Oil, Water and Words: Energy and the Digital Future

by Karen Hovde

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Books, and the libraries that house them, for all their staid reputation, stand as major players in the plots of a substantial number of science fiction works. Books burn in the fires of *Fahrenheit 451* and teach apocalypse survivors essential skills in *Dies the Fire*. In *Earth Abides*, Ish, a survivor of the Great Disaster and now an old man, sits on the steps of the long-abandoned university library, pondering its useless legacy for a population that lives by the bow and arrow.

Global catastrophe and apocalypse are surely the stuff of fiction and where lesser cataclysmic events such as earthquakes and severe storms interrupt the lives of contemporary, industrialized populations, they have been on a scale for which the rest of the infrastructure compensates. But catastrophe can build in subtle, slow trickles that presage a torrent, a cumulative event with implications fully as severe as the sudden tsunami. Those trickles are running now, and their names are energy and digital information.

The energy element has several tributaries, the two most significant being climate change and peak oil. They share the factor of being mildly controversial, in that the scientific and expert communities regard them as givens (with a range of potential future scenarios), while numerous doubters give voice in the governmental, business and general populations. Climate change is most evident in an accelerating global warming trend, with its significant and deleterious effects on water and resource availability. Peak oil, perhaps less well known, is the premise – well established in geochemical science – that the world's petroleum and natural gas reserves are in the process of depletion. Decline of yields mirrors a corresponding world oil discovery peak (discovery peaked in the 1960s), and while the debate rages over the precise year of peak oil (estimated to be somewhere between 2005 and 2020), the concern should be with the realities of the slide down the other side of the peak [1], [2].

It is not the place of this essay to deal with the pros and cons of substitutes for oil. Suffice it to say that alternative energy sources come nowhere near providing the cheap, safe, uncomplicated and overwhelmingly *available* benefits of oil. And the unfortunate factor that intrudes on any discussion of new fuels and new technologies is that of the zero sum game. The natural and economic resources are finite. Those diverted to one form of substitution steal from something else.

So why should the digital information industry care about water and tar sands? Electricity. Remember the electricity aliens from old science fiction movies? The Internet is an electricity being. It was born, lives and dies with electricity. It eats electricity and, like any good alien, eats it exponentially.

Item – Feb. 2010: Severe drought in Venezuela causes an electricity shortage that is expected to lead to higher oil prices. The worst drought in 10 years has dried up the water that generates hydroelectric power. In an effort to stem the hours-long blackouts that have gripped the nation for months, President Hugo Chavez has indicated that he may divert electricity from oil-producing and -refining operations. Venezuela owns 3.5% of the world's known oil supplies [3].

Item: The western states of California, Arizona, Colorado

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and Nevada have had their eye on Washington's mighty Columbia River for years. Giant waterworks projects were proposed as long ago as 1968; one of the more current plans is for an undersea pipeline that would carry water to Southern California from the Columbia [4].

Item – January 2010: Google Energy LLC, subsidiary of Google, Inc., has requested permission from the U.S. Federal Energy Regulatory Commission to buy and sell energy [5].

Electricity is provided by hydroelectric power, the burning of oil or coal and nuclear power plants. Worldwide water and oil resources are compromised by current supply and increasing global demand. Climate change restricts the availability of water and limits the ramping up of coal use. Nuclear power plants need abundant supplies of cheap water, and cheap oil underpins the construction of all these plants and the infrastructure that delivers it to homes and businesses.

Google knows that its energy alien, housed in an estimated 24 or more data centers, consumes hundreds of megawatts of energy a day – day in and day out. Internet companies are fully aware of the current and projected energy needs of their burgeoning businesses. A smaller data center might consume as much as a large university, about 31 megawatts, including everything from stadium lights to its medical school. A larger complex – 180 megawatts – would be enough to provide energy for a city of 900,000 inhabitants. Data centers on average use about as much electricity as large oil refineries. Data centers, or server farms, are a billion dollar business. They are composed of buildings and entire warehouse-sized complexes crammed with computer servers, and for every dollar spent on power, an additional dollar goes for temperature control. According to Department of Energy estimates, data center power requirements will increase from 1.2 percent to 4 percent of all power consumption in the United States in the next few years [6].

As the software industry moves increasingly to a web environment, Internet companies are building their own data centers. Initially concentrated in California and suburban Washington DC, Google, Yahoo and Microsoft are all headed for the hills – the hills in this case being those of Washington State and the generators of the Columbia River [8]. Local utilities are hard-pressed to handle current demand in the context of existing exigencies such as infrastructure failures and weather-related outages (storms or air-conditioning draws). Add the double whammy of realistic, projected shortages and/or soaring costs for oil and water. Then consider that the rivers that provide the water for agriculture and hydroelectric power and for filling all the reservoirs and Sigg bottles have their genesis in the mountain snow packs, and that global warming is quietly working on the mountains. The disappearance of more than 80% of Mount Kilimanjaro's fabled snows is predicted to have worldwide implications for drought. And in the Yakima basin in Washington, this winter's reduced snow pack spells problems for irrigation [9]. The Yakima River is a tributary of the Columbia River.

The first premise of this construction is that the Internet, those massive layers of data and code residing in increasingly energy-hungry warehouses around the economically beleaguered United States (and elsewhere) is going to reach a point where growth will be constrained by energy limits. "With the possible exclusion of nuclear fusion energy, there are no rational expectations that significant unknown sources of energy can be unlocked through advances in science and technology. Depletion of fossil fuel resources can only be mitigated by a combination of efficiency gains, conservation and substitution of renewable and nuclear fission energy" [10]. The second premise is that the success of the effort to divert, conserve and find substitutes for fossil fuel resources will be severely impacted by the already demonstrable effects of climate change, particularly with respect to water.

Is it wise for the information world to dedicate itself unreservedly to the digital format? (And we haven't even mentioned sunspots; a new 11-year cycle of heightened solar activity brings increased risks for power grids, cyber warfare or sharks, which gnaw underwater cables.)

The publishing industry, willingly or not, has committed itself irreversibly to digitization [11]. It can neither sustain a physical inventory of backlists nor withstand the storm surge of the worldwide digital marketplace. Libraries are constrained by materials supply, linked as they inextricably are to the publishing industry and also by the access and format preferences of their patrons. Academic libraries subscribe to indexing products that are overwhelmingly digital, to associated digital text, to independent digital serials titles and to an increasing array of electronic books, archives and other full-text products. The legacy that was once restricted to paper stored in physical buildings, on the steps of which our fictional hero sat, is flowing ever faster to the hard drives in the servers in the data centers. Hard drives were not intended to be long-term storage devices in the event of prolonged power outages [12]. How they might perform in that capacity remains to be seen. Can we really delude ourselves that the electricity and the water and the oil will be sufficient to sustain indefinitely the infrastructure of the digital medium? There is an ever more visible thread running through the writings of those concerned with the fragility of the information universe – a thread that is at once both more rational and thus more worrisome than the alarmist prophecies of fiction and doomsayers. From the ruminations of thoughtful and articulate workers in the industry to feature articles in *New Scientist*, the question is being asked – what happens to our stored knowledge "if something goes wrong?" Or, as is the theme of this essay, what happens when the something that goes wrong is the simple projection of prohibitive parameters of energy and climate factors?

There is an analog for knowledge and concern for its fate in an uncertain future. Deep inside a sandstone mountain lined with permafrost on the Norwegian Arctic island of Spitsbergen is a vault designed to hold and preserve around 2 million seeds. The three million dollar project was initiated by the Norwegian government to safeguard the world's seed heritage (the world's food supply) from nuclear war, climate change, terrorism, rising sea levels, earthquakes and the collapse of electricity supplies. It has meter-thick reinforced concrete walls, airlocks and blast-proof doors. It is a seed depository, not a seed bank, and it is not an apocalypse film set. It is real – designed and constructed by a government that was willing to do something more than whine and fret about uncertainty.

Museums hold a publicly accepted mandate to preserve the artifacts of cultural heritage, and libraries follow a similar conservation mandate, albeit for a lesser galaxy of objects. It would be silly and pointless to envision a second doomsday vault on Spitsbergen housing copies of the world's literary and scientific heritage. But it is not silly to be realistic about the vicissitudes of the path we tread as we purchase, utilize and store for future use the hard-won body of knowledge on which civilization as we know it depends. Libraries need to hold to that stewardship mandate, to preserve and celebrate the integrity of print formats. They should preserve in print form the world's literary canon and seminal philosophical and scientific works. They should keep in book form the kind of functional information people take so easily now from the web: basic tenets of health and education, instructional literature for building and maintaining essential services, for the raising of plants and animals – a body of print back-up tapes so that when the lights flicker and the blackouts roll, there will be some place to go, and something to hold onto – so that the human heritage of both the practical and the esoteric will not go also into the blackness. ■

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