BEFORE THE OTAGO REGIONAL COUNCIL
AT DUNEDIN

Under the	Resource Management Act 1991
In the Matter of	Proposed Otago Regional Council's Draft Regional Policy Statement

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STATEMENT OF EVIDENCE OF NELSON JOHN PEET TO ACCOMPANY SUBMISSIONS BY THE WISE RESPONSE SOCIETY INC.

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26 November 2015

BACKGROUND

1. My full name is Nelson John Peet, of 87 Soleares Avenue, Christchurch 8081.

2. I am a professional chemical engineer, now retired. I have a B.Sc. degree in Chemical Technology and a Ph.D. degree in Chemical Engineering. I am professionally qualified as a Fellow of the Institution of Professional Engineers New Zealand, as a Fellow of the Institution of Chemical Engineers (London), as a Fellow of the New Zealand Institute of Chemistry, and as a Member of the Royal Society of New Zealand. Until I relinquished them upon my retirement about 10 years ago, I was also legally qualified as a Registered Engineer in NZ and a Chartered Engineer in the UK and Europe.

3. I have professional experience in coal combustion and gasification technology, oil refining and petrochemicals manufacture, and have been involved in research and writing in energy and fuel-related fields for all of my professional career, extending into policy-related areas such as ecological economics over the last 30 years.

4. I have published a book and many papers on aspects of energy (see my website www.peet.org.nz/john for details). My papers include 16 peer-reviewed papers in refereed international and national science journals, 7 chapters in books and some 30 or more papers on various aspects of energy and economic policy.

5. I have read the Code of Conduct for Expert Witnesses, and agree to comply with it.

6. I confirm that the issues addressed in this brief of evidence are within my area of expertise.

SCOPE OF EVIDENCE

7. The general intention of my evidence is to clarify and correct some of the fallacies that are implicit in currently-dominant government policy areas and priorities and, by extension, to those of local government. I do this in order to put forward options that have the potential to better explain some facts about the long-term availability of those critical biophysical resources that are essential inputs to all socioeconomic processes. In this context, I assert that long term sustainability of the entire global environment-society-economy system is an essential requirement for humanity. Despite this, I observe that the basic understandings of economic growth as understood by mainstream economics are both scientifically questionable, and generally incapable of leading to a sustainable future.

GLOBAL BIOPHYSICAL LIMITS AND THEIR RELEVANCE TO LOCAL RESOURCE MANAGEMENT

8. What people actually need, now and in the future, is not adequately dealt with by simply planning for economic growth (eg. growth in GDP). As one justification for this statement, in 2008 French President Nicolas Sarkozy

invited three eminent economists, Joseph Stiglitz, Amartya Sen and Jean-Paul Fitoussi, to head a high profile commission to identify the limits of GDP as a measure of economic performance and social progress. I quote them: (ref: Dalziel & Saunders)1

> Another *key message, and unifying theme of the report, is that the time is ripe for our measurement system to shift emphasis from measuring economic production to measuring people's well-being.* And measures of well-being should be put in a context of sustainability.

9. It is Wellbeing that should be at the core of the Otago Regional Council's policy aims for the future, not Business as Usual with growth in GDP. Wellbeing can only be ensured if the total environment-society-economy system within which a society such as ours exists is guaranteed long-term sustainable existence. No such guarantee can be meaningful if we continue along our current path as a nation or as a region.

10. As a scientist and engineer, let me start to address the issue of long-term availability of critical biophysical resources by affirming that Life on Earth, in its entirety, occurred and evolved through the interactions of Matter and Energy, via processes governed by universal laws such as those of conservation of matter and energy and the entropy law.

11. Without prior acknowledgement of that basic fact and these laws, none of the complex network of interactions between environment, society, economy and all the branches of life on earth can be fully understood. Physics is the science that lies at the core of that understanding, especially via the branch of physics known as thermodynamics and a subset known as biophysics or its related branch, ecology.

12. From a biophysical viewpoint, an economy is a social system characterised by the physical activities that take place in it. That social processes are involved in the myriad of decisions made in that society is to some extent secondary to and constrained by the physical processes that are occurring. (ref: Peet, 2004)2

13. That also means that if the sciences, physics and ecology especially, show up the existence of limits to whatever humanity wishes to do, these limits must be respected. From physics we know that while many processes involving matter and energy are possible, many others are not, no matter how hard humans may try to circumvent these constraints. There are unavoidable physical limits to growth on what is a finite planet.

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[1] Paul Dalziel and Caroline Saunders, '*Wellbeing Economics; Future Directions for New Zealand'*, Bridget Williams Books, 2014.

[2] John Peet, "*Economic Systems and Energy, Conceptual Overview*", Encyclopedia of Energy vol 2, Elsevier Inc. 2004 pp 103-115.

14. In the specific context of these hearings, it is simply not realistic to assert that growth in an economy is not subject to any constraints. No evidence exists that any form of growth in Nature has ever continued indefinitely; all known forms of growth have proceeded to a state where growth ceased or reached a point of collapse. It would appear that every civilisation in recorded history has suffered that fate. To continue along that policy path is guaranteed to fail.

15. Nor is it realistic to claim that since replacement resources have apparently always been available in the past when current ones ran out, this will always happen in the future. The many histories of past civilisations available in the literature make it clear that they all grew eventually to a level at which the costs of the resources required for further growth exceeded the benefits, after which the civilisation declined or died. We already know a lot about a very wide range of substitutes of essential resources, especially energy and fuels and none shows the necessary promise, whether due to cost, undesirable externalities or an inability to match the massive quantities of, for example, petroleum and coal currently used.

16. As a more detailed specific example, the supply of a key non-renewable resource, petroleum, was effectively limited only by the level of investment in oil wells and refining capacity for most of the last century. A few years ago, it was confirmed that the maximum global production of conventional oil (known as Peak Oil) had been confirmed – the supply of petroleum had passed the stage at which half of the total resources of the planet had been used, and that for coal was not far in the future (ref: Mohr et al, 2015)3.

17. Since the oil and coal majors have been rational in extracting the easily-accessible (low cost) and high-quality resources first, both worldwide and in NZ, what remains is of lower accessibility and often also of lower quality, which affects net energy return. Prospecting in remote areas such as the Arctic and Antarctic, or in deepwater areas, is both physically and financially risky.

18. Currently, we are experiencing a widespread global economic recession which maintains a relatively low, flat demand for petroleum. If or when economic growth starts to increase, as most countries hope, the extra demand for petroleum products will have to be met from the newer, more costly, sources, resulting in increases in price. That increase in turn may be expected to suppress demand again, meaning likely continuation of economic recession.

19. In 2014 according to NZ MBIE Energy statistics (MBIE website), petroleum supplied 31%, coal 6% and gas 23%, a total of 60% for non-renewable fossil fuels in this country. While hydro and geothermal sources supplied most of the remaining (renewable) energy, the place of petroleum and gas is of major importance in enabling economic activity to continue. More particularly, the role of petroleum in the food and agriculture sectors is central. NZ's much-

[3] SH Mohr et al, '*Projection of world fossil fuels by country'*, Fuel 141 (2015) 120-135

vaunted food production at anything like current levels would not be sustainable without cheap petroleum and local gas inputs.

20. Arguments around availability of the wide variety of other generalised resources needed for continuation of economic growth, especially in order to supply the accelerating, compound interest rate sought by politicians and economists, were examined in the famous Limits to Growth (LTG) scenarios debate of the early 1970s. Over the years, those scenarios have been examined by several researchers (e.g. ref: Turner 2014) 4 in the light of the actual events since publication in 1972. They have shown that the LTG results are in fact remarkably accurate – far more so than any of the economic prognostications of the time. In my opinion, the primary reason for this is that they are firmly founded in, and logically derived from, basic laws of physics.

21. At this point I refer to the Business as Usual "Standard run" of the 1972 study, with Turner's historical data from 1970 to 2010 overlaid. This diagram demonstrates that the data to 2010 reflect the 1972 scenario figures remarkably well, given that those figures were constructed over 40 years ago.

22. The scenario pointed to general economic and environmental collapse occurring over a period of about 20 years, starting around 2020, due largely to limits in essential resources being reached, for which no equivalent substitutes could be found and which caused an abrupt collapse in human population.

23. Turner (2014) concludes that "Although the modelled fall in population occurs after about 2030—with death rates rising from 2020 onward, reversing contemporary trends—the general onset of collapse first appears at about 2015 when per capita industrial output begins a sharp decline".

24. Other studies of the LTG in recent years support that of Turner, and extend the computer model used in the LTG studies to include a wide range of other critical resources (ref: Ragnarsdottir and Sverdrup)5, with similar results.

25. Hence, without major changes to the rate at which resources are used (i.e. demand) and/or wastes discharged, or a change in the boundary conditions of this physical system, an outcome of the type produced by the LTG study is, by the laws of physics, both credible and almost certainly unavoidable.

26. On the basis of this fundamental analysis, to avoid such an outcome a major rethink of our policy priorities is urgently needed.

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[4] Meadows et al in 1972, *Limits to Growth* and subsequent updates and reviews (e.g. Turner 2012, 2014)

[5] Kristin Vala Ragnarsdottir and Harald U Sverdrup, '*Limits to Growth Revisited*', www.geolsoc.org.uk/geolscientist, October 2015 pp 10.

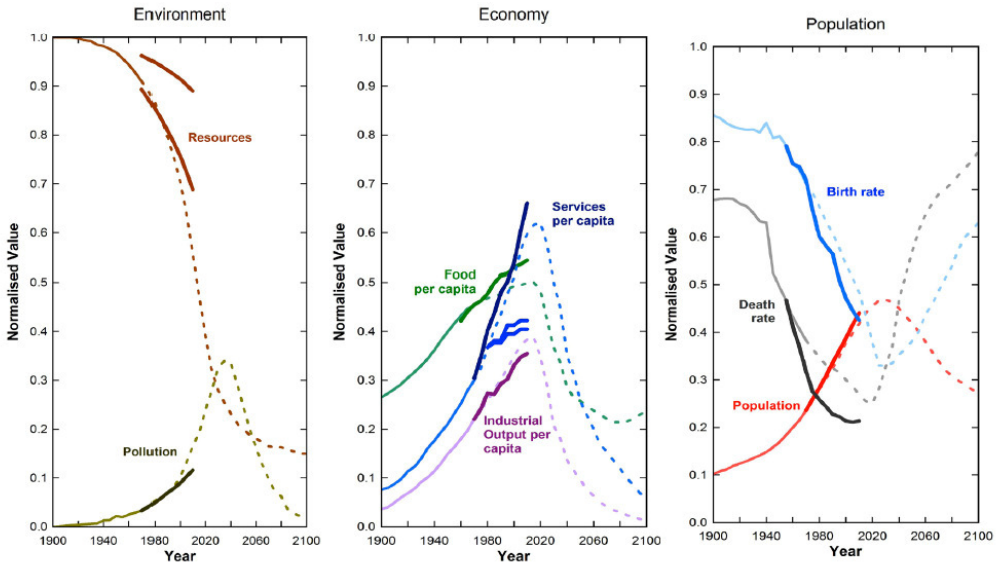

Figure 1. *LTG* BAU (Standard Run) scenario (dotted lines) compared with historical data from 1970 to 2010 (solid lines)—for demographic variables: population, crude birth rate, crude death rate; for economic output variables: industrial output per capita, food per capita, services per capita (upper curve: electricity p.c.; lower curves: literacy rates for adults, and youths [lowest data curve]); for environmental variables: global persistent pollution, fraction of non-renewable resources remaining (upper curve uses an upper limit of 150,000 EJ for ultimate energy resources; lower curve uses a lower limit of 60,000 EJ [Turner 2008]).

CONCLUSIONS

27. All production and consumption processes require resources comprised of matter and energy. The consequences of all economic policies must therefore include those raw resources of matter and energy that are extracted from the earth system, and which, together with labour and capital, are used to produce the goods and services that are the basis of human social and economic activities.

28. In the specific context of examining the widespread belief that substitute resources will always be available in the quantities and qualities needed, it is important to note that a vast area of mainstream economics bases its theories on the notion that continuing growth in production and consumption is not only essential but possible. That is the reason why mainstream economic principles based on finance and banking continue to rely upon the notion of perpetual compound-interest growth without end, meaning that the possibility – indeed, the certainty – of resource constraints is not taken seriously, despite the strong contrary evidence produced by scientists and engineers. The evidence and lessons of the global financial meltdowns of 2008 have yet to be fully understood and acted upon by policymakers.

29. The laws of physics as they relate to closed material systems (such as Planet Earth) under increasing demand mean that humanity will very shortly become aware of increasing constraints in the availability of important resources and could lead to socio-economic collapse on a large scale. Avoiding the worst manifestations will require rigorous implementation of mitigation and adaptation strategies (general ref: SANZ, 2009).6

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[6] Sustainable Aotearoa NZ and Nakedize Limited, *'Strong Sustainability for New Zealand: principles and scenarios'*, 2009, downloadable from www.earthslimits.org.

30. The effects of activities at individual and local levels across the globe combine to impact at a global level. If this combined impact at a global level is unsustainable then individual and local activities that rely on it become unsustainable on a highly connected planet. Climate change is the most obvious example but is by no means the only one.

31. The mismatch between economic expectation and biophysical reality is the key sustainability issue of our time. In my considered opinion, it is only once we accept the reality of material limits and the requirement to use and manage our physical resources accordingly that we will have any chance of achieving our goals of sustainability (ref: Peet, 2015)7.

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John Peet

Date:

[7] John Peet, '*A global perspective on achieving a just and sustainable future'*, United Nations Association of NZ National Conference, 5 – 6 June, 2015, Wellington.