

The Journal of the Christian Engineers' Association

CEA Perspective – Summer 2007

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Editorial

John Baden Fuller

Following David Kay's appeal in the last issue of *Perspective* he has put together for us a combination of articles which look at various aspects of environmental issues and sustainability. He deserves our thanks for all his hard work. We are particularly pleased to receive a contribution similar to that from Tony Fletcher. It is good to have a contribution from a CEA member and, when he voices approval of our Journal, then we are doubly pleased. Tony Fletcher comments on environmental issues such as population growth and alternative sources of energy. At the time I write this, the government has announced that it is considering approving the construction of new nuclear plants. If we move about the country we cannot but notice the new wind farms with their gigantic wind mills. Tony mentions tidal schemes such as the Severn River barrage and David Kay offers a contribution with some details of the Morecombe Bay barrage.

We shall need more generating power in this country soon and we have various options. Renewables, nuclear power, gas-fired and coal-fired power stations are all being considered. Renewables are kind to the environment but can be expensive and are sometimes unpopular locally. They also only provide power intermittently. Nuclear power does not contribute to global warming but there are concerns about safety and waste disposal. Gas and coal powered generators both contribute to global warming. However, the last two can be built relatively cheaply and quickly whereas nuclear and tidal barrage schemes take a long time and are costly. Fifteen years ago we featured a number of articles in our Journal discussing the necessity of using nuclear power generators to relieve our energy needs. We also discussed nuclear safety. I wrote an article pointing out that we were not necessarily going to run out of raw materials, based partly on God's goodness, but also with the evidence that change of use reduces the requirement for scarce resources. For example, in telecommunication circuits relatively scarce copper is being replaced by glass fibre using one of the most abundant elements on the earth's surface.

The Mystery of Salvation

John Baden Fuller

It is appropriate that we think about the basis of our faith and our relationship with our God and saviour Jesus Christ. If we are to act as effective ambassadors of the gospel we need to understand the basics of our faith. Christianity is an historical religion. The Bible is an historical record of how God revealed himself to mankind throughout history. It is a record of God's gradual revelation of Himself to mankind. A record of how people have understood what God wanted them to do and what was happening to them. The Bible is a progressive unfolding of salvation in which God's purpose is steadily accomplished.

The reality of evil

God's good creation has been disrupted by evil, but evil is not inherent in the nature of creation. However the possibility of evil has to be there for freewill to exist. Damage has been done which needs to be repaired. Going right back into prehistory, whether we believe the stories to be folk tales or not, human beings, who were created as morally innocent creatures, chose evil. We all know the story of Cain and Abel. Among the descendants of Cain was Lamech. His attitude shows us that mankind appeared to be living in a state of anarchy at the time (Genesis 4v23-24). As far as we are told, only one family was anywhere near faithful to God. Everyone else was rampantly evil. Noah was chosen to give mankind a new start. But even after that, we didn't appear to be much better. Then God chose the Israelites to be a shining beacon of righteousness in the world, but still evil, or disobedience to God, kept breaking through. Even since Christ, evil continues to be rampant in the world and is certainly not absent in the Church. We need to be saved!

Save/Saved/Salvation

The word group 'save' holds various nuances of meaning.

- the idea of *rescue*, when the fire-brigade saves people from a burning building or when a lifeguard saves a drowning man.
- the idea of *restoration* as when we are given something which we believe we had lost.
- the idea of *healing/wholeness* as when something is re-created into what it was meant to be. The easiest example is when English Heritage restore a ruined building to how it was constructed and so *save it for the nation*.

Your faith has saved you, is equivalent to, your faith has healed you.

There is a problem, because in society we no longer accept that there is a *power* beyond human *power*, or a *reality* beyond human *imagining*. We do not accept that there is a *reality* beyond human *control*. However, much folk religion still exists and many people still accept God as creator, Jesus as the Son of God, the efficacy of prayer or meditation, and adherence to basically Christian moral values.

We need to assess how our message can be conveyed and lived out in a society in which transcendence is no longer part of the common currency, a society where there is no sense of shared human peril and no common quest for salvation?

Sin in human beings has direct consequences for God's creation. In its fallen state, creation itself is also sinful and less than perfect. Since sin is a misuse of power, mankind living within this creation will make it subject to a wrongful exercise of that power. Consequently, creation will bear the marks and scars of mankind's defective stewardship. Not only will mankind fail to fulfil God's purpose, but His creation will be dominated and shaped by mankind's sin.

God's Plan for His Creation and People

As we consider the God-giveness of the whole created order, despite the reality and awfulness of sin, we assume that the world is basically good. However, the world and mankind are in deep trouble. Sin and death do not represent the creator's best and final intention. God's aim is to reclaim and restore created order. Jesus is the one who came to deal with the root of the problem.

The wrong in human life is due to the lack of God's presence. Life without God is meaningless, leading to evil, tragedy and death. *Sin* is our propensity to selfishness which God must oppose and condemn as evil. We become alienated from God. *Suffering* is the meaningless tragedy of life. We sense that God has turned his back on us. *Death* is the fate of the godless to perish without God, and the fate of the godforsaken to die alone. The deepest horror of these depths is the absence of God. When we face this, we recognise that in its deepest dimension, the human plight is *alienation* from God. God, in Jesus, came to save us from all this.

The Incarnation

Jesus' human life is the completion of the divine plan, and not merely the fulfillment of what went before. The New Testament sets out to prove to the Jews that Jesus and the Spirit were the climax of their history, the ending of their story. The incarnation was the completion of the long divine plan. God entered into His creation in a new way. God did something new. Jesus' story is not just the logical outcome of the Old Testament. God surprised his people by coming as a person and dying on a cross.

Proclamation of the Kingdom

Jesus' proclamation of the kingdom of heaven was an announcement to Israel that her story was reaching its conclusion, but it had an unexpected end. Only those who join Jesus' renewal movement will constitute the *new people of God*, who will be the beneficiaries and thus the agents of the kingdom.

The cross

The cross was the supreme achievement of Israel's God returning to Zion to deal with his people's sins and their consequences. It was the completion of Israel's covenant history. No-one can fully understand how the cross rescues mankind from sin and death and brings us close to God. Salvation is experiencing the mighty acts of God in ourselves. Somehow or other Jesus takes the sin of the world from us onto Himself, and offers everyone life, forgiveness and the indwelling of the Holy Spirit.

God did this in the crucified Jesus. He enters our situations and makes our plight his own. In His life, Jesus identified especially with those who were rejected by society, the very sick, destitute beggars, lepers, outcasts, notorious sinners. He died *forsaken*. His death symbolises God's verdict on sinful humanity. We are condemned to die, but Jesus chose to identify himself in love with us so that we need not die. Since Jesus suffers the absence of God, no one else need do so. For the guilty, there is forgiveness. The cross does not remove suffering, but heals its depths by overcoming the absence of God. Since He died our death, His resurrection can be ours.

The resurrection

The death and resurrection of Jesus is the event through which the world is redeemed. The story of Jesus is the climactic moment in the story of Israel, and offers itself as the focal and redeeming point in the story of the world.

Human failure frustrates the purposes of God and prevents a full relationship with him, but God begins to restore that relationship with us on a new basis in Jesus Christ. God does not ignore human failure but puts it right in Jesus. The only question left for us to decide is, will we then accept His proffered relationship of blessing? We have to accept and believe that God wishes to do, and is able to do, what He has promised. Our own obedience to God, becomes an expression of our gratitude to God, who in Jesus has done everything on our behalf. This brings us into a right relationship with God.

As we come to realise the depth of our sinfulness or depravity, we feel: how can I be forgiven? Our longing to say sorry becomes increasingly incapable of realisation, the more we understand how far we have departed from the plan God intended for our world. But Jesus stands in for us. His perfect life makes perfect amends for us. His life empowers our feeble efforts at amends and transforms them. God the Son became one of us to stand in solidarity with our mess and was able to offer to God a life of perfect obedience and thus make perfect amends.

The Holy Spirit

The gift of the Holy Spirit was to create a community of renewed humanity, still subject to sin and death, but with the sure hope of sharing the resurrection of Jesus Christ. The church is the agent of salvation that transforms the world.

New Life

The Christian understanding of *life* means a loving relationship between God and people. Such a relationship exists when God abides in us, and we in Him. It creates peace between us and God and mediates peace to our environment. Salvation occurs when we not only receive forgiveness, but we also receive into ourselves He who forgives. So deep is the alienation that God is not to be found by us unless God enters our world and finds us. As the creed says, He descended to the dead.

The New Testament writers see the redemption achieved by Jesus as the victory of God over the power of sin and evil. The forces of evil are powerful, dominating and deceiving. Despite this, the redemption achieved by Jesus is the definitive victory of God over the power of sin and evil. At the cross, death seems victorious. Jesus enters the realm of death and darkness, sharing to the full our human destiny. God bears our pain by suffering with or for us. God is present in our darkest affliction. He shares our pain, bears our sorrows, and sustains us through everything, creating good in spite of evil. So he reveals the true nature of divine power as showing mercy and pity. In Jesus, the rule of God is present and God's kingdom comes. For Jesus, death is not the end. From death, He is raised in triumph. Christ's victory overcomes the world so that Christians are those who are called to live in the power of that victory.

Receiving the Gift of Salvation

In the Bible and subsequent history, there are a number of useful images of the atonement:

- ransom from slavery.
- victory over supernatural powers.
- sacrificial victim.
- deliverance from bondage in Egypt.
- restoration of health
- restoration of sight from blindness
- reconciliation with enemies.
- bringing new life to birth.

Forgiveness is always accompanied by, and perhaps only properly comes through, a simultaneous

discovery of the depths of one's own depravity. The initiative at every stage is always God's, not ours, but God carries us no further than we assent. The primary stress is not on our own faith or on our own works, but on the gracious initiative of God. The course of events in the present world can be changed by God acting in various ways, including action through human agents. That is where Christians are able to make their contribution.

Conclusion

We can summarise.

- God does not offer salvation without sacrifice.
- salvation was effected through Jesus Christ's sacrifice of himself.
- the salvation that God bestows through Jesus Christ is available for everyone.

God's design is beyond our comprehension. God's promise is for everyone and everything!

- it is for this life and not only for this life.
- it is for persons individually and also for the communities and nations of the world
- it is for humanity and also for the creatures with which we share this planet
- it is for our world and also for the vastness of the universe.

Our Choice

Let us so place ourselves within God's purpose that we may make our contribution to that purpose and expedite the coming of His kingdom and purpose on earth as it is in heaven. There is a sense in the Bible that God has chosen us. Many Christians looking back on their lives have a sense of inevitability that they became Christians (Jeremiah.1v5). The words *fore-knowledge* and *election* imply a relation to individuals who believe, and a divine control of the steps leading up to their becoming Christians (John.15v16).

God is love and God made a creation with beings capable of loving. In creating the world, God chose to give human beings freedom in such a way that it becomes possible for them to choose to rebel against him. God valued that choice more than the production of mere automata who always obey the divine will. God wanted us freely to choose to love him. He risked a world that would reject Him.

In human terms, *election* and *freewill* appear to be incompatible, but this is just one of the many paradoxes in the Christian faith. Election gives us confidence that we are in God's care and protection. He will not let us go. Freewill gives us an incentive to work to bring others to faith in Jesus Christ. This is a paradox we must accept by faith.

The Bible teaches the judgment and final destruction of unrepentant sinners. In the Old Testament, this is portrayed as the condemnation of all those outside God's covenant relationship with his chosen people. In the New Testament we have the teaching of the righteous judgment of the living and the dead. For those who have rejected Christ, there will be irretrievable loss. For Christians, there will be an assessment of their stewardship and the giving of rewards for faithfulness.

Grace

There is a very strong strand in the New Testament that we are saved by grace alone and that there are no works we need to do to effect that salvation. All we need to do is to accept Jesus Christ and all that he has done for us. However, there is also Biblical teaching that once we have welcomed Jesus into our lives, our attitudes and actions change so that we show forth our salvation by what we do. When we accept Jesus, we are filled with the Spirit, and the fruit of the Spirit grows in our lives. Unless we show some evidence of the outworking of that fruit, our claims to be Christian are suspect.

We are also told to work out our own salvation. The law of liberty indicates that we, by the outworking of the Holy Spirit, automatically fulfil the requirements of the law. This is just another paradox in our understanding of the Christian faith.

Jesus came to show us the way and to save us from our evil inclinations. We need to let Jesus work in our lives and personalities, to make us holy people, worthy to be in fellowship with God. As the writer of the letter to the Hebrews says, we need faith that God will purify our hearts and intentions, that through faith in Jesus, He will forgive all our wrongdoing and make us worthy to have fellowship with God. Then, we need to get out into the world. We need to infiltrate our society and purify it for God.

The wrong issue?

By Tony Fletcher

Introduction

Perhaps like me you have noticed the appeals for contributions in recent issues of *Perspective*. I have never offered an article before as I felt I did not know enough about any particular engineering subject, and that there always ought to be plenty of other people who were experts in their field and good Christians as well, that would be able to provide interesting contributions. I am still convinced that this is true! However, in view of the recent appeals and lack of material I felt I ought to try to contribute something having enjoyed reading *Perspective* for many years now and I hope that by doing so I will encourage others who do not feel well-qualified to make some form of a contribution. As I began to think what I could write about, a few ideas came to me. They are somewhat loosely connected. I hope overall you will find something of interest and, more importantly, something that perhaps provokes you to challenge or elaborate on. You too can then make a contribution and develop the arguments and information-sharing, perhaps leading into some form of action or at least some form of influence on those that can take action.

Environmental Issues

Some time ago on television I heard a Christian from a particular group apologise for becoming active on environmental issues late in the day, after it had gained secular popularity in the United Kingdom. It struck me that that may well have been true for himself and his group, but we have no excuse if this is true, because we have had our prophets calling us to wake up for many years. Francis Schaeffer wrote several books promoting Jesus and Christianity to the people of the culture of his day, and also for Christians interpreting present-day culture to them. I must confess that I heard of these books while at University in the late sixties and early seventies but never found time to read them. The only Frances Schaeffer book I read was called 'Pollution and the Death of Man'¹, which expounded a Christian view and a proper regard for ecology. In those days, more the thirty five years ago, climate change was not a recognised issue, but the effect that industrial development was having on the environment was at least partially appreciated, particularly the effects of acid rain on forests and historic buildings and sculptures and the loss of species. Frances Schaeffer, in this short and readable book of only 86 pages, called Christians to take a biblical view of ecology and to be active in promoting the well being of the world, as well as the welfare of people. So as the Church we have no excuse, because we have been given 'prophets' who have brought the issues to our attention.

Limits to Growth

Something else that influenced me in my university days was a report by the 'Club of Rome'² published in 1968 called 'Limits to Growth'. I must confess that I did not read the treatise itself, but at the time I did read various articles about it and see various graphs. The models and assumptions that they used have proved to be somewhat inaccurate, but I think their underlying message remains true. The world's resources are limited and some of the resources that we rely on are finite and will run out at some point in time. This particularly concerns oil and gas but also includes metals such as copper. For instance, I have heard it said that there is not enough copper available for us all to run electric vehicles using present technology and at the present population size.

Population Growth

As I recall the basic message of the 'Club of Rome' was that population growth was really the number one issue. If the population of the world remained small, then there would always have been enough renewable resources particularly food and water, and finite resources such as oil, gas, coal and metals to go round, but if the population continues to grow exponentially then there will come a point when the finite resources will start to become scarce and their price increase. Likewise there will come a time when we are unable to feed and provide enough drinking water to sustain the population of the world. Thus the 'Club of Rome' was warning about a possible doomsday situation where large sections of population would be malnourished and underprivileged and therefore there was a great likelihood of social unrest. The population growth could start to limit via some unpleasant mechanisms.

Population limits!

Perhaps in reaction to this line of thinking I understand that China has had a law for some number of years limiting the number of children per family to one. I do not know how long this law was in place for, or how successful it was. Perhaps someone would like to contribute information on these points. My suspicion would be that the law may have had some effect on reducing population growth in China but would not have stopped the growth altogether and would also have created hardships for many families. Personally I am not convinced direct laws and legislation such as tried in China are an appropriate or effective way of controlling population. From what I have heard and learnt so far, I understand that providing a good living environment is the most effective way of reducing the pressure for families to have large numbers of children, though in some cases the reasons for having large numbers of children in the family may have become enshrined in the culture as well as practicalities, and therefore will take some time and education to change. This may be a controversial point that others might like to think about and contribute on, but I currently feel that the continued population increase is actually the number one issue confronting world society.

Sustainable Energy Sources

This links to what I think is the second most important issue and that is the ability to provide adequate food and water for everyone throughout the world, and to provide a good quality of life for everyone. Providing a good quality of life will in general mean the consumption of finite resources such as metals and energy, generated from fossil fuels at the present time. Therefore I think that a subsidiary issue that we should be thinking about and tackling is indeed how to replace the current finite resources that we use to produce energy with sources of energy that are sustainable.

Use Tidal Power

On this last topic one of the ideas that has fascinated me for many years, partially because I lack the knowledge to really understand it's advantages and disadvantages (!), is the possibility of using tidal

power to generate a significant amount of the energy that the United Kingdom consumes. It was in the early 1970s when I was acting as an assistant on an Open University Technology Foundation (T 100) Course Summer School at Bath University that I heard about plans to build a big barrage across the entrance to the River Severn down river from Bristol. This would have been a big industrial undertaking taking about 10 years to complete, I think the estimate was, but would have generated a considerable proportion of the UK electricity requirement.

Severn River Barrage

I think I recall that there were in fact two potential schemes one for a smaller barrier more upstream which as a consequence would have generated less energy, and a second for a longer barrier more downstream that would have generated a larger amount of electricity. To the best of my current knowledge this scheme was never taken forward and I would be interested to know the reasons why.

Was it due to environmental concerns which nowadays might be outweighed by the greater climate change concerns that we have? Were there technical/Civil Engineering problems that meant the project was too risky? Or was it just that no one would fund the project due to its long payback period? Again if anyone is able to contribute information or further thoughts and ideas on this topic I for one would be interested. It seems to me that tidal power has great potential for producing a large proportion of the energy needs of United Kingdom and some other localities.

Multiple Tidal Schemes

One thing about tides is that they are fairly predictable. A tidal power scheme will generate power four times a day for a few hours depending on the details of the scheme, and the time of this generation will change from day to day, but in a predictable manner. If a number of schemes were to be built in different locations around the coastline then tidal schemes could be producing energy for most, if not all, of the day as the timing of tides varies around the coast in a fairly predictable way and therefore locations can be chosen to take best advantage of this. This seems to me one big advantage of tidal power over many other forms of renewable energy, which cannot be guaranteed to be present all the time and are subject to random variation as to when they are available. This includes solar, wind and even wave power (although with wave power there may then be a certain minimum power generation that can be relied upon with high probability).

Upper Loch Linnhe

Last summer I and my family spent a week of our holiday at Corpach near Fort William, which is at the head of Upper Loch Linnhe. It struck me that Upper Loch Linnhe, a tidal sea loch, could make an ideal location for a full-scale pilot tidal generation scheme. It is about nine miles long by a half to one mile wide and also has Loch Eil connected to it around the corner. At its southern end it naturally narrows at the Corran narrows thus minimising the size of the barrier that would need to be built.

There is some boat traffic both local fisher folk and pleasure boating, and also boats coming from and heading to the Caledonian Canal, one end of which is at Corpach. Thus a lock would have to be incorporated but this could be left open during the four periods of slack water a day which would also allow the movement of fish and other sea life between upper and lower Loch Linnhe.

The schemes that I am suggesting (and inviting comment on) are tidal barrage schemes which involve building a dam with generators in. I suspect that tidal barrage schemes would be much more expensive (in initial capital cost - relatively cheap thereafter) but generate a lot more power than a tidal stream scheme in the same place, which conversely would be quicker and cheaper to build and get operating, but generate much less power.

Summary

To provide sufficient energy for everyone, I feel that we need a mixture of big and small measures. I am not completely opposed to nuclear generation, but I am not convinced that that is now the best option given the possible alternatives and the known problems with decommissioning nuclear fission plant. At some time in the future nuclear fusion might become a practical contributor. My favourite for countries like the UK which have rivers and a coastline is wave, tidal and hydro, as evidenced by my thoughts above. So called 'clean' coal powered stations may also have a significant part to play for a while as I understand that there are still substantial reserves of coal left. I am sure that smaller scale schemes also have a part to play, such as wind, solar and energy saving measures. I have tried to do my bit by having water heating solar panels on my roof for the last fifteen years or so!

Conclusion

In conclusion I would say that it looks like significant climate change and its effects will happen, and we should prepare for it. This climate change may be, in some part, due to the generation of excess carbon dioxide and other greenhouse gases, although I have noted a recent TV programme which reported on the view of some scientists that this effect is actually quite small and that the real underlying driver for the climate change that is indeed happening is a slow variation in the activity of the Sun. As a Radio Amateur I am familiar with not only day and night and summer and winter effects of the Sun but also the eleven-year cycle that affects radio propagation. Thus I find it easy to accept that there are other cycles that affect the activity of the Sun and that these may well have an effect on our longer-term general weather patterns just as the short-term interactions between the Sun and the air affect our short-term weather patterns. Thus concern about carbon dioxide and other greenhouse gas generation may not be wrong, but may not be the best.

Encourage development activities

I feel that the number one issue that we should be addressing is the continued increase in the world population and that the way to tackle this issue is by development activities, such as those of Tearfund, Christian Aid, Oxfam, trade justice and the like. We should study the reasons for continued population expansion and extol the virtues of stabilisation and even contraction. The consequential issue is the limitations on some of our resources and the replacement of these with sustainable resources. As a side effect, or as the criteria for acceptability, the way in which we replace limited resources with sustainable resources should also reduce, or eliminate, carbon dioxide and other greenhouse gas generation. The third issue in my current view is looking after our environment. In preparing to write this article I did re-read the first few pages of Francis Schaeffer's book and I would now like to read the remainder again. I take his point that looking after our ecology, our environment, is biblical, and I think is what Jesus would want from people who know Him and have an interest in, and knowledge of, engineering topics that can contribute practically.

Tony Fletcher made a commitment to Christ early in life. He is married with two children, qualified in electronics, and his work experience includes telecommunications, systems and information technology.

1. Pollution and the Death of Man – The Christian View of Ecology, Francis A Schaeffer, 1970, published by Hodder and Stoughton ISBN 0 340 12601 9.
2. Looking on the Internet, somewhat to my surprise, I found that this group still exists. Their web site is at www.clubofrome.org and <http://esc.clubofrome.org>, and you can read something of the history of the group at http://en.wikipedia.org/wiki/Club_of_Rome. Further references and commentary at <http://dieoff.org/page25.htm> and www.abc.net.au/science/slab/rome/default.htm. (These are the references that I found easily. There may be better ones.)

Morecambe Bay Tidal Barrage Scheme

David Kay

The idea of a bridge across Morecambe Bay has been around for some time. Some points picked up “live” in a lecture in Manchester in April 2007 should be of interest.

The proposed project would both generate a considerable amount of renewable energy, and also provide a much needed link between Heysham and Barrow-in-Furness. The regeneration of some deprived areas is another positive feature of the project. The bridge would be the world’s first “green bridge”. However, the project has also faced opposition because of the significant potential threat to the natural environment. Some technical details follow.

1. The current installed generating capacity in the area is about 2200 – 3000 MW (8640 MW for the Severn estuary).
2. The proposed project would have a capacity of 200 MW.
3. The mean tidal range is 6.2m (7m for the Severn).

Vertical-axis tidal turbines are proposed – a design that should not mince up any wildlife that gets caught up in the works. Leading-edge research is being undertaken about the performance of turbines in arrays. The effect on the Irish Sea of the installation would be such that the full height of the tide would still be reached.

An environmental impact assessment is essential in such a sensitive area.

The start of building works could be 5-6 years away.

There was no hint in the lecture that inspiration from the gospel of Christ lay behind the idea, but I feel that Jesus would have an approving smile.

David Kay is a CEA committee member and assistant editor of Perspective

Sustainability – an Overview

David Kay

Climate Change

The Stern Review, published by the government last year, focused attention on the economics of climate change. Since then, the concern about sustainability seems to have gathered quite a lot of momentum. It is not clear whether engineers are taking the lead on this matter. Some information of general interest is given below.

Stop Climate Chaos is a growing coalition, which contains most of the UK’s leading environmental and international development organisations as well as women’s organisations, activist groups and faith-based campaigns. It aims to build irresistible popular pressure on politicians to act to halt climate change. When viewed (see www.stopclimatechaos.org/about_us/9.asp) on April 9, 2007, there were 52 participating organisations.

Another useful source of organisations providing environmental resources is the website www.ecen.org/oldsite/resourc3.shtml.

Some Christian Organisations

The following paragraphs provide a very brief summary of what a few organisations are doing.

Christian Aid has launched its own campaign, and has produced a report on climate change. This report states that the government's claim that the UK's carbon emission is only 2% is wrong.

Tearfund is very interested in development issues around the world, and has published many items (see <http://tilz.tearfund.org/Publications>). A discussion paper on sustainable production and consumption was produced in July 2002.

Bible Society is also very interested in development issues; a short report on Christian stewardship and energy sustainability is worth reading, see www.biblesociety.org.uk/exploratory/articles/horelacyautumn06.doc.

Operation Noah is a project of the *Environment Issues Network of Churches Together in Britain and Ireland and Christian Ecology Link*, and is running the churches' climate change campaign.

A Rocha is an international Christian environmental organisation. *A Rocha* projects are frequently cross-cultural in character, and share a community emphasis, with a focus on science and research, practical conservation and environmental education. *A Rocha* has issued a climate change policy statement. The telephone number for international operations is 020 8574 5935.

Eco-Congregation is an ecumenical programme helping churches make the link between environmental issues and Christian faith, and respond in practical action in the church, in the lives of individuals, and in the local and global community. 100 churches that have won awards for good practice in environmental stewardship are listed on their website (www.ecocongregation.org). It should be noted that *Eco-Congregation* operations in England and Wales are now organised by *A Rocha*.

The **John Ray Initiative** exists to promote environmental sustainability and to connect environment, science and Christianity. It is an educational charity, named after John Ray (1627-1705), who pioneered the classification of plants and animals. *JRI* places a high priority on working in partnerships with other individuals and organisations (including *Christians in Science*). *JRI*'s aim is to complement and contribute to the activities and outreach of the UK churches, and of inter-church groups such as the *Environment Issues Network of the Council of Churches in Britain and Ireland* and the proposed *Ecumenical Environmental Agency*. The president, Sir John Houghton, has recently produced a very detailed briefing paper on the topic of "Global Warming, Climate Change and Sustainability". He gave a Christian response on the topic of climate change during the Sunday Worship broadcast from Jesus College, Oxford, on February 11, 2007.

Secular Organisations

Environmental concern is not, of course, restricted to Christians, nor to the UK. Three examples of secular organisations involved in sustainability are given below.

The **Centre for Alternative Technology** in Machynlleth focuses on practical solutions to environmental problems. It has built up an exceptional range of services for people wanting to make their lives more sustainable.

Chalmers University of Technology in Göteborg, Sweden, aims to be a world leader in Systems Analysis of Technology and the Environment. The *Centre for Environment and Sustainability* is a network organisation promoting research and education for sustainable development (see www.chalmers.se/en).

The *Co-operative Programme on Water and Climate* aims to improve the capacity in water resources management to cope with the impacts of increasing variability of the world's climate (see www.waterandclimate.org/index.php).

David Kay is a CEA committee member and assistant editor of Perspective

Sustainability – Comment

John Baden Fuller

The first two articles in this Journal have touched on the topic of our relationship with the environment and how we can contribute to minimising the damaging effect we are having on our world. We now move to a number of contributions which discuss the topic of sustainability from differing viewpoints. Are we doing all we can to minimise the effect our actions have on the environment? Are we doing all we can to build artefacts that last longer and can be easily repaired? Does being a Christian make us more environmentally responsible than our professional colleagues? Your contributions will be welcomed.

Engineering the Environment & Social Entrepreneurship

Bill Kennedy

As a Christian I see the need for a social revolution in the way we use resources. Our consumer society with its throwaway mentality and its never-ending quest for economic growth is one that is on a crisis trajectory. The recent Stern report on climate change is a salutary wakeup call to our society and the world. Make amends **NOW** or face a future that will become increasingly unstable.

I have chosen in the title of this article to link engineering with the environment and social entrepreneurship. According to Wikipedia the definition of a social engineer is:

‘ - - someone who recognizes a social problem and uses entrepreneurial principles to organize, create, and manage a venture to make social change. Whereas business entrepreneurs typically measure performance in profit and return, social entrepreneurs assess their success in terms of the impact they have on society.’

In weaning our society from a consumer-led, unsustainable society there will indeed need to be social change – engineers should be at the heart of orchestrating and mobilising entrepreneurial principles to organise, create and assist in managing ventures to facilitate major social change. Schumacher, the founder of the UK's Intermediate Technology Development Group, coined the phrase ‘small is beautiful’. Our ‘small is beautiful’ future sustainable society will surely be based on developing much more local, sustainable communities that have less need for mobility – the personal mobility will be limited to human-powered vehicles (you might even call them bicycles!) and solar-powered cars limited to covering no more than 100 miles per day. The need for motorways will be limited owing to fast public transportation systems based on new fast track railways – possibly making use of the old motorways. International travel will be limited – at least for holidays – on the basis of one permit per year. Our throwaway society will be transformed into a conservation society in which products will be made to last. The transformation of our society will mean that our addiction for the

latest gadget will be transformed into a much more people-orientated emphasis in which our local communities are the places we find meaning and sustenance.

The purpose of this short article is to invite readers to share their visions of a future world. What I have mapped out above is a *very* brief initial scenario of my evolving thought on this important issue. It needs further input from others to set the ball rolling. Over to you!

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Sustainability – The Development Engineer’s Viewpoint

Dick Waller

Definition

The Oxford English Dictionary offers a number of definitions of “sustain”. The most helpful is “keep (something) going over time or continuously”. Hence I see “sustainability” as the inbuilt capacity of a structure, mechanism or process to perform as designed without significant deterioration, either in the inputs needed or in the effects of outputs on the users, their neighbours or their environment. These words are entirely mine, but I think most engineers, left to themselves, would come up with something quite similar. Ultimately everything we do, as engineers or simply as people, depends on the environment and has some effect on it.

WDWJS?

Consulting a concordance for references to “sustain” and associated words is at first sight a little disappointing because there are no references to “development” in the sense in which we are using it here, and certainly none to “sustainable development”. We do better to look from a different direction and realise that any “sustaining” done by man must use the resources provided by God. A reading of Genesis 1 – 3 and Psalm 104 shows that we owe everything to God and that, having created the earth and everything it, he *sustains* it all. We are constantly applying our knowledge to make changes which we perceive as beneficial, sometimes changing geography considerably. Sadly, we also get carried away by the excitement, and damage our surroundings (careless waste disposal), our bodies (industrial poisoning) and even our souls (unsuitable broadcasting and Internet use), but mercifully God ensures that at least some of our adventures turn out for good.

I suggest that sustainable development embraces those changes made by man which fit in with God’s creation. The well-known question WWJD? (What would Jesus do?) might be restated WDWJS? (What development would Jesus support?). Answers to the first question are invalid if they are incompatible with the Bible and I feel the same must apply to the second. Our past is catching up with us. The problem is the old one – sin. The Psalmist gets round to it in 104: 35 – “May sinners vanish from the earth and the wicked be no more”. The answer to WDWJS? is basically “development which is not sinful”.

An example from recent history

Now, let's look at an application of engineering which seems to be the ultimate in sustainable development. I'm referring here to the mobile phone. Those who have travelled in the developing world will be aware how difficult it can be to escape the mobile phone, even in regions which seem really remote. Why is it that countless quite simple things like hand-operated water pumps fail for want of a few pence and a bit of thought while a very advanced development like the mobile phone is kept going against all the odds? I think it has something to do with status and fashion. A person with status but no phone is by-passed in favour of those who can be reached more easily. There is also the feeling of power conferred by the ability to make people jump from hundreds of miles away. More than anything, of course, a mobile phone is increasingly essential in public affairs and business. The perceived benefits are enormous, and this, I think, is one reason why people who say they are poor will spend large amounts on one. By contrast, it seems pointless to lubricate a car which is apparently going well, or to worry about overloading a pick-up which hasn't yet collapsed.

Does this mean the mobile phone is truly sustainable? I fear not, at least not in the environmental sense: the materials involve mining which exploits the people who do it and those living nearby; safe disposal of unwanted phones has only just struck us as a good idea, but certainly isn't a universal practice; more and more power is needed at more and more remote locations to keep the transmitters working – the chain of relay stations along the Nairobi-Mombasa road has disfigured the landscape and needs a lot of maintenance. While all this has been happening, the level of service and reliability of "old-fashioned" landlines has dropped, partly because the income to keep them going has diminished.

Although the mobile phone has, as one of its positive results, made it easier to keep in contact with CED personnel in the field, great care is needed when new technology is introduced in the developing world to ensure that it is truly sustainable.

Durability in the water supply industry

Durability is another important aspect of Sustainability. Unless systems are made as durable as possible, we are wasting energy and other scarce resources and contributing to the throw-away economy. Within my own field of engineering (water supply) the water must be drawn from a source which can withstand its loss (bearing in mind downstream consumers, including the environment), must be and remain potable as it enters the distribution system, must not adversely affect the system components (corrosion, over-pressure, etc.) and must be supplied in the context of matching developments ensuring that the users know how to use it, keeping it clean and dealing properly with the health and sanitation problems that arise from availability of the water. All this raises questions about

- source selection;
- intake design and location;
- supply of power for any treatment and pumping;
- appropriate location and management of treatment works and other plant;
- assured supply of any necessary fuel and chemicals;
- correct disposal of arising wastes such as sludge from clarifiers;
- proper alignment and material choice for pipelines with provision for their maintenance;
- suitably trained staff and provision for replacing those who retire or leave for better jobs;
- efficient revenue collection and management, etc.

Two short pipeline case-histories will illustrate what I understand by durability:

1. In East Africa, the pipeline delivering raw water from a dam to a treatment works 5 km away was laid in PVC pipes of 600 mm diameter on an alignment which was virtually level. Usually a pipeline is laid in saw-tooth fashion with rising and falling sections so that air and other gases escaping from solution can accumulate at the peaks and be vented by air-valves at appropriate intervals. On this occasion the fault was compounded by installation of a fast-closing valve at the treatment works intake. Operation of the valve created a pressure surge wave which ran up and down the pipeline, carrying with it the accumulated gas. The pipeline habitually failed under this treatment at a point where it had been laid under a heavily-trafficked road without attention to the effects of external loads.
2. In West Africa, a ductile-iron pipeline conveying treated water failed by collapse of the internal cement-mortar lining – a fairly standard feature of ductile-iron pipes which inhibits corrosion of the iron by aggressive water. The treatment process corrected acidity by dosing with an imported alkali. When foreign exchange ran short, a decision was taken by non-engineers to suspend the import of an apparent luxury and the lining steadily corroded until it lost strength and fell away from the pipe soffit.

Both these case-histories illustrate installations which were not durable, one due to faulty design, the other to economic changes outside the engineer's control. They were not durable in the sense that continued operation in the conditions forced on the operators saw the pipelines fail beyond the point at which routine maintenance could rescue them. I am sure many readers can think of examples in their own experience.

As we work to help others through our work in development we must be careful that we do not sloppiness or wrong motives spoil the effectiveness of the projects that we undertake. There are too many ways in which we can let the devil spoil the work that we do. Here are some ideas of some sins we can allow to get into our projects.

How sin can enter development

1. Wrong motives: does pride lead us to encourage development so that we can add it to our CVs and point to something achieved? Is God showing us the way, or are we tagging along behind the devil, placing more weight on the satisfaction of visibly helping the poor than on ensuring the best solution is adopted in face of a real need? (Sometimes the answer to an “engineering” problem lies outside engineering).
2. Wrong audience: do we talk only to those we find it easy to communicate with in our terms? Do we talk enough to the people we are trying to help, understanding properly what they *really* need and how far their *maintenance* skills can be stretched without breaking? Is God part of our conversations?
3. Wrong personnel: do we involve to the greatest possible extent engineers and technicians of the beneficiary community? Are we prepared to recognise that God puts engineering skills into other hands than ours?
4. Wrong approach: do we pray for guidance in project choice, definition, execution and USE? Are we guilty of the “We’ve always done it that way” syndrome?
5. Wrong relationship: having been part of a development, do we move quickly off to the next one, or do we maintain a relationship with the community concerned, returning in person or sending a local representative as and when we can to support them?
6. Wrong history: do we record the problems encountered in such a way that the lessons learnt will not be forgotten in another project to which they are relevant?

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Sustainability – Consumption

Richard Bourne

Acquisition

Going to B&Q terrifies me. Linger in the car park and watch people carry away huge amounts of natural resource crafted into patio heaters, ornamental gravel and chipboard kitchens. The feeling of watching the modern-day version of pillage is inescapable (especially, perhaps, in York where I live - the Viking legacy!). This time, though, it's not just a local community that's the victim. It's the world. All the stuff is loaded into cars and carted away for the enjoyment of its liberators. And this is just one B&Q on one day (typically, it's a Sunday too. I can remember when Sunday was a welcome break from all this). But how long can it go on? What if the whole population of China go for patio heaters in a big way? How can this level of consumption possibly be sustained?

Deterioration

Isn't this activity part of something bigger, though? Cliffs are continually eroded. Rock falls are unfaillingly downwards. Weathering rarely puts material back on. People use up that which is limited. Isn't this the natural world in all its facets consuming itself? The next cataclysmic event that creates new mountains will probably be the end for a sizeable number of us anyway. (According to Bill Bryson the Yellowstone Park caldera - all 9,000 square kilometres of it - is 30,000 years overdue to erupt on its 600,000 year cycle.) So why worry? Let's have two patio heaters.

Consumption

We humans, though, are a not really like that. Sentient beings with an unparalleled ability to craft things out of our environment for both personal and common good. Add the latent survival instinct (latent because a great many of us do have it rather easy these days) and we will tend to maintain our surroundings. Until that is we are moved to cater for the self. Somewhere along the way we began to crave possessions. Income just for food and shelter wasn't enough. Whatever was necessary, we wanted one. Then whatever was just available, we wanted that too. This has been a seductive process and, recognising that this is rather a big jump, my particular *bête noire* is the car.

The Car!

Whilst a private and instantly-available means of transport may sound like an unqualified Good Thing it does have its drawbacks. Whilst we now all have vastly increased "wealth" (whatever that may be but usually, for the avoidance of embarrassment to economists who may otherwise have to acknowledge people, it means "money") we now also have every man and all his family members each seeking to own roughly a ton of metal and plastic in which to move themselves around. We all demand places to keep it (if not a garage then the piece of road outside which is of course ours by right) and somewhere to stand it when we've used it to get somewhere (a sort of vast cloakroom equivalent which we expect others to provide for as little as possible).

Drivers!

It's not so much the car itself that I have trouble with, it's the attitudes the application of it generates in people. Nothing else seems to bring out so much aggression to channel, pride to be hurt, or supposed status to be flaunted or sought. It's an ideal way to demonstrate the belief that the rules aren't really for you. Excesses are demonstrated. And all this is fuelled by the Consumption Fanatics. We do rather let our fascination with this shiny gadget blind us to a lot of other socially-significant things. And others set out to blind us. Cars are relentlessly promoted through advertising and elsewhere as chic and sophisticated, a key to freedom and independence, an opportunity to go where you want when you want. Notice it's "want", not "need". We're generating those attitudes again.

The Car Dominates

Why do we allow this device such a place in our affairs? Is a car the only impressive piece of engineering there is? (Impressive here = extravagantly-appointed, sensually-styled, personally available and, well, excitingly dangerous...). I suppose the current truth is that it's probably about the most impressive thing any individual is likely to own, and there's the rub. When these things are being relentlessly marketed as though we're all completely inadequate if we don't have one, the disadvantages are not likely to figure highly.

Fundamental Questions

However, one very soon gets to more fundamental questions. Does ownership really deliver satisfaction (beyond the first proud driving-home of the new car)? What about all those worries about having it damaged, stolen, or perhaps worst of all, mocked? And the time we expend simply driving the thing around - surely the ultimate at one time was to be driven? But we have to feel in control - no waiting around for me, I've got a car. I'm in charge, I do what I want when I want. Until, that is, we encounter everyone else doing the same thing. Then we're stuck in the queue, behind the "idiot" in front, fuming, helpless and, yes, suddenly inadequate and feeling slightly foolish. Which makes it far, far worse.

Are we wrong?

We all know (except perhaps Top Gear *aficionados*) that this can't go on, but to admit we're wrong is the biggest challenge of all. It's obviously all the fault of the politicians, the town planners, Tesco's, the public transport operators, Aunty-Frances-for-living-in-such-an-out-of-the-way-place. It's nothing to do with our choosing to live where there are no bus routes, assuming we will always be able to drive 40 or 50 miles to work every day, or just needing to be seen in the company car as often as possible.

Conclusion

It really hurts to say we're wrong. It takes courage. To expect such admissions about the ownership and use of a device which has acquired such an emotional charge as the car is asking something. But it has to happen. We need some shifts of emphasis, and of values. It has to be good to save, to reduce, to eliminate. The Consumption Fanatics who currently drive advertising have to be curbed and the messages reversed – it's been done for tobacco, so cars next please. The advertising boys need to channel their efforts into promoting something sustainable. There's no shortage of challenge, imagination, danger if we fail, or downright necessity in solving the problems consumption has created. So why waste time on something that can't be sustained. There is huge vested interest around the car, but it won't be the first industry whose time has passed and which has had to come to terms with the fact.

Can we contribute?

Above all perhaps it needs some courageous leaders. Or perhaps a prophet. Someone who can make what needs to happen sound as though we've all just thought of it ourselves. To lead us each to challenge the assumptions about ownership and consumption, to open up ways of reducing travel. To be able to savour a short trip as much as a long journey. Turn water into wine.

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Sustainability of Organisations

John Baden Fuller

Dick Waller has contributed the following piece which discusses the viability of *Christian Engineers in Development*, (CED). They do valuable work and we are pleased to give their activities publicity. Perhaps God may be calling you to get involved. However, CEA is also in need of help. We have difficulty in finding sufficient members to join the committee. New members are desperately needed to help organise the activities of our association. Your chairman is well past retirement age and we need new people and ideas to revitalise your *Christian Engineers Association*. Can you help in any way? Please pray about this and pray for the committee members listed inside the front cover of every issue of *Perspective*.

CED's Sustainability

Dick Waller

I want to address the question of whether CED is itself sustainable. We also must ask WDWJS? (What development would Jesus support?) To keep going, we need the blessing of God, a sound Christian approach to everything, members who are capable of the work and available, projects to work on, funds to execute them and supporting engineers in the countries where we work. There is not enough space to look at all these, but I will mention the personnel who are the heart of the operation.

CED is a charity in which most of the members are student, practising or retired engineers of one or other discipline, their common interest being use of their engineering skills in the service of the poor. "Service" includes designing engineering works, either on behalf of a community or on behalf of another organisation seeking to help. In this we draw on our collective experience and on any useful knowledge that can be gleaned by consulting local engineers and other technical people.

After something in excess of 50 projects assisted over more than 20 years, CED is fortunate that it still benefits from the enthusiastic contribution of two founding Directors. With their help, we have been able to avoid some mistakes, but there is a big challenge ahead. Our Board is composed largely of retired engineers who, no matter how active they are now, will in time be less and less able to carry on. Our average age is over 60. We are badly in need of younger people to help carry the load. This is not to say we have no young members in CED: we do have them, but in the nature of things they are usually in full-time employment, often with young families, and cannot regularly attend meetings, let alone be available for overseas visits.

Thus we need ways of retaining and using past experience while working within the limitations. We have to find and involve in some feasible way the younger people we have in our membership, not forgetting those who are perfectly useful engineers already available in the beneficiary countries as citizens. The Board is now putting its mind to the rest – as yet there are no clear answers. One reason why we have membership of CEA is to have access to the views and help of other engineers sharing our hope in Christ. Please help us by:

1. Considering enrolment in CED (see our website: address below)
2. Mentioning us to others you meet who might be interested
3. Mentioning us to churches and other groups who are assisting the world's poor but have come across a technical problem which an engineer might help solve.
4. Praying for our work as often as you can (the website again)
5. Praying especially that we might find a sustainable way of developing our organisation.

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