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Short Communication

EKISTICS AND ENERGETICS: A SUSTAINABLE FUTURE PLANNING APPROACH

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EDITOR'S NOTE

After majoring in Physics at Otago University in 1974, the author entered the Auckland Architectural School from which he has recently graduated. He is currently working in the MOW & D Architectural division, Box 5040, Auckland, New Zealand. This article is a summary of his undergraduate thesis, 'In Search of Steady State' and is printed as evidence of the extent to which urban ecology studies have permeated traditional fields of education.

ABSTRACT

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Future planning involves the self-reflexive assumption of mankind's continued survival. The study of Steady State settlement patterns based upon sustainable energy sources provides an epistemological framework within which to base transition planning strategies. One synthetic and holistic approach to Steady State involves the fusion of Ekistics and Energetics. An immediate, subsequent outcome is the Growth and Steady State settlement pattern matrix. A task of future planners would be to quantify and refine this matrix while simultaneously constructing a parallel planning strategy matrix which is internally consistent.

INTRODUCTION

In 1978 a small group of students at the Auckland Architectural School, New Zealand, under the supervision of Associate-Professor Cam McClean, made an undergraduate thesis study of Low Energy Settlements in New Zealand. Although various energy forecast studies, such as 'Energy Scenarios for New Zealand' by Dr Garth Harris et al. and 'Goals and Guidelines: An Energy Strategy for New Zealand' by the Ministry of Energy have been made before, the students' contribution is unique in that it is the first holistic approach towards preparing for a sustainable low energy future made in New Zealand. Each student concentrated on a particular aspect of human settlements while at the same time participating in a group 'think tank'. Some areas of study led to more conventional conclusions while others — in particular Leslie Mathews's chosen topic of agriculture, a key factor — led to a group consensus that settlement spatial patterns would ultimately need to change with the advent of a diminishing supply of easily accessible high-grade energy.

My own thesis concentrated on the Context of a sustainable low energy future. Having read the usual ecology books of the late nineteen sixties and early nineteen seventies I initially thought that Steady State could simply be summed up as being ZPG (Zero Population Growth) and ZEG (Zero Economic Growth, or more correctly, Zero Energy Growth). Upon starting the thesis I was dismayed when there were few solid research articles directly related to Steady State to be found in New Zealand. The majority of books published before 1973 were not written with a full awareness of the subtle complexities and inter-relationships of the energy problem, and many before and after represented a reductionist viewpoint of the problems that we face in the future. To my knowledge, the first comprehensive treatise on Steady State has yet to be written. This is, perhaps, not so surprising because the information explosion has created a trend towards specialisation, reductionism, and fragmentation rather than towards a synthetic and holistic overview. A major step in the right direction is C.H. Waddington's contributions to a sustainable future — 'Tools for Thought' and 'The Man-Made Future' — which are written in a style of exceptional clarity easily assimilated by the general public.

EKISTICS AND ENERGETICS

Energetics is the study of the energy transformations which occur within ecosystems. Energy is involved in all the functions of life and physical systems, being used in the growth and maintenance of the system. The study of energy inputs, distributions, and uses represents a logical and useful entry point into ecological studies of human settlements since energy is one of the few common denominators that cuts across all levels of environmental, human and bio-social considerations. There is an immediate advantage in using the study of energy flows within human settlements as a vehicle for cross-disciplinary integration.

By using Energetics to study the flows of energy within ecosystems, we are able to unravel the complexity of inter-related factors that characterise all ecosystems in their growth stage as compared to climax. It can be shown why continued growth within a 'closed' system cannot be sustained and that an ecosystem either develops a mature, homeostatic, climax phase of growth commonly known as Steady State — or else declines. The term 'a closed system' is not correct with respect to energy in that solar energy enters our global ecosystem from without the boundaries of the biosphere. By using GST (General Systems Theory) mathematical techniques it can be independently shown that the eventual growth characteristic of all open systems is Steady State.

The combined limits to growth for all ecosystems on Earth, including human settlements, is the rate that solar energy enters and leaves the biosphere and the size and efficiency of the 'energy net' that each ecosystem is able to utilise to capture this incoming energy without succeeding other ecosystems necessary for its survival. (The criteria of a sustainable energy source precludes nuclear fission energy when taking into account the doubts whether nuclear fission technology produces net energy without reliance on a fossil fuel economy). Table I is a summary of the differences between Growth Settlement and Steady State Settlement patterns. Note that even Steady State cannot make more ample that which is scarce. Both the population level and the consumption rate set the pace of depletion of resources which represent the life support system of future generations. The actual level of Steady State to be maintained in the future is a future moral decision.

In New Zealand and elsewhere Steady State has been discredited as being an idealistic utopian concept which has no place in a world of practical realities. Ironically, Steady State is best approached from the viewpoint of the Law of Entropy which not only explains the ultimate degradation of all forms of energy to heat but also the process of organised complexity to disorder — or the process of life to death. On a wide-time horizon the message of Steady State is one of inevitable harsh reality. Counter arguments against Steady State can be most impressive, especially if voiced by those more knowledgeable than ourselves in conventional economics. But existing economic 'wisdom' is based on a misconception of our economic system, which is an open system and not a closed system as so many economists fail to observe or choose to ignore. It is the lack of understanding and awareness of the processes of our human ecosystem and our own value system that lead to misplaced judgement of Steady State.

There has also been criticism of over-relying on biological analogies applied to human settlements. This is why I recommend a fusion of the two fields of Ekistics and Energetics. Ecology, the systems study and management of ecosystems, is an already established multi-discipline whereas Human Ecology, the holistic study and 'management' or design and planning of human settlements is not. I foresee Ekistics as being the structure within which to use the established tools of systems ecology and General Systems Theory.

The factors that distinguish mankind from other forms of life are as follows:

(a) Man alone has the ability to 'timebend' or 'freeze' information that can be non-genetically communicated to succeeding generations.
(b) Man alone utilises and depends upon Exosomatic Capital Stock in the form of tools, machinery, buildings and networks which form the basis of human settlements.
(c) Man alone has been able to tap and utilise non-renewable Energy Stock sources such as coal, oil and gas as well as the renewable Energy Flow

TABLE I

Summary of Steady State Settlement Patterns

Settlement Attribute	Growth Settlement	Steady State Settlement
Economic Philosophy		
1. Primary concept	Scarcity	Scarcity
2. Attitude to scarcity	Conflict	Acceptance
3. Purpose of production	Consumption	Maintenance
4. Emphasis on production	Productivity	Distribution
5. Timescale horizon	Narrow	Wide
6. Incentive for work	Income for consumption	Satisfaction
7. Attitude to work	Necessary evil	Part of life
8. Work and leisure	Differentiated	Little difference
9. Place of man in ecosystem	Dominant	Participatory
Population		
10. Doubling time	36 years decreasing	No doubling time
11. Percentage growth	2 %	0 %
12. Age composition profile	Triangular	Cylindrical
13. Dependency ratio	High	Low
14. Total fertility	2.23 (NZ)	Aprox. 2.11
15. Time to restabilise	70 years	Already stable
16. Net reproduction rate	1.221 (NZ)	1.000
17. Family structure	Nuclear family	Extended family
18. Urbanisation	High (80% NZ)	Low (20—40% ?)
Capital Stock		
19. Durability	Low	High
20. NMEC*	High	Low
21. Recycling	Not accounted for	Important
22. Creation of new capital stock	Investment from profit (increase in energy)	Allow old stock to depreciate, or forgo consumption
Energy Production		
23. Source	Energy stock	Energy flow
24. Quantity	Abundant	Scarce
25. Limits of production	Depletion and net energy decrease	Technological and energy/food balance
26. Permanence of source	Non-renewable	Renewable
27. Source pollution	High pollution	Low pollution
28. Pattern of energy inflow	Increase, then decline	Constant level
Consumption		
29. Pattern per capita	Increasing per capita	Constant per capita
30. Goods and services consumption	Unnecessary consumption	Necessary consumption

Settlement Attribute	Growth Settlement	Steady State Settlement
31. Tertiary sector	Large tertiary sector Dependence	Small tertiary sector. Self-sufficiency
32. Distribution of consumption	Unequal distribution	Equal distribution
33. Wastage	High wastage.	Low wastage.
Production		
34.	Heavy pollution	Light or no pollution
35.	Low energy efficiency	High energy efficiency
36.	High energy consumption	Low energy consumption
37.	Technological accidents: frequent and serious	Technological accidents: infrequent and insignificant
38.	Processes, complicated and out of control	Processes, comprehensible and under control
39.	Destruction of other life forms	Partial dependence on life forms
40.	Processes ecologically dangerous	Processes ecologically adapted
Agriculture		
41.	Monoculture	Diversity
42.	Specialized industry	Food industry involves everyone
43.	Energy and capital intensive	Labour intensive
44.	Artificial fertilizers used	Natural recycled fertilizers used
45.	Animals used for carbohydrates value	Animals used for protein value
46.	Animals used primarily as food source	Animals used for resource and mechanical energy value
47.	Dangerous pesticides used	Ecological techniques used
Organisation of Production		
48.	Centralisation of production	Decentralisation of production
49.	Interdependence of production units	Self-sufficient produc- units
50.	Large production units	Small production units
51.	High centralisation of specialisation	Low specialisation
52.	Science and technology practised by specialist elite	Science and technology practised by all
53.	Capital and energy intensive	Labour intensive
54.	Mass production	Emphasis on artisanship

TABLE I (cont.)

Settlement Attribute	Growth Settlement	Steady State Settlement
55.	Unemployment due to unprofitability of labour	No unemployment. Concept of work non-existent. No profits in economy — maintenance only
Money Flow		
56.	Inflation as net energy of energy stocks approaches zero	No inflation. Dollar to energy ratio remains constant
57.	Interest rates include inflation	Interest rate does not have an inflation component
58.	Production produces profit over and above maintenance. Accumulation of capital has positive feedback	Production produces liquid capital for maintenance only
59.	Production output is controlled by "owner" of capital and land	Production output is controlled by "owners" of labour and land

*NMEC, or Net Maintenance Energy Cost, is defined by myself as being that average power required to maintain Capital Stock within the settlement over time. NMEC can also be applied to Energy Converters where a negative NMEC represents Net Energy.

sources such as agricultural production, wind power and water power, which are based upon solar energy processes.

The development of social organisation, technology, and the tapping of high-grade Energy Stock sources has allowed the centralisation of settlement spatial patterns, population increases, and higher consumer levels of life than has ever before been possible.

CONCLUSION

Regardless of the temporal accuracy of any energy forecast, with a finite Energy Stock reserve there comes a transition stage when energy supply can no longer match the energy demands of an increasing population demanding an increasing consumer level of life. Although this transition stage is approaching at the same energy growth rate we have now, we do not face an 'Energy Crisis'. Mankind continually comes across limits in every sphere of life. The eventual depletion of easily accessible high-grade energy is but one of many limits. A crisis develops when mankind does not accept his limits. We do not face an Energy Crisis — we face, instead, a Values Crisis. The real problem that mankind faces in the near future is the transition from a *Growth Context* to a *Steady State Context* and the attendant teething pains of accepting a value system change which is necessary to enable this transition to take place without strife and grief.

Each individual should be aware that one's own value system is the product of a value system held by most for many generations. A growth philosophy has been useful during the growth and development phase of human civilisation. Further development does not imply further growth. Each and every one of us needs to re-examine our own value system within the Context of the inevitable change which, according to a consensus of forecasts, will take place within the lifetime of our existing younger generation. Each and every one of us should be prepared for initial value system pre-judgement and dichotomies during this internal as well as external transition period.

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