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Energy Sustainability and Pope Francis' Encyclical on Care for our Common Home: National Policies and Corporations as Change Agents

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Abstract

It has been widely accepted by policy makers, corporate executives, and citizens alike that economic growth is the measure of a nation's prosperity and well-being. The almost single-minded focus on growth, however, is achieved at high ecological and social cost, which has become a source of great concern. One of the driving forces behind unbridled growth has been the unquenchable thirst for energy worldwide. This paper investigates the challenges posed by the growth-energy nexus. While renewables are making giant strides, they account for a mere fraction of the world's energy demand. The Papal Encyclical Laudato Si' offers a detailed analysis of the harm humanity has inflicted on its common home, and the arguments developed in this paper are evaluated through the prism of the Encyclical. The underlying mindset preventing more sustainable ways of generating and using energy is explored, and the need to articulate human spirituality while accepting scientific consensus is emphasized. The recent international accord addressing climate change, already facing the threat of withdrawal by the United States after the recent election, can only work if the "technocratic" paradigm is radically modified. The paper provides evidence that national and local policies mirror public attitudes to tackle deteriorating environmental and social conditions. It concludes that corporations, mentioned in passing in the Encyclical, are beginning to play a central role in finding sustainable solutions, regardless of whether the international consensus holds.

Key words: Economic growth, energy needs, Papal Encyclical, mind-sets, government policies, corporate sustainability

Author's Note:

As a Professor of Business, my research focus has generally been on ways in which business firms can achieve greater success, particularly through innovative practices. I decided to change the direction of my enquiries, and perhaps my life, when a student of mine asked me, "But with all this innovation going on, and new products coming out all the time, aren't we using up more and more resources and throwing away so much we have made?" Not only did this set me on the path to looking at Sustainable Development more carefully, and why it has become such a contentious issue, I have started teaching Sustainability in Business and infused the concept into all my courses.

After reading and studying the Papal Encyclical, Laudato Si', I felt compelled to view it from the perspective of technical and social dimensions of energy generation and usage in a sustainable world. I think the Pontiff Pope has not acknowledged the contributions business firms are making to sustainable development, and will continue to do so, regardless of whether the political will to act exists or not.

Economic Growth and Its Discontents

Economic growth worldwide has averaged 3% or more per year over the past twenty years, even considering the financial crisis of 2007-'08 (Tani, 2016). Rapid economic growth has not come without a cost. Inequalities both among and within countries have been exacerbated, creating a crisis from capitalism's unremitting and almost single-minded focus on economic growth (Alderson, 2001; Izaak, 2005; Stiglitz, 2006). Stagnating incomes have spurred a rising tide of nationalism in parts of the developed world, which appears to be driven in large part by the perception that free trade has helped millions in less developed nations at the expense of the middle class in wealthy countries (Collins, 2015). The pursuit of rapid economic growth has not only contributed to rising disparities in economic outcomes and hostility to the Other (across and within countries); it has also accelerated ecological damage. As Rees (2012) shows, rising incomes stimulate increased consumption, thus exerting greater pressure on resources, and furthering environmental deterioration. Though ignored or denied for almost two centuries after the start of the Industrial Revolution, environmental damage and resource shortages (costs of which are borne by society, resulting in what Hardin (1968) referred to as the Tragedy of the Commons) have accelerated, especially over the past two decades. The question of carrying capacity (resource availability and waste/emission absorption in a specified region) has been debated for almost half a century and is now beginning to acquire ever-growing urgency (Ophuls and Boyan, 1992).

In this paper, we focus on the challenges posed by the world's seemingly insatiable demand for energy and natural resources. We discuss why urgent action is needed, and what forms the solutions might take. In making the case for action, we draw on the literature and on the wisdom of Pope Francis, as exhaustively explicated in his recent Encyclical Laudato Si' (2015a), and address some of the criticisms leveled against the Pontiff's assertions. We concur with the Pope that a radical transformation of people's mindsets and the development of a spiritual, reflective perspective on our relationship with Nature and with one another is imperative. The paper contends that governmental policies, working in tandem with public concern over deteriorating (local) environmental and social conditions, are beginning to address the complex challenge posed by climate change. Paradoxically, business firms, which have been widely

viewed as being culpable of contributing in large part to the world's ecological and social problems, could play a leading role in finding solutions to the crisis.

Energy Usage and Carbon Emissions

Since the Industrial Revolution, the predominant sources of energy have been fossil fuels, chiefly derived from oil, gas, and coal. The burning of these fuels has resulted in an increase in greenhouse gases (GHGs), most importantly carbon dioxide and methane (according to a large body of scientific evidence), which have contributed significantly to the rise in atmospheric carbon. By the first decade of this century, the carbon content in the atmosphere had gone up from 280 parts per million (PPM)in the early 19th century to over 400 PPM, an increase of over 40%. Experts note that if the carbon level were to rise to the 450-500 PPM range (which is expected by 2050, if carbon generation continues at the present rate), the accumulation of carbon and its cumulative effect may become irreversible (Jackson, 2009; Imster, 2015). In fact, recent reports suggest that despite a brief dip in carbon emissions in 2009, carbon pumped into the atmosphere exceeded 40 gigatonnes in 2013 with CO2 added at a rate of almost 2ppm per year (Plait, 2014), a tonnage and rate which makes a damaging temperature increase of over two degrees Celsius all but inevitable (Harvey, 2011). Though the United States has recently achieved a partial decoupling of emissions from growth, the substitution of gas for coal has been a contributing factor (Davenport, 2016).

Pope Francis, in his Encyclical Laudato Si' (2015b), cites his predecessors when arguing that an economic system whose success derives from ever-rising levels of consumption coupled with the perception that resources (including sources of energy) are limitless has had a tremendously deleterious effect on all creation. It is imperative, in his view, that we take care of our common home. Echoing Patriarch Bartholomew, the Pope posits that causing harm to any part of creation is a sin against all of creation. He calls on us, in the words of St. Francis of Assissi, to feel "…intimately united with all that exists…" (Laudato Si', 2015c).

Montgomery (2015) takes issue with the Encyclical on the grounds that tinkering with the market economy would hurt both the rich and the poor. He argues that, as incomes rise in developing nations, emissions and pollution will decline. As evidence, the author cites the reductions in sulphur dioxide, particulate pollution, and

carbon emissions per capita in the United States over the past two decades. However, Montgomery does not mention that a combination of many factors- GDP growth slowing down in the US, energy efficiency going up, gas substituting for coal, more stringent regulations (rather than a simple inverse relationship between income growth and emissions), and a ramping up of outsourcing of manufacturing (as well as services)- contributed to the decline in GHG emissions. Moreover, capitalism varies in terms of regulation, industrial policy emphasis, state ownership of firms, political freedoms, and intervention, and levels of foreign investment change from country to country (The Economist, 2012). Generalizing from the experience of the United States to highly dissimilar societies does not seem to be grounded in reality.

The promise and limitations of Renewable Energy

The world's appetite for energy is so voracious that generation capacity has to be added in large chunks measured in gigawatts (GW) or billions of watts. The world's electrical energy capacity grows by about 500 billion kWh per year (the equivalent of 30 million American households' energy needs) and is expected to reach 26 trillion kWh in 2020 (EIA, 2016), even accounting for capacity that becomes obsolete. China alone will add almost half that amount. The additions will probably be more efficient at reducing both coal consumption and CO2 emissions per unit of output. However, the net carbon being added to the atmosphere is far from insignificant. The world is nowhere near the ideal of absolute decoupling or delinking energy generated and used from carbon produced. For low-carbon energy to become a reality, drastically different methods of generation, transmission, distribution, and consumption of electricity are needed.

Solar power generation has been growing at an extraordinary pace over the past decade, particularly in countries which are the leading carbon emitters. In the United States, for instance, a total of 7.3 GW solar photovoltaic (PV) capacity was added in 2015, with around 9GW likely in 2016. The total installed capacity of solar PV is of the order of 28GW (an approximation, since accurate data on rooftop installations is hard to come by; SEIA, 2016). The cost of solar cells has dropped by an order of 10 in the last 15 years, making solar even more attractive as a power source (Solarcell, 2015).Wind power has grown by leaps and bounds and reached a total of over 50 GW installed capacity in 2012 (EIA, 2016). Coal generated power installed capacity has decreased over the past few years due to

increases racked up by renewables and natural gas. Just in 2015, coal-fired power declined by almost 13 GW. However, considering that the country's installed capacity for electricity generation stands at about 1100 GW, renewables constitute only around 2% of power generation added every year. The picture was, till recently,even less promising in the developing world, as noted later in the paper.

The impact of fossil-fuel based power generation (and, it may be added, transportation) is made even more harmful when one considers that emissions also contain particulate aerosols. Larger particles trap heat and act like GHGs, while smaller aerosols reflect light back into space, reducing warming effects. Unfortunately, when inhaled, the latter (in particular, those known as PM2.5) are dangerous to health; the most widespread and immediate effects include pulmonary and cardiac illnesses. (Hicks, et.al., 2012)

While solar and wind power are clean, albeit non-continuous, sources of energy (unless high capacity storage systems, such as batteries become available), they are often dependent on subsidies and incentives. Battery technology is indeed advancing at a rapid rate. Indications, however, imply that affordable large-scale batteries may not emerge till 2020 or later. It has been noted that if renewables were installed at sufficient scale in diverse locations, this energy "portfolio" might provide a steady supply of electricity when connected to the grid (Marcus, 2015). On the other hand, nuclear energy—a relatively carbon-free source of electric power—is capable of substituting for coal at a gigawatt scale. However, the risks inherent in operating huge nuclear plants and in disposing of radioactive waste have policy makers and sections of public opinion opposed to installation. Large developing nations like China and India plan to install scores of nuclear plants in the coming decade, while simultaneously expanding solar and wind capacity in large chunks. It might be worthwhile for other countries with massive energy needs to explore making nuclear power safer and speedier to install in terms of product and process technology, location, and so on.

The Encyclical makes the case for ramping up the availability of renewable energies, and for redoubling efforts to develop better battery storage. Pope Francis emphasizes the importance of carbon emission mitigation efforts, such as cutting down on consumption in rich nations while substituting fossil fuels with renewable energy sources (Laudato Si', 2015d). The "ecological debt" owed by early industrializers to the developing world (arising from carbon

emissions, pollution, resource depletion) should, the Pope argues, be repaid by helping poor countries ameliorate the abject conditions in which the poor live and subsidizing the use of advanced technologies (including renewables). The Encyclical makes the case for systemic solutions, arguing that piecemeal efforts (e.g. renewables alone) in which one technology seeks to ameliorate the impacts of another can only make the situation worse. Efforts to reduce energy usage in production and transportation as well as in living and working spaces must complement the moderation of demand and consumerist tendencies. Though the Encyclical does not specify the amount or modality of settling the "debt", the fact that the concept of a debt owed by one set of nations to another has been incorporated into the Paris accord (UNFCCC, 2016) is an achievement in itself.

Equity Today and in the Future

Sustainability is often framed in terms of Brundtland's formulation of present actions not limiting future actions or harming future generations (WCED, 1987). When the harm caused by carbon emissions and increased pollutants is projected to make itself felt as soon as 2050, policy makers and the general public tend to favor postponing action until definitive proof of the costs of inaction is available. However, some of the repercussions of industrial growth without restraints can be seen in the present, though climate change skeptics either deny the evidence or attribute the undeniable to natural causes. For instance, parts of the world are facing increasingly arid conditions, while other regions are being deluged with far-above-average rainfall. Some are experiencing rising sea levels and/or temperatures, loss of fish populations, and a variety of other persistent near-catastrophic phenomena (McKibben, 2007). All this is happening right now, and are not events which might occur sometime in the future. In nearly all these instances, the ecological burden has fallen disproportionately on the less privileged and the poor, which could be one reason why powerful actors are so slow to take action.

Large scale malnutrition, diseases exacerbated by warming climates, shooting wars, and floods of refugees are already posing a major challenge for countries which are not equitable societies to begin with, as well as for entire regions (such as Europe) which have seen a surge in people fleeing areas of conflict engendered, in part, by the nexus of ecological damage and social inequity. The armed struggles which have broken out in parts of the Middle East (e.g.

Syria and Iraq) and Africa have been attributed to a succession of burning hot summers in regions suffering from acute poverty and wide disparities (Biello, 2009). The Environmental Justice Foundation views climate change as a "threat multiplier", exacerbating simmering tensions in already vulnerable communities (EJF, 2017). According to the Center for Climate and Security, agriculture-dependent areas marked by poor governance or active repression are places where climate change could be the tipping point leading to rebellion and violence (CCS, 2017). Pope Francis concurs, observing that "…once certain resources have been depleted, the scene will be set for new wars" (Laudato Si', 2015 e). With much of the rich world preoccupied with growth and consumption, the result is "…the globalization of indifference" (Laudato Si, 2015f). A focus on the individual and a lack of caring for others, an obsession with technology to the detriment of a sense of community, sacrificing future generations on the altar of today's wants, and a sense of futility when confronted by the gradual damage being done to all of creation only help institutionalize this indifference.

Furthermore, when tackling increasing inequality, the Pontiff's focus is on the poor of the world, particularly in less developed countries, and not so much on the middle-class in the rich world, who appear most exercised over the perceived harm caused to them by globalization. In fact, Pope Francis explicitly mentions decision-makers and opinion leaders living in rich urban areas as being responsible for ecological deterioration (in fishery depletion, water pollution, sea-level rising, floods, etc) which disproportionately affect the poor of the world. (Laudato Si', 2015g). With rapidly increasing urbanization, the energy demands of large cities worldwide are exacerbated by the fact that city dwellers often have tenuous connections to Nature in all its wonder and beauty. The work being done in some of the world's largest cities to reduce the use of fossil fuels, conserve water, facilitate mass transport, and lower harmful emissions in partnership with firms like Siemens constitutes an admission of the inadequacy of, and a direct intervention into, the workings of the market to reduce and even reverse environmental damage (Portney, 2013).

In Gregg's (2015) view, the Encyclical has been strongly influenced by the Pope's Latin American background (the use of the terms 'global north' and 'global south' seem to particularly irk the researcher), and glosses over the social and ecological damage done by left-leaning regimes (though he avows that the Pontiff is no

Marxist). The author argues, like Montgomery (2015) earlier, that growth is the best remedy for poverty. He finds it paradoxical that those who seem to be highly exercised over the impact of climate change on future generations do not appear as concerned about mounting debt levels. In his defense, Pope Francis does not exonerate leftist regimes of the past or present; he merely points out where the human race stands now, and what factors today constitute the greatest threats to our continued existence.

Admittedly, the Pope takes a 'subaltern' (Guha, 1983) perspective; that is, events as seen from ordinary citizens', as opposed to the elites', point of view. Given how markets can be distorted by elites (even in countries with stable institutions), the Encyclical's intent and tone seem apropos to the state of the world. While debt and deficits are indeed worrying factors, neither are existential threats, and from the developing nations' standpoint, ecological debt must be part of the conversation.

Sustainability: Institutional and Cultural Tensions

It is worth noting that concerns over anthropogenic climate change and its worsening repercussions are far from universal. Climate change skeptics and deniers abound, including politicians (who label climate-change findings and scenarios, even when studies are conducted by reputable institutions, as "junk science"), corporations, think tanks, anti-UN activists, and lobbying groups (Mooney, 2005; Muller, 2012). It is clear that there is an essential, deep-rooted tension between sustainability and the dominant market/technocratic paradigm. One way to understand the contradiction is to examine our prevalent mental models. Based on empirical research, Adams et. al. (2009) observed that respondents (middle managers) in a variety of countries seemed to adopt a position best characterized as:

Short term (immediate priorities) vs. long term (vision and potential-driven)

Reactive (responding to external demands) vs. creative (novel solutions, internally driven)

Local (concern for self or narrow needs) vs. global (larger collective-organization/nation/world)

Separation (specialized) vs. systemic (holistic)

Accountability (clear responsibility) vs. learning (improvement oriented), and

Possession (ownership, materialism) vs. being (reflective, value of intangibles).

The results indicate that while one-third of the respondents occupied the middle ground, the overwhelming majority of the remaining two-thirds expressed a preference for the constructs on the left (short-term, reactive, etc). Four of the five countries from which respondents were drawn are developed nations, and the fifth (India) is an emerging economy. Though the survey reflects corporate perceptions, it is a microcosm of societies in these nations. Citizens in some countries, however, (e.g. the Netherlands) might lean more toward the right side of the above scale.

While questions concerning sustainability call for the ability to think expansively in both time and space (i.e. beyond the immediate present, and in a global sense) and pursue greater equity, participation, and transparency, the dominant mental models held by people in a variety of countries do not support either the ends or the means proposed to achieve them.

Ehrenfeld (2008) contends that a Newtonian, Baconian worldview still dominates our thinking. It remains focused on the individual, is atomized, and values human needs above all else. In the author's view, a "sustainability culture" is characterized by holism, a sense of belonging to a community, and flexibility in adapting to emerging challenges. Ehrenfeld provides a taxonomy of caring and discusses the importance of caring for oneself, for others, and the world as a whole, with self-actualization and spirituality forming foundational elements.

Pope Francis' encyclical Laudato Si—which, as we noted earlier, makes the critical connection between ecological damage and the worsening plight of the poor living at the margins of all societies, particularly in the developing world—sees the natural environment as a "…collective good…" to be nurtured. Rather than view creation as being at the service of humanity, he calls on us to recognize that human beings and the rest of the natural world are equal partners in creation and the Divine plan (Laudato Si', 2015h). The Pope zeroes in on individualism as the root of humanity's socio-ecological deterioration. When we value self over community, possessions over being and caring, and seek external affirmation rather than inner peace, we are, in effect, diminishing the sacred in all of God's creation. While Francis exhorts us to solve social problems through community networks, he does not expect individualistic societies to switch to a collective or communitarian mind-set (Hofstede, 1980).

Instead, he proposes spirituality and a search for inner peace as the means to attain a sense of oneness with creation. Rather than focusing on what we lack, we should fully appreciate and enjoy what we do have. The Pontiff commends to us the Ignatian ideal of seeing God in all things to help us break the individualism-consumption-growth cycle that has held us in thrall for about two centuries. Francis confronts a shibboleth of the market economy head on: that customer needs and demand are paramount. He appeals directly to consumers to moderate their needs, do with less, and to attach less importance to possession and more to community, sharing, and reflection. He also appeals to citizens to make small sacrifices, even ones as minor as turning down the heating or cooling. A recent report exemplifies what the Pope has in mind. In the English town of Ashby. a bottom-up campaign is underway to reduce energy usage at home, use bicycles for transportation, substitute fossil fuels with renewables, and so on in order to achieve energy-neutrality (Schlossberg, 2016). This is exactly the type of grass-roots action the Pontiff would like to see on a large scale (as we note in a later section,this sort of bottom-up activism is spreading, arising often from serious, even catastrophic, events experienced by people in different parts of the world). Materialistic, consumption-driven, wealth-creating, individualistic societies are not likely to turn spiritual overnight. However, faced with tragedies and disastrous occurrences of our own making, a mindset change could develop over time.

As we begin to perceive the dangers in pursuing the economic, "technocratic" paradigm deeply embedded in the psyches of modernizing societies, it is necessary, according to Walker (2013), for our thinking to shift from designing products, services, and processes to designing social systems to foster reflectiveness, contemplation, and caring for others. The author argues that striving to attain what Maslow referred to as 'self-transcendence' is critical to the shift from a material, time-driven, possession-oriented society to one based in spirituality. Though the Pope accords high priority to heeding scientific studies and conclusions, he by no means cedes the moral high ground to science. On the contrary, he takes the position that science is our handmaiden in creating a better world, one characterized by community, caring, and contemplation. Eiseley (1958) and other spiritual scientists have called on us to extend our thinking beyond science and the values of the modern world, and to find personal meaning by understanding, respecting, and identifying with Nature. As Eiseley observes in a later work, Nature, rather than

being in Emerson's words, "…the immense shadow of man…", is, to quote Thoreau, "…a civilization other than our own."

Changing the Paradigm: National and International Cohesion

An obstacle to achieving international agreement on a common approach to minimize human impacts on the planet may be found in the residual effects of the colonial era. In addition to a reluctance to apply the brakes on growth, countries like China, India, Brazil, and Indonesia, with their large populations and rising incomes, are unlikely to deviate from the path to industrial growth, in part because that would mean submitting to the will of their colonial masters all over again. Globalization has set off a race for economic growth. However, it has not erased memories of domination by European powers (and by the US in its sphere of influence), in part because the rules of the game were framed by developed nations whose multinationals (and their shareholders) benefited greatly from the low cost production, marketing expansion, and knowledge-sharing (Izaak, 2005; Steyngart, 2008; Stiglitz, 2006). In fact, Klein (2014) argues that globalization is merely an extension of colonialism— or, to put it in current terminology, colonialism 2.0.

If any progress is to be achieved in sustainable development, the first move has to come from the advanced nations which, rightly or wrongly, have the tag of colonialism attached to them. One might imagine that, with more than half a century having elapsed since many of the large developing nations achieved independence, memories of foreign aggression or oppression would have faded. However, while many countries have adopted capitalist growth models of the former colonial powers (Coyle, 2014), feelings of suspicion and distrust linger. This contributes to the glacial pace at which agreement on and implementation of strategies to moderate resource depletion, atmospheric and water pollution, carbon emissions, and so on, is being reached. The irony of the situation is that, having persuaded poorer nations to adopt free market economics (or variations thereof) and having espoused globalization as a means to achieving more rapid growth, many people in the rich world are disenchanted with free trade (due to jobs lost, decline in middle class incomes, investment flows to emerging countries). Reversing the process of globalization and asking developing countries to undertake "planet-saving" measures to restore an

ecological balance , both of which are Western initiatives, is proving to be a difficult undertaking as noted by Porter (2015) and may even be viewed as Colonialism 3.0.

The Paris Climate Change Conference, signed late 2015, appears to have achieved a breakthrough in that respect (UNFCCC, 2016). To some extent, we might argue that Pope Francis' voice built momentum for the agreement to be struck, and in fact may have marked the tipping point. With 195 countries signing off on it, the agreement to limit temperature rise to two degrees Celsius relative to pre-industrial age levels broke a series of infructuous attempts from Rio to Copenhagen to find a common platform that countries at varying stages of economic development, with diverse political systems, and facing a multitude of social and cultural issues could agree upon.

Approaches to mitigation include ramping up renewable energies, preserving forests, and transferring technologies, funding, and capacity building methods from developed to developing nations. A fund providing $100 billion per year beginning in 2020 has been proposed for this purpose. Recognizing that much damage has already occurred and will continue to, adaptation mechanisms have also been proposed. Risk forecasting and management, dealing with economic losses, early warning systems, emergency preparedness, and building ecosystem resilience are among the adaptation initiatives listed.

As the Pope's contends, a radical mindset shift, a heightened sense of spirituality, and a sense of oneness with all of creation are central to changing the course that nations have set for themselves. International resolutions and national policies can provide guidelines, set priorities, reallocate resources, and so on, but changing mindsets needs help from as many quarters as possible.

National and Local Policies as Initiators and Reflectors of Change

Given the accumulating, almost overwhelming scientific evidence that human-induced climate change is occurring, public opinion in many countries in most countries has not changed accordingly. The complexities associated with understanding various projected scenarios and the probabilities of each, taken in conjunction with the perceived trade-off between addressing rising carbon emissions and economic growth are among the contributing

factors, accentuated by the political forces discussed earlier. One strategy to convice citizens and consumers that the science behind the climate issue is sound is to employ spokespeople who can effectively connect with non-academics. While "celebrities" such as Alan Alda, Mark Ruffalo, Matt Damon and others have done notable work to spread the word, experts with the ability to use everyday language might also be successful in countering the powerful economic interests vested in the status quo. For instance, television programs such as along the lines of Carl Sagan's or Neil Degrasse Tyson's Cosmos could complement the work of scientists, activists, NGOs, and others.

In addition to attempting to achieve a shift in attitudes through a direct appeal to individuals, tools are also available to governments through the adoption of appropriate policies. There are a variety of initiatives accessible to policy-makers at the national and local levels to enable more effective mitigation. Among the more commonly used tools are the carbon tax, cap-and-trade, incentives/subsidies tied to conservation, and generation of low-carbon energy. A tax on carbon is one of the simplest ways to reduce CO2 emissions. The levy is imposed on carbon as near to the source as possible (e.g. coal received at a power station). The rate is determined by the energy produced (or Btu), thus allowing for variations in emissions from different types of fuel (Carbon Tax, 2016). Ideally, the tax should be imposed nationwide (in countries with many regions) to prevent the flight of carbon-intensive processes across state lines. In the case of imported goods, a border (adjustment) tax would be in order if the country of origin did not have a corresponding carbon penalty. Energy users, such as manufacturing firms, may choose to raise prices to pass on the increased cost to customers. However, if competitors were to opt for renewable energy sources, it would create an incentive to switch to clean energies. In any case, a rise in product prices would reflect the true cost of production, inclusive of future costs to society. (The Corporate Average Fuel Economy, or CAFE, standards set an average fleet mileage for major automakers; this is, in effect, a carbon tax with penalties imposed for non-compliance.)

Like the carbon tax, a cap-and-trade (CAT) regimen sets a price on carbon. However, the tax only kicks in when a preset limit on carbon emission (which differs by industry and type of firm) has been reached. Firms which exceed the cap may pay the penalty or trade with firms which come in under the cap (EDF(a), 2016). The

trading often takes place through intermediaries or by auction as in California, which has operated a CAT system since 2013 (Cap and Trade, 2016). Its emissions have fallen by about 4% since that time. The advantage of a CAT system vis-à-vis the carbon tax is that it allows businesses a certain "quota" of CO2 emissions, which means costs do not have to rise as long as firms take steps to control emissions. Another plus is that regulators can progressively lower the cap, thus reducing total emissions (Roberts, 2011). Problems arise when the cap or price (initial or trading) of carbon are set too low. Under such conditions, it might become less expensive to pay the penalty or the auction/trading price. Despite potential flaws in the system, China is also about to launch a cap-and-trade policy nationwide in an effort to combat the deadly effects of climate change and pollution (EDF(b), 2016) (It may be noted that China's emissions have already declined due to a transformation in energy production and consumption, as well as an economic slowdown).

Complementing policy initiatives are approaches aimed at rewarding the generation and use of zero-carbon energy. Subsidies given to R&D, engineering, and manufacturing activities in wind, solar, geothermal, and battery technology are in place in many countries including Germany, Spain, the United States, China, and India. The use of renewables is fostered by offering incentives such as tax credits for rooftop solar (often combined with feed-in tariffs, i.e. selling electricity back to the grid at a favorable price), subsidies and tax credits offered to large-scale installations such as solar arrays and wind farms, certification of energy-efficient appliances ("Energy Star"), and so on.

While countries in the European Union and the United States have been actively pursing policies to stimulate the generation and utilization of carbon-free electricity, China and India are now stepping up their efforts. China, the world's largest emitter of GHGs, has announced that it will invest at least $360 billion by 2020 in renewable energy installations (New York Times, 2017). The intent is both to gradually replace coal-fired power with clean energy, and to assume leadership in solar and wind technologies while creating employment for millions in these fields. It is indeed ironic that China (together with India, to some degree) who had resisted efforts by European nations and the United States to tackle its rapidly spiking emissions, appears to be assuming the mantle of leadership in the worldwide race to combat climate change (The Economist, 2017). In 2015, China outspent the United States two to one by investing $100

billion in renewables. The country is also extending its push in clean energy beyond its borders, pouring $30 billion into establishing projects abroad (Renewable Energy World, 2017). The latest Chinese five-year plan calls for raising the share of renewables in the energy mix to 15% by 2020, with wind power contributing 30 GW by that time. (Jiang, et al., 2013).

India, also a late "convert" to the cause of ameliorating climate change, intends to quadruple its renewable capacity in five years to 175 GW. Though reaching this target would entail a mammoth financial commitment by a country which lacks the resource pool of China (Forbes, 2017), India has little choice. People in major Indian cities are faced with almost the highest global levels of CO2, nitrous oxides (NOx), and particulate matter are demanding immediate action. Similarly to China, a potent combination of bottom-up activism (caused by climate-related factors, deteriorating social conditions, dangers to public health) and governmental concern about future economic uncertainty have spurred action. Private corporations, public agencies, infrastructure investment trusts, foreign governments (such as the United Arab Emirates), and multinationals such as Japan's Softbank are collaborating in the burgeoning renewable energy efforts (The National, 2017). As a result of this multi-pronged strategy, the Indian government expects to generate 50% of its electricity needs from carbon-free sources by 2027 (The Guardian, 2016).

The world's population is becoming increasingly urban, reaching 23% in 2016 (UN, 2016). The energy needs of major cities comprise around 70 % of world emissions (Zdnet, 2016), and leaders of such cities have been engaged in efforts to tackle emission problems by reconfiguring services and activities. Collaboration and competition among cities have yielded positive results. Efforts have typically focused on traffic congestion, electricity used at home and in the workplace, the location of recreational, shopping, and educational centers, urban agriculture, recycling, transit hubs, and more (Portney, 2013). Munich, for instance, meets 40% of its energy needs through renewables. Bogota transports 70% of its seven million population through public transport. Copenhagen aims to be carbon-neutral by 2025. San Francisco leads in waste management (Fast Company, 2016). Chinese cities are becoming more involved in the Sustainable Cities effort, which could have a significant impact on emissions since the equivalent of a megacity (around 20 million) is added to China's urban population each year (World Bank, 2012).

When discussing policy formation, Pope Francis warns us against the "…myopia of power politics…" and argues strongly in favor of actions to conserve energy and resources as a centerpiece of public policy (Laudato Si', 2015i). While making the case for better transportation, leisure spaces, and improved living conditions in mega cities, the Encyclical observes that ".. respect for our dignity as human beings often jars with the chaotic realities…" of urban life. In fact, enabling greater social interaction is a key factor in ensuring urban harmony and environmental health (Laudato Si, 2015j).

Corporations: Merchants of Doom or Cavalry to the Rescue?

Klein (2014) attributes our climate-related problems to corporations' unbridled greed (and clearly there is much truth to this assertion, though consumers, employees, and governments have been at least passively complicit in the excesses of capitalist economies). However, the unremitting anti-capitalist, multinationals-as-villains strain that marks the author's work leads her to dismiss the corporation as a possible partner in undoing the impacts of industrialization. We contend that corporate actions, paradoxically, could prove to be a vital building block in the edifice of sustainability. How can an institution which is almost universally reviled for having played a leading role in creating the resource and emission crisis be counted on to ameliorate the existential problems that face us ecologically, socially, and spiritually? Though business firms must, indeed, share much of the guilt, there are other segments of society which have been passively or actively complicit in the damage done to all of creation, present and future. As consumers, people all over the world eagerly await the release of new products, which appear to give us greater control over our own lives, over others, and over Nature itself. Appliances, cars, planes, weapons, building materials, heating and cooling systems, and apparel, among other products, have inculcated in us a desire to indefinitely increase consumption. If demand decreases, policymakers step in to stimulate it. Politicians assure us that growth will pick up soon and may even urge us to go shopping. How can the cycle of resource squandering and indifference to social and ecological damage be broken? While governments could enact effective policies (cap and trade, carbon tax, incentives for renewables, and so on), and people may gradually alter their mindsets, companies can play an active role in helping us

reverse course (Olson, 2010). Culture as a collective indoctrination programming of the mind arises when actions help instil values and beliefs. Corporate actions can go a long way to replace a culture of waste and destruction with one of responsibility and revival. As Lampikowski et. al. (2014) note, a vision and culture of sustainability are more likely to come to fruition if corporations are woven into the fabric of action.

Numerous firms are beginning to view sustainability as a possible approach to attract customers, enhance their reputation with diverse stakeholders, gain the allegiance of communities in which they operate, and increase profits (if nothing else, by cutting costs). They treat sustainability as an opportunity to gain anedge over their competitors, align sustainable strategies with core competences, and stay ahead of (and perhaps even enhance) the regulatory arc. For instance, Starbucks forms binding partnerships with coffee growers, ensuring they are provided with the necessary knowledge to deal with pests in a way that does not harm the local ecosystem, to handle fluctuations in weather and world prices of coffee beans, etc. The direct financial and reputational benefit to Starbucks along with the reduced uncertainty facing growers makes for a combination of risk reduction, increased profits, environmental citizenship, and social responsibility. Interface, the largest carpet manufacturer in the United States, has,over the past two decades embarked on a course of environmentally-friendly strategies. The "Missions Zero" program has set a goal of powering its operations fully using renewable energy by 2020 (as of 2015, renewables provided over 80% of their energy needs). The firm has reduced waste sent to landfills by 90%, water use has gone down by 70%, and its carbon emissions are about 30% of what they were in 1994. The company has also helped design modular carpets. These require replacement only in high-traffic areas, thus reducing waste for the customer despite the fact that it cuts sales. Interface has also worked towards socially-oriented goals regarding employees, suppliers, customers, and the local community in an attempt to optimize its triple-bottom line (TBL) performance (Interface, 2016). The TBL, proposed by Elkington (Slaper and Hall, 2011), suggests that business performance should be assessed in terms of how well they firms nurture the physical environment and care for social needs (including those of employees, customers, suppliers, local community, etc.) in addition to the financial yardsticks (profit, market share, etc.). While the TBL does not offer a single composite measure, firms which use it typically formulate goals for all

three dimensions (e.g carbon emissions, stock prices, and employee development). Other firms with a triple-bottom line include Unilever, 3M, and Procter and Gamble (Slaper&Hale, 2011; The Economist, 2005). Walker (2013), whose work on spirituality was cited earlier, suggests a quadruple bottom line, where the fourth is the reflective dimension, in which one discovers a sense of personal meaning, and the economic dimension is the least important. While this may be viewed as an ideal end state, with the potential to undo the ecological and social damage wrought by the unmitigated pursuit of economic growth, firms need to first work on recalibrating the relative emphases placed on economic, ecological and social issues before embarking on the quest for spiritual design.

Laszlo and Zhexembateva (2011) delineate seven strategies to achieve this, which range from ensuring corporate survival to embedding sustainability into the firm's culture. The strategies are risk mitigation (e.g. abide by regulations, reduce mitigation costs); cost reduction (e.g. in energy, resources used); differentiation (by offering products that use less energy, food grown locally); developing new markets (conserving local resources, ways to minimize damage due to flooding); enhancing reputation (publicizing achievements in sustainability); raising industry standards (e.g DuPont's efforts to establish a cap-and-trade system); and radical innovation (e.g. carbon fiber bodies for airplanes, electric cars with extended ranges). Some firms may position themselves on different sustainability levels at the same time when dealing with various stakeholders. For instance, Herman Miller, a furniture manufacturer, uses primarily recycled inputs, requires suppliers to adhere to its own high standards, refurbishes/recycles products when customers are done with them, designs customer workspaces to save energy, recycles products when their useful life is over, and powers its factories with renewable energy. Renault, in addition to designing cars to use less fuel, also refurbishes used vehicles for sale at lower prices, fostering sustainability values among its suppliers and maximizing its "cradle-to-cradle" potential (Nguyen, Stuchtey, and Zils, 2014). GE's increasing focus on the "internet of things" is in large part positioned to develop smart strategies to reduce energy wastage. 3M, a firm whose competitive advantage has been rooted in product innovation centered around certain core technologies, has now begun to view its core competence as sustainability, directing its innovations toward the various facets discussed above.

While incorporating sustainability into the strategy process, firms can use techniques commonly used in the field of strategy. As Epstein (2008) notes, sustainability needs to be framed in measurable terms such as a specified reduction in carbon emissions, water usage, the use of harmful materials, etc; crafting an appeal to customers and other stakeholders using sustainability as a distinctive feature; motivating employees to think innovatively about socio-ecological aspects of the firm's mission; enhancing sustainability of supply chains; or measuring performance in sustainability as a function of goal attainment as well as in relation to long-term competitive advantage. The Balanced Scorecard- which links stakeholder needs, internal processes, learning and improvement, and financial outcomes- may also be adapted for this purpose. The value chain could also be modified so that activities (inputs, operation, technology development, and so on) are tailored to the firm's emphasis on sustainability.

It is clear that corporate sustainability efforts are in their infancy, with some firms resisting even the concept while others have developed long term plans to embed sustainability into their strategies. However, as more firms join the sustainability "bandwagon", whatever the reasons might be, the impact on customers, suppliers, financial institutions, and other stakeholders could be significant. In fact, in a recent report, Ernest and Young (2015) conducted a survey among 272 executives in large firms competing in a range of industries and concluded that GHG reporting is quite common and water-related reports are increasing, despite that measures are still under discussion. The Chief Financial Officer is becoming a key player in sustainability strategies, and involving employees seems critical to successful sustainability outcomes in corporations, a finding corroborated by McKinsey (2014).

It is possible that sustainability strategies might increase short-term costs, not appeal to customers, require supply chain coordination or reconfiguration, or call for the development of new designs or production methods. Any of these could affect performance and the careers of top executives. The temptation for businesses is to pick low-hanging fruit, in a way harking back to techniques such as value analysis, a forerunner of the total quality management (TQM) revolution. Just as value analysis focused on eliminating components and substituting more expensive materials, thus lowering total cost, an ongoing emphasis on "cost-driven"

sustainability strategies might constitute a low-level trap from which firms and industries find it difficult to escape. For corporate sustainability initiatives to have a noticeable impact, top executives will have to take risks by redesigning products and processes, pushing for stricter industry standards, assessing energy usage during their products' life cycles, enlisting the support of their entire supply chains, reconfiguring the value chain to make sustainability a distinctive feature, and involving employees in the effort to ensure a better future for all. Companies need to move beyond short-term and self-serving outlooks on sustainability. Corporate leaders, who assert that they are convinced that urgent action is needed to prevent climate change, acute resource shortages, and social collapse, must act decisively by investing in products and services which mitigate the damage already done. These actions would extend beyond resource usage and emission curtailment to consume fewer resources during their useful lives, educate customers, suppliers, and shareholders on the challenges facing the world, or working with NGOs, governments and other actors. It may take a while, but corporate actions to heal the planet could influence public opinion and our responsibility to our "common home".

It should be noted that, according to a global survey conducted by McKinsey (2014), sustainability was among the top three strategic priorities for nearly 50% of the CEOs surveyed worldwide. The percentage of respondents who viewed the alignment of sustainability with corporate strategy as imperative doubled to over 40%, while the percentage emphasizing cost reduction actually declined from 2012 to 2014 by 25%.

In the Encyclical, business is viewed as a "…noble profession…" which can create wealth and make our world a better place, especially if it creates more jobs (Laudato Si', 2015k). While this appears to be a less than enthusiastic endorsement of business, the Pope calls to adopt a "…circular model of production…" which would reduce resource usage, energy waste, lower demand for new products through reuse and refurbishment, and other stratigies. As noted earlier, companies are engaged in a range of efforts to innovate in sustainability, including the ways the Pontiff makes special note of. However, given that the consumption-growth model has been in place for over a century, weaning people, firms, and nations off it is still a work in progress. Corporations have played a significant role in wealth creation and poverty reduction over the past century, while at the same time contributing to ecological damage and social

disparities. This vital institution has both the obligation and the ability to address the cumulative negative impacts of economic growth. Even more, corporate actions could play a vital role in changing mindsets, attitudes, and behaviors. An indicator of corporate reaction to potential US withdrawal from the Paris Accord (now, apparently, a reality) was a statement issued by around three hundred and fifty large firms soon after the American elections. Meeting in Morocco, these corporate titans asserted that they had committed themselves too deeply and invested too much time, energy, and resources in sustainability to reverse course. Top business leaders in the United States have come out strongly in favor the Paris accord (Shultz and Halstead, 2017). It is quite possible that, despite the insistance of national leaders on placing economic growth over the future of the planet, corporations might offer us a way out of the ongoing crisis.

Sisyphean Endeavor?

A few years ago one could have claimed, with justification, that attempting to curtail carbon emissions, resource depletion, and the increasing immiseration of the poor worldwide was a futile endeavor, equal to that of Sisyphus (condemned to rolling a rock up a hill only to find it roll all the way down just when he was near the peak). With China, India, Brazil and other developing countries joining in the race to industrialize and reluctant to act on low-carbon solutions and resource conservation, it appeared the world was headed for an inevitable climate catastrophe. However, due to circumstances outlined earlier, China and India- two of the largest polluters in the world- have both embarked on a path to grow their economies while moderating environmental and social impacts. Both countries have formulated national policies to reach sizeable renewable energy goals and the significant reduction of carbon emissions by 2020 (the year was perhaps chosen since it has a certain ring to it). Realistically, one might expect that China, India, Brazil, Indonesia, and other developing nations will be able to curb the growth in emissions by 2025. Absolute reductions could take longer, even up to 2030. However, a combination of national policy changes, coordinated urban initiatives, corporate strategies aimed at gaining a competitive advantage through sustainability, and moral suasion by thought leaders (such as Pope Francis) are altering values and mindsets in diverse societies which have witnessed the outcomes of unchecked industrial growth.

References

Adams, J., Kelley, L., Applegate, B., McNichol, T. (2009). Mental Models for Sustainability. In Wirtenberg, J. (Ed.).

Alderson, A. 2001. "Globalization and the Great U-Turn: Income inequality trends in 16 OECD countries", DESA working paper, Department of Sociology, Indiana University, March.

Biello, D. 2009. "Can Climate Change Cause Conflict? Recent History Suggests So", Scientific American, Nov. 23.

Cap and Trade. 2016. 2017.
https://www.arb.ca.gov/cc/capandtrade/auction/results_summary.pdf/. Retrieved May 4,2017

Carbon Tax. 2016. https://www.carbontax.org/whats-a-carbon-tax/ Retrieved May4, 2017

CCS. 2017. Center for Climate Security. https://climateandsecurity.org/2017/05/05/interview-how-climate-change-influence-geopolitics/ Retrieved May 5, 2017.

Collins, M. 2015."The Pros and Cons of Globalization",
http://www.forbes.com/sites/mikecollins/2015/05/06/the-pros-and-cons-of-globalization/#3297d4f12170. May6). Accessed Sep.20, 2016

Coyle, D. 2014. GDP: A Brief but Affectonate History. Princeton, N.J.: Princeton University Press.

Davenport, C. 2016. "Economies can still rise as Carbon Emissions fade", New York Times, Apr. 7, p. A3

EDF (a). 2016. Environmental Defense Fund. https://www.edf.org/climate/how-cap-and-trade-works/ Retrieved May5, 2017.

EDF (b). https://www.edf.org/climate/why-china-center-our-climate-strategy/ Retrieved May 5, 2017

Ehrenfeld, J. 2008. Sustainability by Design. New Haven: Yale University Press.

Eiseley, L. 1947. The Night Country. New York: Scribners.

Eiseley, L. 1978. The Star Thrower. San Diego: Harvest/HBJ.

EIA. Energy Information Agency. 2016. https://www.eia.gov/forecasts/ieo/electricity.cfm.

EJF. 2017. Environmental Justice Foundation.
http://ejfoundation.org/campaigns/oceans/item/climate-and-conflict. Retrieved on May 5, 2017

Epstein, M. 2008. Making Sustainability Work. Sheffield, U.K.: Greenleaf

Ernest and Young. 2013.
http://www.ey.com/Publication/vwLUAssets/Six_growing_trends_in_corporate_sustainability_2013/$FILE/Six_growing_trends_in_corporate_sustainability_2013.pdf. Retrieved on Sep. 20, 2016

Esch, M. 2016. "Crops or Panels: Solar farm developers blanket state with lease offers", April 10, p. D-3 Fast Company. 2016. https://www.fastcompany.com/3016816/the-10-cities-that-are-leading-the-way-in-urban-sustainability

Forbes. 2017. https://www.forbes.com/sites/michaellynch/2017/01/25/renewable-investment-announcement-from-india-seems-misguided/#770b663665c6. Retrieved May 5, 2017

Gregg, S. 2015. Laudato Si': Well Intentioned, Economically Flawed. https://climateandsecurity.org/2017/05/05/interview-how-climate-change-influence-geopolitics/ Retrieved, December 21, 2016.

Guha, R. 1983.Subaltern Studies II: Writings on South Asian History and Society. Delhi: Oxford University Press.

Hardin, G. 1968. "The Tragedy of the Commons", Science, 162, pp. 1243-1248.

Hicks, J., McCarthy,S., Mezei, G., Sayer, C. 2012. PM1 Particles at Coal-and Gas-Fired Power Plant Work Areas. The Annals of Occupational Hygiene, Vol. 58, Issue 2, pp. 182-193.

Hofstede, G. 1980. Culture's Consequences: International Differences in Work-Related Values. Beverly Hills CA: Sage Publications.

Imster, E. 2015. "Atmospheric Carbon Dioxide hits record high," http://earthsky.org/earth/global-carbon-dioxide-reaches-new-monthly-level. Retrieved Sep. 20, 2016

Interface. 2016. http://www.interfaceglobal.com/Company/InterfaceFlor.aspx. Retrieved Sep. 20, 2016

Izaak, R. (2005). The Globalization Gap. New York: Prentice-Hall.

Jackson, T. (2009). Prosperity without Growth:Economics for a Finite Planet. London:Earthscan

Jiang,P., Chen, Y., Geng, Y., Dong, W., Xue, B., Xu, B., and Li, W. 2013. Analysis of the co-benefits of climate change mitigation and air pollution reduction in China. Journal of Cleaner Production, 58, 130-137

Klein, N. 2014. This Changes Everything: Capitalism vs. The Climate. New York: Simon and Schuster.

Lampikoski, T., Westerlund, M., Rajala, R., Moller, K. 2014. "Green Innovation Games: Value Creation Strategies for Corporate Sustainability", California Management Review, Vol. 57, No. 1, pp. 88-116.

Laudato Si' 2015a. http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html.

Laudato Si'. 2015b. Ibid, sections 3-7

Laudato Si'. 2015c. Ibid, sections 8-12

Laudato Si'. 2015d. Ibid, sections 26, 51, 165.

Laudato Si'. 2015e. Ibid, sections 26.

Laudato Si'. 2015f. Ibid, sections 52

Laudato Si'. 2015g. Ibid, sections, 32-42.

Laudato Si'. 2015h. Ibid, sections 67-83.

Laudato Si'. 2015i. Ibid, sections 176-188

Laudato Si'. 2015j. Ibid, sections 150-155.

Laudata Si'. 2015k. Ibid, sections 129,22.

Laszlo, C. and Zhexembayeva, N. 2011. Embedded Sustainability: The Next Big Competitive Advantage. Stanford: Stanford University Press.

Marcus, A. 2015. Innovations in Sustainability: Fuels and Food. Cambridge: Cambridge University Press, pp. 117, 138.

McKibben, B. 2007. Carbon's New Math. National Geographic, October, 33-58.

Mckinsey. 2013. Sustainability's Strategic Worth. McKinsey Global Survey Results, pp.1-12.

Mooney, C. (2005). The Republican War on Science. New York: MJF

Montgomery, D. 2015. The Flawed Economics of Laudato Si'. The New Atlantis, (Fall), 31-44.

Muller, R. 2012. The Conversion of a Climate-Change Skeptic. New York Times, July 28.

New York Times. 2017. https://www.nytimes.com/2017/01/05/world/asia/china-renewable-energy-investment.html?_r=0/ Retrieved May 4, 2017

Nguyen, H., Stuchtey, M., and Zils, M. 2014. Remaking the Industrial Economy. McKinsey Quarterly, Feb., pp. 1-17

Olson, E. (2010). Better Green Business. Upple Saddle River, N.J.: Pearson.

Ophuls, W. and Boyans, S. 1992. Ecology and the Politics of Scarcity Revisited. New York: Freeman.

Plait, P. 2014. http://www.slate.com/blogs/bad_astronomy/2014/08/20/atmospheric_CO2_humans_put_40_billion_tons_into_the_air_annually.

Porter, E. 2015. "Environmentalists rethink Development", New York Times, Apr. 2015, pp. B1, 2.

Portney, K. (2013). Taking Sustainable Cities Seriously: Economic Development, the Environment, and Quality of Life in American Cities, Cambridge: MIT Press.

Rees, W. 2012. On the Use and Misuse of the Concept of Sustainability. (http://williamrees.org/misuse-of-the-concept/ retrieved December 15, 2016)

Renewable Energy World. 2017. http://www.renewableenergyworld.com/articles/2017/01/china-is-leaving-the-us-behind-on-clean-energy-investment.html/ Retrieved May 4, 2017

Roberts, J. 2011. Environmental Policy. New York: Routledge.

Schlossberg, T. 2016. "An English Village leads a Climate Revolution," New York Times, Aug. 22, pp. A1, A7.

SEIA. 2015. Solar Energy Industries Association. http://www.seia.org/research-resources/solar-industry-data/ . Retrieved Dec. 12, 2016.

Shultz, G. and Halstead, T. 2017. Paris Deal Benefits Business.. May 9.

Slaper, T. and Hall, T. 2011. The Triple Bottom Line: What Is It and How Does It Work? http://www.ibrc.indiana.edu/ibr/2011/spring/article2.html/ Retrieved Dec. 12, 2016.

Solarcell. 2015. http://solarcellcentral.com/cost_page.html/ Retrieved Dec. 12, 2016

Tani, D. 2016. Global Growth Tracker. http://www.worldeconomics.com/papers/Global%20Growth%20Monitor_7c66ffca-ff86-4e4c-979d-7c5d7a22ef21.paper (March). Retrieved Sep. 20, 2016

The Economist. 2012. http://www.economist.com/node/21543160. Retrieved Sep. 20, 2016

The Economist. 2017. No cooling. April 22, 37-38.

The Guardian. 2016. https://www.theguardian.com/world/2016/dec/21/india-renewable-energy-paris-climate-summit-target

The National. 2017. http://www.thenational.ae/business/energy/renewable-energy-investments-in-india-to-reach-250-billion-over-next-five-years. Retrieved May 5, 2017

UNFCCC. 2016. United Nations Framework Convention on Climate Change. www.unfccc.int/2860. Retrieved Oct. 28, 2016.

United Nations. 2016. http://www.un.org/en/development/desa/population/publications/pdf/urbanization/the_worlds_cities_in_2016_data_booklet.pdf Retrieved May5, 2017

Walker, S. 2013. Design and Spirituality: Material Culture for a Wisdom Economy. Design Issues, Vol. 29, Number 3 Summer.

WCED. World Commision on Environment and Development. 1987. Our Common Future. Oxford: Oxford University Press.

World Bank. 2012.
https://siteresources.worldbank.org/EXTNEWSCHINESE/Resources/3196537-1202098669693/4635541-1335945747603/low_carbon_city_full_en.pdf/

Zdnet. 2016. http://www.zdnet.com/article/un-cities-contribute-70-percent-of-global-greenhouse-gas-emissions/ Retrieved May6, 2017