### 1NC – OFF

#### Interpretation: Topical affirmatives may only garner offense from the hypothetical implementation by governments that The appropriation of outer space by private entities is unjust

#### Resolved requires policy action

Louisiana State Legislature (<https://www.legis.la.gov/legis/Glossary.aspx>) Ngong

**Resolution**

**A legislative instrument** that generally is **used for** making declarations, **stating policies**, and making decisions where some other form is not required. A bill includes the constitutionally required enacting clause; a resolution **uses the term "resolved".** Not subject to a time limit for introduction nor to governor's veto. ( Const. Art. III, §17(B) and House Rules 8.11 , 13.1 , 6.8 , and 7.4 and Senate Rules 10.9, 13.5 and 15.1)

#### Appropriation

TIMOTHY JUSTIN TRAPP, JD Candidate @ UIUC Law, ’13, TAKING UP SPACE BY ANY OTHER MEANS: COMING TO TERMS WITH THE NONAPPROPRIATION ARTICLE OF THE OUTER SPACE TREATY UNIVERSITY OF ILLINOIS LAW REVIEW [Vol. 2013 No. 4]

The issues presented in relation to the nonappropriation article of the Outer Space Treaty should be clear.214 The ITU has, quite blatantly, created something akin to “property interests in outer space.”215 It allows nations to exclude others from their orbital slots, even when the nation is not currently using that slot.216 This is directly in line with at least one definition of outer-space appropriation.217 [\*\*Start Footnote 217\*\*Id. at 236 (“Appropriation of outer space, therefore, is ‘the exercise of exclusive control or exclusive use’ with a sense of permanence, which limits other nations’ access to it.”) (quoting Milton L. Smith, The Role of the ITU in the Development of Space Law, 17 ANNALS AIR & SPACE L. 157, 165 (1992)). \*\*End Footnote 217\*\*]The ITU even allows nations with unused slots to devise them to other entities, creating a market for the property rights set up by this regulation.218 In some aspects, this seems to effect exactly what those signatory nations of the Bogotá Declaration were trying to accomplish, albeit through different means.219

#### Topicality is key to limits and ground---redefining portions of the resolution permits endless reclarification AND creates incentives for avoidance---only aligning research with agent and mechanism solves.

#### Two impacts:

#### 1---Fairness---an unlimited, unpredictable topic disparately raises the research burden for the negative -- treat this is a sufficient win condition because fairness is the logical structure that undergirds all impacts AND controls any benefit to debate.

**Dascal and Knoll** ’**11** [Marcelo and Amnon; May 18th; former Professor of Philosophy at Tel Aviv University, B.A. in Philosophy from the University of Sao Paulo; former Professor of Philosophy at Tel Aviv University; Argumentation: Cognition and Community, "'Cognitive systemic dichotomization' in public argumentation and controversies," p. 20-25]

He opposes positions whose ‘exclusionist’ outlook rejects the normative approach to the political sphere on the grounds that “normative statements can never be subjected to a reasonable discussion” (ibid.: 2), because—he argues—the discussion of politics “is an area of vital interest to all of us and should clearly not be excluded from argumentative reasonableness” (ibid.: 3)—a view with which we are prone to agree. Nevertheless, he admits that in the present situation critical discussion is far from being systematically and successfully applied to that vital area: “In representative democracies, however, the out-comes of the political process tend to be predominantly the product of negotiations be-tween political leaders rather than the result of a universal and mutual process of deliberative disputation” (ibid.). Political debates, therefore, are ‘quasi-discussions’, i.e., “monologues calculated only to win the audience’s consent to one’s own views”, rather than ‘genuine discussions’, i.e., serious attempts to have an intellectual exchange, which is typical of critical discussions (ibid.). In order to overcome this situation, “democracy should always have promoted such a critical discussion of standpoints as a central aim. Only if this is the case can stimulating participation in political discourse enhance the quality of democracy" (ibid.). This can be achieved, however, only by following “the dialectical rules for argumentative discourse that make up a code of conduct for political discourse [and] are therefore of crucial importance to giving substance to the ideal of participatory democracy” (ibid.: 4); thereby fully acknowledging that “education in processing argumentation in a critical discussion is indispensable for a democratic society (van Eemeren 1995: 145-146).

The reasons provided for the failure of the adoption of the critical discussion model in reality ranges from a general allusion to human nature (“in real-life contexts, it has to be taken into account that human interaction is not always automatically 'naturally' and fully oriented toward the ideal of dialectical reasonableness "; van Eemeren 2010: 4) to specific political sphere argumentation handicaps (unwillingness of people “to subject their thinking to critical scrutiny”; “vested interest in particular outcome”; “inequality in power and resources; “different levels of critical skills”; and “a practical demand for an immediate settlement”; van Eemeren 2010: 4). Although these causes may have some explanatory value in some cases, in our opinion their modus operandi is not accounted for and, what is more important, they do not cover the full spectrum of challenges that the successful use of critical discussion in the public and political spheres must face, as we have seen (cf. sections 2 and 3).

No wonder that van Eemeren himself raises the question “whether maintaining the dialectical ideal of critical discussion in political and other real-life contexts is not utopian” (ibid.), to which he replies by admitting that "[t]he ideal of a critical discussion is by definition not a description of any kind of reality but sets a theoretical standard that can be used for heuristic, analytic and evaluative purpose” (ibid.). This ideal seems to be so inspiring that it remains valid as a pure theoretical ideal, “even if the argumentative discourse falls short of the dialectical ideal” (ibid.).

In the light of the substantial gap between the normative ideal and the actual practices of public and political argumentation that PD’s description and explanation provides, a number of doubts arise: Are there structural, rather than merely contingent obstacles in idealized critical discussion that prevents even its approximate use in the public sphere? Can a theory that claims to be a praxis based normative system fulfill its promise if it sets up a threshold that no one who tries to apply it to the public sphere can reach? Doesn’t the very fact that argumentation is excessively idealized in the model PD proposes cause the gap by distancing people concerned by public issues from argumentation at all? All these doubts suggest that a powerful structural phenomenon like the existence of CSDs in the public sphere is perhaps overlooked by PD and requires, for its overcoming, a radically different approach.

4.2 Discrepancies between the PD approach and reasonable argumentation in the public sphere

The discrepancies in question have to do with basic parameters relevant to every argumentative process, namely:

(A) The discussants’ goals and targets: what do they expect to achieve through the argumentation process and what is it capable of providing.

(B) The preconditions for initiating a critical discussion: what are the discussants presumed to know and accept of these preconditions.

(C) The argumentative process that is supposed to lead to the achievement of the discussants’ goals.

(D) The influence of context and agents on the argumentative process.

4.2.1 Goals

Assuming that argumentation is a voluntary endeavor, the parties are presumed to engage in it if and only if: (i) the process will serve their goals; (ii) these goals cannot be achieved by different, better means.

PD describes as follows the aim of engaging in an argumentative process:

Argumentation is basically aimed at resolving a difference of opinion about the acceptability of a standpoint by making an appeal to the other party's reasonableness. (van Eemeren 2010: 1, with reference to van Eemeren & Grootendorst 2004: 11-18)

The difference of opinion is resolved when the antagonist accepts the protagonist's viewpoint on the basis of the arguments advanced or when the protagonist abandons his viewpoint as a result of the critical responses of the antagonist. (van Eemeren 2010: 33)

Simply put, the basic assumption is that a critical discussion’s aim consists in putting forth a certain position by one of the parties for the critical examination of the other, who calls it into question. The latter undertakes to refute the former’s position, while its proponent is committed to defend it. Four stages (see below) are supposed to ensure a valid performance of the refutation and defense tasks. The essential point is that at the end of the four stages the parties clearly agree whether the proponent’s position has been refuted or not and, accordingly, change their position (either retracting it or withdrawing from his questioning). In ‘mixed’ disagreements, in which the antagonist not only questions but also puts forth an opposed position, the same process takes place sequentially, i.e., at first one side (A) attacks trying to refute the other’s (B) position, and after this stage is concluded, they switch roles and the second side (B) proceeds to attack the first (A) in the same fashion.

Regardless of whether the described process is indeed capable to yield a conclusive decision about the refutation of a position, and of whether the linearity of the refutation process makes sense, it is obvious that debates in the public sphere are for the most part ‘mixed’. Furthermore, in so far as these debates involve dichotomous positions (rather than just opposed ones), it is necessary that at the end of the PD process one of the parties accept the position of the other.

It is also worth noticing that, contrary to deliberative democracy approaches, which in some cases approve the attempt to reach agreement in a (public) debate as a form of justification of political systems, PD claims that it is not a consensus theory at all. Instead, it conceives itself as a theory based on Popper’s critical rationality, i.e., as having as its principal goal to provide each party with the means—i.e., refutation attempts—to test critically its position:

[T]he conception of reasonableness upheld in pragma-dialectics insights from critical rationalist epistemology and utilitarian ethics conjoin … The intersubjective acceptability we attribute to the procedure, which is eventually expected to lend conventional validity to the procedure, is primarily based on its instrumentality in doing the job it is intended to do: re-solving a difference of opinion. … This means that, philosophically speaking, the rationale for accepting the pragma-dialectical procedure is pragmatic—more precisely, utilitarian [italics in quoted text]. … However, based on Popper's falsification idea, this is a ‘negative’ and not ‘positive’, utilitarianism. … Rather than maximization of agreement, minimization of disagreement is to be aimed for. (van Eemeren 2010: 34)

The distinction between maximization of agreement and minimization of disagreement purports to stress that PD doesn’t view agreement as the suitable end of the process, but just as “an intermediate step on the way to new, and more advanced, disagreements” (van Eemeren 2010: 26n). Nevertheless, no explanation is given of how these “more advanced disagreements” are engendered as a part of the dynamics of the critical process, nor what is the role or value of such disagreements in the public sphere or elsewhere. This may be due to the fact that PD’s ‘critical discussion’ is not tuned to the generation of new positions or ideas but only to the testing of extant ones, thus echoing once again Popper, now in his focus on the justification rather than on the discovery of theories (see sections 4.2.4 and 5).

In any case, it is quite clear that the only practical result of the critical discussion à la PD of opposed positions on a public issue is to determine whether one discussant succeeded in refuting the other’s position, thus obtaining the adversary’s agreement, who will then share his/her position, at least for some time. In this respect, PD’s critical discussion is close to Habermas’s ‘reasonable argumentation’, whose aim is to reach consensus.15 In spite of the apparent difference between a critical examination of a position aiming at its refutation or at its acceptance, even van Eemeren admits, to some extent, their similarity. He points out that “the pragma-dialectical procedure deals only with ‘first order’ conditions for resolving differences of opinion on the merits by means of critical discussion” (van Eemeren 2010: 34), and stresses that there are ‘higher order’ conditions, ‘internal’ and ‘external’, that are “beyond the agent’s control”, conditions that are similar to Habermas’s “ideal speech conditions” (van Eemeren 2010: 35n). Anyhow, whether according to PD the main goal of the critical discussion process in the public alliance is to create the opportunity for refutation or for agreement (meaning that one of the discussants acknowledges that his position is wrong), the essential assumption of this process is that the participants in it in the public sphere (or elsewhere) must be aware that one of them holds a wrong position and will have to explicitly acknowledge this.

Is such a goal, especially when conceived as the ultimate aim of the proposed argumentative process, feasible and acceptable in the public sphere?

In our opinion, there are at least four reasons for arguing that it is a utopian, hence unacceptable goal, if one takes seriously what should be expected from argumentative practice and theory in the public sphere. First, because PD deserves a critique similar to the one leveled against the Popperian version of critical rationalism it espouses,16 which defends a theory of knowledge “without a knowing subject” (Popper 1972); obviously, such a-contextual position becomes even more problematic if applied to the public and political spheres, where it must operate in a context essentially involved with practical rationality. Second, due to its analogy with theories such as Habermas’s that were discussed in this section as well as in 2.2—an analogy that deserves additional criticism because, unlike Habermasianism, PD overlooks the relationship between the political and public context and argumentative practice. Third, because of PD’s total overlooking of the role of CSDs in public argumentation (cf. 4.2.2). And fourth, due to unilateral value judgments of positions in the public sphere, which lead to simplistic criteria of refutation or acceptance in a domain where complexity is the rule (cf. 2.1.1 and 4.2.3).

(ii) Let us admit, for the sake of argument, that the refutation goal as claimed by PD is central, feasible, acceptable, and useful in public argumentation. Aren’t there better ways to achieve this goal?

The refutation and defense moves stipulated by the PD critical discussion model include, on the one side, the antagonist’s critical remarks or demands and on the other, the proponent’s replies. We believe that it must be assumed that neither the critique nor the replies are previously known to the contenders, which is why they have an interest in engage in the argumentation process: presumably, the expression of both, counter-arguments and defensive-arguments, is good to both sides. In spite of its usefulness in certain situations, this kind of exchange does not amount to the full manifestation of the dialectical critical process, wherein the context and co-text of the dialectical exchange, as well as the cognitive interaction that takes place and evolves throughout the exchange, play a decisive role in the design and ‘inner’ justification of each of the participants’ moves. Argumentation strategies that take into account these resources and make full use of their potential are no doubt setting up another, broader span of goals for the argumentative process, and are more likely to achieve these goals more effectively than they certainly would achieve their PD more limited counterparts (cf. 4.2.4 and 5).

4.2.2 Preconditions

The ideal PD critical discussion can only be realized if some

#### 2---Clash---forfeiting government action sanctions retreat from controversy and forces the negative to concede solvency before winning a link -- clash is the necessary condition for distinguishing debate from discussion, but negation exists on a sliding scale -- that jumpstarts the process of critical thinking, reflexivity, and argument refinement.

### 1NC – OFF

#### Space Commercialization drives Tech Innovation in the Status Quo – it provides a unique impetus.

Hampson 17 Joshua Hampson 1-25-2017 “The Future of Space Commercialization” <https://republicans-science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf> (Security Studies Fellow at the Niskanen Center)//Elmer

The size of the space economy is far larger than many may think. In 2015 alone, the global market amounted to $323 billion. Commercial infrastructure and systems accounted for 76 percent of that 9 total, with satellite television the largest subsection at $95 billion. The global space launch market’s 10 11 share of that total came in at $6 billion dollars. It can be hard to disaggregate how space benefits 12 particular national economies, but in 2009 (the last available report), the Federal Aviation Administration (FAA) estimated that commercial space transportation and enabled industries generated $208.3 billion in economic activity in the United States alone. Space is not just about 13 satellite television and global transportation; while not commercial, GPS satellites also underpin personal navigation, such as smartphone GPS use, and timing data used for Internet coordination.14 Without that data, there could be problems for a range of Internet and cloud-based services.15 There is also room for growth. The FAA has noted that while the commercial launch sector has not grown dramatically in the last decade, there are indications that there is latent demand. This 16 demand may catalyze an increase in launches and growth of the wider space economy in the next decade. The Satellite Industry Association’s 2015 report highlighted that their section of the space economy outgrew both the American and global economies. The FAA anticipates that growth to 17 continue, with expectations that small payload launch will be a particular industry driver.18 In the future, emerging space industries may contribute even more the American economy. Space tourism and resource recovery—e.g., mining on planets, moons , and asteroids—in particular may become large parts of that industry. Of course, their viability rests on a range of factors, including costs, future regulation, international problems, and assumptions about technological development. However, there is increasing optimism in these areas of economic production. But the space economy is not just about what happens in orbit, or how that alters life on the ground. The growth of this economy can also contribute to new innovations across all walks of life. Technological Innovation Innovation is generally hard to predict; some new technologies seem to come out of nowhere and others only take off when paired with a new application. It is difficult to predict the future, but it is reasonable to expect that a growing space economy would open opportunities for technological and organizational innovation. In terms of technology, the difficult environment of outer space helps incentivize progress along the margins. Because each object launched into orbit costs a significant amount of money—at the moment between $27,000 and $43,000 per pound, though that will likely drop in the future —each 19 reduction in payload size saves money or means more can be launched. At the same time, the ability to fit more capability into a smaller satellite opens outer space to actors that previously were priced out of the market. This is one of the reasons why small, affordable satellites are increasingly pursued by companies or organizations that cannot afford to launch larger traditional satellites. These small 20 satellites also provide non-traditional launchers, such as engineering students or prototypers, the opportunity to learn about satellite production and test new technologies before working on a full-sized satellite. That expansion of developers, experimenters, and testers cannot but help increase innovation opportunities. Technological developments from outer space have been applied to terrestrial life since the earliest days of space exploration. The National Aeronautics and Space Administration (NASA) maintains a website that lists technologies that have spun off from such research projects. Lightweight 21 nanotubes, useful in protecting astronauts during space exploration, are now being tested for applications in emergency response gear and electrical insulation. The need for certainty about the resiliency of materials used in space led to the development of an analytics tool useful across a range of industries. Temper foam, the material used in memory-foam pillows, was developed for NASA for seat covers. As more companies pursue their own space goals, more innovations will likely come from the commercial sector. Outer space is not just a catalyst for technological development. Satellite constellations and their unique line-of-sight vantage point can provide new perspectives to old industries. Deploying satellites into low-Earth orbit, as Facebook wants to do, can connect large, previously-unreached swathes of 22 humanity to the Internet. Remote sensing technology could change how whole industries operate, such as crop monitoring, herd management, crisis response, and land evaluation, among others. 23 While satellites cannot provide all essential information for some of these industries, they can fill in some useful gaps and work as part of a wider system of tools. Space infrastructure, in helping to change how people connect and perceive Earth, could help spark innovations on the ground as well. These innovations, changes to global networks, and new opportunities could lead to wider economic growth.

#### Strong Innovation solves Extinction.

Matthews 18 Dylan Matthews 10-26-2018 “How to help people millions of years from now” <https://www.vox.com/future-perfect/2018/10/26/18023366/far-future-effective-altruism-existential-risk-doing-good> (Co-founder of Vox, citing Nick Beckstead @ Rutgers University)//Re-cut by Elmer

If you care about improving human lives, you should overwhelmingly care about those quadrillions of lives rather than the comparatively small number of people alive today. The 7.6 billion people now living, after all, amount to less than 0.003 percent of the population that will live in the future. It’s reasonable to suggest that those quadrillions of future people have, accordingly, hundreds of thousands of times more moral weight than those of us living here today do. That’s the basic argument behind Nick Beckstead’s 2013 Rutgers philosophy dissertation, “On the overwhelming importance of shaping the far future.” It’s a glorious mindfuck of a thesis, not least because Beckstead shows very convincingly that this is a conclusion any plausible moral view would reach. It’s not just something that weird utilitarians have to deal with. And Beckstead, to his considerable credit, walks the walk on this. He works at the Open Philanthropy Project on grants relating to the far future and runs a charitable fund for donors who want to prioritize the far future. And arguments from him and others have turned “long-termism” into a very vibrant, important strand of the effective altruism community. But what does prioritizing the far future even mean? The most literal thing it could mean is preventing human extinction, to ensure that the species persists as long as possible. For the long-term-focused effective altruists I know, that typically means identifying concrete threats to humanity’s continued existence — like unfriendly artificial intelligence, or a pandemic, or global warming/out of control geoengineering — and engaging in activities to prevent that specific eventuality. But in a set of slides he made in 2013, Beckstead makes a compelling case that while that’s certainly part of what caring about the far future entails, approaches that address specific threats to humanity (which he calls “targeted” approaches to the far future) have to complement “broad” approaches, where instead of trying to predict what’s going to kill us all, you just generally try to keep civilization running as best it can, so that it is, as a whole, well-equipped to deal with potential extinction events in the future, not just in 2030 or 2040 but in 3500 or 95000 or even 37 million. In other words, caring about the far future doesn’t mean just paying attention to low-probability risks of total annihilation; it also means acting on pressing needs now. For example: We’re going to be better prepared to prevent extinction from AI or a supervirus or global warming if society as a whole makes a lot of scientific progress. And a significant bottleneck there is that the vast majority of humanity doesn’t get high-enough-quality education to engage in scientific research, if they want to, which reduces the **odds that we have enough trained scientists to come up with the breakthroughs** we need as a civilization to survive and thrive. So maybe one of the best things we can do for the far future is to improve school systems — here and now — to harness the group economist Raj Chetty calls “lost Einsteins” (potential innovators who are thwarted by poverty and inequality in rich countries) and, more importantly, the hundreds of millions of kids in developing countries dealing with even worse education systems than those in depressed communities in the rich world. What if living ethically for the far future means living ethically now? Beckstead mentions some other broad, or very broad, ideas (these are all his descriptions): Help make computers faster so that people everywhere can work more efficiently Change intellectual property law so that technological innovation can happen more quickly Advocate for open borders so that people from poorly governed countries can move to better-governed countries and be more productive Meta-research: improve incentives and norms in academic work to better advance human knowledge Improve education Advocate for political party X to make future people have values more like political party X ”If you look at these areas (economic growth and technological progress, access to information, individual capability, social coordination, motives) a lot of everyday good works contribute,” Beckstead writes. “An implication of this is that a lot of everyday good works are good from a broad perspective, even though hardly anyone thinks explicitly in terms of far future standards.” Look at those examples again: It’s just a list of what normal altruistically motivated people, not effective altruism folks, generally do. Charities in the US love talking about the lost opportunities for innovation that poverty creates. Lots of smart people who want to make a difference become scientists, or try to work as teachers or on improving education policy, and lord knows there are plenty of people who become political party operatives out of a conviction that the moral consequences of the party’s platform are good. All of which is to say: Maybe effective altruists aren’t that special, or at least maybe we don’t have access to that many specific and weird conclusions about how best to help the world. If the far future is what matters, and generally trying to make the world work better is among the best ways to help the far future, then effective altruism just becomes plain ol’ do-goodery.

### Case

#### Alt cause – public sector sustains capitalist space exploitation – there is zero risk NASA solves capitalist spatial fix

#### Space exploration fails without private sector leadership.

WAMU 20 [(interviewing Ariel Ekblaw, founder and lead of MIT Media Lab’s Space Exploration Initiative and Charles Bolden, NASA administrator from 2009-2017) “How Private Companies Are Changing The Future Of Space Exploration,” February 6, 2020, https://wamu.org/story/20/02/06/how-private-companies-are-changing-the-future-of-space-exploration/] TDI

How Private Companies Are Changing The Future Of Space Exploration LISTEN SpaceX founder Elon Musk addresses the media alongside NASA Administrator Jim Bridenstine, and astronauts Doug Hurley and Bob Behnken, during a press conference announcing new developments of the Crew Dragon reusable spacecraft, at SpaceX headquarters in Hawthorne, California on October 10, 2019. (Philip Pacheco / AFP) Private companies like SpaceX are testing vehicles for manned space missions. We’ll peer out into the near future and next steps in human space exploration. Guests Ariel Ekblaw, founder and lead of MIT Media Lab’s Space Exploration Initiative. (@ariel\_ekblaw) Charles Bolden, NASA administrator from 2009-2017, and a former astronaut and Marine Corps general. (@cboldenjr) Interview Highlights American astronaut Christina Koch broke the record for the longest-ever space flight by a woman today. Where is human space exploration going next? Ariel Ekblaw: “It’s a huge milestone. Part of her story around the spacesuit, and the sizing of the spacesuits, and the all-female spacewalk is something that we pay a lot of attention to at our group at M.I.T. And then being able to be in space for that length of time provides an invaluable sense of knowledge of what is the human lived experience of space. “How might we better design for her comfort to delight her in space? To now, thanks to standing on the shoulders of groups like NASA and Charlie’s work, think about not just a survivalist mode for space exploration, but what are the artifacts, and the tools, and the experiences that we could design for Christine in the future? Given her experience of this 300-plus-day journey and stay to really delight her for her experience in space exploration. And in the future, scale that to space tourists and others besides astronauts.” On how close we are to regular space tourism Ariel Ekblaw: “I would say we’re both close — we’re dangerously close — and yet so far away. So companies like Blue Origin and Virgin Galactic are racing to be able to send some of the first space tourists into low Earth orbit on some of their crafts, in either this year, or upcoming years. With Axiom and the announcement from NASA about the first commercial space station to be attached to the International Space Station. “We’re beginning to build up that infrastructure that could support real space tourism. There are still, as I’m sure Charlie can also speak to, large unanswered questions about how do you prepare someone if not off the street — A space enthusiast — for the experience of space when they’re not necessarily going to have the same in-depth, extensive training as a NASA astronaut? How do we keep them safe? How do we handle mental health? How do we prepare them for both the excitement and the responsibility that they might have as a member of a crew in a resource constrained environment?” On whether people who aren’t trained as astronauts should be able to go into space Charles Bolden: “Yes, without a doubt. … They’ve got to have some training. But I would say it depends on what the flight is going to be. I haven’t had a chance to talk to Beth Moses from Virgin Galactic. But Beth would be — she’s not a normal person off the street, because she’s the astronaut training officer at Blue Origin. But Beth had an opportunity to fly, and she didn’t go through years of training. You know, I think there’s some fundamental things that you teach someone about mobility. And, ‘don’t touch that.’ And you let them go.” On whether it’s possible to go to Mars without commercial interest involved Ariel Ekblaw: “I think it’s critical to have both. As Charlie and Dava Newman — another colleague of mine — have shown: the path from moon to Mars is going to be a public-private partnership path. And we need the capability that private brings and the inspiration that NASA and that the governments can still bring to the task.” On what it’s like to go to space Charles Bolden: “It’s much more spectacular than the pictures portray. We have great cameras nowadays. They’re better and better than they ever were before, but they just cannot capture what the human eye sees. God’s camera is pretty awesome. The ability to play around with Newton’s law, the fact that, you know, because gravity is overcome by the speed at which you’re going around the planet allows us to seem like we’re floating. And that’s a lot of fun to get to play with. You know, a body at rest stays at rest, a body in motion stays in motion. And for every action, there’s an equal and opposite reaction. It makes all that stuff that you learned in middle school, if you learned it, or if you avoided it, it brings it to life for you. So that’s incredible.” From The Reading List Wall Street Journal: “Space Is Poised for Explosive Growth. Let’s Get It Right.” — “In the 19th century, urban planners wrangled the chaotic metropolises of Paris and New York into “planned cities,” turning warrens of streets into orderly grids, building sewage systems and transit lines, and allowing for new types of architecture, such as apartment buildings. Today, we face a similar inflection point in developing the nearest reaches of space. “The next decade is set to bring explosive commercial growth and more private industry players to low-earth orbit, the area spanning 100 to 1,240 miles above the planet’s surface. SpaceX has proposed a satellite-based internet, and Planet is growing its fleet of Earth-imaging satellites. NASA plans a transition towards commercial management of the international space station. Several startups are developing low-earth orbit advertisements—logos or other designs, visible in the night sky, made from tiny, reflective satellites. Entrepreneurs are making plans for space hotels. “Before we let rampant development go unchecked, we should consider how these efforts might conflict with or complement each other. We still have the chance to intentionally design humanity’s first ‘planned orbit.’” MIT Media Lab: “Democratizing Access to Space” — “The Space Exploration Initiative’s founding mission is to rigorously, vigorously build out the technologies of our sci-fi space future while keeping our innovations and team as open and accessible as possible. When we say we’re ‘democratizing access to space exploration,’ what do we mean? In the context of our blue sky goal — to realize an inclusive, impactful — we approach democratization in four core ways. We are: “1. Democratizing access by inviting and uniting new disciplines in our creative practice] “2. Democratizing access by designing space tools, products, and experiences for all of us, not just the pinnacle of human talent embodied by astronauts. “3. Democratizing access by developing hands-on, widely accessible opportunities to shape the technologies of our space future. “4. Democratizing access through the celebration of new narratives through which we can tell the story of Space Exploration, writ large.” The Verge: “This was the decade the commercial spaceflight industry leapt forward” — “Two years into the decade, on May 25th, 2012, a small teardrop-shaped capsule arrived at the International Space Station, packed with cargo and supplies for the crew living on board. Its resupply mission at the ISS wasn’t remarkable, but the vehicle itself was unique: it was a Dragon cargo capsule, owned and operated by a private company called SpaceX. “Before 2012, only vehicles operated by governments had ever visited the ISS. The Dragon was the first commercial vehicle to dock with the station. The milestone was a crowning achievement for the commercial industry, which has permanently altered the spaceflight sector over the last 10 years. “This decade, the space industry has seen a shift in the way it does business, with newer players looking to capitalize on different markets and more ambitious projects. The result has been an explosion of growth within the commercial sector. It’s allowing for easier access to space than ever before, with both positive and negative results. Such growth is providing the commercial space industry with lots of momentum coming into the 2020s, but it’s unclear if this pace is something that can be kept up.” Axios: “NASA’s murky commercial space future” — “NASA’s plans to create a robust economy in low-Earth orbit where private spaceflight companies can flourish could eventually leave the agency’s astronauts stranded on Earth with nowhere to go. “Why it matters: NASA hopes to play a lead role in developing a private spaceflight economy, including private sector astronauts. The agency sees this as a way to free it up to focus on farther afield goals like bringing humans back to the Moon and, eventually, to Mars.

#### Public sector thumps

NASA 19 [“NASA Invests in Tech Concepts Aimed at Exploring Lunar Craters, Mining Asteroids,” NASA, June 11, 2019, <https://www.nasa.gov/press-release/nasa-invests-in-tech-concepts-aimed-at-exploring-lunar-craters-mining-asteroids>] TDI

NASA Invests in Tech Concepts Aimed at Exploring Lunar Craters, Mining Asteroids

Robotically surveying lunar craters in record time and mining resources in space could help NASA establish a sustained human presence at the Moon – part of the agency’s broader [Moon to Mars exploration](https://www.nasa.gov/specials/moon2mars/) approach. Two mission concepts to explore these capabilities have been selected as the first-ever Phase III studies within the [NASA Innovative Advanced Concepts](https://www.nasa.gov/niac) (NIAC) program.

“We are pursuing new technologies across our development portfolio that could help make deep space exploration more Earth-independent by utilizing resources on the Moon and beyond,” said Jim Reuter, associate administrator of NASA’s Space Technology Mission Directorate. “These NIAC Phase III selections are a component of that forward-looking research and we hope new insights will help us achieve more firsts in space.”

The Phase III proposals outline an aerospace architecture, including a mission concept, that is innovative and could change what’s possible in space. Each selection will receive as much as $2 million. Over the course of two years, researchers will refine the concept design and explore aspects of implementing the new technology. The inaugural Phase III selections are:

Robotic Technologies Enabling the Exploration of Lunar Pits

William Whittaker, Carnegie Mellon University, Pittsburgh

This mission concept, called Skylight, proposes technologies to rapidly survey and model lunar craters. This mission would use high-resolution images to create 3D model of craters. The data would be used to determine whether a crater can be explored by human or robotic missions. The information could also be used to characterize ice on the Moon, a crucial capability for the sustained surface operations of NASA’s Artemis program. On Earth, the technology could be used to autonomously monitor mines and quarries.

[Mini Bee Prototype to Demonstrate the Apis Mission Architecture and Optical Mining Technology](https://www.nasa.gov/directorates/spacetech/niac/2019_Phase_I_Phase_II/Mini_Bee_Prototype)

Joel Sercel, TransAstra Corporation, Lake View Terrace, California

This flight demonstration mission concept proposes a method of asteroid resource harvesting called optical mining. Optical mining is an approach for excavating an asteroid and extracting water and other volatiles into an inflatable bag. Called Mini Bee, the mission concept aims to prove optical mining, in conjunction with other innovative spacecraft systems, can be used to obtain propellant in space. The proposed architecture includes resource prospecting, extraction and delivery.

#### Alt cause – broad space privatization

Muelhapt et al 19 [(Theodore J., Center for Orbital and Reentry Debris Studies, Center for Space Policy and Strategy, The Aerospace Corporation, 30 year Space Systems Analyst and Operator, Marlon E. Sorge, Jamie Morin, Robert S. Wilson), “Space traffic management in the new space era,” Journal of Space Safety Engineering, 6/18/19, <https://doi.org/10.1016/j.jsse.2019.05.007>] TDI

The last decade has seen rapid growth and change in the space industry, and an explosion of commercial and private activity. Terms like NewSpace or democratized space are often used to describe this global trend to develop faster and cheaper access to space, distinct from more traditional government-driven activities focused on security, political, or scientific activities. The easier access to space has opened participation to many more participants than was historically possible. This new activity could profoundly worsen the space debris environment, particularly in low Earth orbit (LEO), but there are also signs of progress and the outlook is encouraging. Many NewSpace operators are actively working to mitigate their impact. Nevertheless, NewSpace represents a significant break with past experience and business as usual will not work in this changed environment. New standards, space policy, and licensing approaches are powerful levers that can shape the future of operations and the debris environment.

2. Characterizing NewSpace: a step change in the space environment

In just the last few years, commercial companies have proposed, funded, and in a few cases begun deployment of very large constellations of small to medium-sized satellites. These constellations will add much more complexity to space operations. Table 1 shows some of the constellations that have been announced for launch in the next decade. Two dozen companies, when taken together, have proposed placing well over ~~20,000~~ [twenty thousand] satellites in orbit in the next ~~10~~ [10]years. For perspective, fewer than ~~8100~~[eight thousand one hundred] payloads have been placed in Earth orbit in the entire history of the space age, only 4800 [1] remain in orbit and approximately 1950 [2] of those are still active. And it isn't simply numbers – the mass in orbit will increase substantially, and long-term debris generation is strongly correlated with mass.

[Table 1 Omitted]

This table is in constant flux. It is based largely on U.S. filings with the Federal Communications Commission (FCC) and various press releases, but many of the companies here have already altered or abandoned their original plans, and new systems are no doubt in work. Although many of these large constellations may never be launched as listed, the traffic created if just half are successful would be more than double the number of payloads launched in the last 60 years and more than 6 times the number of currently active satellites.

Current space safety, space surveillance, collision avoidance (COLA) and debris mitigation processes have been designed for and have evolved with the current population profile, launch rates and density of LEO space.

By almost any metric used to measure activity in space, whether it is payloads in orbit, the size of constellations, the rate of launches, the economic stakes, the potential for debris creation, the number of conjunctions, NewSpace represents a fundamental change.

3. Compounding effects of better SSA, more satellites, and new operational concepts

The changes in the space environment can be seen on this figurative map of low Earth orbit. Fig. 1 shows the LEO environment as a function of altitude. The number of objects found in each 10 km “bin” is plotted on the horizontal axis, while the altitude is plotted vertically. Objects in elliptical orbits are distributed between bins as partial objects proportional to the time spent in each bin. Some notable resident systems are indicated in blue text on the right to provide an altitude reference. The (dotted) red line shows the number of objects in the current catalog tracked by the U.S. Space Surveillance Network (SSN). All the COLA alerts and actions that must be taken by the residents are due to their neighbors in the nearby bins, so the currently visible risk is proportional to the red line.



The red line of the current catalog does not represent the complete risk; it indicates the risk we can track and perhaps avoid. A rule of thumb is that the current SSN LEO catalog contains objects about 10 cm or larger. It is generally accepted that an impact in LEO with an object 1 cm or larger will cause damage likely to be fatal to a satellite's mission. Therefore, there is a large latent risk from unobserved debris. While we cannot currently track and catalog much smaller than 10 cm, experiments have been performed to detect and sample much smaller objects and statistically model the population at this size [3]. The (solid) blue line represents the model of the 1 cm and larger debris that is likely mission-ending, usually called lethal but not trackable. If LEO operators avoid collisions with all the objects in the red line, they are nonetheless inherently accepting the risk from the blue line. This risk is already present.

The (dashed) orange line is an estimate of the population at 5 cm and larger and is thus an estimate of what the catalog might conservatively be a few years after the Space Fence, a new radar system being built by the Air Force, comes on line (currently planned for 2019) [4]. Commercial companies offering space surveillance services, such as LeoLabs, ExoAnalytics, Analytic Graphics Inc., Lockheed, and Boeing, might also add to the number of objects currently tracked. Space Policy Directive 3 (SPD-3) [13] specifically seeks to expand the use of commercial SSA services.

Existing operators can expect a sharp increase in the number of warnings and alerts they will receive because of the increase in the cataloged population. Almost all the increase will come from newly detected debris [5].

The pace of safety operations for each satellite on orbit will significantly change because of the increase in the catalog from the Space Fence. This effect is compounded because the NewSpace constellations described in Table 1 will drastically change the profile of satellites in LEO. The green bars in Fig. 1 represent the number of objects that will be added to the catalog (red or orange lines) from only the NewSpace large LEO constellations at their operational altitudes. This does not include the rocket stages that launch them, or satellites in the process of being phased into or removed from the operational orbits. Neighbors of one of these new constellations may face a radically different operations environment than their current practices were designed to address.

Satellites in these large LEO constellations typically have planned operational lifetimes of 5–10 years. Some companies have proposed to dispose of their satellites using low thrust electric propulsion systems, which would spiral satellites down over a period of months or years from operating altitudes as high as 1500 km through lower orbits where the Hubble Space Telescope, the International Space Station, and other critical LEO satellites operate [6]. Similar propulsive techniques would raise replacement satellites from lower launch injection orbits to higher operational orbits. These disposal and replenishment activities will add thousands of satellites each year transiting through lower altitudes and posing a risk to all resident satellites in those lower orbits. More importantly, failures will occur both among transiting satellites and operational constellations, potentially leaving hundreds more stranded along the transit path.

### Capitalism

#### Extinction outweighs – CX binding

#### Capitalism solves extinction through environmental collapse – reject evidence that ignores synergistic deployment of adaptative tech – the public won’t transition to Maoism but WILL channel political energies into innovative solutions that turn case.

Bailey ’18 [Ronald; March 12; B.A. in Economics from the University of Virginia, member of the Society of Environmental Journalists and the American Society for Bioethics and Humanities, citing a compilation of interdisciplinary research; Reason, “Climate Change Problems Will Be Solved Through Economic Growth,” <https://reason.com/2018/03/12/climate-change-problems-will-be-solved-t>; RP]

"It is, I promise, worse than you think," David Wallace-Wells wrote in an infamously apocalyptic 2017 New York Magazine article. "Indeed, absent a significant adjustment to how billions of humans conduct their lives, parts of the Earth will likely become close to uninhabitable, and other parts horrifically inhospitable, as soon as the end of this century." The "it" is man-made climate change. Temperatures will become scalding, crops will wither, and rising seas will inundate coastal cities, Wallace-Wells warns. But toward the end of his screed, he somewhat dismissively observes that "by and large, the scientists have an enormous confidence in the ingenuity of humans….Now we've found a way to engineer our own doomsday, and surely we will find a way to engineer our way out of it, one way or another." Over at Scientific American, John Horgan considers some eco-modernist views on how humanity will indeed go about engineering our way out of the problems that climate change may pose. In an essay called "Should We Chill Out About Global Warming?," Horgan reports the more dynamic and positive analyses of two eco-modernist thinkers, Harvard psychologist Steven Pinker and science journalist Will Boisvert. In an essay for The Breakthrough Journal, Pinker notes that such optimism "is commonly dismissed as the 'faith that technology will save us.' In fact, it is a skepticism that the status quo will doom us—that knowledge and behavior will remain frozen in their current state for perpetuity. Indeed, a naive faith in stasis has repeatedly led to prophecies of environmental doomsdays that never happened." In his new book, Enlightenment Now, Pinker points out that "as the world gets richer and more tech-savvy, it dematerializes, decarbonizes, and densifies, sparing land and species." Economic growth and technological progress are the solutions not only to climate change but to most of the problems that bedevil humanity. Boisvert, meanwhile, tackles and rebuts the apocalyptic prophecies made by eco-pessimists like Wallace-Wells, specifically with regard to food production and availabilty, water supplies, heat waves, and rising seas. "No, this isn't a denialist screed," Boisvert writes. "Human greenhouse emissions will warm the planet, raise the seas and derange the weather, and the resulting heat, flood and drought will be cataclysmic. Cataclysmic—but not apocalyptic. While the climate upheaval will be large, the consequences for human well-being will be small. Looked at in the broader context of economic development, climate change will barely slow our progress in the effort to raise living standards." Boisvert proceeds to show how a series of technologies—drought-resistant crops, cheap desalination, widespread adoption of air-conditioning, modern construction techniques—will ameliorate and overcome the problems caused by rising temperatures. He is entirely correct when he notes, "The most inexorable feature of climate-change modeling isn't the advance of the sea but the steady economic growth that will make life better despite global warming." Horgan, Pinker, and Boisvert are all essentially endorsing what I have called "the progress solution" to climate change. As I wrote in 2009, "It is surely not unreasonable to argue that if one wants to help future generations deal with climate change, the best policies would be those that encourage rapid economic growth. This would endow future generations with the wealth and superior technologies that could be used to handle whatever comes at them including climate change." Six years later I added that that "richer is more climate-friendly, especially for developing countries. Why? Because faster growth means higher incomes, which correlate with lower population growth. Greater wealth also means higher agricultural productivity, freeing up land for forests to grow as well as speedier progress toward developing and deploying cheaper non–fossil fuel energy technologies. These trends can act synergistically to ameliorate man-made climate change." Horgan concludes, "Greens fear that optimism will foster complacency and hence undermine activism. But I find the essays of Pinker and Boisvert inspiring, not enervating….These days, despair is a bigger problem than optimism." Counseling despair has always been wrong when human ingenuity is left free to solve problems, and that will prove to be the case with climate change as well.

#### Uniqueness goes neg – growth is sustainable, physical limits aren’t absolute or are chronically underestimated, AND resource use is declining now – BUT – degrowth unleashes disaster that slips into Malthusian population crunches.

Bailey ’18 [Ronald; February 16; B.A. in Economics from the University of Virginia, member of the Society of Environmental Journalists and the American Society for Bioethics and Humanities, citing a compilation of interdisciplinary research; Reason, “Is Degrowth the Only Way to Save the World?” https://reason.com/2018/02/16/is-degrowth-the-only-way-to-save-the-wor; RP]

Unless us folks in rich countries drastically reduce our material living standards and distribute most of what we have to people living in poor countries, the world will come to an end. Or at least that's the stark conclusion of a study published earlier this month in the journal Nature Sustainability. The researchers who wrote it, led by the Leeds University ecological economist Dan O'Neill, think the way to prevent the apocalypse is "degrowth." Vice, pestilence, war, and "gigantic inevitable famine" were the planetary boundaries set on human population by the 18th-century economist Robert Thomas Malthus. The new study gussies up old-fashioned Malthusianism by devising a set of seven biophysical indicators of national environmental pressure, which they then link to 11 indicators of social outcomes. The aim of the exercise is to concoct a "safe and just space" for humanity. Using data from 2011, the researchers calculate that the annual per capita boundaries for the world's 7 billion people consist of the emission of 1.6 tons of carbon dioxide per year and the annual consumption of 0.9 kilograms of phosphorus, 8.9 kilograms of nitrogen, 574 cubic meters of water, 2.6 tons of biomass (crops and wood), plus the ecological services of 1.7 hectares of land and 7.2 tons of material per person. On the social side, meanwhile, the researchers say that life satisfaction in each country should exceed 6.5 on the 10-point Cantril scale, that healthy life expectancy should average at least 65 years, and that nutrition should be over 2,700 calories per day. At least 95 percent of each country's citizens must have access to good sanitation, earn more than $1.90 per day, and pass through secondary school. Ninety percent of citizens must have friends and family they can depend on. The threshold for democratic quality must exceed 0.8 on an index scale stretching from -1 to +1, while the threshold for equality is set at no higher than 70 on a Gini Index where 0 represents perfect equality and 100 implies perfect inequality. They set the threshold for percent of labor force employed at 94 percent. So how does the U.S. do with regard to their biophysical boundaries and social outcomes measures? We Americans transgress all seven of the biophysical boundaries. Carbon dioxide emissions stand at 21.2 tons per person; we each use an average of 7 kilograms of phosphorus, 59.1 kilograms of nitrogen, 611 cubic meters of water, and 3.7 tons of biomass; we rely on the ecological services of 6.8 hectares of land and 27.2 tons of material. Although the researchers urge us to move "beyond the pursuit of GDP growth to embrace new measures of progress," it is worth noting that U.S. GDP is $59,609 per capita. On the other hand, those transgressions have provided a pretty good life for Americans. For example, life satisfaction is 7.1; healthy life expectancy is 69.7 years; and democratic quality stands at 0.8 points. The only two social indicators we just missed on were employment (91 percent) and secondary education (94.7 percent). On the other hand, our hemisphere is home to one paragon of sustainability—Haiti. Haitians breach none of the researchers' biophysical boundaries. But the Caribbean country performs abysmally on all 11 social indicators. Life satisfaction scores at 4.8; healthy life expectancy is 52.3 years; and Haitians average 2,105 calories per day. The country tallies -0.9 on the democratic quality index. Haiti's GDP is $719 per capita. Other near-sustainability champions include Malawi, Nepal, Myanmar, and Nicaragua. All of them score dismally on the social indicators, and their GDPs per capita are $322, $799, $1,375, and $2,208, respectively. The country that currently comes closest to the researchers' ideal of remaining within its biophysical boundaries while sufficient social indicators is…Vietnam. For the record, Vietnam's per capita GDP is $2,306. "Countries with higher levels of life satisfaction and healthy life expectancy also tend to transgress more biophysical boundaries," the researchers note. A better way to put this relationship is that more wealth and technology tend to make people happier, healthier, and freer. O'Neill and his unhappy team fail drastically to understand how human ingenuity unleashed in markets is already well on the way toward making their supposed planetary boundaries irrelevant. Take carbon dioxide emissions: Supporters of renewable energy technologies say that their costs are already or will soon be lower than those of fossil fuels. Boosters of advanced nuclear reactors similarly argue that they can supply all of the carbon-free energy the world will need. There's a good chance that fleets of battery-powered self-driving vehicles will largely replace private cars and mass transit later in this century. Are we about to run out of phosphorous to fertilize our crops? Peak phosphorus is not at hand. The U.S. Geological Survey (USGS) reports that at current rates of mining, the world's known reserves will last 266 years. The estimated total resources of phosphate rock would last over 1,140 years. "There are no imminent shortages of phosphate rock," notes the USGS. With respect to the deleterious effects that using phosphorus to fertilize crops might have outside of farm fields, researchers are working on ways to endow crops with traits that enable them to use less while maintaining yields. O'Neill and his colleagues are also concerned that farmers are using too much nitrogen fertilizer, which runs off fields into the natural environment and contributes to deoxygenated dead zones in the oceans, among other ill effects. This is a problem, but one that plant breeders are already working to solve. For example, researchers at Arcadia Biosciences have used biotechnology to create nitrogen-efficient varieties of staples like rice and wheat that enable farmers to increase yields while significantly reducing fertilizer use. Meanwhile, other researchers are moving on projects to engineer the nitrogen fixation trait from legumes into cereal crops. In other words, the crops would make their own fertilizer from air. Water? Most water is devoted to the irrigation of crops; the ongoing development of drought-resistant and saline-tolerant crops will help with that. Hectares per capita? Humanity has probably already reached peak farmland, and nearly 400 million hectares will be restored to nature by 2060—an area almost double the size of the United States east of the Mississippi River. In fact, it is entirely possible that most animal farming will be replaced by resource-sparing lab-grown steaks, chops, and milk. Such developments in food production undermine the researchers' worries about overconsumption of biomass. And humanity's material footprint is likely to get smaller too as trends toward further dematerialization take hold. The price system is a superb mechanism for encouraging innovators to find ways to wring ever more value out less and less stuff. Rockefeller University researcher Jesse Ausubel has shown that this process of absolute dematerialization has already taken off for many commodities. After cranking their way through their models of doom, O'Neill and his colleagues lugubriously conclude: "If all people are to lead a good life within planetary boundaries, then the level of resource use associated with meeting basic needs must be dramatically reduced." They are right, but they are entirely backward with regard to how to achieve those goals. Economic growth provides the wealth and technologies needed to lift people from poverty while simultaneously lightening humanity's footprint on the natural world. Rather than degrowth, the planet—and especially its poor people—need more and faster economic growth.

#### Elites react with war – if goods don’t cross borders, then soldiers will.

Liu ’18 [Qian; November 2; Economist, Managing Director at Greater China, citing the economist Thomas Piketty and political scientist Samuel Huntington; Project Syndicate, “From economic crisis to World War III,” p. 1-2; RP]

The next economic crisis is closer than you think. But what you should really worry about is what comes after: in the current social, political, and technological landscape, a prolonged economic crisis, combined with rising income inequality, could well escalate into a major global military conflict. The 2008-09 global financial crisis almost bankrupted governments and caused systemic collapse. Policymakers managed to pull the global economy back from the brink, using massive monetary stimulus, including quantitative easing and near-zero (or even negative) interest rates. But monetary stimulus is like an adrenaline shot to jump-start an arrested heart; it can revive the patient, but it does nothing to cure the disease. Treating a sick economy requires structural reforms, which can cover everything from financial and labour markets to tax systems, fertility patterns, and education policies. Policymakers have utterly failed to pursue such reforms, despite promising to do so. Instead, they have remained preoccupied with politics. From Italy to Germany, forming and sustaining governments now seems to take more time than actual governing. Greece, for example, has relied on money from international creditors to keep its head (barely) above water, rather than genuinely reforming its pension system or improving its business environment. The lack of structural reform has meant that the unprecedented excess liquidity that central banks injected into their economies was not allocated to its most efficient uses. Instead, it raised global asset prices to levels even higher than those prevailing before 2008. In the United States, housing prices are now 8% higher than they were at the peak of the property bubble in 2006, according to the property website Zillow. The price-to-earnings (CAPE) ratio, which measures whether stock-market prices are within a reasonable range, is now higher than it was both in 2008 and at the start of the Great Depression in 1929. As monetary tightening reveals the vulnerabilities in the real economy, the collapse of asset-price bubbles will trigger another economic crisis – one that could be even more severe than the last, because we have built up a tolerance to our strongest macroeconomic medications. A decade of regular adrenaline shots, in the form of ultra-low interest rates and unconventional monetary policies, has severely depleted their power to stabilise and stimulate the economy. If history is any guide, the consequences of this mistake could extend far beyond the economy. According to Harvard’s Benjamin Friedman, prolonged periods of economic distress have been characterised also by public antipathy toward minority groups or foreign countries – attitudes that can help to fuel unrest, terrorism, or even war. For example, during the Great Depression, US President Herbert Hoover signed the 1930 Smoot-Hawley Tariff Act, intended to protect American workers and farmers from foreign competition. In the subsequent five years, global trade shrank by two-thirds. Within a decade, World War II had begun. To be sure, WWII, like World War I, was caused by a multitude of factors; there is no standard path to war. But there is reason to believe that high levels of inequality can play a significant role in stoking conflict. According to research by the economist Thomas Piketty, a spike in income inequality is often followed by a great crisis. Income inequality then declines for a while, before rising again, until a new peak – and a new disaster. Though causality has yet to be proven, given the limited number of data points, this correlation should not be taken lightly, especially with wealth and income inequality at historically high levels. This is all the more worrying in view of the numerous other factors stoking social unrest and diplomatic tension, including technological disruption, a record-breaking migration crisis, anxiety over globalisation, political polarisation, and rising nationalism. All are symptoms of failed policies that could turn out to be trigger points for a future crisis. Voters have good reason to be frustrated, but the emotionally appealing populists to whom they are increasingly giving their support are offering ill-advised solutions that will only make matters worse. For example, despite the world’s unprecedented interconnectedness, multilateralism is increasingly being eschewed, as countries – most notably, Donald J. Trump’s US – pursue unilateral, isolationist policies. Meanwhile, proxy wars are raging in Syria and Yemen. Against this background, we must take seriously the possibility that the next economic crisis could lead to a large-scale military confrontation. By the logic of the political scientist Samuel Huntington, considering such a scenario could help us avoid it because it would force us to take action. In this case, the key will be for policymakers to pursue the structural reforms that they have long promised while replacing finger-pointing and antagonism with a sensible and respectful global dialogue. The alternative may well be global conflagration.

#### It’s key to CCS – link-turns every impact.

Graciela ‘16 (/16 – Professor of Economics and of Statistics at Columbia University and Visiting Professor at Stanford University, and was the architect of the Kyoto Protocol carbon market (being interviewed by Marcus Rolle, freelance journalist specializing in environmental issues and global affairs, “Reversing Climate Change: Interview with Graciela Chichilnisky,” http://www.globalpolicyjournal.com/blog/01/09/2016/reversing-climate-change-interview-graciela-chichilnisky)//cmr

GC: Green capitalism is a new economic system that values the natural resources on which human survival depends. It fosters a harmonious relationship with our planet, its resources and the many species it harbors. It is a new type of market economics that addresses both equity and efficiency. Using carbon negative technology™ it helps reduce carbon in the atmosphere while fostering economic development in rich and developing nations, for example in the U S., EU, China and India. How does this work? In a nutshell Green Capitalism requires the creation of global limits or property rights nation by nation for the use of the atmosphere, the bodies of water and the planet’s biodiversity, and the creation of new markets to trade these rights from which new economic values and a new concept of economic progress emerges updating GDP as is now generally agreed is needed. Green Capitalism is needed now to help avert climate change and achieve the goals of the 2015 UN Paris Agreement, which are very ambitious and universally supported but have no way to be realized within the Agreement itself. The Carbon Market and its CDM play critical roles in the foundation of Green Capitalism, creating values to redefine GDP. These are needed to remain within the world’s “CO2 budget” and avoid catastrophic climate change. As I see it, the building blocks for Green Capitalism are then as follows; (1) Global limits nation by nation in the use of the planet’s atmosphere, its water bodies and biodiversity - these are global public goods. (2) New global markets to trade these limits, based on equity and efficiency. These markets are relatives of the Carbon Market and the SO2 market. The new market create new measures of economic values and update the concept of GDP. (3) Efficient use of Carbon Negative Technologies to avert catastrophic climate change by providing a smooth transition to clean energy and ensuring economic prosperity in rich and poor nations. These building blocks have immediate practical implications in reversing climate change and can assist the ambitious aims of Paris COP21 become a reality. MR: What is the greatest advantage of the new generation technologies that can capture CO2 from the air? GC: These technologies build carbon negative power plants, such as Global Thermostat, that clean the atmosphere of CO2 while producing electricity. Global Thermostat is a firm that is commercializing a technology that takes CO2 out of air and uses mostly low cost residual heat rather than electricity to drive the capture process, making the entire process of capturing CO2 from the atmosphere very inexpensive. There is enough residua heat in a coal power plant that it can be used to capture twice as much CO2 as the plant emits, thus transforming the power plant into a “carbon sink.” For example, a 400 MW coal plant that emits 1 million tons of CO2 per year can become a carbon sink absorbing a net amount of 1 million tons of CO2 instead. Carbon capture from air can be done anywhere and at any time, and so inexpensively that the CO2 can be sold for industrial or commercial uses such as plastics, food and beverages, greenhouses, bio-fertilizers, building materials and even enhanced oil recovery, all examples of large global markets and profitable opportunities. Carbon capture is powered mostly by low (85°C) residual heat that is inexpensive, and any source will do. In particular, renewable (solar) technology can power the process of carbon capture. This can help advance solar technology and make it more cost-efficient. This means more energy, more jobs, and it also means economic growth in developing nations, all of this while cleaning the CO2 in the atmosphere. Carbon negative technologies can literally transform the world economy. MR: One final question. You distinguish between long-run and short-run strategies in the effort to reverse climate change. Would carbon negative technologies be part of a short-run strategy? GC: Long-run strategies are quite different from strategies for the short-run. Often long-run strategies do not work in the short run and different policies and economic incentives are needed. In the long run the best climate change policy is to replace fossil fuel sources of energy that by themselves cause 45% of the global emissions, and to plant trees to restore if possible the natural sources and sinks of CO2. But the fossil fuel power plant infrastructure is about 87% of the power plant infrastructure and about $45-55 trillion globally. This infrastructure cannot be replaced quickly, certainly not in the short time period in which we need to take action to avert catastrophic climate change. The issue is that CO2 once emitted remains hundreds of years in the atmosphere and we have emitted so much that unless we actually remove the CO2 that is already there, we cannot remain long within the carbon budget, which is the concentration of CO2 beyond which we fear catastrophic climate change. In the short run, therefore, we face significant time pressure. The IPCC indicates in its 2014 5th Assessment Report that we must actually remove the carbon that is already in the atmosphere and do so in massive quantities, this century (p. 191 of 5th Assessment Report). This is what I called a carbon negative approach, which works for the short run. Renewable energy is the long run solution. Renewable energy is too slow for a short run resolution since replacing a $45-55 trillion power plant infrastructure with renewable plants could take decades. We need action sooner than that. For the short run we need carbon negative technologies that capture more carbon than what is emitted. Trees do that and they must be conserved to help preserve biodiversity. Biochar does that. But trees and other natural sinks are too slow for what we need today. Therefore, negative carbon is needed now as part of a blueprint for transformation. It must be part of the blueprint for Sustainable Development and its short term manifestation that I call Green Capitalism, while in the long run renewable sources of energy suffice, including Wind, Biofuels, Nuclear, Geothermal, and Hydroelectric energy. These are in limited supply and cannot replace fossil fuels. Global energy today is roughly divided as follows: 87% is fossil, namely natural gas, coal, oil; 10% is nuclear, geothermal, and hydroelectric, and less than 1% is solar power — photovoltaic and solar thermal. Nuclear fuel is scarce and nuclear technology is generally considered dangerous as tragically experienced by the Fukushima Daichi nuclear disaster in Japan, and it seems unrealistic to seek a solution in the nuclear direction. Only solar energy can be a long term solution: Less than 1% of the solar energy we receive on earth can be transformed into 10 times the fossil fuel energy used in the world today. Yet we need a short-term strategy that accelerates long run renewable energy, or we will defeat long-term goals. In the short term as the IPCC validates, we need carbon negative technology, carbon removals. The short run is the next 20 or 30 years. There is no time in this period of time to transform the entire fossil infrastructure — it costs $45-55 trillion (IEA) to replace and it is slow to build. We need to directly reduce carbon in the atmosphere now. We cannot use traditional methods to remove CO2 from smokestacks (called often Carbon Capture and Sequestration, CSS) because they are not carbon negative as is required. CSS works but does not suffice because it only captures what power plants currently emit. Any level of emissions adds to the stable and high concentration we have today and CO2 remains in the atmosphere for years. We need to remove the CO2 that is already in the atmosphere, namely air capture of CO2 also called carbon removals. The solution is to combine air capture of CO2 with storage of CO2 into stable materials such as biochar, cement, polymers, and carbon fibers that replace a number of other construction materials such as metals. The most recent BMW automobile model uses only carbon fibers rather than metals. It is also possible to combine CO2 to produce renewable gasoline, namely gasoline produced from air and water. CO2 can be separated from air and hydrogen separated from water, and their combination is a well-known industrial process to produce gasoline. Is this therefore too expensive? There are new technologies using algae that make synthetic fuel commercially feasible at competitive rates. Other policies would involve combining air capture with solar thermal electricity using the residual solar thermal heat to drive the carbon capture process. This can make a solar plant more productive and efficient so it can out-compete coal as a source of energy. In summary, the blueprint offered here is a private/public approach, based on new industrial technology and financial markets, self-funded and using profitable greenmarkets, with securities that utilize carbon credits as the “underlying” asset, based on the KP CDM, as well as new markets for biodiversity and water providing abundant clean energy to stave off impending and actual energy crisis in developing nations, fostering mutually beneficial cooperation for industrial and developing nations. The blueprint proposed provides the two sides of the coin, equity and efficiency, and can assign a critical role for women as stewards for human survival and sustainable development. My vision is a carbon negative economy that represents green capitalism in resolving the Global Climate negotiations and the North–South Divide. Carbon negative power plants and capture of CO2 from air and ensure a clean atmosphere together innovation and more jobs and exports: the more you produce and create jobs the cleaner becomes the atmosphere. In practice, Green Capitalism means economic growth that is harmonious with the Earth resources.

#### Growth solves war AND root causes their impacts – throw out non-empirical analyses.

Cortright ’16 (David; 5/18/16; Ph.D. in Political Science from the Union Graduate School, M.A. in History from New York University, B.A. in History from the University of Notre Dame, Director of Policy Studies at the Kroc Institute for International Peace Studies, former research associate at the Center for National Security Studies; Kroc Institute, “Linking Development and Peace: The Empirical Evidence,” <https://peacepolicy.nd.edu/2016/05/18/linking-development-and-peace-the-empirical-evidence/)>

The connections between **development and peace** are firmly supported by social science research. All the standard indicators of economic development, including per capita income, economic growth rates, levels of trade and investment, and degree of market openness, are **significantly correlated** with peace. Virtually every study on the causes of war finds a strong connection between low income and the likelihood of armed conflict. Economist Edward Miguel describes this link as “one of the most **robust empirical relationships** in the economic literature.” Irrespective of all other variables and indicators, poverty as measured by low income bears a strong and **statistically significant** relationship to increased risk of civil conflict. No one has made this point more convincingly over the years than Paul Collier. He and his colleagues have shown that civil conflict is heavily concentrated in the poorest countries. The risk of civil war is strongly associated with joblessness, poverty and a general lack of development. They famously conclude, “The **key root cause** of conflict is the failure of economic **development**.” They also make the reverse point. Raising economic **growth rates** and levels of per capita income may be “the single **most important step** that can be taken” to reduce the likelihood of armed conflict. War is reverse development. It undermines economic well-being and reduces income levels. War may bring profit for the few, those ‘masters of war’ as Bob Dylan called them, but it creates economic misery for many. Once started, war becomes a self-sustaining system, an “economy of war” Mary Kaldor calls it in New and Old Wars, a feeding trough for profiteers, warlords and mobsters that becomes exceedingly difficult to stop. War reduces life expectancy and destroys education and public health systems. It tears apart the social fabric. The World Development Report 2011 calculates the cost of a major civil war as equivalent to more than **30 years of typical growth** for a medium-size developing country. Trade levels take 20 years to recover. The negative economic impact of conflict helps to explain why countries at war are often caught in a deadly conflict trap, why the chief legacy of a civil war is another war. The linkage between **poverty and war** has a human face. We can see it the hallowed out stare and angry glare of the mostly young men who fight in these wars. Surveys of insurgents and militia fighters confirm that many are driven by poverty and unemployment. The majority of child soldiers “are drawn from the poorest, least educated and most marginalized sections of society.” The link between low income and conflict risk does not mean that poverty causes war, however. There is no automatic connection. Some poor countries, such as Zambia or Bangladesh, have not experienced recent major civil conflict. Other mid-level income countries, such as Croatia and Serbia, have fought bitter wars. It is not poverty per se but a general lack of **economic development** that is most strongly associated with armed conflict. Poverty and a lack of opportunity are **most disruptive** when communities experience a decline in social and economic status, and when they perceive an unjust discrepancy between what they have and what they expect or feel they deserve.

#### Growth is sustainable and inevitable – unparalleled data proves tech solves, but transition doesn’t.

Bailey ’16 (Ronald; 12/16/16; B.A. in Philosophy and B.A. Economics from the University of Virginia, member of the Society of Environmental Journalists and the American Society for Bioethics and Humanities, citing a compilation of interdisciplinary research; Reason, “Is Economic Growth Environmentally Sustainable?” <http://reason.com/archives/2016/12/16/is-economic-growth-environmentally-sust1)>

Is economic growth environmentally sustainable? No, say a group of prominent ecological economists led by the Australian hydrologist James Ward. In a new PLoS ONE article—"Is Decoupling GDP Growth from Environmental Impact Possible?"—they offer an analysis inspired by the 1972 neo-Malthusian classic The Limits to Growth. They even suggest that The Limits to Growth's projections with regard to population, food production, pollution, and the depletion of nonrenewable resources are still on track. In other words, they think we're still heading for a collapse. I think **they're wrong**. But they're wrong in an instructive way. The authors describe two types of "decoupling," relative and absolute. Relative decoupling means that economic growth increases faster than rates of growth in material and energy **consumption** and **environmental impact**. Between 1990 and 2012, for example, China's **GDP rose 20-fold** while its energy use increased by a factor of four and its material use by a factor of five. Basically this entails increases in efficiency that result in using fewer resources to produce more value. Absolute decoupling is what happens when continued economic growth actually **lessens resource use** and impacts on the natural environment, that is, creating more value while using less stuff. Essentially humanity becomes richer while withdrawing from nature. To demonstrate that continued economic growth is unsustainable, the authors recycle the hoary I=PAT model devised in 1972 by the Stanford entomologist and population alarmist Paul Ehrlich and the Harvard environmental policy professor (and chief Obama science adviser) John Holdren. Human Impact on the environment is supposed to equal to Population x Affluence/consumption x Technology. All of these are presumed to intensify and worsen humanity's impact on the natural world. In Ward and company's updated version of I=PAT, the sustainability of economic growth largely depends on Technology trends. Absolute decoupling from resource consumption or pollutant emissions requires technological intensity of use and emissions to decrease by at least the same annual percentage as the economy is growing. For example, if the economy is growing at three percent per year, technological intensity must reduce 20-fold over 100 years to maintain steady levels of resource consumption or emissions. If technological intensity is faster then resource use and emissions will decline over time, which would result in greater wealth creation with ever lessening resource consumption and environmental spillovers. Once they've set up their I=PAT analysis, Ward and his colleagues assert that "for non-substitutable resources such as land, water, raw materials and energy, we argue that whilst efficiency gains may be possible, there are minimum requirements for these resources that are ultimately governed by physical realities." Among the "physical realities" they mention are limits on plant photosynthesis, the conversion efficiencies of plants into meat, the amount of water needed to grow crops, that all supposedly determine the amount of agricultural land required to feed humanity. They also cite "the upper limits to energy and material efficiencies govern minimum resource throughput required for economic production." To illustrate the operation of their version of the I=PAT equation, they apply it to a recent study that projected it would be possible for Australia's economy to grow 7-fold while simultaneously reducing resource and energy use and lowering environmental pressures through 2050. They **crank the notion** that there are nonsubstitutable physical limits on material and energy resources through their equations until 2100, and they find that eventually consumption of both rise at the same rate as economic growth. QED: Economic growth is unsustainable. Or as they report, "Permanent decoupling (absolute or relative) is impossible for essential, non-substitutable resources because the efficiency gains are ultimately governed by physical limits." **Malthus wins again!** Or does he? GDP growth—increases in the monetary value of all finished goods and services—is a crude measure for improvements in human well-being. Nevertheless, rising incomes (GDP per capita) correlate with lots of good things that nearly everybody wants, including access to more and better **food**, longer and **healthier lives**, more educational **opportunities**, and greater scope for life choices. Ward and his colleagues are clearly right that there is only so much physical stuff on the Earth, but even they know that wealth is not created simply by using more stuff. Where they go wrong (as so many Malthusians do) is by implicitly assuming that there are limits to human creativity. Interestingly, Ward and his colleagues, like Malthus before them, focus on the supposed limits to **agricultural productivity**. For example, they cite the limits to photosynthesis, which will limit the amount of food that humanity can produce. But as they acknowledge, human population may not continue to increase. In fact, **global fertility rates** have been **decelerating** for many decades now, and demographer Wolfgang Lutz calculates that world population will peak after the middle of this century and begin falling. Since the number of mouths to feed will stabilize and people can eat only so much, it is unlikely that the **biophysical limits** of agriculture on Earth will be exceeded. But it gets even better. Agricultural **productivity is improving**. Consider the biophysical limit on photosynthesis cited by the study. In fact, researchers are already making progress on installing more efficient C-4 photosynthesis into rice and wheat, which would **boost yields by** as much as **50 percent**. British researchers just announced that they had figured out how to boost photosynthetic efficiency to create a super-wheat would increase yields by 20 percent. In a 2015 article for the Breakthrough Journal, "The Return of Nature: How Technology Liberates the Environment," Jesse H. Ausubel of Rockefeller University reviews how humanity is **already decoupling** in many ways from the natural world. "A series of 'decouplings' is occurring, so that our economy no longer advances in tandem with exploitation of land, forests, water, and minerals," he writes. "American use of almost everything except information **seems to be peaking**." He notes that agricultural applications of fertilizer and water in the U.S. peaked in the 1980s while yields continued to increase. Thanks to increasing agricultural productivity, humanity is already at **"peak farmland"**; as a result, "an area the size of India or of the United States east of the Mississippi could be released globally from agriculture over the next 50 years or so." Ward is worried about biophysical limits on water use. But as Ausubel notes, U.S. **water use has peaked** and has declined **below the level of 1970**. What about meat? Ausubel notes the **greater efficiency** with which chickens and cultivated fish turn grains and plant matter into meat. In any event, the future of farming is not fields but factories. Innovators are already seeking to replace the entire dairy industry with milk, yogurt, and cheeses made by genetically modified bacteria grown in tanks. Others are figuring how to culture meat in vat. Ausubel also notes that many countries have already been through or are about to enter the "forest transition," in which forests begin to expand. Roger Sedjo, a forest economist at Resources of the Future, has projected that by the middle of this century most of world's **industrial wood** will be produced from planted forests covering a remarkably small land area, perhaps **only 5 to 10 percent** of the extent of today's global forest. Shrinking farms and ranches and expanding forests will do a lot toward turning around the alarming global reduction in wildlife. How about unsubstitutable stuff? Are we running out of that? Ausubel notes that the U.S. has apparently already achieved **absolute decoupling**—call it peak stuff—for a lot of materials, including plastics, paper, timber, phosphate, aluminum, steel, and copper. And he reports relative decoupling for **53** other **commodities**, all of which are likely heading toward absolute decoupling. Additive manufacturing is also known as 3-D printing, in which machines build up new items one layer at a time. The Advanced Manufacturing Office suggested that additive manufacturing can reduce material needs and costs by up to **90 percent**. And instead of the replacement of worn-out items, their material can **simply be recycled** through a printer to return it to good-as-new condition using only 2 to 25 percent of the energy required to make new parts. 3-D printing on demand will also eliminate storage and inventory costs, and will significantly cut transportation costs. Nanomanufacturing—building atom-by-atom—will likely engender a **fourth industrial revolution** by spurring exponential economic growth while reducing human demands for material resources. Ward and company project that Australians will be using 250 percent more energy by 2100. Is there an upper limit to energy production that implies unsustainability? In their analysis, the ecological economists apparently assume that energy supplies are limited. Why this is not clear, unless their model **implicitly assumes** a growing **consumption** of fossil fuels (and even then, the world is not close to running out of those). But there is a source of energy that, for all practical purposes, is limitless and has few deleterious environmental effects: **nuclear power**. If demand for primary energy were to double by 2050, a back-of-the-envelope calculation finds that the **entire world's energy needs** could be supplied by 6,000 conventional nuclear power plants. The deployment of fast reactors would supply "renewable" energy for thousands of years. The development of thorium reactors could also supply **thousands of years** of energy. And both could do so without harming the environment. (Waste heat at that scale would not be much of a problem.) Such power sources are in any relevant sense "decoupled" from the natural world, since their fuel cycles produce **little pollution**. Recall that GDP measures the monetary value of all finished goods and services. Finished goods will become a shrinking part of the world's economy as more people gain access to food, clothing, housing, transportation, and so forth. Already, services account for 80 percent of U.S. GDP and 80 percent of civilian employment. Instead of stuff, people will want to spend time creating and enjoying themselves. As technological progress enables economic growth, people will consume more pixels and less petroleum, more massages and less mortar, more handicrafts and less hardwood. Ultimately, Ward and his colleagues make the **same mistake as Malthus** and the Limits to Growth folks: They **extrapolate trends** without taking adequate account of human **ingenuity**. Will it be possible to grow the economy 7-fold over this century while reducing resource consumption and restoring the natural world? Yes.

#### Decoupling now.

Newman ’17 (Peter; 7/27/17; Curtin University Sustainability Policy Institute, conducting a twenty-year statistical analysis based on third-party meta studies; EDP Sciences, “The rise and rise of renewable cities,” <https://www.rees-journal.org/articles/rees/pdf/2017/01/rees170008s.pdf)>

Abstract. The **decoupling of fossil fuels** from growth in economic activity has been **proceeding rapidly** for most of the 21st century and is analyzed globally in terms of structures and technologies for energy efficiency and for switching to renewable energy in the world’s cities. This is leading to the **decline of coal** and oil. The evidence suggests that the changes are **based on demand** for the structures and technologies that are emerging, facilitating a **disruptive process**. The rise of renewable cities can therefore be expected to accelerate. 1 Introduction The rise of renewable cities began in the 1990s but has accelerated in the 21st century [1,2]. As shown below, both coal and oil have begun to fall in the nations of the world driven mostly by their cities as this is where **growth and change** is happening [3]. The question raised by this paper is whether the rise will continue and even accelerate. The theory behind whether the rise in renewable cities is likely to continue or accelerate is partly left to economists who project the future based on the past [4] and more recently by those who see disruptive innovation as causing the future and thus leading to much accelerated change [5,6]. Disruptive innovation is caused by demand rather than supply. The costs of supply need to be competitive but may not be the cheapest option when people discover they want it for many reasons and this changes the whole system that the market is based around. An example often given by Christensen [5] is how small floppy discs outcompeted the larger discs which were cheaper per unit of memory storage but were not as convenient to carry; the system changed in response by developing the portable lap top computer. Disruptive innovations can surprise businesses who focus just on supply costs and they can go bankrupt whilst their product is still the cheapest and the whole structural system around them changes in response to the new demand. This is known as the “Kodak effect” due to the way Kodak chose not to develop their digital cameras as they saw them as too expensive. This paper seeks to find evidence of whether the renewable city is being driven by disruptive innovations based on demand, as well as competitive costs of supply, leading to a whole system change. If it is so, then the rise in renewable cities is likely to continue and even accelerate based on demand for the structures and products of the renewable city at a surprising rate. The decoupling of economic growth and fossil fuels In 2017, the International Energy Agency confirmed that economic growth has been **decoupling from** greenhouse **emissions** and fossil fuels since the start of the 21st century and that this was now leading to the first **drop in fossil fuel consumption** and subsequent emissions [7]. How this relates to the rise of the renewable city is the focus of this paper. The mechanisms are first understood by looking at a range of national data as set out in Figure 1. Denmark decoupled relatively from the 1990s but absolutely over the last 17 years and is typical of many European nations and cities. The US and Australia have been slower but have now decoupled relatively from the 2000s and absolutely over the past 5–9 years. China decoupled relatively from 2005 and absolutely over the past few years with coal whilst **oil has plateaued**. India has started relative decoupling in the past decade and may change to an absolute decline in fossil fuels as it is investing strongly in renewables and urban electric rail [11]. These trends suggest a global process the rise of the renewable city as outlined by Droege [1,2]; this appears to be occurring much faster than expected and invites the question as to whether it will accelerate [3]. 3 Mechanisms for the rise of the renewable city The mechanisms behind the decoupling of wealth and fossil fuels and the resulting rise of renewable cities are likely to be based around **structural energy** efficiencies and **growth** in renewables. Whether they are disruptive, demand driven changes, will be examined with coal and oil. 3.1 The fall of coal 3.1.1 Structural built environment energy efficiencies In the period from 2000 to 2013 the Organization for Economic Cooperation and Development improved energy efficiency by a steady 0.6% per year but in 2013/14 it improved 1.5% and in 2014/15 it improved 1.8% [12]. This rapid growth seems to be more **structural** in its base as appliances and buildings are becoming **significantly more efficient** as shown by the Intergovernmental Panel on Climate Change [13]. This does appear to be a demand driven process involving digital smart systems in appliances and in construction and management of buildings leading to declines in electricity consumption [14]. 3.1.2 Renewable fuel growth Bloomberg New Energy Finance (BNEF) has made projections of the growth in renewables based on the relative costs of fuels. They suggest that from 2015 to 2040 renewables will become the **dominant power source** in the world; wind and solar will account for **64% of** the **new** generating **capacity**, and globally there will be 60% zerocarbon power, replacing coal and gas, which will decline from 57% to 31% [15]. The predictions are made based on trends and on declining costs for renewables relative to fossil fuels. The **biggest**

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**growth** is predicted to be roof top solar which will drop in cost by 60%. However, it may be driven at an **even faster rate** if it has demand driven characteristics. Carbon tracker researchers have suggested that the changes may be even more radical than BNEF are predicting as they appear to be following more rapidly than any previous predictions and are indicating elements of disruptive innovation [16,17]. The question is therefore whether there is any new evidence of the changes being disruptive with adoption of renewables proceeding more rapidly than supply cost projections. There is evidence from Australia of a **remarkably rapid adoption** of roof top solar at a time when little investment in power was happening in the aftermath of abandoning the Australian carbon-pricing scheme [18]. Perth in particular showed this as the city grew rapidly in wealth over the past decade and 25% of households invested in roof-top solar photovoltaics (PV). This happened well beyond what would have been predicted based just on supply costs and household solar is now the largest power station in the grid [18]. Battery storage is now following the same trends [19] and analysis in Perth shows solar-storage systems enable over **90% gridfree** electricity as well as producing more renewable energy to feed into the grid and generate income [18]. The technology of PV and batteries seems to fit into a niche for ordinary single residential householders [20]; recent demonstrations are showing similar heavy demand in medium density shared households that integrate PV and batteries using Citizen Utilities and blockchain software to enable peer to peer trading [21]. The signs are there that demand is driving the electricity system toward a rapid decline in coal even faster than supply costs would indicate. This may involve more gas in some cities like in the US where this is significantly cheaper but the attractions of roof-top solar and batteries are more than likely going to outcompete gas when the **market enables it to work** as it is in Australia with simple financing, permitting and installation [22,23]. 3.2 The fall of oil 3.2.1 Structural transport energy efficiencies Oil is embedded in the structure of cities through 50 years of automobile dependence in the practice of town planning; however this is changing as an unpredicted peak in car use per capita has occurred across the world’s developed cities and even into emerging cities [24]. This is driven by: – increases in density that have led to exponential declines in car use [24]; – rapid growth in transit across all the world’s cities as traffic congestion has led to faster rail options that bypass the traffic [25]; – similar trends in walking and cycling driven by health considerations and the demand for better networks [26,27]. These trends are all demand driven. Vehicle efficiency has also been slowly increasing despite an increase in vehicle size washing out some of this improvement [28]. 3.2.2 Electric mobility Electric vehicles are growing globally at **over 40% per year** and are expected to reach at least 25% of the vehicle fleet by 2040 [29]. Most of this growth is in China which is likely to mean cheaper exports. The demand for electric vehicles is high whether they are personal cars, buses, trains or electric bikes and certainly with cars this is happening well before the **supply cost** is competitive though the daily costs of operation are significantly lower and this is a strong demand factor for most consumers; some are therefore predicting even higher adoption rates [30]. There is another demand-based trend that will impact on the shift to **electric mobility**. The trend in electricity to become more **based on renewables** means that growth in solar-powered EVs are likely to be driven by demand similar to roof top solar. EVs are already being used to fit cleverly into home PV and battery systems with the high potential for “vehicle to grid (V2G)” transfers of power to enable extra storage options in the grid. Electric transit is also beginning to be switched to renewable power as demand for clean transport grows across cities [24] and new ways of financing this demand are being found [31]. 4 Will the demand for renewable cities rise and rise? The rise of the renewable city has been quite dramatic and this paper suggests that it will continue to rise due to demand which **facilitates disruptive innovation** in replacing both coal and oil. Such demand is seen in the improved electricity systems that are emerging as a result of the demand for roof top solar and in the demand for re-urbanized cities where electric mobility can better service the needs of the community. There are two other demand factors that are likely to continue to drive the need for a **renewable city** the knowledge economy and the digital economy The knowledge economy is based around creative interactions where people work together in dense urban centers as these are where the innovative, face-to-face synergies occur between people [32]. Old central business districts and new suburban centers have been transformed back into functional walking cities and those which have done this best have attracted the most capital and young talent to work there [33]. The six most walkable cities in the US have 38% higher GDP. In Boston 70% of the knowledge economy workers live in walkable locations [24]. Transit systems and walking are the most spatially efficient forms of transport as well as being the most free of carbon. If one km of a lane of road was considered as a unit of travel then car traffic can fit about 800 people per hour down that lane in a suburban street, a freeway up to 2500, a busway around 5000, a light rail between 10,000 and 20,000 and a heavy rail up to 50,000 [24]. These striking differences in spatial efficiency are translating into competitive advantage based on the need to bring people together in centers. There is a strong demand for such cities because they represent the places where the new knowledge economy will most likely emerge and provide new opportunities. The data is also strong that there is demand for **low carbon buildings** in these new regenerating urban centers [34]. Indeed, cities are competing for residents and workers through the provision of new sustainability oriented precincts and neighborhoods; the data shows that sustainability features in buildings are a close third behind **affordability and location** [3,32,35]. As with many economic changes, there is another cultural dimension to this change that perhaps explains the rapidity of the changes observed above as well as the demographic complexion of the change. Young people (especially those involved in knowledge economy jobs) are moving to reduce their car use and switch to alternative transport faster than any other group. This has been recognized by a few commentators and has been related to the use of social media devices in the digital economy. On transit or walking (and even to an extent while biking) young people are already connected by their smart technology phones and tablets. They are hardly usable while driving a car. The report by Davis et al. [34] shows that the mobile phone is a far more important device than a car for younger people. This is a cultural revolution that partly underlies the rail revolution as well as the re-urbanization of cities. It is essentially a smart city phenomenon. Thus, the structural expression of this change is that younger people are moving to live in the walking city or transit city as these locations more readily enable them to express the kind of urban experience and culture that they aspire to as well as save precious time. This is the demand that enables peak car, the rail revival and city center renewal to continue. This can explain why cities like Washington, D.C. and Portland are demonstrating the decoupling of GDP from car use per capita (Fig. 2). 5 Conclusion The evidence gathered in this paper has shown that there is a **new trend**: the rise of the renewable city which has emerged this century from the **decoupling of fossil fuels** and economic **growth**. The fall of coal and the fall of oil are both caused by structural **energy efficiency gains** (smart technology and smart buildings for coal; smart, dense transit-oriented cities that reduce car dependence for oil) and by switching to renewable fuels (coal is being replaced by wind and solar especially roof-top PV; oil is being replaced by electric mobility). This appears to be led by demand in cities as well as somewhat competitive supply costs. The rise and rise of the renewable city is thus to be expected as demand is likely to continue to rise for the urban living advantages associated with renewable city technologies and structures.