (1987, p408), to describe the coming conflagration of the world. It will dissolve (*lyomai* - v10, 11 and 12), melt (*tekomai* - v12), and burn (*kausoomai* - v10 &12, and *pyroomai* - v12). Obviously the ‘Day of the Lord’ was an important concept in the Old Testament that spoke of the final consummation of all things whereby God would judge the earth and the nations in it.

Overstreet (1980, p359) notes that Jews during Peter’s era would have ‘expected fire before the kingdom’ and ‘the new heavens and new earth would be preceded by fire’, but it is also useful to bear in mind that Jewish expectation of the coming Messiah was completely undone in the coming of Christ. Jewish expectation, whilst interesting and notable, should not shape our eschatological view too much.

Wolters (1987, p409) notes that Peter’s imagery is possibly based on Malachi’s fiery vision of the day of the Lord. Malachi 3:2-2 ‘For he is like a refiners fire and like a fullers soap. He will sit as a smelter and purifier of silver’ (NASV). Green (1987, p150) suggests that Peter may have had in mind the words of Jesus from Matthew 24:35, ‘Heaven and earth will pass away but my words shall not pass away’ (NASV). Bishop (1991, p20) believes this could be rendered as ‘Heaven and earth will be transformed but my word never changes’, giving us a helpful slant on recreation and redemption.

Certainly the Old Testament paints various pictures of apocalyptic chaos [5] where fiery destruction is seemingly certain. What must be remembered is that, ‘Peter’s language is not entirely clear in detail. He is using the language of apocalyptic in an attempt to describe the indescribable’ (Green 1987, p150). ‘The point’, notes Green (1987, p152), ‘of it all is not that
the apocalyptic imagery, which may or may not be taken literally is fulfilled but the moral implications’. Green, writing in 1987, saw the literal fulfilment of cosmic conflagration as possible due to the primeval destructive power of nuclear weapons in the Cold War era, but we face a very different political context.

If context of the Old Testament and Jewish apocalyptic paints a certain picture we may also ask how much Peter was influenced by ideas from contemporary Greek thought, most importantly the stoic idea of *ekpyrosis*. Rossing (2008, p366) suggests, ‘Peter may have transposed the Jewish notion of burning of evildoers into the more Stoic Greek notion of the burning of the whole created order in an attempt to persuade [the] Gentile audience that God is indeed involved in history.’ Green (1987, p143) suggests this is unlikely given the very real differences, ‘the Stoic programme is pantheistic, Peter’s monotheistic, the Stoics looked for a fresh world to emerge from conflagration...while the Christian hope was for a transformed world, the necessary complement to their belief in the resurrection of the body.’

What of the internal context of 2 Peter 3? Chapter 3 seems to be dealing with those ‘mockers’ following after their own lusts (probably a nod to the issue of the Gnostics) who were asking ‘where is the promise of his coming?’ Wolters (1987, p408) and Heide (1997, p50) help us by noting that Peter speaks of three worlds; firstly, a world before the flood (3:6), secondly, the present world between the flood and the Day of the Lord (3:7) and thirdly, a future world after that day, called ‘the new heavens and the new earth.’

Wolters says ‘in speaking of the future judgement, the Apostle is explicitly drawing a parallel with the earlier world judgement.’ We know that the flood was a purification of the world, a purging of evil. The Noahic covenant [6] should be born in mind at this point. The same destruction of the world caused in the flood may well be what Peter has in mind. The world after the flood continued to exist and the world after its final fiery purging will be renewed, recreated and re-imagined. Peter’s imagery here may be his attempt at emphasising, ‘the radical discontinuity between old and new but it is never the less clear the intention to describe renewal not abolition of creation’ (Green 1987, p154). This passage will have the tendency to ‘let down’ those advocating a serious Christian environmental ethic, but it must be born in mind that apocalyptic material of this nature is not to be interpreted literally. Heide (1997, p50) notes that, ‘the total destruction viewpoint...takes the language of this passage in the narrowest sense.’ God’s judgement is ‘unavoidable and impending rather than merely destructive’ (Heide 1997, p51).

We now move on to consider the opening verses of Revelation 21, as a counter balance to 2 Peter 3, before drawing some conclusions and offering some missiological considerations.

**Revelation 21:1-4**

Again in Revelation we are dealing with apocalyptic material. The beginning of John’s vision in this section is the seeing of a new earth and a new heaven and the passing away of the first earth and heaven. Mounce (1977, p398), Kwame (1988, p32) and Heide (1997, p42) all remind us that John was drawing upon Isaiah’s own vision (Isaiah 65:17). But Heide (1997, p43) queries, ‘what does John mean when he describes the first heaven and earth passing
away?’ Kwame (1988, p32) notes that any reading must be understood in the light of the rest of passage. Verse 5 stating ‘behold I am making all things new’ might suggest the remaking of what already exists.

Heide (1997, p43) suggests the usage of ‘passed away’ is commonly used to express the death of a person [7]. The verb here is aperchomai meaning ‘to depart, go away.’ Juxtaposed with 2 Peter 3, John makes no attempt to say exactly how the first earth and heaven are to pass away. What Heide (1997, p43) feels is clearly important is, ‘John is not saying that God has simply wiped everything away to begin again with nothing’. As Blanchard (1997, p17) points out, ‘if God were to annihilate the first cosmos and start again, it would at least suggest that Satan had ruined the first beyond remedy.’

Mounce (1977, p369) seems uncomfortable with an over-preoccupation as to what will take place physically at the Parousia, ‘probably the new order of things is not to be thought of primarily as a physical transformation.’ Kwame (1988, p32) too doesn’t seem particularly bothered about the ‘how’, but this may simply be a reflection of the shift in focus of mission studies since the late 1980s [8]. The word for ‘new’ here is the same word used in the 2 Peter passage, kainos, which Mounce (1977, p369) suggests can be understood as ‘fresh life rising from the decay and wreck of the old world.

Phillips (1987, p247) adds that, ‘the word new means not merely new as yo time, but also to kind.’ Kwame (1988, p33) does note that the new heavens and new earth are the context for the New Jerusalem, coming down out of heaven. The New Jerusalem is to be seen as the ideal of perfect community (Mounce 1977, p370), where God himself comes to live amongst his people [9]. Ladd (1975, p275) has emphasised that, ‘the ultimate destiny of God’s people is an earthly destiny.’ Button (2009, p9) concurs with this idea reminding us, ‘we are made from earth for earth yet we are spiritual beings and our resurrected bodies will be different.’ The language of the new earth is analogous to that used in Scripture of the resurrection of bodies. Paul’s attempt to describe this is found in 1 Corinthians 15:42-52. Blanchard (1997, p19) says, ‘the new body is not identical but will be identifiable with it.’ The resurrection, the physical resurrection of the body of Christ, then has enormous significance in the new heavens and new earth, as Button (2009, p4) believes, ‘the resurrection of Christ lays the blueprint for the future of humanity and humanity’s future is intrinsically earthbound.’

Continuity and discontinuity seemingly stand in tension, yet there is much to suggest that this is indeed a biblical view of what will take place; what Guthrie (1984, p43) calls ‘continuity and discontinuity merging with each other.’ An interesting point may be made here; the ‘now’ and ‘not yet’ of the Kingdom is a useful idea to keep in mind. New heavens and new earth are, ‘not new as such but that which stands in continuity to what previously existed’ (Blanchard 1997, p17). Button (2009, p10) believes it is ‘crucial to see the continuity between the present age and the age to come’, with Wright (1999, p197) confirming this idea by saying, ‘God intends to create new heavens and new earth, married together in dynamic and perhaps material continuity with the present creation.’

**Missiological consequences - the need to abandon a dualistic view of the cosmos**
Kwame (1988, p36), Heide (1997, p47), Wright (1999, p199) and Button (2009, p9) all acknowledge that a primary misreading of passages like 2 Peter 3 and Revelation 21 take place because of what Heide calls, ‘the consequence of Platonic overtones in our hermeneutical presuppositions’. Essentially, ‘the dualist supposes that, to escape evil, one must escape the created, physical universe’ (Wright 1999, p199). Certain groupings within Evangelicalism seem to favour a highly dualistic approach and one also wonders how much the reformed thinking of Calvin’s TULIP invades the understanding of the total depravity of not only the human agent but the physical world.

A hopeless physical world in terminal decline is best destroyed with a start-again philosophy. Wright (2007, p222) insists that, ‘matter is to be redeemed’, a point emphasised by Button (2009, p3) that ‘matter matters to God.’ God as ‘renewer’ and ‘restorer’ rings true. He does not consign the physical earth to the rubbish tip but is always looking to redeem, to regenerate, to reclaim, to make new that which was once tarnished, even damaged beyond recognition; it is essentially a reflection of God’s overflowing self-giving character.

Where is heaven?

Related to our first point is the need to re-orientate ourselves with regards to heaven. Blanchard (1997, p20) proposes, ‘believers banking on spending eternity on the other side of Jupiter should revise their expectations.’ A vital key to understanding what the Bible says about the location of heaven is to grasp what it says about the future state of the earth. Wright (2007) and Button (2009) make it clear that, ‘the terminal point of human life is not death, nor is it spiritual existence in Heaven; rather the terminus is resurrection.’ It is both the prevailing dualistic worldview and, perhaps, a medieval notion of ghostly spiritual existence of Heaven that has drawn us away from a concrete and earthly understanding of real resurrection. C.S. Lewis (1945) writes beautifully and movingly about the very real physicality of Heaven in his Great Divorce. A concrete understanding of Heaven ‘down here’ could mean a greater desire to engage environmental concerns for the future of the planet.

Taking redemption, repentance and hope seriously

‘The problem with secular environmentalism is that when the tipping point is reached, when it seems we can no longer make a difference, political will and therefore funding is lost’ (Button 2009, p11). ‘If the earth is to be destroyed at the Parousia then environmental action is at best patching up a dying man’s coat and a waste of time’ (Bishop 1991, p19). ‘God does not consign the creation to destruction’ (Rossing 2008, p365).

Some of Rossings (2008) reflections are helpful at this point as we close. Rossing (2008, p368) suggests that the apocalyptic nature of both 2 Peter and Revelation need to be understood in slightly different ways. Following the work of Schussler Fiorenza, Rossing (p366) notes that apocalyptic language can function in two ways, ‘either to control the behaviour of individuals or to provide an alternative vision and encouragement of new community structures in the face of oppression.’
Rossing feels the 2 Peter 3 material falls into the first more moralist category yet one might argue that both should be considered [10]. Rossing believes that essentially Revelation is a clarion call to the church to come out of ‘Empire’. She has great difficulty in finding any other reading of 2 Peter 3, other than a literalistic interpretation of world-destroying fire, but senses that ‘Revelation teaches a logic that invites readers to embrace life on earth.’ Indeed, it seems that Revelation 21 offers us a picture of hope, a source of comfort and both 2 Peter 3 and Revelation 21 invite us to consider our actions in the immediate future.

God’s judgement is not to be taken lightly and judgement is not just excluded to personal moral acts but to our inconsideration of the world at large. Judgement is meant not to cause paralysis but to bring repentance and, ultimately, renewed commitment to action. This is what Rossing (p370) calls, ‘the Bible’s counter-imperial message of repentance and hope.’ ‘We should believe that this world has a future in God’s plan of redemption’ (Heide 1997, p40).

If indeed the world has a future, what are some practical steps we might consider in the light of 2 Peter 3 and Revelation 21? The future hope of resurrection will surely penetrate into our concrete situations, for our vision of the future enables several things. Whilst we strive to participate in earth care, in eco-justice and serious reflection on these issues, Revelation 21 reminds us of the missio dei (Kwame 1988, p36). Mission finds its source in Him and flows from Him. Whilst thinkers like Button (2009, p8) remind us of ‘the idea that we might actually be partially responsible for fashioning and constructing the New Heaven and New Earth [it] is not a widely-held view in Christian theology.’ A helpful reminder is that the ultimate work of renewing of creation is in His hands. In tension with this, Button’s notion forces our hand that we must work alongside Him.

**Conclusion**

Environmental action, then, is not futile in the light of a balanced reading of 2 Peter 3. In fact, the idea that our efforts to preserve, restore and, at times, nurse our fragile ecosystems actually reflect a deeper understanding of mission from a holistic perspective. If we continue our lust after non-renewable energy sources, if we continue a blatant disregard for the suffering of our brothers and sisters in susceptible locations to destructive environmental forces, then we reveal our true eschatological understandings.

The early church sought to form communities thoroughly committed to living counter-culturally and resisting the pull of being serfs of the Empire. The church in the West must begin to seriously re-examine its allegiances. It must reject an ‘I-spy’ approach to ‘spotting’ the events in the Final Days in the style of Hal Lindsey and thinkers of his ilk have managed to do; instead we need to reject a Neo-Gnostic view of the physical world. The challenge is enormous, especially if some scientific predictions are correct in asserting that we may well be coming significantly closer to the tipping-point.

The hope of the resurrection and redemption of the physical world, including our physical bodies, means we can look forward to His return knowing ‘he will make all things new.’
References


Rossing, B.R. (2008) "Hastening the day" when the earth will burn?: global warming, Revelation and 2 Peter 3’ Currents in theology and mission, 35(5), pp. 363-373 <http://www.thefreelibrary.com/%22Hastening+the+day%22+when+the+earth+will+burn%3f+Global+warming%2c...a0186594230> [Accessed 24.01.2011]


Notes

[1] James Inhofe might be an environmentalist's worst nightmare. The Oklahoma senator makes major policy decisions based on heavy corporate and theological influences, flawed science, and probably an apocalyptic worldview, and he chairs the Senate Environment and Public Works Committee’ (Scherer 2004, p1)
[2] ‘I believe that global warming is an unproven phenomenon and may actually just be junk science being passed off as fact’ (Falwell 2006, p1). This seems (unsurprisingly) a bold and fairly arrogant statement

[3] Rossing seems especially concerned with the idea of ‘hastening’ but this need not be the case. The NRSV suggests ‘earnestly desiring’ and Peterson’s *The Message* uses ‘eager for its arrival’ which places the emphasis on expectation rather than intervention (Rossing 2008, p363)

[4] Heide notes that, ‘Justin (AD 100-165) was quite willing to accept a view of cosmic conflagration for apologetic purposes’ (Heide 1997, p48)

[5] Isaiah 34:4; ‘The heavens above will melt away and disappear like a rolled up scroll. The stars will fall from the sky. Isaiah 66:16 ‘The Lord will punish the world by fire and by his sword’ (NLT)


[7] ‘Passed on’ is more common in South African English, denoting death as a move to some other destination

[8] Here again, it matters little whether the new universe is a renovation of what already exists, or is newly-created’ (Kwame 1988, p36)

[9] Revelation 21:3b; ‘Look God’s home is now amongst his people!’

[10] See Piper, J. (1982), *What sort of persons ought you to be?* 2 Peter 3:10-14, for a moralist perspective

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