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MELTING SNOW: RUN-OFF FROM THE HEIGHTS OF SYSTEMS FORECASTS

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Abstract: *That this conference is taking place at all means that the more extreme Y2K disaster forecasts were not correct. This probably reflects both a success and failure of those forecasts. To some extent the warnings may have been accepted as potential real problems, which were then solved. However as predictions of an actual disaster, the forecasts were false. This paper first discusses reasons for why so many prominent systems disaster forecasts have proven spectacular failures. And, since the session is about forecasting, the paper ventures one of its own, on why the North American Power grid will not fail forY2K technical reasons.*

I. THE DISASTER OF DISASTER FORECASTING

Y2K disaster forecasts join other spectacularly failed systems-based forecasts of imminent disaster in the last half century. The new ice age foreseen in the 1950's to early 1970's did not visit us (though perhaps that was not a true systems forecast). The population explosion has not carried the earth past its inherent "carrying capacity" by the early 1990's. Instead world population growth is slowing, itself an unpredicted phenomenon by all but one systems theory. The purported limits to growth of economic resources have not been reached. Instead at the same time that mineral prices have fallen in real terms an unpredicted (by systems analysis) efficiency of use increased and absolute remaining known resource grew. The planet has not run out of "fossil fuels". Known energy reserves have grown, total use has far outpaced forecasts and real price has fallen - not exploded to the predicted heights forecasted. The idea of imminent global warming is seen with increasing disbelief, and often if believed not considered a threat.

This record deserves some explanation. It is not that all system-based

forecasts are wrong. Many forecasts are made and used daily in business planning and areas of government economic policy, some with good success. None the less the large-scale forecasts have been the ones on which much systems science has staked its public reputation. Their failures have contributed to wide public skepticism of such forecasting, particularly where it involves human activity.

This paper proposes one reason common to the spectacular failures that deal with human activity -- which is to say, all but the forecast of the new ice age, which was based purely on purported geological forces. The same reason proposed for these failures underscores a related reason for the one successful system forecast noted above (certain population predictions), and underlies in part the most successful Western institutions.

Recall that in the 1950's C.P. Snow was renowned for discussing the great gap between science and the humanities. Snow saw two worlds that lacked a common language or purpose. As a critique of education in Britain and much of the West in the 1950's this was probably accurate. But as a description of systems science it is false. Biology and economics share common intellectual foundations from the turn of the last century. The basis for creation of early computer languages and language theory grew from work of Carnap and others to create formal logic for cultural descriptions. Much modern systems analysis grew (and still grows) from efforts at cognitive analysis and creation of artificial intelligence to emulate natural models, including of course natural language, human communication and natural discourse. There is no intellectual disconnect between science and humanities (however badly the universities may have failed to understand either).

More to the point here, the most long lasting institutions in the Western include the most humanistic: the religions. What in the United States at least has come to be called the "Judaeo-Christian tradition" has existed in some continuous form for thousands of years. The presently existing forms have existed for at least hundreds of years, and in several prominent cases (the Catholic, Orthodox Christian, and Orthodox Jewish forms) for more than a millennium. These institutions share at least one common feature with the longest lasting continuous forms of government, and with the successful examples of forecasting of human activity.

What is that property? Consider this citation from 12 Romans 6, summarizing the duties of Christians and their relationship to the Church: "Having them gifts differing according to the grace that is given us, let us prophesy according to the proportion of faith." Individuals with unique graces have common duties or roles due the Church. A similar notion is expressed within the

Talmud (the ancient collection of Jewish law and teaching based on the Testaments), at Sanhedrin Chapter 4 Mishna 5 as follows: " ... man stamps many coins with one seal and they all resemble one another but the King of Kings … stamped man with the seal of the first man yet not one of them resembles his fellow" … and therefore each person has certain obligations. The common pattern: unique persons with common obligations in law or contract.

Recognition of human uniqueness is fundamental to viable institutions and social theories. One of the more successful branches of economics, micro-economics, also known as the theory of the firm, is constructed on the concept of "incomparability of individual utilities". The theory assumes the existence of unique individual human preference functions, yet which are manifest by economic activities of "firms" which have similar forms capable of analysis. Likewise, the more stable continuous Western political systems are predicated on individuals acting on their own choices, constrained in certain ways (largely by criminal laws proscribing certain acts and mandating honesty of action) but otherwise free to act as they wish. Biology of course creates genetically unique individual humans, so these more successful institutional concepts also reflect biological reality.

What the above share is the notion of unique individuals, acting on their own preferences, while sharing certain common classes of roles. What all of the failed systems forecasts share is the opposite of these assumptions: implicitly or explicitly they assume that all humans are and will act, identically. The recently failed communist and socialist political systems assume that individual differences could be often ignored. In doing so they eliminated (or failed to take into account) the very human diversity which creates the possibility of solving problems by previously unforeseen, or simply diverse, solutions.

In short, systems of analysis that assume human identity ignore the possibility of adaptation, of innovation, of "progress", by denying the existence of the sources of that innovation and progress. In a very literal sense, the failed forecasts share a common technology: the assumption of identical humans. The assumption of identical particles in thermodynamics leads to predictions based on use of density functions using the Stirling Number of the First Kind (identical objects into unique locations). Since these methods underlie traditional thermodynamics, and since traditional systems techniques are borrowed from thermodynamics, even technical-looking systems methods make wrong forecasts. In contrast, the above-cited successful analyses and institutions are based on analysis assuming unique individuals -- analysis requiring density functions using the Stirling Number of the Second Kind.

The failed forecasts shared the same mistake to which the journal of science commentary, Scientific American, attributes the failure of American government programs to design more fuel efficient cars: "They stuck to some of the [technological] requirements in such a dogmatic manner that they wound up with nothing at all." Communist systems voided their capability of technical innovation (more precisely, implementation of innovation) by limiting choices and risks taken to those of a tiny minority, thus eliminating practical diversity. In the West religions and enterprises that ignore the presence of human diversity have found little long-term success, whatever their professed uniformity of faith.

The claim of "finite" resources falsely freezes the concept of resource to the technology of a moment, failing to recognize the essentially cognitive (and short-term technological) nature of definition of resource, hence failing to recognize the possibility of change or diversity in that cognition. Energy is but one cognitively created resource. Predictions of imminent disaster due to "finite resources" are false because at any given time the concept of what constitutes a "resource", and how to use it, is changing due to continuing invention. Since what is human is always potentially unique the concept of technology is always subject to unique (in specific cases, unpredicted) innovation.

Thus the more spectacularY2K doom forecasts failed for similar reasons: failure to recognize adaptability, innovation, change and diversity of individuals and of systems composed of individuals. Y2K disaster forecasts ignored that humans could and would adapt their systems, and otherwise act in unique, diverse and unpredicted non-identical ways. It is our very humanity that saves us, whether in science or more "humanistic" endeavors.

II. VENTURESOME

As this conference session is about (this author predicts) failed forecasts, it is fair to ask the author to venture one which presumably will be correct. Thus on the May 10, 1999 date on which this is written, the author predicts that the electric power system of the United States will not suffer a spectacular failure on January 1, 2000, or at least not one due to Y2K issues. (I do not forecast the weather with such certainty so far ahead; a late Carribean hurricane ridding into a Canadian winter storm could produce fascinating practical tests of power system reliability in eastern North America.)

Why will the Y2K disaster not occur on the North American power grid? One reason is that the forecasts of disaster have caused the power industry to act to prevent it. Why does this author believe the actions will be successful? The reasons are all applications of the logic of Part I of this paper: humanity and

diversity.

First, to believe that the power system, or indeed any industry, will fail due to Y2K is to believe that the operators of that industry are irresponsible. But just the reverse, the very human individuals who make the actual operating decisions have risen to their positions because they assume personal and actual responsibility for what occurs on "their watch". They do not wish to see the system fail while they are in charge, and will therefore act to prevent it. The single most unexplained facet of Y2K disaster forecasters is the basis for their implied belief that all operators of all major systems will act irresponsibly.

Second, in North America at least, ownership and control of operating systems is highly diverse. This is a product of two primary factors: the predominantly private ownership of industry in North America; and the structural consequences of the legal separations of sovereign powers in all national jurisdictions of North America. Due to this diversity of actual operating responsibility, a failure in any one local operating system is exceedingly unlikely to simultaneously occur in nor equally affect all of the others.

Third, the design and construction of the power supply and distribution grid in North America includes a high degree of redundancy coupled to diversity of structure. This also occurs due to two primary factors: the same diversity of ownership means a diversity of management styles and technological solutions; and intentional design for redundant systems to accommodate normal planning scenarios. The first of these implies that it is unlikely that all systems will fail simultaneously for the same reason at the same time, as each has different operating characteristics. This is one reason that private industry generally is more resilient than socialist industry.

The second of these reasons is somewhat more technical. Ordinary power system design includes an intentional and desirable "overbuilding"of capacity compared to normally expected peak (extreme) experienced operating conditions. Typically the extreme operating condition occurs in North America in their summer, perhaps in the hottest days of July. A typical design is to plan for the existence of actually available production and transmission capability equal to the expected (experienced) peak, plus perhaps 20%, so the total system has available about 120% of the expected greatest demand. Now, the Y2K disaster is predicted to occur in mid-winter, not mid-summer. In mid-winter most power systems are operating at about 50% of their summer peak. Indeed on January 1 at midnight (of December 31) power systems might be operating at much less than 50% of peak, due to normal general shut-down of industry for the new year holiday reducing power demand significantly. The result is that even if capacity representing up to

70% of peak operating requirements were shut down unexpectedly due to Y2K failures, the system could still operate to produce the required demand of up to 50% of system peak in mid-winter (50% + 70% = 120%, the total actually available capacity).

It would require a truly spectacular failure of responsibility for 70% of designed peak capacity to fail simultaneously in so many diversely managed systems. This scenario however is even more extreme than the most commonly forecasted reason for purported failure of North American power: the presumed shut down of all nuclear production. Like much public "analysis" of purported problems in the nuclear power industry of North America, this one is also based on fantasies of irresponsible action. But even if it were granted that somehow, all nuclear production in North America were to fail unexpectedly (or even, planned) on December 31 at midnight, the complete loss of all this power would not collapse the grid, and certainly not for any sustained time. Why? Redundancy. Nuclear power provides about 20% of all North American production. The system however is designed with 120% of required capacity. Loss of about 20% of that capacity, especially on a date when only 50% is required to cover total output, is a manageable problem. It is especially manageable for those scenarios in which all nuclear plants are intentionally shut down in advance due to pure (if irrational) fear. In that event, other plants would already be scheduled to be on-line, so there is little risk of even short term interruption, and if it occurred it would not (in that event) be due to "nuclear" failures.

III. CONCLUSION

In short, the greatest Y2K risk to the power system, or any other system, in North America is probably not from any Y2K technical issue. The risk, if any is instead from the purely social cause of potential mass-hysteria induced by ignorance of how human systems actually work.