The New University of Herefordshire:

Why it should be an Exemplar of Sustainable Development.

A Draft Discussion Document written by Richard Priestley, July 2014

Summary

There are many challenges and opportunities facing humanity in general and the people of Herefordshire in particular: some place specific, some universally shared. The formation of the New University of Herefordshire is a very exciting opportunity to help solve some of these local and global problems. The students leaving the new university will be entering a world very different from the past. They will need to be highly flexible with a good interdisciplinary education and a confident approach to working on complex multifaceted real world issues. The challenge of working out what is truly meant by 'Sustainable Development', and how to achieve it, will fall to them and their generation.

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1a, The Twenty-first Century: a time of flux

The opening decades of the Twenty-first Century are a time of profound and disruptive change. Climate change, ocean acidification, loss of biodiversity, myriad forms of pollution and a host of other interrelated macro level ecological challenges threaten humanities future. The global economy is dependent on a wide range of finite and rapidly diminishing resources. The world is urbanising at breakneck speed. Technology is rapidly changing people's lives the world over. New forms of social organisation, in part dependent on new communication technologies, are changing how people live and work, and how they perceive themselves and their place in the world. Extreme economic volatility seems to be a feature of this new economy. Economies in China and in much of Asia, Africa and Latin America are booming as much of Europe is in crisis. Socially, economically, ecologically and politically the world is in flux.

1b, The Anthropocene: the necessity of exiting the fossil fuel age

The last two hundred and fifty years have essentially been 'The Fossil Fuel Age'. Coal, then oil and gas, drove the industrial revolution that saw much of the world industrialize and urbanize. Life expectancy, rates of literacy, levels of prosperity all rose on this wave of technological innovation and productivity. Unwittingly humanity started having major impacts on the entire biosphere. Astronomer Royal Martin Rees said in his 2010 Reith Lecture "this is a crucial century. The Earth has existed for 45 million centuries. But this is the first when one species, ours, can determine — for good or ill — the future of the entire biosphere." Geologists now say we are in a new era, the Anthropocene, when for the first time in history one species is determining the changing composition of the atmosphere, oceans and soils. As Steward Brand said in his 2009 book, Whole Earth Discipline, "We are as gods and HAVE to get good at it". Our future and that of every other species on the planet depends on it. Planet management is now the central task for humanity.

1c, Managing the Planet to fit bio-physical reality

There are numerous bio-physical limits into which humanity must fit in order not to jeopardize its future. Planet management is the term used to describe the task for humanity to develop a future path that fits within these Biophysical limits. The best known of these bio-physical limits is atmospheric carbon dioxide, which now stands at 401 ppm and is still rising fast due to largely to our dependency on fossil fuels. Human civilization evolved in a relatively stable climate, one factor of which was a relatively stable atmospheric Co2 level that fluctuated only very slightly around the 285 ppm mark. Ideally we would get back to about 285 ppm, but 350 ppm is increasingly becoming identified as the safe upper limit. This requires us to not only cease carbon emissions but also to sequester past emissions. Carbon dioxide is only one Greenhouse gas, and climate change only one of many areas in which we are currently jeopardizing our future.

1d, The quest for sustainable development

Humanity's challenge for the Twenty-first Century is to create real Sustainable Development that manages humanity's affairs so as to bring our impact on the Earth back within these bio-physical limits. Gro Harlem Bruntland in 1987 defined this as "Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The word sustainable has become rather overused and often stripped of this deeper meaning. The quest to really discover what is meant by sustainable development, and to implement it, will be one of the defining themes of the Twenty-first Century.

2, The global situation: the opportunity of Sustainable Development

2a, Encouraging signs

In many ways things are getting better: life expectancy and literacy rates are increasing very fast, millions are rising out of poverty and a prosperous middle class is emerging in many countries. The innovation pipeline in the Cleantec sector is showing what can be done as new forms of low carbon energy are continually being developed and more energy efficient buildings, vehicles and appliances are manufactured. Full life cycle analysis helps us understand the

environmental impact of our products and services. Products are increasingly designed for full end of use recyclability and reuse. All this is not only good for the environment but good for the economy. Countries and companies, cities, regions and communities that best manage this transition from a wasteful fossil-fuel based economy to an energy efficient renewables based one will prosper, probably at the expense of others that fail to make the necessary changes in time.

2b, The solar revolution

If the last two hundred and fifty years can be characterized as 'The Fossil Fuel Age', the era we are now entering may well in future be called 'The Solar Age'. Many forms of renewable energy generation are undergoing rapid technological innovation, continued declining costs, and increasingly rapid deployment. Various forms of solar are perhaps the best exemplars of this process. In 2000 just 4 MegaWatts of solar pv panels were installed in the USA: by 2013 the annual installation rate had risen to 4,751 MW, more than a thousand-fold increase in thirteen years. Annual growth rates fluctuated from about 25% to well over 100%. Future projections are that exponential growth rates will continue as solar cells follow computer chips and are applied to an ever wider range of applications. We are familiar with roof mounted and ground mounted systems. An organisation called Solar Roadways are developing panels that can replace asphalt roads and car parks: if all such surfaces in USA were redeveloped it would produce three times total current American electrical consumption. Other solar technologies are being developed and deployed: field scale solar thermal systems in Denmark are feeding hot water into the nation's district heating systems. Concentrating solar power is now being deployed at scale and with thermal energy storage systems it is now the norm for such solar power stations to continue to produce electricity into the evenings or even 24/7. Also energy storage and transmission technologies are being developed at breakneck speed: increasingly renewable energy needs no, or minimal, fossil fuel backup, and this will certainly be the case in the not too distant future.

2c, Herefordshire's current energy economy

In Herefordshire we currently spend approximately half a billion pounds per annum on energy. This figure includes electricity, heating and transport across the various sectors; residential, commercial, agricultural and industrial. Almost all this money leaves the county and most leaves the UK altogether. This is a tremendous drain on the county's economy. Substituting locally owned and controlled renewable energy for this imported energy represents perhaps the largest single economic opportunity in the history of the county. My 2012 report 'Localising Herefordshire's Energy Economy' explored the most beneficial ways in which this could be done. In it I argued that we in Herefordshire should learn from examples of global best practice in this regard.

2d Learning from global best practice: Güssing

A careful study of global best practice shows many examples of communities, cities and countries that are cutting carbon emissions and reducing pollution in general while developing innovative cleantech economies and providing new opportunities for young people, amongst a broad range of other social, economic and ecological benefits.

In 1992 the Austrian town of Güssing (which has a population of 3,800, equivalent to Bromyard in a Herefordshire context) worked out it was spending 6 million Euros a year on energy and that this outflow of money was a drain on the towns finances. Unemployment and youth out-migration, as in Herefordshire, were features of the local economy. Over the last 20 years they have changed their economy from one based on imported fossil-fuels to one based on locally owned and controlled renewables, (for electricity, heating and transport) replacing the 6 million Euros outflow into a 15 million Euro locally circulating turnover. At the same time they've created over 1,100 new jobs and reversed the historic youth out-migration: exactly the same demographic impact that many wish to see in Herefordshire. Güssing has also cut its carbon emissions, increased its biodiversity and boosted tourism, all as part of the same transition. As with Güssing Herefordshire's key opportunity is in how it manages its energy transition, and on the success of this will ride many other indicators of success.

3, Herefordshire: the need for and purpose of a New University

3a, Hereford in historical context and the local need for a University

Hereford is an ancient city in the heart of a rural county. It has never had a university. Hereford grew over many centuries as the market town and central hub of the county of Herefordshire. Agriculture employed the vast majority of the population for hundreds of years. In the last century employment in agriculture has fallen from about 80% of the working population to about 8%. Manufacturing and services have to some extent filled the gap, but one of the defining features of Herefordshire now is that it has an ageing population. There are very few interesting, skilled or well paid jobs for young people and few opportunities to pursue higher education. Young people leave the area in droves and the majority of incomers are middle aged or elderly, resulting in an ever more skewed demographic profile. One aspiration that nearly everyone in Herefordshire seems to agree on is the need to create more opportunities for young people. The creation of the New University of Herefordshire is seen by many as one of the best ways to make this happen. Fostering the local development of innovative cleantech start-ups closely allied to the research specialities of the University will be critical. Herefordshire already has a relatively buoyant small and medium enterprise sector with which collaboration could be mutually beneficial.

3b, The New University of Herefordshire: Challenges & Opportunities

The New University of Herefordshire's website makes it clear that the growth-focused economic regeneration of Herefordshire is a key goal, and that the establishment of a science and engineering focused university is a key aspect of this wider economic agenda. However we know that if that economic growth pushes us closer to the bio-physical limits of the planet it will further jeopardize the continued existence of our species. I have previously argued that transforming the energy economy of the county from one based on imported fossil-fuels to one based on locally owned and controlled renewables is the greatest economic opportunity in the history of the county, and an outstanding opportunity to create an exemplar of combining economic growth with rapidly reducing environmental damage. Globally investment is flooding into the renewables and Cleantec sector and innovation in this sector is happening at breakneck speed. The New

University of Herefordshire should place itself at the centre of a locally focused Cleantec revolution.

Working in conjunction with European Bioenergy Research Institute at Aston University we could develop the commercial scale roll-out of algal bioreactors suitable for a farming county such as Herefordshire. We could work with the Solar Roadways team to develop solar electric road surfaces. These plus hundreds of other cutting edge applications of renewable energy offer tremendous opportunities to be early entrants to rapidly growing global markets.

3c, The New University of Herefordshire: Curriculum & Pedagogy

Training a new generation of students capable of taking leading roles in this rapidly changing economy will be the task for our new University. The focus of the University in offering 'Liberal Sciences' degrees utilizing an interdisciplinary approach that draws on both the natural and social sciences to find meaningful answers to complex real world problems has excellent potential, and it is what humanity desperately needs. The question proposed for the initial pre university summer school set for 2016, 'How do we feed the world in the face of a growing population, increasing urbanisation and climate change?' is a very good example. In traditional universities this would be dealt with in different departments, with for example the life sciences focusing on the potential of genetic engineering, a social sciences department focusing on the role of conflict, political exclusion and economic inequality, and perhaps an engineering department focusing on the potential of Seawater/Saltwater Greenhouses, automated hydroponics and vertical agriculture. Students equipped to look in the round at complex real world issues, to question conventional wisdom and to write and speak about their ideas of possible solutions should be good for the students themselves, for potential employers and for the world at large.

In March 2014 the Pedagogy Group published a two side document 'New University of Herefordshire – A new pedagogy for complex world'. I could not improve upon it. It states that 'the NUH aspires to develop a more rounded graduate who blends complex technical know-how with highly developed social skills in order to lead in solving future challenges'. Rather than repeat the

document in its entirety I suggest that this essay be read in conjunction with that document. The key point I wish to make in this essay is to make the case for Sustainable Development to be at the heart of everything that the University says and does, including its curriculum, pedagogy, its ethos, where it seeks to find and distribute its funding and resources. Humanity does not yet know how to bring its economy and civilization back within the bio-physical limits of the planet. It is of existential importance that it finds this out, and even more challengingly, implements it. Of course this will be a highly complex and evolving process that no one person will be in control of, but the critical point is that the university and its students need to find their place in this process.

3d, The New University of Herefordshire: The Greening of Universities

Universities have a considerable environmental footprint. This is coming under increasing scrutiny. One example of this is People and Planet's Green League Table[1], which most UK universities now participate in. Students considering where to study now frequently want to study within institutions that not only are consciously striving to minimise the damage they do but also actively pioneering ever higher standards. Most of Herefordshire's competitor universities are trying to add-on environmental sustainability criteria onto established institutions with all their existing buildings, policies and culture. They have a lot of inertia to overcome. Starting a new institution gives many opportunities to leap-frog the competition. This has many implications for the New University of Herefordshire even before it opens its doors to the first students. The early appointment of key staff with a passion for this agenda will be vital. The financial investments and funding streams, procurement policies and practices, energy suppliers and energy use, environmental auditing and management will all be up for scrutiny. Scrutiny of the curriculum and pedagogy will increasingly be made from the perspective of macro level ecological sustainability.

3e, The New University of Herefordshire: Making it Relevant to the Real-World

One valid criticism of many British universities has been their 'ivory towers' isolation from real world issues. Historically science and engineering was great at doing the early stage research and less good on the development of concepts into

commercially viable products. Now there is huge emphasis globally on connecting science based innovation to business start-ups. This is particularly strong in the solar field, where for example the new start-up Oxford Photovoltaics[2] emerged from the physics department at Oxford University. Collaboration aimed toward commercialization can also come from two existing partners, with Global CSP and Cranfield University currently pioneering what may become a significant breakthrough in the exponentially growing field of concentrating solar power.[3] Olin Collage in USA is a fine example of an institution pioneering closer ties with real world problem solving, and the fact that the New University of Herefordshire has strong links with Olin Collage suggests that we locally will at least not be stuck in some remote ivory tower: the key challenge will be can we bring our emerging expertise to bear on the most crucial issues of Sustainable Development, and do it in such a way as to create numerous new businesses?

3f, The New University of Herefordshire: Its Buildings

Many universities around the World are now seeking to use their buildings as exemplars of high-tech low-carbon architecture. Naturally this will include good design to minimise the lifetime energy use, low embodied energy materials, maximising on-site renewable energy sources. The New University of Herefordshire should be seeking not to be paying energy bills at all, but rather to be in receipt of energy income from surplus generation. Building new buildings has many advantages over retrofitting old buildings, in, for example, that it is much easier to achieve higher thermal efficiency. However in both retrofitting old buildings or in designing new ones there are many opportunities to push ever higher standards, and to use the buildings themselves as teaching materials. A striking and innovative building can itself be a great attraction: the Crystal in London, the Bullitt Centre in Seattle or the Sir Samuel Griffith building at Brisbane University are all good examples that have attracted global recognition. Can Herefordshire raise the bar still further?

3g, The New University of Herefordshire: Supply chains and procurement

The New University of Herefordshire will have great influence on the economy of Herefordshire in many ways. Getting the supply chains and procurement policies

and practices right can be a useful way in which to demonstrate that the university is putting its ideas into practice. Whether it is in the purchase of carbon negative cement for the construction of the building, locally grown organic vegetables for the on-site catering, Forestry Stewardship approved paper and construction timber or in the ethical sources of the materials and software of its digital technologies the University will have much to prove. Can it walk the talk, and can it become a beacon of best practice with which it can inspire its own students and impress its competitors?

3h, The New University of Herefordshire: Links to the wider economy

One criteria by which the New University of Herefordshire will be judged is what effect it has upon the economy of the county. If Herefordshire is to become one of those places that attract global recognition as a beacon of sustainable development it will probably be largely down to the role that the New University of Herefordshire creates for itself, its students and alumni. Will the demographic profile of the county, its carbon footprint and other key indicators of success move in the direction that we all want, and what will have been the role of the University in the evolving economy of the county? Time alone will tell, but it is of crucial importance that at this early stage we set our sights on the goals we wish to reach, and in this brief essay I hope I have made the case for why macro level ecological sustainability should be at the heart of the life of the University. All future economic development has to help bring humanity back within the Bio-physical limits of our planet; otherwise it truly cannot be sustainable.

[1] http://peopleandplanet.org/green-league-2013/tables
[2] http://www.oxfordpv.com/
[3] http://www.global-csp.com/news/