CARBONOMICS

Trinity of Elements 6, 92 and 94 may Re-define the World Economy

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Progress of civilization and ethical gains from global productivity are held hostage by element 6 [1]. To pay the ransom, the existing world order may need to re-engineer to sense and respond with a dynamic and agile economic structure which can withstand higher transaction costs [2]. Global growth shall be forced to adapt and adopt an economic standard where operations may be pegged to the cost of unit energy based on an index of about US$100-US$150 per barrel of oil (current price of more than US$100 per barrel) which resemble recession numbers [3] from 2008. This prediction is not about actual cost of crude but based on estimates that energy from nuclear fission and clean coal with carbon sequestration may become competitive if oil costs US$150 per barrel [4].

The cartel of oil producing nations are fueling a designed dis-incentivization strategy to punctuate the pursuit of alternative non-fossil energy sources by aiding price volatility. The inflation of $35 per barrel price of oil in 2004 to nearly $150 per barrel in July 2008 occurred without any key changes in production. In January 2009 the fall to $50 per barrel versus the current price which is above $100 per barrel is not associated with resource reorganization. Development and deployment of non-fossil energy must be a priority for world leaders who may need to inculcate the personal discipline necessary to remain oblivious of the Russian roulette of oil prices and platitudes from OPEC.

The obvious answer to the carbon conundrum is US Patent 2,708,656 and has been staring in our face for half a century: nuclear fission [5]. Political positioning of 'nuclear' catalyzed by the orchestrated '*march of unreason*' [6] by effective groups of environmental dissidents are forcing rational thinkers with good intentions to generate short lived, poorly designed, crowd pleasing, semi-scientific, *ad hoc* measures [7]. Carbon pricing, carbon calculators, carbon credits, carbon exchanges, carbon policy compliance and environmental risk management [8] are now a part of our vernacular.

These carbon initiatives are gaining momentum. It may serve as a necessary but perhaps a wobbly platform for the climate control debate. In the next quarter century, with the rise of a new generation of thinkers and leaders, the potential for demise of carbon regulatory measures are imminent. One reason is embedded in the flawed principle of its construction. It assumes that enforcing a price on carbon will act as a financial incentive to use non-fossil fuels. The logic is weak because carbon taxation primarily impacts the end-user or the average citizen. The investment and ability to manufacture and distribute non-fossil energy is concentrated in the hands of a few behemoths or governments. Energy oligopoly may continue unless innovative approaches [9] are allowed to ***distribute*** energy manufacturing to individuals or groups. The stimulus for the end-user to use green or renewable or non-fossil fuel is blunted by the lack of adequate non-fossil energy supply. Availability of the latter is not (yet) controlled by the consumer while carbon pricing affects the cost of goods and services, which are passed on to the end customer, directly or indirectly.

Carbon pricing may be viewed by some as a deterrent to productivity and may increase transaction cost. A pragmatist faced with the present state of global quagmire must reluctantly add that the short-term impact of carbon pricing may merit implementation despite the bleak prediction about its long-term value. The current call for carbon pricing is a sign of the times [10]. Perhaps 'doing' something is viewed with sympathy by the public even though citizens may not be scientifically literate to understand that tax and price does not address the science of reducing carbon emissions or the root cause producing the effect (emissions). In fact, carbon pricing may turn the age-old aphorism on its head: go where the pastures are not so green! Carbon pricing in the "systems age" may also ring similar to the cliché of running out of iron ore in the middle of the industrial age. In other words, carbon pricing may produce the unanticipated effect of industries migrating to zones where carbon regulation is not ratified or sloppy in its execution and enforcement. It may be naïve to expect harmonized global carbon pricing or uniform taxation (carbox) schemes [11].

Governments may choose to ignore carbon regulations to attract businesses. Ireland, an EU member state, has successfully resisted EU calls for uniformity in corporate tax. In order to attract and keep big corporations operating and "cooking" their finances in Ireland, the government has held fast to the low 12.5% corporate tax rate. The Irish ignited the wrath of some by ignoring EU's call for constitutional harmony by voting against the adoption of the Lisbon Treaty but in the wake of its financial scandal and bankruptcy, the country made a dramatic political U-turn. Ireland voted decisively in favor of the Lisbon Treaty (10/2009) just 16 months after it first rejected the EU reform plan. Ireland then applied to the EU for over 70 billion Euro in bailout to prevent bankruptcy due to its corrupt banking practices.

Hence, carbon pricing initiatives are plagued with politics and acrimony stemming from ambiguities about models, standards, metrics and data dependencies. Lack of global accord shall segue to an uneven playing field of carbon haves and have nots. If viewed from the perspective that the glass is half full, legislating carbon pricing may induce awareness that climate change affects all and each one of us has a role to play. The urgency to shake off the economic burden of carbon taxation or to legally defy the validity of carbon legislation, the energy industry may engage to educate and inform the masses why investment in nuclear fission energy guarantees sustainable return with long term benefits for the economy and the environment. The recent tsunami in Japan (3/2011) and damage to its nuclear installation in Fukushima may deter the global ramp up of non-fossil energy from nuclear fission and may empower OPEC to fracture the global resolve to reduce dependency on oil.

Nevertheless, the US Nuclear Regulatory Commission (NRC) has registered applications for licenses to build 25 new reactors (as of 07/07). The projection that in 2030 nuclear energy shall provide about 10% of the global energy demand may be short sighted [3]. By 2030, China and India's energy demand is expected to exceed 4,000 and 1,000 MTOE (million tones of oil equivalent), respectively. The global demand for energy is expected to approach 15,000 MTOE by 2030. The good news is that there are solutions [9] and the demand can be met by an abundance of non-fossil non-vegetative carbon neutral energy. The advances in the next few decades may also enable reduction of the unit cost of nuclear energy from $150 per barrel oil equivalent, estimated at present. Capital expenses, amortized over time, shall further aid nuclear energy cost reduction and stabilization of energy supply. The latter is preferred over carbon taxa and the burden of bureaucracy implicit in compliance.

It appears that the energy debate is losing its coordinates in the cost versus value argument. The value of non-fossil nuclear energy is far more important that the present or perceived cost. In 1960, DEC produced PDP-1, a desktop computer at $120,000. Today, Walmart sells powerful desktop computers at $300 or less. In 1956, Ampex pioneered the video recorder market and each VCR unit was priced at $50,000 [12]. Today you cannot find a VCR. By 2050, the cost of clean and safe non-fossil energy from nuclear fission may follow similar trends in addition to competition from emerging energy supply from nuclear fusion [13]. No matter how irrational, Fukushima and Chernobyl will be used to stoke public resistance. The oil industry will fashion its business by pushing for fossil fuel exploration and even modest success [14] could push aside the drive to be free of fossil fuel [9].

Global productivity gains and improvements in standard of living may not be constructed through the tunnel of energy conservation, either. It is imperative that the global economy strives to become agnostic of energy. Availability of energy to fuel progress should become a non-issue. An analogy may be found in the cost of computing. It has decreased so much so that applications, irrespective of complexity, may ignore the cost of processing power as an insurmountable transaction cost. A garden variety chronometer watch bought from a corner convenience store has more computing power than ***all*** computers in Silicon Valley before 1975. Can you imagine a world where Nintendo Wii, Sony PSP, iPad, Facebook, Amazon or Google users may be required to pay a computer processing tax or "MIPS based pricing" for computing intensive applications? How about an internet-over-user (IOU) tax?

Innovation in renewable sources [9] may add to the safety net of grid based electricity powered by nuclear energy. Innovation in hydrogen generation through replication of photosynthesis [15] and hydrogen storage in carbon nanomaterial [16] fuel cells may change the transportation industry [17]. An energy agnostic green economy will need liquid fuel in the post-2050 era when liquid petroleum availability may extract a price which may not be affordable or justifiable. Short-chain hydrocarbons such as liquid butanol produced from metabolic genomic engineering of microorganisms feeding on wate biomass [18] rather than items with food value (corn, sugarcane) is another source of carbon neutral liquid fuel. In addition, biosynthesis of butanol or glucose by photosynthetic microorganisms [9] may provide renewable sources of non-fossil non-vegetative carbon neutral liquid fuel.

Harnessing the power from other renewable sources depends on innovation in storage technologies. Wind, wave and solar energy are excellent alternatives as long as the need for affordable storage is not a part of the process. The best batteries, at present, can store only about 300 watt-hours of energy per kilogram (gasoline stores about 13,000 watt-hours per kilogram) and is one of the available solutions for storing solar energy (or any energy). The numbers add up poorly if wind energy [13] is used to pump water at an elevation and then (run water through a turbine to) generate electricity. 1 kg of water raised to 100m stores 1 kiloJoule of energy compared to 1 kg of gasoline which stores 45,000 kilojoules of energy.

If policy and principles are based on scientific evidence, then, one must wonder whether carbon pricing or levying a duty based on emissions can be rationalized as an ***incentive*** when the business of non-fossil alternatives are embryonic or demonized by society (nuclear energy). But, there is no doubt that 'something' must be done to restrain the unbounded and perhaps unbridled growth of the carbon footprint. Energy conservation through micro-metering and monitoring usage by deploying wireless sensor networks [19] to reduce waste are healthy approaches to limit the carbon footprint. Accumulation of carbon credits by demonstrating the reduction of carbon footprint is certainly a goal worth pursuing. However, the metrics and data stream necessary to determine carbon savings and assignment of carbon credits are still developing [10]. This quagmire may offer temporary advantages and innovative opportunities for integrating systems that may meter and monitor usage, document reduction in footprint over time and generate online metrics-based real-time analytics. This integrated system may serve as a platform or a standard operating procedure promoted the by climate control organizations [20] or innovators [21]. Entrepreneurs [22] may have the wisdom to grasp these emerging needs and profit from creating analytics (metrics, carbon calculators) and predictive engines [23] as hosted cloud computing applications accessible through mobile web services. It may also enable grocery chains to aggregate demand to reduce waste [24] or affix carbon footprint numbers to your banana [7], depending on its source, production, transport and distribution, or, in other words, the digital carbon supplychain [20]. If you pay more for a banana imported from Central America, then, the carbon pricing scheme in effect, masquerades the temporary failure of government incentives and leadership to provide global public goods [[25]], in this case, safe supply of non-fossil energy.

Later in this century, to provide about 10 billion people in the world an adequate level of energy prosperity, conservatively estimated at a couple of kilowatt-hours per person per day, the global demand may exceed 60 terawatts or almost a billion barrels of oil per day [[26]]. Three Gorges Dam in China, the largest hydroelectric power station, built at a cost of US$22.5 billion, may generate 22,500 MW at its peak, an order of magnitude more energy than what is generated by the Hoover Dam or the largest nuclear reactor in operation [[27]]. The construction necessary to build power plants to meet the domestic energy demand will be staggering even if the US were capable of reducing its energy craving and consume a mere 10% of the projected global energy demand.

Climate control and carbon pricing may be synonymous but it does not address the root cause and only a temporary measure. The implication of taxing the key medium of global productivity (energy) is similar to the scenario where one hopes that a race horse will win the race even when a heavy load is mounted around its neck. Economic hindrances imposed on mediums of growth (energy), communication (internet), human capital (healthcare) and capacity development (immigration) may only serve to slow the progress of civilization.

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