Financially Advantageous Approaches To Sustain The Ecosystem

Ethical Markets highly recommends this article "Financially Advantageous Approaches to Sustain the Ecosystem" by NASA Chief Scientist Dennis Bushnell, which outlines the best ways forward to accelerate the shift from fossilized industrial sectors to the fully competitive, renewable, highly-efficient circular economies we have tracked in our Green Transition Scoreboard® annually since 2009, currently totaling a cumulative $10.387 trillion.

Introduction

Humans are shorter term in their approach to problems and solution spaces. For evolutionary, gradual changes/issues with less than major impacts in the longer term, such a tactical approach is/has been successful. Abetting such a prevalent near term focus are two realisms: first, the amygdala, the part of our brain that keeps us conservative and second the power, financial and political of the current status quo/"winners". The overall result is a reluctance/resistance to change, risk aversion, and shorter-term fixation.

Although we have extensively studied climate change and ecosystem degeneration driven by human activities for decades, there has been huge inertia-to-denial until rather serious changes/impacts became readily apparent. Examples of such impacts for climate change include more prevalent and extreme floods, storms, disease, fires, ocean level rise, species extinctions, ocean acidification, ocean circulation changes, and temperature increases and are in fact evident now. In fact, during the Permian Extinction (also known as "The Great Dying") the ocean circulation changes resulted in increased anoxic ocean conditions, leading to an overgrowth of cyanobacteria/blue-green algae. This alga produces hydrogen sulfide, which, in small percentages in the atmosphere, is a poison and attrite the ozone layer. Therefore, climate change is more than warm days and wet feet. The book "Drawdown" by Paul Hawken provides an extensive compilation of approaches to mitigate climate change. He discusses 80+ ways forward with an estimated total savings of approximately $73T over 30 years (Ref. 1). Current impacts to ecosystems include: fresh water shortages, species extinctions, pollution, deforestation, loss of topsoil, and wildlife habitat. The humans are practicing anti-terraforming, with many and rapidly increasing costs (e.g. financial, human/species lives, quality of life, etc.).

Fundamentally, humans have been too successful as a species. We have pursued ever greater human numbers and an overall growth mantra as the economic basis without consideration of the

finite size and capacity of available resources and the dumping ground (e.g. the major human uses of the finite ecosystem). The ecosystem provides the essentials for life including water, air, food, soil, plants, minerals, etc. and we are seriously now degrading it at our peril. Water regulation, pollution filtering, waste sink functionality, soil retention, nutrient cycling, and waste decomposition are all becoming degraded. Ever greater growth with a fixed resource is only possible via utilizing technology and approaches to alter resource utilization and/or controlling population. For many centuries, as humans depleted local resources, they have simply moved to other regions where resources were available. That is no longer an option as the present technologies and processes are degenerating the entire planet. There appears to be general agreement that we are short approximately 50% of a planet now. As world population growth continues and living standards rise, projections include a shortage of some three planets (i.e. ecosystem resource utilization and dumping will have to reduce considerably). Altering technology and approaches to adapt to such growth is termed sustainability, with various alternatives termed green growth, reusability and The Circular Economy. It also involves the valuing, protection, and strengthening of what are termed "ecosystem services" (Ref. 2).

The purpose of this report is to consider the examination and application of financial gain incentives to greatly accelerate the development of sustainability as a whole. This financial approach is responsible for the now hugely successful growth of renewable energy generation and storage. During the last decades, technology has reduced the costs of renewables and storage to the point where they are below parity and still reducing in cost. Not much happened with regard to application and utilization of renewables until their costs reduced such that financially they were the best solution (Ref 17). The major determiner of their application was financial gain and not the climate downsides enumerated above. Also, inexpensive renewable, green electric generation and storage are the pivotal key or enabler for climate mitigation as electrification can be applied widely to the other major sources of CO_2 besides electric generation (e.g. transportation, industrial and commercial operations, building HVAC, etc.). Many functions and processes now producing CO_2 can be electrified, so the renewables growth will have a seriously major overall impact on climate. It is perhaps useful to examine the particulars regarding this financial driven renewables success story, and then to collect and ideate some similar financially overarching approaches and technologies for ecosystem rejuvenation/sustainability to hopefully greatly accelerate such.

There are two obvious high-level sources of financial benefit for both the ecosystem and the portion of the ecosystem currently being seriously worked (i.e. climate). These financially beneficial approaches strive to mitigate the trillions of dollars of negative effects due to ecosystems and climate if the current negative trends continue, and to alter technology and approaches to situations with major profit potential. First, the current financial approaches for climate will be examined and then secondly, a similar overall approach will be applied to the rest of the ecosystem to enable

sustainability, the circular economy, green growth, etc., obviating continued ecosystem degradation in the process. The overall bottom line of business as usual is an average loss of some 7% (or more depending upon actual temperature rise) of global Gross Domestic Product (GDP) by 2100 (Ref. 3). On the other hand, seriously working mitigation of the ecosystem including climate is projected to increase global GDP by some 5% by 2050.

It is not possible to change things for the overall financial and ecosystem good without, in fact, changing some things. There will be winners and losers. In the case of climate, for renewable energy the winners are the public with reduced climate impacts across the board, reduced energy bills, cleaner air, and firms that successfully manufacture and sell various types of renewable energy. Losers thus far, due to availability of lower cost options, include coal and nuclear power. As renewables and storage continue to reduce in cost and become more efficient, gas and petroleum will probably be seriously affected. Investors in these previously dominant industries will be left with stranded assets even though the amounts invested in these fossil carbon industries were, are, still remain, major. Therefore, as we change our approaches to reverse the current climate and ecosystem trends, there will be financial difficulties associated with such losers that will have to be considered/worked. For example, the stock market value of the U.S. coal industry in 2011 was worth approximately $37B. As of 2019, its worth was about $2B (Ref. 4). Historically, there have been concerns regarding the costs of ecosystem/climate remediation. However, now action has shifted to concerns going forward regarding the even greater costs of not taking action/remediation (Ref. 5) along with not taking advantage of the financial opportunities associated with those remediation approaches (e.g. green growth and the circular economy). As mentioned previously, there will be some cases where specific major industry/resources will be negatively impacted.

An indication of this 180 degree shift is mirrored in the increasing importance of climate/environmental performance upon the evaluation of top management. The governor of the bank of England stated that companies that fail to respond to the challenges of climate change will go bankrupt without question. The value of the rapidly growing Global Green Economy in 2015/16 was at least $7.87T (Ref. 6).

A Simplex Look at The Climate Financials Story

Part One – Negative Climate Change and Financial Avoidance

1. Avoidance of huge insurance*, personal, productivity, commercial/industrial losses from climate change induced/increased phenomena including:

- Flooding

- Storms
- Fires
- Sea Level Rise
- Droughts
- Disease
- Temperature increase/heat
- Landslides

*Insurance is some 11% of the U.S. GDP (Ref 5).

2. Avoidance of negative impacts on fields such as:

- Agriculture
- Fishing
- Health services

Infrastructures

- Mining
- Supply chains
- Food systems
- Asset prices (including real estate)
- Land/labor productivity

3. Projections indicate that the U.S. economy could shrink on the order of 10% to 25% by 2100 depending upon the effects of positive feedbacks.

4. Recent estimates of the social monetized cost/ton of CO_2 emissions on the economy is on the order of $100/ton in 2018, with 37B tons emitted, resulting in $3.7T/yr societal costs or approximately 4% of GDP (Ref. 7). Other recent estimates of the social cost of carbon range from $220 (Ref. 8) to $500+ per ton of CO_2 emissions, depending upon what costs are included.

5. Given the cost of raising children, it is of interest that in terms of reducing carbon emissions at the personal level, having one fewer child saves the most by far, 58 tons of CO_2 emissions/yr (Ref. 9).

6. Consumers, given the now obvious manifestations of climate change, are increasingly demanding climate friendly operations and products across the board, producing loss of business for those who do not deliver such

7. Almost a quarter of all disease is caused by adverse environmental exposure (Ref. 10).

8. Estimates indicate a two degree C temperature rise would reduce GDP by 15% and a three degree C rise would reduce it 25%. In 2100, temperature rise is slated for 4 degrees C, producing a 30% reduction in GDP (Ref. 11).

9. Yearly cost for unmitigated climate change would total at least 5% of GDP and the yearly cost could be as high as 20% of GDP (Ref. 12).

10. Warming of 6 degrees C could lead to present value loss of $43T or 30% of the global total (Ref. 13).

11. Since 1980, extreme weather has cost $1.6T (Ref. 11).

12. Over a decade the U.S. EPA Regulations cost $45B and produced $640B in benefits (Ref. 14).

13. In the U.S., $23 trillion will be lost if temperatures rise four degrees by 2100 (Ref. 15).

Part Two – Prospective Financial Gains from Mitigating Climate Change

1. Due to technologies and economies of scale, renewable energy generation is now at or below cost parity with fossil carbon fuels and still plummeting. Energy storage costs are reducing rapidly, leading to cheaper electricity and electric transportation, new markets, and reduced costs of living and manufacturing costs. Indicators show large job increases in related fields, reduced health issues from fossil fuel pollution, along with much reduced cooling water requirements.

2. Less costly energy enables more profitable desalinization, aluminum production, ocean mining, etc.

3. Distributed energy, including at home energy generation, constitutes a more reliable, robust, and less expensive system.

4. Energy conservation developments enabled efficient buildings that produce energy vice constituting a sizable source of energy load, major costs.

5. There are potentially huge profits from switching from Glycophyte/fresh water agricultural approaches to halophyte/saline (Ref 16) agriculture. It allows for utilization of massive currently unexploited planet resources such as deserts/wastelands and saline/seawater. This new approach would:

- Produce biomass for replacing petroleum for petrochemical feedstock
- Produce massive amounts of food/free up a sizable portion of the 70% of the fresh water now used for agriculture
- Produce massive amounts of biofuels
- Sequester major amounts of CO_2
- Address resource challenges relating to land, water, food, energy, and climate
- Reduce costs of, and the need for, ever more courageous water conservation

6. This new approach would result in a wholly new agricultural industry with a huge environmental upside utilizing ultra-inexpensive land and water.

7. Battery/energy storage markets are huge, and increasing rapidly. Battery prices have fallen some 85% in a decade (Ref 17).

8. Renewable energy investments over the past decade are estimated at $2.5T, with a major growth in related employment (Ref 18).

9. Reportedly, investing $1.7T in climate change mitigation over the next 10 years would yield $7T in economic returns, due to avoidance and increased productivity of new equipment (Ref 19).

A Look at the Potential Ecosystem Financials Outlook

Part One - Negative Ecosystem Degradation Financial Avoidance

1. Avoidance of major personal, commercial, industrial, and agricultural losses from ecosystem degradation due to:

   - Loss of topsoil
   - Fresh water shortages
   - Species extinctions
   - Pollution including trash and industrial waste
   - Deforestation
   - Loss of fish stocks
   - Depletion of natural resources

2. Avoidance of some 9 million deaths/year from pollution (e.g. ozone, CO, NO_2, particulates, SO_2, ammonia, lead, chemicals), which is 15 times the number of deaths from wars and 16% of global deaths/year. Costs of pollution are some $4.6T on the global economy (Ref. 20).

3. Marine plastic pollution costs the world up to $2.5T a year (Ref 21).

4. Nine out of 10 people in the world breathe highly polluted air (Ref 22).

5. The world's terrestrial ecosystem services have been valued on an annual basis to be approximately equivalent to the annual GDP (Ref. 25).

6. The cumulative loss of biodiversity and associated ecosystem services between 2000 and 2050 could be equivalent to 7% of the 2050 world GDP (Ref 24).

7. Between 1997 and 2011, estimates indicate the world lost up to $21T in ecosystem services due to land cover change and land degeneration (Ref. 23). [Note: certain references calculate ecosystem services loses differently based on certain variables.]

8. Ecosystem services vital to human well-being (e.g. crop pollination, water purification, flood protection, and carbon sequestration), are evaluated at an estimated $125-140T/ year, 1.5 times greater than the global GDP (Ref. 23). [Note: certain references calculate ecosystem services differently based on certain variables.]

Part Two – Prospective Financial Gains from Approaches to Reverse Ecosystem Degradation

1. Halophytes, salt plants on wastelands, deserts using saline/seawater

The immense advantages of switching to halophytes (Ref. 16) include:

- Saline-tolerant plant biomass utilizing what we have a surfeit of (and what could be our last major play regarding the ecosystem): wastelands, deserts (which make up 44% of the land area), and seawater (97% of the planet's water resources).
- Seawater contains 80% of the nutrients needed to grow plants, and researchers are developing new techniques to extract nitrogen from the air, thus requiring little fertilizer.
- Advanced technology is not required and cultivation uses inexpensive land and water, so the economics are very favorable. The shift to halophytes could be accomplished in relatively short order.

- Halophyte cultivation for food would free up 70% or more of the total freshwater used for conventional glycophyte agriculture, and which we are now running out of for direct human use, thus solving both water and food problems
- Cultivation of halophyte biomass would similarly obviate the necessity of using arable land and freshwater for biofuels and provide petrochemical feedstocks for plastics and other industrial products, essentially eliminating the need for petroleum feed stocks. It is literally green energy and chemicals.
- Halophytes sequester up to 18% of their carbon dioxide uptake in their deep roots (5 tons of CO_2/Ha) removing CO_2 from the atmosphere.
- Seawater contains trace elements essential to healthy human physiology, which we have largely depleted from arable land due to overuse.

2. Ocean mineral extraction using inexpensive renewable energy instead of hard rock mining which is a major source of pollution.

3. Recycling (aka the circular economy) for nearly everything including solids, liquids, and gases. Tech companies to do this at ultra-low costs and increasingly local including printers.

4. The University of Nottingham is attempting to utilize atmospheric nitrogen for agriculture, incurring far less fertilizer costs, runoff, and reducing ocean O_2 loss.

5. On less than a half-acre and with help from developing technologies, going forward we could:

- Grow own food
- Print what we want/need
- Recycle on site
- Use distributed energy generation
- Conduct tele-education and tele-medicine
- Utilize five senses virtual reality (VR)/tele-travel

This could all be done with far less physical travel needed. Many in the gig economy (based on flexible, temporary or freelance jobs connecting to customers through an online platform) and those tele-working/commuting can live just about anywhere. Going forward some may not need a job since these opportunities could result in huge personal financial independence and minimal impacts upon the ecosystem.

6. The ongoing major shift in wealth generation from exploiting natural resources to inventing things has a far smaller ecosystem impact in general.

7. Various adaptations/resilience approaches to ecosystem and climate changes have overall benefits estimated at $7T (Ref 26).

8. Mckinsey estimates business opportunities on the order of $60B/yr for new approaches to plastics recycling (Ref. 27).

9. 3-D printing will transform manufacturing by allowing the manufacturing of products to be accomplished at the individual level. This would reduce waste, enable use of new/different materials and much more complex/optimized designs/functionalities, while using 90% less material and at greatly reduced costs. 3-D printing is set to be an emerging, ecosystem friendly evolving market. (Ref. 28).

10. U.S. green economy estimated at $1.3T/yr, 6.8% of our $19T/yr economy. There are greater returns in the green economy than in the stock market. Estimated GDP climate losses/yr are some 4% of GDP. Therefore, the total effect of mitigating the losses and the green economy is 4 plus 6.8 or some 11% of GDP, which is nearly 2T (Ref. 29). The global green economy is approximately $8T.

11. There has been $10.4T in private investment during 2009-2019 in the Global Green Economy (Ref 30).

Concluding Remarks

Favorable financials and increased profits are, due to massive reductions in the costs of renewables and storage, currently on a path to mitigate/fix climate in a few decades. It is more than conceivable, given the huge economic value of the ecosystem and the major financial upsides of various mitigation approaches/alternatives, that the financials could also fix the rest of the ecosystem issues. These considerations, options, and experiences refute the long held conventional wisdom that fixing the ecosystem issues, including climate, would be extremely costly and anti-growth. In fact, considering both the avoidance of financial downsides and evolving markets for mitigation approaches and their offshoots, fixing the ecosystem and climate is the way forward to excellent financial growth and success. It will require changes, which are either already underway or available for financial exploitation. So, yes, decarbonization and a circular economy/green growth are both achievable in the midterm, and are very financially advantageous. In the case of climate, there was minimal progress until the financials became advantageous. That same power of the financials can, and should be successful in regards to greatly improving the outlook for the rest of the ecosystem.

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