Preventing Nuclear Catastrophe:

Making the Case for Investors and the Private Sector to Work Towards Reducing the Risks of Nuclear Weapons

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About the Author

David Epstein spent nearly two decades as a research analyst on Wall Street. The first half of his career was spent as a senior research analyst at two multi-billion dollar investment managers – Froley Revy, (now part of SSI) and Advent Capital management. The second half of his career was spent as a senior research analyst at investment bank Cowen Inc., and CRT Capital before being purchased by Cowen, where he published research for institutional clients.

Over the years, he has worked on analyzing both debt and equity. David has a particular expertise in distressed and convertible securities. With a big focus on distressed securities, he gained an appreciation of risk and the importance of being on the lookout for multi-sigma (low frequency but high impact) events. He has covered many sectors over his career, including Oil & Gas, Financial Services, Shipping, Utilities, Biotech, and Telecomm/Tech.

He has long studied nuclear risks and is trying to spread awareness among investors and the broader financial and business communities about ways in which they might be able to help prevent nuclear catastrophe. He has consulted for and has been an Innovation Fellow for the N Square Innovators Network. N Square brings together nuclear experts and experts in other fields - finance, media, technology, etc. - in order to devise novel methods of reducing the risks posed by nuclear weapons.

David, who is a Chartered Financial Analyst, received an MBA in Finance from the UCLA Anderson School of Management and a BA in Psychology from Johns Hopkins.

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Executive Summary

If and when a belligerent detonation of a nuclear weapon occurs… anywhere… it could deeply affect us all even if the incident itself kills or injures just a tiny fraction of the global population. A single detonation could shock global capital markets and economies, our jobs, and our way of life.

Along with climate change and, to some degree, future pandemics, nuclear weapons are an existential threat. Most experts agree that it is a near miracle that there has not been a nuclear detonation that was an act of aggression (i.e. excluding tests) since the end of WWII. It is extremely dangerous to assume that such luck will continue if nothing is done to change the odds. Recognizing this state of affairs, in January 2020 the Bulletin of the Atomic Scientists moved the hands of the iconic Doomsday Clock, a metaphor for the existential threats posed by the likes of nuclear weapons and climate change, to 100 seconds to midnight – the closest ever.

It is also important to recognize the link between the risks of nuclear weapons and the fight against climate change. Even short of a U.S.-Russia war involving thousands of nukes, an India-Pakistan regional nuclear war involving hundreds of nukes[1], or a smaller exchange involving some particularly powerful nukes, could still potentially have catastrophic effects on the climate and society in terms of nuclear winter. Separate from these potential direct impacts on climate in terms of nuclear winter, the economic effects of a nuclear confrontation could also fatally impact society's collective will or financial wherewithal to maintain its efforts to mitigate the climate change caused by CO2 emissions. This is in addition to the many other hardships that would likely result from an economic collapse following a major nuclear incident.

The ripping up of treaties and lack of dialogue among the U.S. and Russia, the evolving perspective around there being potentially acceptable use cases of lower payload tactical nukes, the introduction of hypersonic weapons by the Russians, and a host of other factors have increased risks of a confrontation between the two nations to the highest level in three decades. No one expects a nuclear confrontation between the two nations over the short-term, particularly any sort of global thermonuclear war, but when talking about such grave risks it is also important to look beyond the short-term. And the U.S.-Russia relationship is one of just many potential hotspots, with others even more likely to boil over.

The situation with North Korea, while dialed down from the blustery rhetoric of 2017, remains extremely dangerous – probably the greatest nuclear quandary over the short to intermediate term. And, to repeat, an incident involving just a single act of aggression with one nuke, even if we were lucky enough that it not spill over into a broader nuclear conflict, could greatly impact the financial world order as well as ability to deal with CO2 emissions and the rest of society's challenges.

Despite the gravity of the threat, **ESG** and **Impact** investors[2] are not nearly as focused on nuclear weapons risks as they are climate change and other societal challenges. In this report, we will discuss some of the causes of this state of affairs. We will also highlight some of the opportunities for an increased focus on nuclear weapons risks by such investors.

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[1] https://advances.sciencemag.org/content/advances/5/10/eaay5478.full.pdf

[2] ESG investing is the practice of screening investments for their risks/performance on a number of Environmental, Social, and Governance factors. Impact investments are, as defined by the Global Impact Investing Network (GIIN), "investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return".

We will also make recommendations relevant to others in the financial sector, such as banks and insurers, and broader industry, including such sectors as defense, utilities, tech, and shipping. All of these groups have an important role to play - far beyond anything that is being done today - in helping to reduce the threat of nuclear weapons. With the increased focus among these various players on sustainability and the importance of all stakeholders, not just shareholders, we think the time is right.

This report is also targeted at the nuclear non-proliferation and philanthropic communities, which need to work together with the investment and broader financial and business communities in order to achieve such risk reduction.

Ultimately, we venture to achieve the following with this report:

- **We will strive to convince market participants that nuclear weapons risks are relevant to the seventeen Sustainable Development Goals (SDG's), which are something of a North Star to ESG and impact investors. While nuclear risks are not explicitly discussed in the Sustainable Development Goals (SDG's), lowering the risk of nuclear weapons risk appears implicit to us in SDG #16 "Peace, Justice and Strong Institutions," as well as in one or more of the underlying targets for SDG #16. Similarly, we believe that lowering the risk of nuclear weapons is quite consistent with achieving the goals of most of the other sixteen SDG's, as a major nuclear incident could, on many levels, threaten society's ability to achieve those goals.** This view is reinforced by our conversations with a range of participants in the ESG and impact space, and we believe that the focus on nuclear risk reduction can be grown through continued education and by helping ESG and impact investors figure out how to incorporate such efforts into their business models.

- **We aim to start a dialogue among market participants on how ESG screening might better take into account the risks that various sectors pose in terms of nuclear weapons and how to encourage companies and the collective marketplace to take steps to reduce such risks**. Nuclear risks are not easy to model and are applicable to fewer companies than, say, environmental and gender and equality issues, but this issue is still important on multiple levels. The first is that such screening may force companies - and it is potentially relevant to many more industries than one might think at first blush - to change certain behaviors and thereby lower the risks stemming from their operations. A second benefit is, that by making investors and the press more aware of the systemic aspects of the risks, it may trigger the financial and business communities to take collective actions to reduce such risks. We will touch upon some of the collective actions they can take.

- **In terms of attracting impact investors, a major challenge, beyond education and convincing them that nuclear falls under their purview, is the limited pipeline of potential for-profit projects in the nuclear risk reduction space. In this report, we discuss ways to increase the pipeline of for-profit projects as well as some blended finance[3] approaches to financing both for-profit and non-profit projects.**

[3] Blended finance is this concept of blending together concessionary capital – capital willing to accept returns that are not commensurate with the risks and used to get a nascent project to a later, more investable stage - with impact or commercial capital requiring a higher financial return.

- **In addition, we would like to get the dialogue started on how some potential novel financing concepts and market-based solutions from the climate and conservation spaces could be applied to reducing nuclear risks. We also hope to trigger some grander ideas from bankers, economists, and others in finance and business about how we might tackle some of the most intractable geopolitical complexities of nuclear weapons.**

Beginning with this report, in the coming months we plan to begin building out and/or assist others in building out the ecosystem necessary to make some of the recommendations happen. This includes encouraging dialogue and debate about the topics, providing additional educational materials, putting in place some of the necessary financial frameworks and tools, and stimulating the pipeline of both for-profit and non-profit projects aimed at nuclear risk reduction. We will need many partners and allies of all stripes, along with participation from and a major focus on countries outside the U.S. Please contact us if you would like to collaborate in this endeavor or at least have an introductory conversation.

Lessons from the Coronavirus

Before moving on, it's important to acknowledge the elephant in the room – that we are still in the throes of the coronavirus (COVID-19) pandemic during the writing of this report.[4] On the one hand, we can appreciate that many readers may currently be overwhelmed in dealing with the crisis either directly, in terms of personal well-being and the needs of their employer and co-workers, or indirectly, as a result of its impact on, say, capital markets.

On the other hand, though, and the reason we are publishing this report now, is because we think the coronavirus crisis creates a uniquely visceral understanding in us all that the unimaginable can happen. If we wait too long, that feeling may be forgotten. Hopefully the rawness of this situation will help incite those in the investment and broader financial and business communities - at least those who have some bandwidth to spare - to recognize the incredible risks that nuclear weapons pose and begin taking action soon to alleviate those risks.

The coronavirus situation, including the initial inability of the U.S. government to provide testing or PPE, should hammer home the need to be proactive rather than reactive and the dangers of relying on government to prepare appropriately. The private sector, private-public partnerships, academia, and broader civil society have been critical in ramping up testing, searching for a vaccine and other treatments, manufacturing of PPE and ventilators, distributing financial aid to businesses, conducting epidemiological research, and a host of other emergency measures to try to get through the crisis:

- Dozens of hackathons have been held to search for COVID-19 solutions, including #BuildforCOVID19 Global Online Hackathon, The Global Hack, and #WeVsVirus.[5][6]

[4] We are also, of course, sensitive to the important issue of racial equality that is center stage in the minds of many. And nuclear issues can become racial issues in many ways, with indigenous people (e.g. the Marhsallese) having suffered from past testing of nuclear weapons by the U.S. and some groups of Americans having suffered from pollution caused by the nuclear weapons complex. In this report, we focus on the coronavirus to a greater degree, though, because of the greater overlap we see for it with nuclear in terms of disruption to economies and the capital markets, the need for technological solutions, etc.

[5] https://www.forbes.com/sites/tomokoyokoi/2020/04/16/the-hackathon-approach-to-covid-19-showcases-agile-innovation-at-its-best/#2de2c30d1e0c

[6] https://ssir.org/articles/entry/countering_coronavirus_with_open_social_innovation

- Many accelerators have been launched, including the COVID-19 Therapeutics Accelerator from the Bill & Melinda Gates, Wellcome and Mastercard.[7]
- GIIN, the Global Impact Investing Network, has launched the "Response, Recovery, and Resilience Investment Coalition" in order to streamline impact investing efforts to address the social and economic consequences of COVID-19.[8]
- Equity crowdfunding platforms such as Wefunder have put the spotlight on and subsidized fees for COVID-19 projects.[9]
- A collection of top scientists, billionaires, and leaders on Wall Street, which call themselves Scientists to Stop Covid-19, have teamed up to provide detailed recommendations to the Trump administration on how to combat the pandemic.[10]
- And the list goes on…

Scientists to Stop Covid-19 have described their work as a type of Manhattan Project. The term Manhattan Project has also been used by others to describe the type of response needed to fight the pandemic, from both a medical and economic perspective. The original Manhattan Project was, of course, the one that gave birth to the nuclear bomb.

A new nuclear Manhattan Project is now needed to deal with the risks of nuclear catastrophe. Just as we are seeing with the coronavirus and the society's response, nuclear risks are great enough that similar type efforts are needed by non-governmental parties. These groups, with all their financial and physical resources and capacity for innovation, need to work to prevent the potential occurrence of a nuclear incident and, should prevention efforts fail, dealing with its aftermath.

A bit later in this piece we will touch upon similarities and differences between the coronavirus pandemic and the risks of nuclear weapons. Also, while we don't explore it in detail in this piece, we think that a number of conclusions and approaches we make with regards to nuclear weapons could also be adapted to non-nuclear issues, including future possible pandemics and various weapons of mass destruction and disruption. For instance, just as we suggest companies report on and ESG investors screen investments on a range of nuclear-related variables, we think a similar approach could be taken for the risks of pandemics. Similarly, many of the novel financing concepts from conservation and climate finance we discuss, which should be adapted for combating the risks of nuclear conflict, can also be explored for battling future pandemics.

[7] https://www.gatesfoundation.org/Media-Center/Press-Releases/2020/03/COVID-19-Therapeutics-Accelerator
[8] https://thegiin.org/assets/GIIN%20LAUNCHES%20COALITION%20FOR%20COVID-19%20RESPONSE%20AND%20RECOVERY_Immediate%20Release.pdf
[9] https://wefunder.com/fight-the-virus
[10] https://www.wsj.com/public/resources/documents/NzmmjfMFB5tdwux9BARi-WSJNewsPaper-4-28-2020.pdf

Section I: Nuclear Risks – A Quick Look Around the World

Here we provide brief background on some of the world's nuclear flashpoints for our readers that do not come from the nuclear world.

Cold War Redux?

While the probability of mutual assured destruction (MAD) between the U.S. and Russia is far below where it was during the height of the Cold War, Western relations with Russia have deteriorated over the last several years. The dialogue and cooperation that the West and Russia enjoyed over nuclear weapons for a couple of decades has also but vanished.

The U.S. has begun building new tactical nukes and there is a dangerous school of thought among some folks on both sides that there might be an acceptable situation where such smaller payload nukes could be detonated without setting off a much broader nuclear conflict. Russia has also introduced a range of new nukes over the last few years, including some more powerful than ever before plus nuclear-capable hypersonic (i.e. ~5 times the speed of sound) missiles.

Both the U.S. and Russia withdrew from the Intermediate-Range Nuclear Forces (INF) Treaty last year after each accused the other side of violating the pact. This was followed by the U.S. announcing its intention to withdraw from the Open Skies Treaty. The incredibly important New Start Treaty between the two nations, which limits their arsenals and contributes to transparency, expires in 2021 and at this point it is far from clear whether it will be renewed. While Russia is currently indicating a willingness to extend it, it has also given many mixed signals, and the U.S. is somewhat uncomfortable that, among other things, the treaty does not cover China. [11]

China has a much small nuclear arsenal than either the U.S. or Russia. Also, unlike them, China maintains a no first use policy and does not keep its nukes on high alert; it stores its warheads separate from its missiles and would only pair them if and when it planned to use them. However, it is also expanding and modernizing its arsenal, it is unknown whether it would truly abide by its no first use policy in the event of a conventional threat, and there are some concerns that its policies could evolve over time.[12]

In many ways, China is really the only other superpower in the world – not Russia - and the relationship between China and the U.S. has grown increasingly contentious. This is due to competing strategic interests and battles for influence around the world, the scars from a trade war, forced technology transfer of U.S. companies wanting to operate in China, perceived lack of Chinese transparency about the coronavirus, tensions over Hong Kong, and a host of other issues.

Graham Allison of the Harvard Kennedy School is profoundly concerned about a military collision between the two countries if they do not figure out how to better navigate their rivalry. Allison has characterized the situation as the Thucydides Trap, as originally explained by Thucydides 2,500 years ago in the case of Athens' rise to rival Sparta in ancient Greece. As Allison describes it, "when a rising power threatens to displace a ruling power, alarm bells should sound: extreme danger ahead." He points out that in the last 500 years he sees sixteen cases in which a rising power threatened to displace a major ruling power, and he calculates that twelve ended in war.[13]

[11] https://foreignpolicy.com/2020/04/29/trump-china-new-start-nuclear-arms-pact-expiration/
[12] https://chinapower.csis.org/china-nuclear-weapons/
[13] https://www.belfercenter.org/publication/beyond-trade-confrontation-between-us-and-china

North Korea

The summits between the two leaders certainly did not lead to North Korea taking a path towards denuclearization. Few experts believed they ever could.

North Korea has refrained from doing any test detonations of nuclear bombs or launches of long-range missiles since first meeting with Trump, but it's far from clear how long that state of affairs will last as North Korea stated at the end of 2019 that the self-imposed moratorium is no longer in place. Meanwhile, North Korea has continued to improve its capabilities even while avoiding those particular tests.

While not quite at the level of the "Fire and Fury" comments and other dangerous rhetoric between Trump and Kim Jong Un in 2017, relations between North Korea and the U.S./South Korea have recently been on a downslope. North Korea has been making confrontational commentary of late, and in June it blew up the liaison office with South Korea and shut off lines of communication. The Korean Peninsula clearly remains a very dangerous region and is by most accounts the most vexing nuclear issue that exists.

The North Korea situation, combined with no limitations on the U.S. President's ability to launch a first-use nuclear strike without Congressional approval, has us on tenterhooks. It is clearly one of the main motivations for this author to focus on nuclear weapons issues rather than returning to a more traditional, cushy job on Wall Street.

India and Pakistan

In 2019, the world was reminded of the longstanding animosity between these two nuclear powers. After a terrorist attack that killed dozens of Indian paramilitary police, India responded with an attack against militants in Pakistan. This was then followed by a confrontation in the air that led to the downing of one of two Indian planes and, per Indian reports, a Pakistani aircraft.

While that crisis has de-escalated, relations between the countries remain extremely poor and the region remains a nuclear powder keg. Christopher Bidwell, a Senior Fellow for Nonproliferation Law and Policy at the Federation of American Scientists, highlights to us that any future standoff in the region is made particularly dangerous by the fact that Pakistan's declaratory policy reserves the right use nuclear weapons if India or another adversary uses conventional forces that interfere with Pakistan's ability to defend itself. Further, Pakistan may be of the mind that it can use some smaller nukes without the situation escalating into all-out nuclear war.[14]

Iran

The Joint Comprehensive Plan of Action (JCPOA) is an agreement had been reached in 2015 between Iran, the EU, U.S., China, Russia, France, Germany, and the United Kingdom. It was designed, and by all accounts had been working, to monitor and limit Iran's nuclear program. Many of the limits were to

[14] While less likely to ever evolve into nuclear war, India and China are also unfriendly neighbors. That relationship has been particularly fraught of late with skirmishes leading to at least a couple dozen deaths.

expire within 10 – 15 years, but some were to be permanent. However, the U.S. left the JCPOA in 2018 based on its concern around such issues as Iran's sponsorship of certain military/U.S.-designated terrorist groups, its continued work on its ballistic missile program, and the fact that the agreement had sunset provisions, which critics of the deal argued would enable Iran to pursue a nuclear bomb more quickly at some point in the future.

Neither Iran nor the other parties, other than the U.S., had left the deal as of June 2020. However, since the time the U.S. exited the deal, Iran has violated the deal in terms of uranium enrichment and other activities. In January 2020, France, the U.K., and Germany activated the deal's dispute resolution mechanism – the process through which a complaint about a potential violation would be resolved, potentially at the U.N. Resolution could take the form of Iran returning to its commitments under the JCPOA, from the three European countries backtracking on taking the case to the U.N. Security Council, or from the three European countries slowing down the formal dispute resolution process in the hopes of getting Iran to return to compliance or the U.S. to re-enter the deal.[15] It remains to be seen whether Iran will eventually try to accelerate its work in an attempt to build a nuclear bomb, and, if it does, how the U.S., Israel and Europeans might respond. The recent explosion at the Natanz Uranium enrichment center, whether caused by sabotage or an accident, would likely slow down Iran in any attempt, but it clearly remains a very dangerous state of affairs.

Terrorism

There is also the ever-present danger of a nuclear or radiological terrorist attack somewhere in the world. Terrorists have tried in the past to obtain nuclear bombs and weapons grade materials and are assuredly going to make such attempts in the future. On some dimensions, the risk of nuclear terrorism has dropped over the last fifteen years or so as a result of preventative measures taken by countless individuals inside and outside of government, both in the U.S. and elsewhere. However, the risk of nuclear terrorism in the coming decades still very much remains, even if some of the likely mechanisms have shifted.

For example, among the various paths, there is always the potential of, say, terrorists stealing nuclear weapons or materials from Pakistan or India. The shift toward tactical nuclear weapons by Pakistan also might have increased the likelihood of such theft if those weapons were being transported during a major crisis.[16]

Among the other existing weapons states, there is, for instance, the possibility of North Korea choosing to sell nuclear weapons and/or materials.[17] It is also fairly well-accepted that sophisticated terrorist groups, if they were able to obtain enough weapons-grade material, would have the knowledge and wherewithal to build a nuclear bomb. And procuring the materials for and making a dirty or radiological bomb would be even easier; while such a device would not be nearly as destructive as a nuclear device, it could still potentially instill widespread panic and disrupt the global capital markets.

[15] https://foreignpolicy.com/2020/02/12/jcpoa-dispute-resolution-mechanism-europe-iran-deal/ and https://www.nti.org/analysis/articles/status-iran-nuclear-deal-q-ernest-j-moniz/

[16] https://scholar.harvard.edu/files/matthew_bunn/files/bunn_revitalizing_nuclear_security_in_an_era_of_uncertainty_2019.pdf

[17] https://cco.ndu.edu/Portals/96/Documents/prism/prism7_3/180518_Allison_PQP.pdf?ver=2018-05-18-174536-027

The Potential for Blunder and Miscalculation

Maybe most troubling is the potential for some miscalculation where two state actors blunder into a nuclear exchange. The command and control infrastructures of the U.S. and other nuclear nations are far from foolproof and there have been many near-misses in the past. For instance, as detailed by the Union of Concerned Scientists (UCS) and Eric Schlosser, author of *Command and Control*, in 1983 a Soviet early warning satellite had reported that five U.S. missiles were in flight towards the Soviet Union. Fortunately, despite tensions having been high between the two countries at the time, the Soviet officer in charge decided to not report what his systems were saying was an incoming attack. It was later revealed that reflections of the sun had fooled the satellite systems into perceiving it as a missile attack. Had a different officer, with different instincts, been in charge that day the world may not have been so lucky.

Schlosser has also detailed how during the Cuban Missile Crisis "the captain of a Soviet submarine mistakenly believed that his vessel was under attack by U.S. warships and ordered the firing of a torpedo armed with a nuclear warhead. His order was blocked by a fellow officer. Had the torpedo been fired, the United States would have retaliated with nuclear weapons."[18]

In terms of false alarms on the U.S. side, according to UCS, in 1979 the U.S. computers at NORAD indicated a large-scale Soviet attack on the U.S., which an investigation later showed was caused by a technician "mistakenly inserting a training tape containing a scenario for a large-scale nuclear attack into an operational NORAD computer." In another episode in 1980, U.S. early warning systems indicated a large incoming Soviet missile attack, which investigations later found to be caused by a failed computer chip. [19]

These are but a few of many reported instances of mistaken analyses, technical glitches, and misconduct of personnel in the command and control infrastructure around the nuclear arsenal. Despite having narrowly averted cataclysm in the past, vast swaths of the U.S. and Russian nuclear arsenals are kept on hair-trigger alert; U.S. missiles can be launched in minutes and the Russians claim their own weapons can be launched in tens of seconds.

Both the U.S. and Russia are, of course, aware of the risk of and unattractiveness of global thermonuclear war and mutual assured destruction (MAD), which greatly reduces the likelihood of either side purposefully entering into such a bargain. However, the hair-trigger status of the arsenals neutralizes many of the safeguards against an unauthorized or accidental launch or, alternately, a mistaken launch in response to flawed data (e.g. a misconception, based on a computer glitch, malware or incorrect intelligence, that the other side has launched a weapon).

Risk of an Unconstrained Leader

Further, the potential for a U.S. president to order a first-use nuclear strike against an adversary, whether that be Russia or, somewhat more likely, North Korea or Iran, without first receiving Congressional approval is more power than any single individual should have. While the power to declare war officially resides with the U.S. Congress, there has been a long trend of Congress ceding authority and the executive branch claiming greater authority in terms of the use of military force.

[18] https://www.newyorker.com/news/news-desk/world-war-three-by-mistake
[19] https://www.ucsusa.org/resources/close-calls-nuclear-weapons

Regardless of one's interpretation of the precise requirements for a U.S. president to launch a first-use nuclear strike without Congressional approval, clearly there are many grey areas and the president has significant flexibility and authority on their use. It is also not clear whether any legal restrictions on presidential first-use authority, be they from Congress or relating to international humanitarian law, would be considered or respected by a U.S. president, his advisers, and those implementing the strike order, even if such order were unambiguously illegal.[20] This state of affairs just compounds the risks of nuclear catastrophe.

While we think Donald Trump in the White House brings this risk to the fore, this is about more than Trump. For instance, as author Garrett Graff notes in a 2017 Politico article, in the final days of Nixon's presidency when he seemed depressed and was drinking heavily, Defense Secretary James Schlesinger ordered that if the president gave any nuclear launch order that military commanders should first check with Schlesinger or Secretary of State Henry Kissinger before executing them.[21] Graff writes that Nixon had stoked fears when, among other things, he had reportedly said to a congressman that "I can go in my office and pick up a telephone, and in 25 minutes, millions of people will be dead".

It is also not just about the U.S. There are certain other nuclear powers where a nuclear weapon could be launched without any real collective deliberation.[22]

We think the growing prevalence of cyberterrorism, deepfakes, and global disinformation campaigns only magnifies the risks posed by the sole authority possessed by certain leaders and the hair-trigger status of certain nukes.

Later in this report, we will provide some more detail why we believe this is such a tremendous risk and why the investment community and broader financial and business communities should push for a change in the current law in the U.S.

For additional educational resources on nuclear weapons and their risks, here are just a few of many good sites:

https://tutorials.nti.org/
https://thebulletin.org/
https://www.ucsusa.org/
https://www.wjperryproject.org/about

The Disconnect Versus Term Life Insurance

Risk equals probabilities times consequences.[23] A nuclear incident poses such high risk because the consequences are so tremendous and the probabilities are not low enough. As things currently stand, we cannot be remotely confident that we can prevent a nuclear incident from occurring. That is why the financial and business communities must do more to both try to prevent a catastrophic nuclear event and to prepare to deal with its aftermath in the event prevention efforts fail.

[20] https://media.nti.org/documents/The_President_and_Nuclear_Weapons_Authorities_Limits_and_Process.pdf, p 19.
[21] https://www.politico.com/magazine/story/2017/08/11/donald-trump-nuclear-weapons-richard-nixon-215478
[22] https://www.nonproliferation.org/wp-content/uploads/2019/02/Finger-on-the-Nuclear-Button.pdf, p. 34
[23] While a common phrase, we note that Graham Allison has used this or similar phrases in many of his works when talking about the threat of nuclear weapons.

For perspective, as we pointed out in an Enterprising Investor blog[24] for the CFA Institute last year, the probability of a 35 year-old US man dying within the next year is 0.2%, according to US Social Security Administration (SSA) data.[25] For a 35 year-old woman, chances are about 0.1%. These probabilities increase only very gradually with age. Even a 50-year old man runs a mere 0.5% risk, a 50-year old woman just 0.3%.

But what are the odds, in any given year, of the detonation of a nuclear bomb or some other malicious nuclear incident that results in mass casualties somewhere in the world? Many experts put the odds at something considerably higher than the above probabilities.[26] And that's after excluding the potential for accidental meltdowns like those at Fukushima and Chernobyl that have been, and should be in the future, less impactful on the markets. More than a few experts phrase the potential for some such nuclear catastrophe not as a matter of "if" but of "when."

Yet many 35-year-olds own term life insurance policies that pay off only at death, while giving scarcely a thought to how a nuclear incident might affect them. Now, of course, there are some differences. If you die a non-nuclear death, the outcome is quite clear: You are dead. On the other hand, if there is even a limited nuclear event involving, say, a handful or fewer weapons takes place someplace across the globe, it is unlikely to kill you. But you better believe that you and the 99.9% of the world population that survives will care about the ramifications to the economy and jobs, the markets, and our portfolios in the aftermath.

Granted, it is impossible to predict the precise timing and financial toll of any nuclear incident, but the effects could be catastrophic. The investment and broader financial and business communities need to do more today, not *The Day After,* to prevent such events.[27]

Aftermath of a Nuclear Incident

It is understandable that our portfolios, the capital markets, and the economy might have been an afterthought when talking about the threat of mutually assured destruction (MAD) that arose between the U.S. and USSR beginning sixty or so years ago. While the risk of MAD has not completely gone away (it arguably has risen at least a bit in recent years), it is important to recognize that there are a range of potentially smaller, but still catastrophic, nuclear scenarios that are more likely to take place.

Even if a catastrophic incident is not going to happen over the short to intermediate term (i.e. a couple years or less), and it probably won't, it should not be ignored just because it is a longer-term risk. Because when it does happen, anywhere, the global financial repercussions will likely be enormous. By virtue of the fact that it is both man-made and an act of aggression, unlike, say the meltdowns at Chernobyl and Fukushima, even more than its physical impact, it could indeed affect the confidence and economic activity around the world.

[24] https://blogs.cfainstitute.org/investor/2019/04/09/nuclear-risk-and-the-financial-markets/
[25] https://www.ssa.gov/oact/STATS/table4c6.html
[26] Based on conversations we have had with experts and assorted articles, including https://cco.ndu.edu/Portals/96/Documents/prism/prism7_3/180518_Allison_PQP.pdf?ver=2018-05-18-174536-027, p 8.
[27] While not the focus of this report, they also must prepare the economy, the markets, and our portfolios to be more resilient should those prevention efforts fail. And flip answers like "Just buy gold" don't suffice. We briefly touched upon some such recommendations in our Bulletin article from last year - https://thebulletin.org/2019/03/why-the-financial-community-should-work-to-prevent-the-market-and-economic-shocks-of-a-nuclear-incident/

A pandemic was in some ways a similar risk to economies and financial markets as is nuclear conflict, in that a pandemic was somewhat predictable and could have been prepared for to some degree yet was also ignored on so many levels. Let's not make the same mistake with regards to nukes.

We could see the following list of things, among others, occur in the aftermath of a major nuclear incident.

- Discretionary purchases and advertising all but disappear, as does non-defense capital investment.
- Mass hoarding of critical goods.
- Supply chains are interrupted.
- Unemployment spikes.
- Certain cities empty, at least temporarily, and real estate values plunge.
- Mass insolvencies among companies, particularly leveraged companies (which includes most financial institutions).
- Many contracts may not be able to be enforced as counterparties fail or declare force majeure, which may excuse them from the contractual commitments.
- Government policies change, including in terms of price controls, travel restrictions, rules on trading (e.g. prohibition on shorting certain stocks) and cross-border flow of funds.
- The level of inflation and exchange ranges among currencies swing violently. The banking system and general liquidity freeze up and there is near record volatility in the capital markets, with many people seeing their portfolios/savings nearly wiped out.
- The above factors and many others could also limit the world's potential to combat climate change and work towards the U.N.'s Sustainable Development Goals.

Although some of these effects may sound eerily similar to what has happened during the coronavirus pandemic, we actually wrote about many of these effects in a past article or two about the potential aftermath of a nuke. It really should not come as a surprise that such dramatic things have occurred in the wake of COVID-19 and would most likely occur in the wake of a nuclear incident.

Comparison to Coronavirus

The bulk of this report was written before COVID-19 hit and it may seem like strange timing to publish on nuclear weapons issues in the midst of the crisis - that people won't have the bandwidth to focus on nuclear issues. However, we think that when the experience of the coronavirus pandemic is fresh in everyone's minds is exactly the right time to appreciate many of the risks of other potential "gray rhino" events, including those involving nuclear weapons.

Some might call the pandemic, or a nuclear catastrophe for that matter, a "black swan" event. But COVID-19 and a potential nuclear catastrophe are probably better characterized as "gray rhinos" - a term coined by author Michelle Wucker to represent the notion of big obvious problems that are in front us, charging at us, that can be avoided.

The trajectory and ultimate impact of COVID-19 is still not settled. That said, the impacts of the virus thus far, even with the obvious differences versus nuclear, provide interesting context for the potential impacts of a panic around nuclear weapons – whether in the face of an impending conflict or in the aftermath of a detonation.

Since its inception, the coronavirus has had a tremendous effect on supply chains, travel, canceled gatherings and events, school and business closures, a shift to mass telecommuting, quarantines, hoarding and shortages, a huge and disruptive drop in oil prices, and so on. Part and parcel of this has

been the incredible turmoil in global capital markets. All these effects were quite dramatic even while the global death toll remained relatively small, particularly outside of China. This, of course, was due to the threat of contagion that could lead to an increased death toll and to the various epidemiological uncertainties regarding the virus.

Similarly, while nuclear weapons are of course not viruses, there would be fears of figurative "contagion" in terms of whether any first nuclear detonation would be followed by or retaliated against with additional detonations. Also, in addition to a disruption of supply chains and the huge knock-on effects on consumer and business behavior, in the wake of a nuclear detonation there would be uncertainties around the effects of radiation and, if the conflict were large enough, the effects on the food supply and climate from a potential nuclear autumn or nuclear winter.

There would be many common threads in terms of the behavior in the wake of a nuclear incident as there have been during the coronavirus pandemic, even if some of the specifics would vary. Hoarding would take place in the wake of each, even if the particular items being hoarded would be somewhat different. Global equity markets would sell-off in the wake of each, even though the relative performance of stocks in various industries would vary for the two crises. The financial toll exacted by each type of crisis is quite significant and additive to any sickness or death.

The important point is that this coronavirus pandemic and its effect on all facets of society should serve as a reminder to us all that we need to take action today to head off a nuclear catastrophe that could greatly impact all of our lives. We think the instantaneousness and magnitude of an aggressive nuclear detonation or series of nuclear detonations would make the initial global disruption caused the coronavirus, although immense, in many ways look modest by comparison.

When the coronavirus hit, there was time, counted in weeks, to take public health and stimulus and economic measures to try to offset the human, economic and market disruptions. The timeframe for preventing a nuclear incident has to start now; once a blast happens, it's mostly too late to minimize the number of deaths.

In addition to doing everything possible to prevent a nuclear incident, a separate track has to be pursued in terms of preparing to deal with the aftermath of any detonation in terms of the economy and markets. And since economic and market disruptions would be so severe in the aftermath of a detonation, proper emergency planning would have central banks, regulators and the whole of government make sure that prospective tools are in place now to deal with the aftermath, before an incident even happens.

There should also be much to learn from the way national governments around the world mishandled many aspects of the pandemic coronavirus. These shortfalls, to name just a few, include inappropriate regulation of wet markets in China[28], lack of transparency from leadership in China and the U.S. and elsewhere, lack of preparation in the U.S. in terms of having testing kits and supplies ready before the crisis hit, and political infighting in the U.S. slowing the ability to deal with the economic effects. The takeaway for nuclear is not only the hope that federal governments have their acts better together to deal with nuclear risks. It's also that the private sector, civil society, and local and state governments, just as they have been key to the coronavirus response, cannot rely on their federal governments alone to act appropriately to prevent a nuclear incident or deal with its aftermath.

[28] The exact origin of the coronavirus is unknown and we think this statement is true regardless of whether wet markets, a lab, or something else was ultimately the origin.

Beyond domestic misrepresentations of COVID-19 by the Chinese, there was belated notification by the Chinese about the disease to the international community, there were restrictions from India, individual European nations and others with regards to international shipments of PPE, medicines, and ventilators, and less than perfect international coordination in general among nations and the WHO. This should all hammer home that there needs to be greater international coordination and collaboration to head off the likelihood of a nuclear incident or to ameliorate the magnitude of the aftermath.

Be Careful When Looking at Other Conflicts as Market Analogues

First, let's talk about physical conflict. We recognize that a natural observation would be that in the last many decades the U.S. stock market been fairly resilient in the face of terrorist attacks around the world, even including an enormous one like 9/11, and during war, including the immediate aftermath of Pearl Harbor. However, the past for the U.S. stock market in the wake of such violent episodes is not necessarily prologue for what would happen to U.S. and worldwide equity, fixed income, currency, and other markets in the wake of a major nuclear incident, particularly one that has human casualties in the hundreds of thousands or more and/or takes out a major financial center or capital.

We think it's also an example of selection bias to focus on the historical behavior of the U.S. stock market just because it was a relative bastion of strength for so much of the 20th and 21st centuries. It is worth recognizing the many losers of the past as well. In addition to the many sovereign debt and currency crises in recent decades in mostly undeveloped markets, it's also important to go back past the recent period of general quiescence among developed markets and recognize that due to hyperinflation in the wake of World War I, the German stock market suffered a negative 98 percent real return from 1918 to 1922, according to Global Financial Data. Similarly, inflation decimated the value of assets in post-World War II Germany and the inflation and currency reforms in Japan after World War II caused Japanese bonds and bills to lose 99% of their real value in a few years and for Japanese equities to lose 95%. In addition, Global Financial Data shows that between 1914 and 1949, French fixed-income investors in bonds and bills lost over 97% over their capital on a real, after-inflation basis, even on a total-return basis including the reinvestment of interest.

Maybe even more relevant is that there have, of course, been many crises in the U.S. and other capital markets unrelated to violence. These include the Great Depression (during which the Dow fell 89% from 1929 highs), Black Monday (when the Dow dropped 23% in one day in 1987), and the Financial Crisis (during which the MSCI World equity index dropped 57% from peak in late 2007 to the trough in 2009). We think the magnitudes of those crises, along with the ongoing coronavirus crisis, are probably a better starting point for assessing the likely impact a nuclear incident could have on the U.S. and other developed markets and economies than is the resilience of the U.S. to past episodes of war or terrorism. This is particularly the case in the context of the increase in algorithmic trading, the modern-day interconnectedness of global financial markets, and everyone's constant exposure to social media and other forms of media.[29]

The coronavirus story is still being written, but the magnitude of disruption to the capital markets and global economy has clearly been incredibly severe, with most major equity markets down 30 – 40% at the most recent bottoms in March 2020. Many publicly-traded industry groups were hit even much harder than that. The performance of public equity markets has also not been nearly as bad as the economic pain felt by small business, with so many completely wiped out. And while the specific capital

[29] Portions excerpted from this author's article: https://thebulletin.org/2019/03/why-the-financial-community-should-work-to-prevent-the-market-and-economic-shocks-of-a-nuclear-incident/

market impacts in the wake of a nuclear incident would undoubtedly be different, we would not assume they would be less severe.

We actually believe that for many or most types of belligerent nuclear detonations that the effects on the capital markets could be even more dramatic. In terms of effects on the real economy, that is of course difficult to gauge; we would not assume that the short-term effects on the global real economy would necessarily be more severe in the wake of a nuclear incident, but we think it's highly likely that they would be more severe in specific regions and longer-lasting globally. Remember, that as monumental COVID-19 has been, the health effects are limited for most people, treatments are being developed, and there will likely be a vaccine by 2021.

Health professionals and the media have looked all the way back to the Spanish Flu of 1918 for context for the potential death toll of the coronavirus. The lesson in regards to nukes, which weren't even birthed until 1945, should be that the economic and market effects of a nuclear incident could also be unprecedented in terms of what most of us have personally witnessed during our lifetimes.

Section II: Stakeholder Capitalism and Sustainability

U.S. companies, particularly publicly-traded companies[30] or private companies with multiple shareholders, are generally tasked with maximizing returns for shareholders. That is their prime directive with, at least historically, nothing else even coming close. Shareholders appoint of a Board of Directors (BOD) that is in charge of hiring and firing management. The BOD is beholden to shareholders.[31] Large publicly-traded companies from outside of the U.S. have historically factored in the interests non-shareholder stakeholders[32] to a greater degree than have U.S. companies, but even for those foreign companies, particularly in developed markets, shareholders have in many regards been the most important constituent. All that said, the trend both for U.S. and non-U.S. companies is in the same direction – greater focus on sustainability and the needs of other stakeholders in addition to those of shareholders.

Very notably, in August 2019 the Business Roundtable, which is an association of the Chief Executive Officers (CEO's) of major American companies, came out with a much updated "Statement on the Purpose of the Corporation." The statement expressed that the companies commit to focus not only on shareholders but that they have a commitment to all stakeholders including customers, employees, suppliers and partners, and the communities in which they work, including "protecting the environment by embracing sustainable practices across our companies."

This was followed in January 2020 by the World Economic Forum Annual Meeting in Davos and the Blackrock letters. This year's Davos, attended by leaders in business, government, and media, was all about "stakeholder capitalism" and working towards a more equal and sustainable economy, with the Paris Agreement and the Sustainable Development Goals serving as important guideposts. Various groups used that venue to make financial commitments towards those goals, including Nestlé, which pledged to invest up to $2.1 billion to accelerate the development of sustainable packaging solutions[33], and Microsoft, which announced that "By 2030 Microsoft will be carbon negative, and by 2050 Microsoft will remove from the environment all the carbon the company has emitted either directly or by electrical consumption since it was founded in 1975."[34]

Also in January, Larry Fink, the CEO of Blackrock, the world's biggest fund manager (with its equity funds mainly focused on publicly-traded companies), published letters to CEO's and investors saying that sustainability would be central to almost everything it does. In addition to other measures, Blackrock will be putting greater scrutiny on fossil fuels and other ESG (environmental, social & governance) factors in terms of portfolio construction and risk management, start divesting coal producers, and demand greater transparency from the companies it invests in in terms of their reporting on various

[30] At a high level, publicly-traded companies are those who are registered with the U.S. Securities and Exchange Commission (SEC), or equivalent overseas regulator, files financial statements according to specified principles and that are made available to the public, has a number of shareholders in excess of some minimum threshold, and trades on a stock exchange. The vast majority of larger U.S. companies, whose products and services are household names, are publicly-traded companies.

[31] It is important to recognize, tough, that the BOD and management can be the ones really in control in at least the short run; this is particularly the case with publicly-traded companies where the BOD and management have significant stock ownership or where there is a very widely distributed shareholder base with few large institutional shareholder positions.

[32] Non-shareholder stakeholders include such groups as employees, customers, suppliers, and the community.

[33] http://ethicalcorp.com/microsoft-nestle-and-blackrock-put-climate-action-centre-stage-davos

[34] https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/

sustainability goals (e.g. CO_2 emissions, water use, etc.).[35] Meanwhile, Carlyle, a titan among private equity investors, which have historically not been considered socially-minded, is apparently starting to take ESG factors into account across its portfolio.[36]

Many market participants and stakeholders have been skeptical of the statements that have come out of these groups and companies, believing they are just lip service or greenwashing – giving a false impression of the environmental/social impact that they are really making with their actions.

In our view, there is no question that shareholder returns will remain the central mission of corporations, but there has also clearly been some shift among most large publicly-traded companies and investors. This shift had been coming about as a result of the combination of pressures from the growth of investment assets focused on ESG and SRI (socially responsible investing), a desire to improve brand image, regulatory paradigms (labor laws, laws on pollution and emissions, etc.), and other political and consumer pressures. There had also been the recognition that some of these actions – for instance, reducing CO_2 emissions through more efficient operations and electing a more gender-inclusive and ethnically diverse BOD – are not negative on shareholder returns and may actually improve them.

COVID-19 and protests following the death of George Floyd appear to be further accelerating these trends. COVID-19 shut down large swaths of the economy, highlighted the vulnerabilities of employees, and required governments to financially rescue traditional free market economies and capital markets; this all reinforces that companies cannot have an exclusive focus on shareholders. Not only because society will not tolerate it – particularly if those companies are the recipients of financial assistance from the government – but because of the negative repercussions on employees and customers and the communities in which they operate.

The killing of George Floyd, along with the disproportionate effect of COVID-19 on minorities, highlighted racial inequities and led to various pledges by corporate America including changes in hiring practices. In the wake of massive protests, many corporations also suspended social media advertising due to voter suppression, misinformation, racism, and hate speech. These corporations are demonstrating that they will not ignore the values of their customers and employees and that they can take such actions while remaining a good steward for their shareholders.

[35] https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter
[36] https://www.bloomberg.com/news/articles/2020-02-26/carlyle-breaks-from-pack-promising-impact-investing-across-firm

UN Sustainable Development Goals (SDGs)

Source: United Nations

As stated on the U.N.'s SDGs website, "The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests."

Impact investors, philanthropists, multinational development institutions, and others looking to fund new sustainable initiatives often think in terms of these SDGs. Other sustainable investors – those focused on ESG and SRI – also are very focused on the SDGs when screening their investments. Clearly the SDGs are not the only taxonomy - there are other ways to break down the world's problems that need to be solved - but they are something of a North Star and by far the most widely discussed.

Many corporations, big and small, report their progress on sustainability in terms of how they are faring relative to the SDGs. Corporations in other developing countries like Japan and most of Europe still are more likely to discuss the SDGs than those in the U.S., but the number is significant in the U.S. and growing.[37]

Sustainability / CSR (Corporate Social Responsibility) Reports

Companies choose to lay out their sustainability goals and performance on such goals in a multitude of ways. These types of charts can often be found on companies' sustainability/CSR websites and/or in their annual sustainability/CSR reports. Sometimes their goals and performance are explicitly laid out relative to the SDGs they think they can affect, as is shown in the following chart by Bacardi.

Basically, companies can find a way to characterize almost any decent behavior as being supportive of one of the 17 SDGs, which are very broad. This is a bit of a double-edged sword from our perspective. On the one hand it can allow greenwashing – meaning companies can sometimes pretend they are doing something beneficial, even when they are not. On the other hand, though, it gives those of us

[37] Bloomberg reported in October 2019 that ~60% of the companies in the Bloomberg European 500 Index and Japan's Topic 500 Index, along with 30% of the companies in the U.S. S&P 500 index, discussed the SDGs in their financial reports.

focused on nuclear issues, just like those in the climate change space, a way to try to engage companies; if they can do something in terms of nuclear issues that looks like they are doing something favorable towards the SDGs, they will happily highlight it.

Source: Bacardi 2019 CSR

In many companies' infographics, the SDGs are not specifically mentioned, even though many of them are implicit. The following is a sample chart from Raytheon laying out its 2020 Sustainability Goals.

We chose Raytheon, a weapons manufacturer, as an example, but note that there is no direct discussion of nukes in this chart or in most of the Aerospace & Defense industry's sustainability reports. And while Raytheon discusses its supply chain in terms of environmental sustainability, there is nothing mentioned with regards to, for instance, ensuring proper controls over its supply chain in order to make sure no goods are improperly diverted. We hope that can be changed over time, starting with the investment and nuclear non-proliferation communities trying to strengthen the implicit connection between nukes and the SDGs, as we discuss in the next section.

Source: Raytheon CSR May 2019

UN SDGs and Nuclear Risk

Under the 17 UN SDGs, there are 169 global targets that relate to meeting the SDGs. These numbers have not changed since 2015 and are unlikely, particularly with respect to the 17 SDG's themselves, to change before 2030.

Alongside the global targets, there are also 232 global indicators[38] to measure progress on the 17 SDGs/169 global targets. There are also in some cases additional indicators at the regional and national level in order to measure progress on the goals/targets.

None of the 17 UN SDGs explicitly talk about nuclear risks. That said, there are some implicit ties between nuclear weapons and many (arguably even all) of the SDGs.

When talking about any possible connection between nukes and the SDGs, we think it clearly makes sense to start with SDG #16 "Peace, Justice and Strong Institutions," whose stated goal on the UN website is to "Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels." Again, none of the SDG #16 targets or global indicators mention nuclear weapons and none are likely to change to include it, at least not prior to 2030. We have not looked through all national indicators but we think the U.S.

[38] https://unstats.un.org/sdgs/indicators/indicators-list/

national indicators are similar to the global indicators for SDG #16 and that none of the national indicators for the nations possessing nuclear weapons are likely to change to include it.

Still, we think there is a strong implicit connection between the risk of nuclear weapons risk and SDG #16, along with some of the global targets underlying SDG #16, including

- 16.1: Significantly reduce all forms of violence and related deaths everywhere.
- 16.4: By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime.
- 16.8: Broaden and strengthen the participation of developing countries in the institutions of global governance.
- 16.a: Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime

The full list of targets and global indicators under #16 can be found at: https://sustainabledevelopment.un.org/sdg16

While much of SDG #16 and its underlying global targets could be applied to conventional weapons and conventional war generally, we think they can also apply to controversial or unconventional weapons, including nuclear weapons.

We note that in May 2018, the UN Secretary General introduced the initiative/report "Securing Our Common Future: An Agenda for Disarmament." That report argues that there is a strong connection between disarmament (not just nuclear but also among conventional weapons, small arms, and WMDs generally) and being able to meet the SDGs.[39] We believe those types of initiatives/reports by the UN should give sustainable investors comfort that linking nuclear risks to the SDGs is not any sort of stretch.

The Treaty on the Prohibition of Nuclear Weapons,[40] if ever ratified, would also likely strengthen the implicit ties reducing the risks of nuclear weapons and achieving the SDGs (despite the fact that we think it is unlikely to lead to major disarmament by the nine nuclear weapons states in the foreseeable future).

It can also be pretty strongly argued that the use or development of nuclear weapons is incompatible with many of the SDGs other than #16. For starters, the money being spent on nuclear weapons by the nine nuclear nations takes resources away from money that could be devoted by those nations towards the 17 SDGs.[41] Separately, a nuclear weapons exchange could quite directly affect climate change in terms of creating a nuclear winter, could decrease access to clean drinking water and increase poverty, plus have so many other direct effects on, at a minimum, the region where the detonations take place.[42] Further, the knock-on global economic and political effects could mean a lack of funding or global appetite for battling CO_2 emissions or taking on the challenges necessary to achieve any of the other

[39] https://front.un-arm.org/documents/SG+disarmament+agenda_1.pdf
[40] For more background on TPNW, see: https://www.nti.org/learn/treaties-and-regimes/treaty-on-the-prohibition-of-nuclear-weapons/
[41] https://impakter.com/sustaining-destruction-nuclear-weapons-sustainable-development-goals/
[42] For example, depending the location of any nuclear catastrophe or the global spread of panic, there could be increased deforestation and poaching, among other environmentally destructive actions.

SDGs. As such, we think reducing nuclear weapons risk is implicit in virtually all 17 SDGs[43]. If there were ever any doubt about that, COVID-19 surely puts such doubts to rest. COVID-19, despite any short-term reduction it may have caused in terms of carbon emissions, has clearly sucked available funds and attention from climate change and a range of other social causes and clearly hits hardest those that are most vulnerable in society.

Just about everyone we have spoken to in the sustainable investing ecosystem seem to recognize the merit of the above arguments. We think the task going forward is to build awareness among investors and other funders, give them guidance on how to factor it into their practices and make a business out of it – that it can help them do well while also doing good.

[43] Similarly, a nuclear incident would also impact the ability and will of nations to meet other major international agreements, including the 2015 Paris Agreement, which followed the setting of the SDG's earlier in 2015.

Section III: ESG Investing – Expanding to Include Nuclear Risks

Sorting Through the Sustainable Investing Acronyms

Sustainable investing has been around the last couple of decades but has picked up momentum the last few years with the UN's establishment of the Sustainable Development Goals (SDGs) in 2015, a growing acceptance that climate change is an emergency, and an increasing focus on stakeholder capitalism. The fact that sustainable investing approaches do not appear to have hurt financials returns, and arguably even help returns, has almost certainly facilitated the growth.

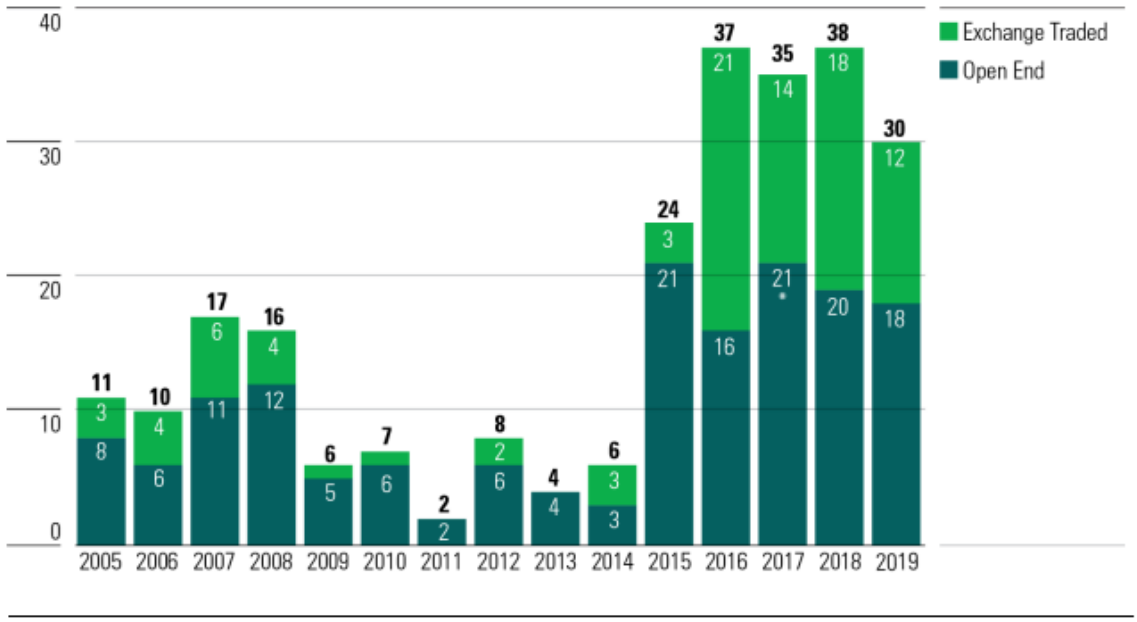
The following charts from Morningstar show the significant growth in the number of sustainable funds and assets under management the last several years[44,45].

This first chart shows that there has been a multi-year trend of a significant number of launches of sustainable exchange-traded funds (ETFs) and open-end mutual funds.

[44] https://www.morningstar.com/content/dam/marketing/shared/pdfs/Research/Sustainable_Funds_US_Landscape_021920.pdf?utm_source=eloqua&utm_medium=email&utm_campaign=&utm_content=20871

[45] We note that Morningstar excludes "ESG Consideration" funds from its definition of sustainable funds. It defines "ESG Consideration" to be mainly conventional funds that have started to include ESG criteria but "without orienting their entire investment process and outcomes around sustainability" and for which "ESG criteria may or may not play a role in the selection of any specific security, and ESG considerations primarily do not come into play at the portfolio-construction state." Clearly sustainability can be defined in various ways and different data providers will choose to include different funds in their total. Also, of course, not all money is invested in the form of funds; for instance, many institutions manage their investments directly rather than through funds. The important takeaway, therefore, is not any precise number but rather just strong growth trends.

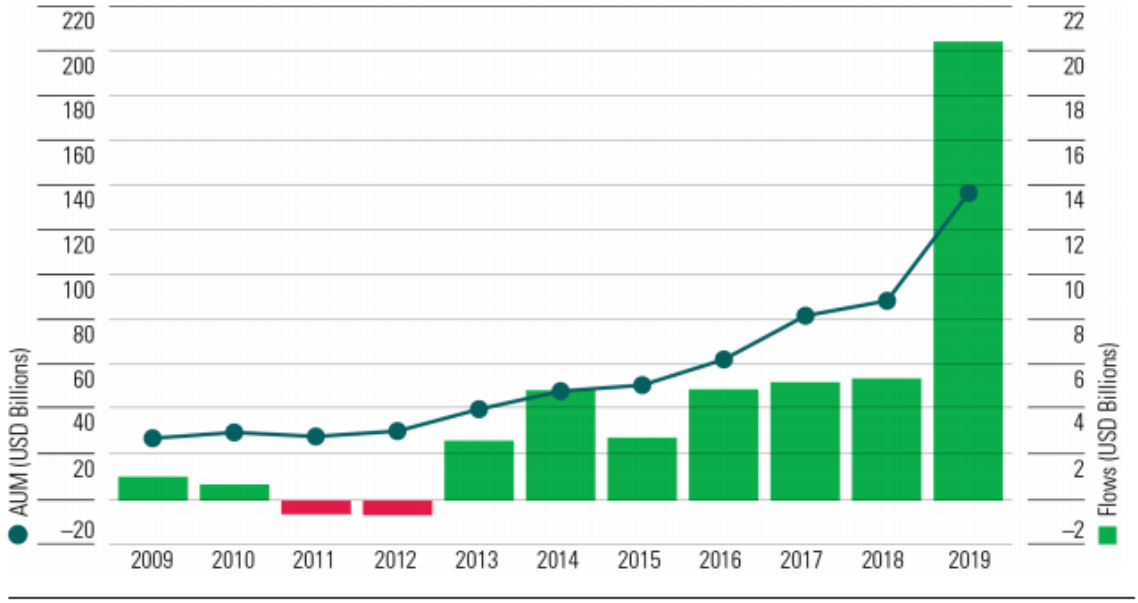
Exhibit: Sustainable Fund Launches: A Multiyear Growth Trend



Source: Morningstar Direct. Data as of 12/31/2019. Note: 38 open-end funds in the report were launched between 1971 and 2004. The earliest ETF launch was in 2005. Includes 20 funds that subsequently have liquidated. *Counts Natixis Sustainable Future Target Date Series as one fund rather than 10.

In this second chart, the green line represents assets under management in the funds (see vertical axis on left) and the green bars represent annual flows into the funds, which greatly increased in 2019 (see vertical axis on right).

Exhibit: Sustainable Funds Annual Flows Set Record in 2019



Source: Morningstar Direct. Data as of 12/31/2019.

There is a confusing bevy of acronyms and overlapping terms and strategies in the sustainable investing space. Many of these terms - ESG, SRI, Impact, Sustainable - are often used interchangeably or inconsistently, and the meanings also tend to evolve a bit over time. There are also some other less common variations. But below we define what we perceive to be the most common definitions for ESG and SRI:

- **ESG (Environmental, Social, Governance)** investing is where investors screen investments focused on companies' performance and risk with respect to a range of measures in terms of the:
    - Environment - CO_2 emissions, pollution, limiting the use/waste of water resources, effects on Biodiversity, etc.
    - Social - gender and racial diversity among employees, safety, treatment of the workforce, etc.
    - Governance - the independence of the board, treatment and voting rights of minority shareholders, etc.

Many of the specific metrics vary based on the sector, industry or company. In addition, not only is reporting on ESG metrics voluntary for the most part, but even for those companies that do report there is a lack of standardization among how even similar companies may report metrics or how investors may analyze them. Here, though, just to give a flavor are some of the types of metrics, in a very general sense, that companies might report and investors might track in terms of the E, S, or G.[46]

- Total CO_2, Sulfur Oxide, and Nitrous Oxide Emissions Intensity per Sales
- CO_2, Sulfur Oxide, and Nitrous Oxide Emissions Intensity per Power Generated
- Renewables as a % of Total Energy Capacity
- CO_2 Emissions per Unit of Production
- Water Intensity Relative to Total Sales
- Biodiversity Policy
- % Women in Workforce
- Equal Opportunity Policy
- Anti-bribery Ethics Policy
- Fatality Rate (relevant for energy or industrial companies, for instance, but not a software company)
- Policy Against Child Labor
- % of Suppliers Audited and in Non-Compliance with Company's Health, Safety and Labor Policies
- % Non-Executive Directors on Compensation Committee
- Whether Lead Director on the Board of Directors is Independent
- Whether roles of CEO and Chairman are Held by Separate Individuals
- % of Executives that are Women or Minorities
- Whether there are Dual Classes of Shares with Unequal Voting Rights
- # of Years Auditor Has Been Employed
- And Many More!

[46] Many examples taken from Bloomberg ESG Performance Scorecard (2019).

Investors combine their analysis of how companies screen on these measures with their financial outlook for the company in order to make a decision on how to allocate their investments... whether they want to own the company and how much.

ESG investors use these screens mainly as a way of reducing risk and trying to achieve equal or better financial outcomes to what they could if they did not pay attention to such issues. There is going to be a range of motivations among ESG investors in terms of how much is driven by their desire to be conscientious investors versus seeking to maximize financial returns. Conscientious capitalism probably plays a role for many ESG investors but, at the end of the day, many of these investors probably have little willingness at the end of the day to sacrifice financial returns. And the evidence thus far is that investors using ESG screens have not had to sacrifice financial returns versus investors not looking through any sort of sustainability lens.[47,48]

SRI (socially responsible investing) is another common investing term and strategy. Sometimes SRI funds utilize a broad range of similar goals and criteria as ESG investing. But for SRI, there is often a greater focus on excluding or divesting investments in "harmful" companies and industries, and social outcomes may be more important in the social outcome/financial return matrix vis-à-vis the relative importance for ESG.[49] We discuss SRI more in the next section.

ESG and SRI Target Investments

When people talk about ESG and SRI investing, particularly in the popular press, they are more often than not talking mainly equity investments in publicly-traded companies. In terms of this report, we are also focused largely on ESG and SRI investing as applies to equity investments in publicly-traded companies, but in addition we want readers to keep in mind that such strategies are also applicable when investing in the debt of publicly-traded companies, the equity and debt of private companies or private projects, the debt of municipalities/municipal projects, and various hybrid entities (public-private partnerships, quasi-governmental agencies, multilateral institutions, etc.). We also encourage readers of this report to always be thinking in terms of a global mindset, as opposed to one that is just U.S.-centric.

Impact Investments

As defined by the Global Impact Investing Network (GIIN)[50], impact investments "are investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return". This is a generally accepted definition, but the financial return required by investors will vary greatly - it can range anything from just a slight return on capital to a full market return commensurate with the risk.

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[47] Of course, many ESG investors have been helped by the fact that many of them are underweight (relative to some sort of benchmark/index) in fossil fuel companies and overweight on tech companies. But in reality, it's always tough to separate out whether that outperformance has anything to with ESG versus other drivers; for example fossil fuel companies have likely just performed poorly because oil prices have been low as a result of an abundance of production in the U.S., while tech stocks have largely performed so well because tech trends have allowed earnings to surprise to the upside and/or earnings multiples have expanded.

[48] https://www.morningstar.com/content/dam/marketing/shared/pdfs/Research/Sustainable_Funds_US_Landscape_021920.pdf?utm_source=eloqua&utm_medium=email&utm_campaign=&utm_content=20871; pp. 20 – 24.

[49] In some cases, SRI funds may just have an exclusionary approach around "harmful" stocks and industries, but with no broader screening on ESG/sustainability issues.

Impact investments can be made into publicly-traded companies and there are some impact funds focused on publicly-traded companies (focusing, for instance, on investments in renewable energy companies, companies that help others to reduce their water consumption, etc.) However, many more impact funds are focused on smaller investments being made in small and private companies or projects in the U.S. and abroad, often in developing countries, with a myriad of goals including improved climate and other environmental practices, increased affordable housing, increased employment for the poor, and countless more. We will discuss impact investments to a greater degree later in this report.

Socially Responsible Investing (SRI) and *"Don't Bank on the Bomb"*

Industries that many SRI investors find objectionable and exclude or divest from their portfolios, include

- Tobacco
- Gambling
- Alcohol
- Coal companies
- Other fossil fuel companies (e.g. oil & natural gas)
- Palm Oil
- Weapons
    - The most frequent exclusions related to weapons, particularly in the U.S., likely relate to firearms manufacturers.
    - Exclusion of manufacturers of nuclear weapons appears rare among U.S. investors.
    - Among European investors, the exclusion of manufacturers of nuclear weapons is somewhat more common, and it is often part of a broader exclusion of manufacturers of "controversial" weapons.
    - There can be more than one definition of "controversial weapons" but it often includes cluster munitions, antipersonnel mines, and chemical, biological, and nuclear weapons; importantly, the nuclear weapons that count as "controversial weapons" are often just those being manufactured for countries that are not party to the 1970 Non-proliferation Treaty (NPT) – i.e. Pakistan, India, Israel, and North Korea[51]. Said another way, when investors exclude manufacturers of "controversial weapons," they may not be excluding many of the manufacturers (mainly U.S. and European) that make nuclear weapons, as the U.S., U.K., France, China, and Russia were all party to the 1970 Treaty.

- Uranium mining and/or manufacturing equipment for nuclear power or generating nuclear power. Among U.S.-focused investors, our instinct is that these types of exclusions are just as common, maybe more common, than the exclusion of manufacturers of nuclear weapons, but there is certainly some debate around these types of exclusions. This is because, despite any of the dangers of nuclear fuel or nuclear power plants, nuclear power remains critical by many measures in the fight against CO_2 emissions over the next many years; nuclear power, at least for existing plants, is a low CO_2 emission power source.

[51] Of course, for some of those four countries their nuclear weapons are not manufactured by companies that can be invested in anyway.

"Don't Bank on the Bomb"

"Don't Bank on the Bomb" is a report/campaign by the International Campaign to Abolish Nuclear Weapons (ICAN), PAX, and Profundo encouraging investors and other financial services companies to divest/not provide funding in any way for companies involved in the manufacture of nuclear weapons (whether those countries are part of the 1970 Non-proliferation Treaty, NPT, or not). This includes many of the publicly-traded Aerospace & Defense companies.

ICAN is the group behind the Treaty on the Prohibition of Nuclear Weapons (TPNW) of 2017, which has been signed but not yet ratified by the mandatory 50 countries (even if it eventually is ratified, there is significant question about what the practical effect would actually be on any action taken by nuclear weapons states).

Arguments made in the report, by others that support divestment of nuclear weapons manufacturers,[52] or for divestment of companies in other sectors include:

- Many nations specifically support the Treaty on the Prohibition of Nuclear Weapons (TPNW) and the general need for disarmament. As such, investors should not make money by investing in the manufacturers of nuclear weapons, which clearly are one of the greatest risks to humankind.

- Even though nuclear weapons manufacturers may be following the laws of their home countries, they are very much a source or part of the problem in that they lobby hard for government programs on nuclear weapons that benefit their bottom lines. Similarly, at least in the U.S., there is also the argument that there is too cozy a relationship between the defense manufacturers, Department of Defense, Congress, and lobbying firms, and that there is also something of a revolving door between that various groups, all of which create conflicts of interest.[53]

- Even if we stop spending on nuclear weapons (other than certain necessary maintenance for safety reasons), countries that have nuclear weapons still have sufficient arsenals for deterrence.

- Defense manufacturing, and particularly nuclear weapons manufacturing, should not be in the hands of the private sector.

- If the divestment is done in a high-profile way, it helps make these companies look like pariahs.[54]

- It is possible that policy changes (whether caused by eventual ratification of the TPNW treaty or other) lead to reduced spending on nukes and potentially even legal liabilities, thereby hurting

[52] While much of this list of pro and con arguments comes from conversations with financial industry participants, another good source for pro-divestment arguments comes from: https://cpb-us-w2.wpmucdn.com/blogs.pace.edu/dist/0/195/files/2020/01/Nuclear-Weapons-are-a-Risky-Business-011620.pdf

[53] https://beyondthebomb.org/the-iron-triangle-in-defense-contracting-and-nuclear-weapons/

[54] An argument Jeremy Grantham has made in regards to divesting fossil fuel companies: https://impactalpha.com/qa-with-jeremy-grantham-hold-fossil-fuel-companies-to-account-and-make-them-pariahs/

these companies' profitability. As such, divestment would help avert potential losses for investors.

- It could raise these companies' cost of debt and/or equity, getting them to think twice about pursuing certain projects.

- Even if investors don't divest nuclear weapons, it's positive that the *"Don't Bank on the Bomb"* movement is stimulating debate.

Arguments against divestment of nuclear weapons manufacturers:

- This is a policy issue and there is no reason to divest as long as the countries such as the U.S., France, and England consider it legal.[55] These companies are just following the law and any change should be through citizens' elected officials and changes in the law.

- No nuclear weapons states even support the Treaty on the Prohibition of Nuclear Weapons (TPNW). Similarly, getting rid of nuclear weapons, while potentially a noble goal, is not a realistic (and in some cases even desirable) goal in the eyes of many.

- Divestment is a blunt instrument and it takes away the ability for investors to engage with companies and alter their behavior or, at the very least, force them to increase their disclosures.

- In some cases, the proportion of business that these companies do on nukes is only a small portion of their overall total and some of it may even be quite desirable - for example, keeping safeguards and other aspects of the nukes properly maintained.

- It could cause an investor to have a less than fully diversified portfolio, with far from full exposure to the Aerospace & Defense industry. In addition to reducing diversification, it could hurt an investor's returns.

- To the degree fewer investors are willing to provide financing to companies involved anywhere in the nuclear weapons supply chain, their cost of capital could go up, thereby making it even more expensive for them to finance not only their nuclear programs but also their larger non-nuclear programs; this more likely just hurts the taxpayer rather than causes amount of work done on nukes to be reduced. Also, it probably is not best to have the public sector, i.e. the government, running a manufacturing program if the goal is efficiency.

- Adversaries are going to spend on their nuclear weapons programs regardless.

- Divestment won't have too much of an effect on behavior for the companies that do not need to raise new capital.

[55] We single these nations out because weapons manufacturers that are in investors' purviews are likely to be supplying these countries, particularly the U.S. At the margin, there may also be a couple of investable companies that supply (at least) components to India.

Divestment Scorecard

- The *"Don't Bank on the Bomb"* report from October 2019 does not claim to be exhaustive but lists three dozen banks, pension funds, insurance companies, and asset managers, mostly in Europe (particularly the Netherlands, Denmark, Sweden and Norway), that qualify for its "Hall of Fame". The "Hall of Fame" qualification is based on them comprehensively excluding all nuclear weapons producers (even for countries party to the 1970 Non-Proliferation Treaty) from their investments/funding activities.[56]

- *"Don't Bank on the Bomb"* lists another 41 financial institutions as "Runners-Up" that "have taken the step to exclude nuclear weapons producers from their investments, but whose policy is not all-inclusive in preventing financial involvement with nuclear weapons companies. For example, some of these institutions only exclude producers involved with the nuclear arsenals of certain countries (i.e. those not party to the 1970 Non-Proliferation Treaty), make case-specific decisions as opposed to general exclusions, or don't exclude producers from some of their index-based products. This list is populated by the same countries as the "Hall of Fame" list with a bit more participation from the United Kingdom, Germany, France, Canada, and U.S.

- Many of these financial institutions are not excluding nuclear producers specifically but rather more generally excluding producers of all "controversial" weapons (nuclear, cluster munitions, biological, chemical, etc.) or, even more broadly, all weapons producers.[57]

- Norges, the Central Bank of Norway/its Sovereign Wealth Fund, has one of the most extensive exclusion lists among major investors and is probably the highest profile investor to exclude companies involved in the production of nuclear weapons. It excludes many of the large U.S. and European Aerospace & Defense companies including Boeing, Honeywell, Lockheed Martin, Northrop Grumman, Airbus, Safran, etc. The *"Don't Bank on the Bomb"* report places Norges/the pension fund(s) managing the assets only on its "Runners Up" category, list, because it has not divested of all companies that *"Don't Bank on the Bomb"* considers associated with nuclear weapons production and related activities.[58]

Other Nuclear-related ESG Initiatives

Early in 2019, Swiss Sustainable Finance (SSF), a Swiss association focused on sustainable investing, and dozens of other signatories (mainly European) that are institutional investors called on global index providers to exclude companies associated with "controversial" weapons – which include cluster munitions, antipersonnel mines, as well as chemical, biological and nuclear – from their benchmarks. SSF's call for exclusion covers only those nuclear weapons manufacturers for countries that have not signed the 1970 Non-Proliferation Treaty (i.e. Pakistan, India, Israel, and North Korea), and in that regard the *"Don't Bank on the Bomb"* report argues that the SSF call does not go far enough.

The number of institutional investors becoming signatories to SSF's initiative has continued to increase and stood at 175 as of May 19, 2020, representing USD $9.7 trillion in assets.[59] It is a relevant initiative because so much money globally is invested passively – i.e. owning whatever is included in a particular

[56] *"Don't Bank on the Bomb"* October 2019 - https://www.dontbankonthebomb.com/wp-content/uploads/2019/10/201910_Beyond-the-bomb_final.pdf
[57] Ibid.
[58] Ibid.
[59] https://www.sustainablefinance.ch/en/engagement-initiatives-_content---1--3117.html

index. We are not aware of the major index providers having yet taken action on this initiative, but we imagine that an ongoing dialogue is taking place.

Additional Thoughts on Divestment Versus Engagement

Although we are not quite in the camp of blanket divestment of all nuclear weapons manufacturers, we do feel that some of the arguments made by the divestment camp *("Don't Bank on the Bomb"* and others) have merit and they inform some of our views, including in terms of ESG-screening. We think that the *"Don't Bank on the Bomb"* report is valuable for highlighting the issues and creating debate, so it is not at all our goal to tear down the report.

At the end of the day, though, we think more might be accomplished if the investment community engages with the manufacturers, and the power to engage often comes with investment rather than divestment. Rather than focus on a blanket exclusionary/divestment approach (an SRI-type approach) as supported by *"Don't Bank on the Bomb"* report with regards to nuclear weapons, in this report we are focused on more refined ESG-type screening. At a minimum, we think ESG-type screening for nuclear would be additive versus investors just flat out ignoring nuclear issues when they invest.

We think that investors should understand in greater detail and make their judgments based on the types of nuclear programs weapons manufacturers are engaged in and the size of those programs. In addition, we believe that investors should delve into the nature of the lobbying the manufacturers are engaged in and any conflicts of interest that may exist. Further, as we discuss in the coming sections, we think that screening for nuclear weapons and proliferation risks should not be confined to financial institutions and nuclear weapons manufacturers but rather expanded to sectors including shipping companies, port operators, utilities, various technology and industrial companies, and others. We, of course, recognize that engagement is not easy and that, at the end of the day, investors may still reach the conclusion that they cannot in good conscious invest in certain companies. But we think the decision is better made on a more nuanced, case-by-case basis.

Climate Change and Nuclear Weapons

Two Existential Threats

In no way are we trying to rank nuclear risks against climate change, which some folks might suggest is the greatest risk to humankind. This is not a competition – they are both existential risks.

We find it encouraging that there is currently momentum in the investment and broader business community around dealing with the risks of climate change, not just for society generally but also in terms of companies' bottom lines and how they might need to prepare their businesses for the future.

Where nuclear-type risks may differ from climate change is the potential for one single nuclear event to be so severe and so instantaneous that the economic aftermath could be catastrophic. There could be no time to respond. In contrast, climate change's destructive force, although it will continue to result in tragedies (particularly for the natural world), likely won't manifest itself in one singular, instantaneous

event, at least in the short to intermediate term, that kills millions of people or brings down the global capital markets and economy before the world has a chance to respond.[60]

That is why we need to take any precautions we can now to try to prevent a nuclear incident and, short of that, ensure at least some level of economic resiliency in the aftermath of such an incident. And circling back to climate change, fighting against it will be all the more challenging if we do not have a functioning and healthy global economy and financial markets to aid in the effort. If there is economic suffering, then governments, companies, and individuals will not have the ability to make the investments necessary to reduce emissions of CO_2 and other greenhouse gases, either in terms of developing new technologies or implementing ones that already exist. If political cooperation breaks down, there will be reduced incentives for various parties to meet any existing commitments to reduce emissions or to make any new commitments.

In addition, economic turmoil could not only hamper any efforts at reducing emissions of CO_2 and other greenhouse gases, but it could actually significantly increase such emissions. This could take place as a result of increased deforestation as displaced or unemployed people need to find a way to survive and/or from a reduced will and funding on the part of the government to fight such deforestation. There might also be increased burning of wood and other dirty fuels if something impinges on the existing energy or power infrastructure's ability to provide people with the fuel or power that they need. It could also lead to the shutting down of more nuclear power plants, as happened in the wake of Fukushima.

Further, if an eventual nuclear incident is not limited to, say, a few smaller tactical nuclear weapons but rather is a substantial exchange involving a couple hundred nukes or less in a regional war between, say, India and Pakistan[61] (or an exchange of even fewer more powerful nukes owned by some other powers), the incident itself could still potentially have catastrophic effects on the climate in terms of nuclear winter or nuclear autumn. This could result in mass starvation and destruction of the natural world. And if you are talking to someone who dismisses global warming and they make the flip comment that a nuclear winter is just what's needed to combat global warming, be sure to let them know - in no uncertain terms – that things don't work that way.

Challenges and Opportunities of ESG-Screening for Nuclear Weapons Risks

Despite the enormity of nuclear weapons risks, it is important to recognize the differences and challenges to an ESG-screening approach for such risks relative to climate change and the multitude of other issues frequently considered under ESG criteria. We list some of these challenges below.

- Even though there is an inexactness and certain arbitrariness to many ESG measures, it is easier to measure how companies are performing on those typical ESG measures versus nuclear measures.
    - For instance, absolute levels and changes in CO_2 emissions from energy and industrial companies can be measured. Water efficiency of manufacturers can be measured. Number of women or minorities in senior management positions can be counted. Independence of a board of directors can be defined and measured.

[60] Even if readers have a different view that climate change could manifest itself in one enormous event with global repercussions, it would not change the conclusion that a nuclear incident could also have such consequences and therefore must be a priority to prevent.

[61] https://advances.sciencemag.org/content/advances/5/10/eaay5478.full.pdf

- Nuclear risk on the other hand is a more challenging concept and difficult to measure. In most respects, it cannot easily be counted or otherwise quantified how much a given company's actions contribute to the risks or how a change in the company's actions might alter the risks. Similarly, many companies only have a very tangential impact on nuclear risks, if any.
- Further, for most companies there is likely no major imminent impact from the nuclear threat and it is difficult to know when or if a major nuclear incident might occur and how it will impact the company in particular.

- With respect to many ESG issues, there is currently limited regulation in place. So ESG screening is often more about judging behavior according to some social mores, trying to choose behaviors that are likely to lead to better financial results, and/or predicting how future changes in laws will affect the company's results. For instance, for most U.S. companies there is no current limit on CO_2 emissions, so investors like to screen CO_2 emissions as a way of handicapping risks the companies might face in the future if there is a tax or cap put on such emissions. Many nuclear issues – both weapons and power-related - are already much more tightly regulated than other environmental, social and governance issues. That, along with the geopolitical aspects of nuclear, may mean there is less room for certain companies to voluntarily change their processes or otherwise alter their behavior.[62]

- There are very logical causal links between improvements on various traditional ESG factors and improved financial performance. For instance, reducing CO_2 emissions or water use through greater efficiency often benefits both performance on ESG metrics and financial performance. Similarly, there appears to be evidence that greater diversity on a board of directors not only helps an ESG score but also boosts financial performance. These are just a couple of many obvious links, and some of the potential links for nuclear are not quite as clear or as intuitive on the surface.

All that said, despite these challenges of factoring nuclear risks into investments, nuclear is not any narrower an issue than some other ESG/SRI/SDG-related issues. For example, many SRI funds screen out firearms or tobacco manufacturers, which actually probably affect fewer companies than are touched by nuclear issues. Also, as we discuss later, the role that many other companies play in regards to nuclear weapons risks, even if indirectly, is greater than one might assume on the surface. As previously mentioned, we think that screening for nuclear weapons and proliferation risks should be expanded beyond financial institutions and nuclear weapons manufacturers to include sectors such as shipping, port operators, utilities, various technology and industrial companies, and others. For many of these industries, in most cases it will not be a question of whether the company has any nefarious intentions so much as it is about minimizing the chance that it is an unwitting participant in someone else's scheme – for instance seeing some goods diverted from its supply chain towards illicit nuclear weapons programs.[63]

[62] We, of course, do recognize that there is also regulation in place in regards to certain industries, including tobacco, firearms, and alcohol. We also recognize that society's attitudes could evolve to be more focused on, and potentially against, the manufacture of nuclear weapons.

[63] We note that proliferation concerns should not be thought of just in terms of non-nuclear states potentially acquiring the means to manufacture nuclear weapons. Rather, it should also be thought of in terms of supplying certain existing nuclear weapons states. This recent study details the extensive international nuclear technology procurement networks of Pakistan and India and notes that at least some of the transfers and networks identified could potentially constitute violations of national export control regulations or contravene Nuclear Supplier Group guidelines:

And while there is less history to go off of, we do think that improved performance on the various nuclear-related ESG-type metrics we are suggesting may also help financial performance of these companies or, at a minimum, probably won't hinder it. For instance, to name just a few possible drivers of financial performance, it can be argued that:

- Greater security could protect companies from future liabilities related to a major nuclear incident or from fines relating to regulatory violations.
- Greater security/disclosure for a nuclear power plant, for instance, could reduce public pressure for closure, allowing it to continue operating and generating revenues.
- Greater security procedures can also be put into place for certain companies without impacting operational efficiency and, in some cases, can lead to greater operational efficiency.[64]
- Improved performance/transparency on a range of measures we suggest could result in improved perception among potential customers, employees, and investors, making it a more desirable place to patronize, work at, and invest in, respectively.[65]

Again, nuclear is also arguably a very critical issue - maybe the most likely, along with climate change, to pose an existential threat.[66] For that reason alone, against a backdrop of society's increasing focus on the importance of corporate responsibility and the needs of all stakeholders, nuclear risks cannot be ignored by investors, others in the financial services industry, or the broader business community.

SASB, GSSB/GRI and Nuclear Standards

In many cases there should be increased transparency on nuclear issues so that investors may be better able to make an informed decision as to whether they want to invest in and/or engage with those companies. In the coming sections, we provide a list of various potential industries which might be screened for nuclear risks/potential opportunities to reduce nuclear risks. As with existing ESG metrics, the most relevant nuclear-related metrics will very much vary by the industry and company.

We provide some suggestions of things that companies should be screened for and/or that they should disclose, but our main goal is to just get the conversation started among investors, the corporations being screened, the nuclear community, existing standards bodies like the Sustainability Accounting Standards Board (SASB) and the Global Sustainability Standards Board (GSSB),[67] vendors of ESG data, and others in the ecosystem so that we can collectively arrive at the best set of measures and expected disclosures.

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https://static1.squarespace.com/static/566ef8b4d8af107232d5358a/t/5eaad1204f2f3e5a01e32f91/1588252973202/Trick+of+the+Trade.pdf

[64] This has been the experience of the Stimson Center, with its Security and Trade Efficiency Platform (STEP), which is focused on supply chain security and eliminating vulnerabilities related to dual-use items.

[65] https://journals.sagepub.com/doi/pdf/10.1177/0096340213485946 and https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-25740.pdf

[66] We recognize, of course, that pandemics are, at a minimum, a systemic risk as evidenced by the coronavirus (coronavirus does not appear to be an existential risk for humanity but we are not commenting on whether future ones might be).

[67] The GSSB is an independent operating entity under the Global Reporting Initiative (GRI). Differences between SASB and GSSB/GRI (Global Reporting Initiative) Standards, can be found at : https://www.globalreporting.org/information/news-and-press-center/Pages/GRI-and-SASB-take-next-steps-in-cooperation.aspx;

SASB is a not-for-profit independent standards-setting organization. Its mission is to "establish and maintain industry-specific standards that assist companies in disclosing financially material, decision-useful sustainability information to investors." In some cases, there may just need to be adaption and wider use of already existing SASB standards that were probably created without nuclear in mind.

SASB has recommended guidelines for companies' sustainability reporting broken down into 77 industry-specific standards.[68] It has guidelines for, and some companies in certain industries report with respect to, certain measures that bear resemblance to some of the reporting metrics and disclosures we will recommend for nuclear. For instance, SASB recommendations include, among others, that:

- Aerospace & Defense companies report with respect to Data Security (e.g. Number of data breaches and % involving confidential information) and Business Ethics (e.g. "Total amount of monetary losses as a result of legal proceedings associated with incidents of corruption, bribery, and/or illicit international trade," and a "Discussion of processes to manage business ethics risks throughout the value chain").
- Electric Utilities & Power Generators report with respect to Nuclear Safety & Emergency Management (e.g. a "Description of efforts to manage nuclear safety and emergency preparedness").
- Metals & Mining companies report tailings waste from mining.
- Internet Media & Services companies report with respect to Data Security.

However, it's important to not only keep in mind that many companies do not report and many investors do not pay attention to the types of metrics recommended by SASB but also that, for those that do, many nuclear-specific issues are left out of the picture or not discussed in proper detail. To the degree we could get the Sustainability Accounting Standards Board to include more nuclear-specific measures in their standards, it might encourage investors and companies to pay greater attention. We recognize there's a bit of a chicken and egg problem that needs to be overcome, as SASB standards are developed based on feedback from companies, investors and other market participants.

In terms of the GSSB and GRI, the GSSB is an independent operating entity under the Global Reporting Initiative (GRI) that sets the GRI Sustainability Reporting Standards. While SASB and GRI Standards are both focused on (currently voluntary) sustainability reporting, SASB is a bit more focused on addressing some of the data which is quantifiable/financially material and has the needs of investors in mind. GRI is designed not just with investors in mind but rather all stakeholders and also focuses on some additional areas, such as human rights, which it says "are difficult to quantify but crucial to achieving solutions to global challenges." The GRI Standards are also not broken down by industry like those of SASB and they use a different overall framework.

As with SASB, GRI Standards provide little actual specificity to nuclear. GRI Standards contain reporting recommendations for companies including such things as lobbying activities, support of political candidates, transport and discharge of hazardous waste, and ethics ("values, principles, standards, and norms of behavior"). These are just a few of many, which we are highlighting based on a potential tangential connection to future nuclear reporting. As with our recommendations for SASB reporting, we would hope that all of us, by working together, can both get GRI to expand nuclear-specific reporting recommendations and encourage companies to increase nuclear-related reporting under existing or future GRI Standards.

[68] https://www.sasb.org/standards-overview/download-current-standards/

Some Hypothetical Nuclear-Related ESG Screens for Assorted Industries

Here we suggest some potential details that might be desirable for companies to report, and investors to screen against, in order to ultimately help reduce the risks of a catastrophic nuclear incident. Depending on the type of information, it could fit in either an SEC-required financial report (e.g. 10Q quarterly filing or 10K annual filing) or the voluntary annual Sustainability/CSR (Corporate Social Responsibility) report many companies file.

The list is not meant to be exhaustive or declaratory in terms of either industries covered or information that companies should report. Our goal is just to start the discussion and for members of these various ecosystems to collaborate in order to get buy-in into the ideal lists.

We then follow up these reporting suggestions with what the investment community and others can do with the results of their screening on that data and in terms of other systemic questions that cannot be encapsulated in company-specific screens.

Again, as we mentioned earlier, when people talk about ESG investing, particularly in the popular press, they are more often than not talking mainly about equity investments in publicly-traded companies. In terms of this report, we are also focused largely on ESG investing as applies to equity investments in publicly-traded companies. But in addition we want readers to keep in mind that it is also applicable when investing in the debt of publicly-traded companies, the equity and debt of private companies or projects, the debt of municipalities/municipal projects, and various hybrid entities (public-private partnerships, quasi-governmental agencies, multilateral institutions, etc.). While we will generally just use the term "company" as shorthand, depending on the context it could be a publicly-traded or private company or other type of entity. We also encourage folks to always be thinking in terms of a global mindset, as opposed to one that is just U.S.-centric.

While their compensation is not the only reason that boards of directors or management teams should or would cooperate in this endeavor, we think that tying a small portion of compensation to performance on certain of these nuclear-related metrics can be a good way to incent proper behavior.

- **Aerospace & Defense - Manufacturers of nuclear weapons and/or purpose-built components for nuclear weapons:**
    - $ amount of money spent on lobbying relating to nuclear weapons projects along with specific details around that lobbying.
    - Conflicts of interest on the board or management/some sort of scorecard in terms of who may be rotating between the company, Congress, the DOD, and Lobbying organizations.
    - % of revenues and operating income from nuclear-related products.
    - Breakdown of nuclear-related revenues and operating income in terms of such things as maintenance of existing weapons, updating of command and control infrastructure, new weapons systems, etc.
    - Procedures in place in order to remain in compliance with all existing sanctions[69] in terms of shipments to certain countries.

[69] Sanctions are powerful tools in bringing bad actors to the table and the financial (banking and insurance), industrial, transportation and other business sectors have a duty to know their customers and diligently enforce sanctions. Unfortunately, a 2019 UN Security Council report (which can be found at: https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3

- Violations of any sanctions or under any dual-use[70] or other export controls..
- Details around which voluntary trade groups and other private sector initiatives the company is a member of (e.g. relating to Aerospace & Defense manufacturers, dual-use and other export controls, etc.). Also, to which industry codes of conduct is the company a signatory.

- **Other Industrial Companies**
  - Procedures in place in order to remain in compliance with all existing sanctions in terms of shipments to certain countries.
  - Procedures in place, including proper training of staff, to limit the export or diversion of dual-use technologies,products, or commodities and to understand internally which technologies or products could be part of a nuclear supply chain.[72]
  - Violations of any sanctions or under any dual-use or other export controls.
  - Procedures in place for the handling and transport of any other radiological materials (for instance, oil and gas service companies use radiological materials in some of their work).
  - Details around which voluntary trade groups and other private sector initiatives the company is a member of (e.g. relating to industrial companies, dual-use and other export controls, etc.). Also, to which industry codes of conduct is the company a signatory.

- **Port Operators**
  - Procedures for enforcing sanctions and for adhering to dual-use or other export controls.
  - Details around all security procedures, including nature and extent of equipment in place for detecting nuclear materials.
  - Violations of any sanctions or under any dual-use or other export controls.

- **Shippers**
  - Procedures for enforcing sanctions and for any dual-use or other export controls.
  - Procedures for vetting and accepting both sender and receiver of goods.

CF6E4FF96FF9%7D/s_2019_171.pdf) indicated that "Global banks and insurance companies continue to unwittingly facilitate payments and provide coverage for vessels involved in ever-larger, multi-million-dollar, illegal ship-to-ship transfers of petroleum products, as well as an increasing number of ship-to-ship coal transfers and attempted transshipments" and that "The world's largest container shipping line continued to unwittingly transport prohibited items later seized by Member States." Regulators need to make sure that not only do companies understand all regulations but also that the regulations are strong and enforceable; companies may not choose to be overly vigilant, unless forced, lest they lose business to competitors that are more lax.

[70] Dual-use, as used here, refers to technologies, products, or commodities that can have applications for nuclear weapons plus applications for nuclear power or other non-nuclear related purposes. According to Gretchen Hund, former Director of PNNL, some major dual-use concerns include vacuum pumps, specialized pressure transducers, maraging steel, and carbon fiber.

[72] While industrial companies should have awareness of export control restrictions, many, particularly smaller companies, may not have a full understanding of all the ways their products could become part of the nuclear supply chain. In such cases, "integrators" – companies that integrate dual-use products into more complex goods or use dual-use products to manufacture other goods – could help to raise awareness among their smaller suppliers about the risks associated with dual-use items and to adopt proper compliance programs. See: Rachel A. Weise & Gretchen E. Hund (2016) Financial incentives for reducing proliferation risks, Bulletin of the Atomic Scientists, 72:5, 332-338, DOI: 10.1080/00963402.2016.1216676 ; pp. 332 – 333.

- Details around security procedures, including nature and extent of equipment in place for detecting nuclear materials.
- Violations of any sanctions or under any dual-use or other export controls.

- **Utilities**
  - Description of efforts to manage nuclear safety and emergency preparedness (as suggested by SASB).
  - Discussion of mandatory regulatory frameworks they adhere to in regards to safety procedures and handling of nuclear materials, along with a discussion of all industry trade groups (particularly those focused on controlling nuclear materials) and codes of conduct of which they are a member/signatory.
  - In terms of cybersecurity procedures, including which systems are air-gapped,[73] we believe that some of that will be classified. So disclosure may not be possible, but it is important that the proper checks and balances are in place.

- **Banks** (some of these disclosures may be covered by SASB and SEC disclosure guidelines)
  - Details around the company's counter-proliferation financing measures (CPF)[74]
  - Any violations they have incurred with respect to "proliferation financing," anti-money laundering rules, sanctions, etc.
  - Procedures in place to understand which of their customers' technologies or products might have a dual-use component and to educate those customers with respect to such risks.[76]
  - Details around financing activities provided to manufacturers of nuclear weapons/components, particularly for specific countries.[77]

- **Insurers**
  - Processes in place in regard to anti-money laundering (AML) and filing SARs (suspicious activity reports). In many cases, insurers are exempt from requirements to implement AML processes or to file SARs.[78]
  - Exposures (i.e. potential losses) to various sorts of potential nuclear incidents.[79]

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[73] An air-gapped system is essentially one that is isolated from/cannot be connected to from the internet. It does not, however, make it immune to attack as the Stuxnet operation on Iran through a flash drive has shown. Again, we recognize the perils of utilities sharing some of this information and that any details might be best shared with and judged by some third party that can retain complete discretion.

[74] From the FATF's "Combating Proliferation Financing: Status Report on Policy Development and Consultation," p. 24, a definition of "proliferation financing" is "the act of providing funds or financial services which are used, in whole or in part, for the manufacture, acquisition, possession, development, export, trans-shipment, brokering, transport, transfer, stockpiling or use of nuclear, chemical or biological weapons and their means of delivery and related materials (including both technologies and dual use goods used for non-legitimate purposes), in contravention of national laws or, where applicable, international obligations". This reference to the FATF is taken from: Rachel A. Weise, Gretchen Hund & Geoffrey Carr (2018) Export controls and counterproliferation finance: two sides of the same underlying illegal WMD activity, The Nonproliferation Review, 25:1-2, 129-145, DOI: 10.1080/10736700.2018.1473107

[76] Rachel A. Weise & Gretchen E. Hund (2016) Financial incentives for reducing proliferation risks, Bulletin of the Atomic Scientists, 72:5, 332-338, DOI: 10.1080/00963402.2016.1216676; p. 333.

[77] Some countries' defense industry is mostly state-financed. The countries that would be most concerning would also very much depend on the vantage point of the investors.

[78] Ibid (Weise, Hund, Carr).

[79] It varies greatly by the line of insurance and whether it's an act of war, an act of terrorism, or some other classification, but in some cases chemical, biological, nuclear and radiological events will not be covered by the insurer.

- Discussion of criteria they take into account before and after providing coverage to their clients (e.g. their clients procedures for adhering to sanctions, export control restrictions, installed nuclear detection equipment, etc.).
- Discussion of any incentives they provide to clients (in terms of pricing or coverage) to encourage those clients to alter behavior in a way that reduces the risks of a nuclear incident.[80]

- **Miners**
  - Policies and procedures to control the flow of uranium and other materials used for nuclear weapons, nuclear power plants, or nuclear reactors used in such industries as nuclear medicine and oil and gas services.
  - Discussion of mandatory regulatory frameworks that oversee their operations, along with a discussion of all industry trade groups (particularly those focused on controlling nuclear materials) and codes of conduct of which they are a member/signatory.
  - Violations of any of the above.
  - Details around any pollution caused by or remediation necessary with respect to nuclear-related materials.

- **Media and Entertainment companies**
  - A discussion of any projects they are doing - movies, television, music, concerts, other live events - with the goal of highlighting the risks of nuclear catastrophe and/or in order to promote relationship building between adversarial nuclear states. (This is just one of various examples of where companies would not really be screened for risks or potential negatives related to nuclear but rather for opportunities relating to the issue that might reflect positively on them).

- **Big Tech and Social Media Companies**
  - Procedures in place to limit the export of dual-use technologies (e.g. certain 3D printers/3D printing technology) and products and to understand internally which technologies or products could be part of a nuclear supply chain.
  - Violations of any sanctions or under any dual-use or other export control statutes.
  - Actions they are undertaking, potentially in conjunction with the government and nuclear non-proliferation community, to understand how their products/platforms might contribute to nuclear states, by design or by accident, falling into nuclear conflict and what actions they are taking to reduce such risks. For example, tech/social media companies such as Twitter, Facebook, and YouTube, which is owned by Google, need to strike a proper balance between the rights of free speech against the misinformation, deepfakes, and other manipulation spread through their platforms. They similarly need to further explore the fact that their platforms have in some cases become a conduit for government officials conducting foreign policy, which raises a host of concerns including the possibility of a head of state having his or her Twitter or other accounts hacked. Considering that nuclear weapons can be launched and strike their targets in minutes, Big Tech and social media companies should not have a failure of imagination that might leave us unprepared for the many ways their platforms could facilitate a nuclear crisis.

[80] Inspired by Olson, Nate, and Brian Finlay. MARKET POWER: Adapting Public and Private Roles for Transnational Commerce and Transnational Threats. Stimson Center, 2013, www.jstor.org/stable/resrep10947. Accessed 11 Mar. 2020; pp. 14-16.

- Details around any activities such companies are taking in order to use their technology and/or platforms to help reduce the risks (that they did not cause) of a nuclear incident. In this case, these companies are not really being screened for risks or potential negatives related to nuclear but rather for opportunities relating to the issue that might reflect positively on them. For instance, they might be able to devise clever uses of their technologies/platforms or invest in new technologies that might reduce one or more potential threats of a nuclear incident - e.g. helping to avoid false alarms in terms of nuclear launches, improving communication/understanding between adversaries, forestalling the dangers of and taking advantage of the promises of AI, etc.

Defining Dual-Use

A dual-use technology or product can be thought of in a few different ways. In a general sense, it is often defined as a technology or product that has both a military and civilian commercial purpose. Some of the technologies and materials used for nuclear power, for instance, can also be utilized in the making of nuclear weapons.

Dual-use technologies or products also include those that have a non-nuclear commercial use and a separate role relating to the manufacture of nuclear weapons (or sabotage or other malevolent nuclear-related activities). Many industrial or tech products, parts, and services for instance, might have some primary civilian commercial purpose - e.g. carbon fiber and anti-corrosive valves[81] - but, if diverted or repurposed, could be used for the manufacture of nuclear weapons by "rogue" or other adversarial states or for inciting of a nuclear conflict. We collectively all must work to make sure that such products are not diverted or otherwise used for such malicious nuclear-related purposes. This was the meaning of dual-use that we were, for the most part, focused on in the preceding section on nuclear-related ESG screens.

In the impact section, we will also discuss dual-use from another perspective – technologies or products, whether military or civilian, that have a non-nuclear use but which can also be used for nuclear risk reduction.

After Screening

With the results of such screens, investors, regulators, and the nuclear non-proliferation community can engage with management teams and boards of directors in terms of where they fall short on disclosures or about what they can do with their policies and procedures to reduce their nuclear risks.

Many aspects of the nuclear weapons and nuclear power business are, of course, regulated by governments and multilateral and bilateral agreements and conventions. However, it's not just about whether a company meets some minimum legal requirement, which may not truly be satisfactory in terms of properly controlling, say, the financing or export of dual-use and other technologies and products that could lead to nuclear proliferation. No, there should also be further qualitative and quantitative analysis of the company's policies, procedures and actual performance, praising those that

[81] Rachel A. Weise & Gretchen E. Hund (2016) Financial incentives for reducing proliferation risks, Bulletin of the Atomic Scientists, 72:5, 332-338, DOI: 10.1080/00963402.2016.1216676 ; p. 2.

go above and beyond minimum legal requirements in terms of compliance and training,[82] and calling out those that don't go the extra mile or even potentially violate the legal requirements.

Questions should be asked like:

- "What other disclosures, policies, and procedures can be put in place?"
- "Has the company signed onto private sector initiatives such as voluntary Codes of Conduct that are designed to reduce nuclear proliferation?"
- "If no, why?"
- "If yes, is the company meeting the commitments it made?"

On a related note, a 2013 article in the Bulletin of the Atomic Scientists, authored by Andrew Kurzrok and Gretchen Hund, along with a 2015 Pacific Northwest National Laboratory Report authored by Hund, argued that companies across many sectors should adopt a wide-range of policies and best practices to reduce the illicit spread of dual-use commodities, products and technologies.[83] These include (with varying degrees of applicability, depending on the industry):

- Communicating a corporate governance statement/pledge on non-proliferation.
- Participating in relevant industry codes of conduct/pledges. [84]
- Preferentially selecting business partners that maintain strong non-proliferation codes of conduct/pledges.
- Developing a corporate policy on reporting suspicious orders and anomalous incidents to appropriate parties.
- Participating in governmental export control rulemaking.
- Requiring non-proliferation training and education for employees.
- Acknowledging any non-compliance that occurs – penalties, voluntary self-disclosures, settlements with regulators, etc.

While there is attention paid to at least some of these factors within the nuclear non-proliferation community, including by regulators, there is room for more to be done. And, unfortunately, there is very limited visibility to and discussion among the financial community in order to hold these companies accountable.

Also, along the lines of the various screening metrics we proposed in the previous section, we believe that companies should not only follow the above practices with respect to non-proliferation of dual-use commodities, products and technologies, but also with respect to a broader range of actions that reduce the risk of a nuclear incident.

Again, we think that tying a small portion of compensation to companies' performance on certain nuclear-related metrics can be a good way to incent proper behavior.

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[82] Training and other best practices are offered by various NGO's, industry groups, and others. For more details on organizations like WINS, NISGS, and FMWG, see https://www.belfercenter.org/sites/default/files/2019-03/RevitalizingNuclearSecurity_Mar19.pdf ; pp 132-136.

[83] https://journals.sagepub.com/doi/pdf/10.1177/0096340213485946 and https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-25740.pdf

[84] For instance, as argued by Kurzrok and Hund, nuclear power plant vendors should probably have signed onto NuPoc – the Nuclear Power Plant and Reactor Exporters' Principles of Conduct, initially facilitated by the Carnegie Endowment for International Peace – and need to be held accountable for remaining in compliance with those principles. For those market players that are not signatories, it needs to be understood why this is the case. More details about the Principles of Conduct can be found at: http://nuclearprinciples.org/the-principles/

A Few Words on Engagement

While investors from the U.S. have been reluctant to engage in the type of wholesale divestiture of manufacturers of nuclear weapons as is supported by the *"Don't Bank on the Bomb"* report/initiative, there are steps they can take short of full exclusion. For starters, they could review those companies, along with their JV's or nuclear-related projects, on a case-by-case basis to better understand their involvement with nuclear weapons; for instance, certain types of maintenance activities in terms of the safeguards on nukes or updating the cybersecurity for the command and control infrastructure might could be considered more tolerable than the building of new weapons systems.

At a minimum, investors should engage with nuclear weapons manufacturers, along with military leadership, the executive branch, and members of Congress, to understand the justification and necessity for various programs and how lobbying may have impacted the decision makers' mindsets. Investors should request, and where appropriate financial and other regulators should demand, greater transparency regarding corporate lobbying efforts around nuclear issues or any sort of "revolving door" practices that may be taking place at certain companies that create conflicts of interest or perverse incentives.[85] Investors may potentially want to divest of certain companies that are not willing to meaningfully engage.

Engagement is probably most important with regards to the defense manufacturers involved in nuclear weapons but is also quite relevant with many of the other industries we mentioned. In some ways, those other industries may be even more receptive to engaging with investors as they are not in the business of nuclear weapons and are likely more transparent businesses by nature; as such, they may be more willing and able to change their policies in order to reduce the risks of a nuclear incident and/or burnish their reputations as good corporate citizens.

"Nukewashing," the Need for Discretion, and Risk of Unintended Consequences

We recognize the need to remain vigilant for any "nukewashing" - our colleagues' term for the nuclear equivalent of greenwashing. Greenwashing refers to companies giving the false impression that their corporate behavior or reported metrics are more environmentally friendly than they actually are. The nukewashing equivalent is where a company gives a false impression that its corporate behavior or reported metrics are reducing nuclear risks more than they actually are.

We also recognize the need to be on the lookout for the possibility of creating perverse incentives or unintended consequences; we wouldn't want to incent any behavior that actually creates more harm than good. For instance, while we think there is good coming out of certain carbon offsets[86] models for lowering CO_2 emissions (and we also hope to investigate whether there is some sort of carbon offset framework that can be adapted to novel ways of reducing nuclear weapons risk), there are also concerns that some carbon offset programs have been ineffective or even counterproductive.[87]

[85] See https://readsludge.com/2019/01/10/jon-kyl-voted-nuclear-after-taking-payments-from-nuclear-company-sandia/ and https://s3.amazonaws.com/docs.pogo.org/report/2018/POGO_Brass_Parachutes_DoD_Revolving_Door_Report_2018-11-05.pdf

[86] Carbon offsets are a mechanism by which individuals, companies, or governments attempt to offset their CO2 emissions by investing in projects that reduce CO2 emissions – e.g. reforestation and renewable energy.

[87] https://www.bloomberg.com/news/newsletters/2020-01-28/trees-aren-t-the-simplistic-climate-solution-you-think-they-are and https://features.propublica.org/brazil-carbon-offsets/inconvenient-truth-carbon-credits-dont-work-deforestation-redd-acre-cambodia/

Similarly, we recognize that it could be counterproductive or dangerous if companies (e.g. utilities and port operators) reveal too much about the status of their security efforts, thereby making them vulnerable and possibly even inviting adversaries to test their defenses. Because much of the information could be sensitive, even classified, there may be times when the information disclosed has to be more general in nature, if it can be disclosed at all.

It may be necessary in certain instances to involve some sort of trusted third-party service that gets greater access to company details and provides scoring of the company's performance and makes recommendations for improvement, all while maintaining complete discretion with regards to sensitive information. We have in mind groups like the James Martin Center for Nonproliferation Studies (CNS), which does a report for the Nuclear Threat Initiative (NTI) on incidents regarding lost nuclear and other radioactive materials; a group like CNS could both set out best practices that companies should follow and help the financial community to interpret their overall performance.

While it would be vitally important to tread carefully, the financial services ecosystem (investment banks, financial media, credit rating agencies) gets material non-public information on a regular basis and does a pretty good job of properly keeping such information confidential via firewalls.[88]

Regarding Nuclear Power

Related to the topic of unintended consequences, it is important to us that readers do not walk away from this report with the takeaway that they should divest anything or everything related to the nuclear power plants, which would include companies in the utility and industrial sectors (in terms of the manufacture of nuclear power equipment). It is quite a large and heated debate, but we are in the camp that existing nuclear power plants, with their low to no CO_2 emissions, are important for battling climate change.

This is not to say that all existing nuclear power plants, along with the nuclear fuel they require, pose zero risk or that precautionary actions should not be taken with respect to certain nuclear power plants. We do in fact recognize that there are safety and security issues that need to be mitigated at many plants, including better insulating themselves from natural disasters and terrorism. While in some cases there are very real risks associated with certain of these existing plants, for the most part (in the U.S. anyway) we don't think the diversion of fuels for nuclear weapons purposes is at the top of the list.

There is also a heated debate as to whether new nuclear power plants should be built in order to fight global warming, with arguments centering on such issues as:

- the CO_2 emissions created in constructing a new plant (e.g. laying all that concrete).
- high costs and long lead time for building new nuclear plants, which might take away finite dollars from renewables.[89]
- the pace at which renewable power such as solar and wind can be built out.
- the % of installed capacity that can come from renewables without compromising reliability of the grid.[90]

[88] The term "Chinese wall," although some may consider it a culturally insensitive term, is still commonly used in the industry, probably more so than terms like "firewall" or "ethical screen".
[89] https://podcasts.apple.com/us/podcast/175-is-it-time-to-expand-nuclear-power/id216713308?i=1000464894427
[90] Ibid.

- pollution caused by uranium mining and dealing with spent fuel.
- the risks that the fuel could be further enriched and ultimately used for nuclear weapons (which depends on the type of plant).
- the safe storage of spent fuel and NIMBY issues.

These are just a few of the many points of debate. We are not opining with regards to new plants, as that issue is beyond the scope of this report. However, we do think it is an important debate for the industry to keep having and that both sides need to make sure they have all the facts rather than be driven by all-or-nothing type views. For folks involved in the debate, it is also important to keep in mind the risk of discouraging American, European, and Japanese manufacturers of equipment for nuclear power plants from participating in the ongoing development of nuclear power technology and new plants. Such development will likely move forward on a global basis with or without their involvement, and it may be good to maintain American, European, and Japanese involvement in the setting of standards and helping to control the risks.

We hope that increased discussion in the financial markets, as recommended in this report, can help in at least small part to contribute to a more ideal result with respect to existing and/or new nuclear power plants. Hopefully, greater ESG-type screening of nuclear risks will help to instill tighter oversight on nuclear power, even above and beyond that which already exists from regulators. To the degree there is a tight regime around the nuclear power ecosystem, and that investors enforce such standards by voting with their pocketbooks, prolonging of the viability of nuclear power may be a positive in fighting climate change.

Section IV: Impact Investing & Other Methods of Financing Innovation in Nuclear Risk Reduction

Impact Investing Basics

In the preceding sections, we discussed various ways the investment community might begin ESG-type screening of entities for nuclear risks. We focused mostly on for-profit publicly-traded companies with somewhat diversified operations. Our view is that such screening would help investors and the companies they are invested in better understand how those companies could change behaviors in order to lessen the risks of a major nuclear incident, along with the related financial risks to both the company and society.

In this section, we are focused on how impact investments can be used to reduce nuclear risks. We have seen a huge increase in mobilization from investors and entrepreneurs in terms of creating impactful solutions for mitigating the effects of the pandemic. We believe the same mobilization, even if on a smaller scale, should begin with respect to nuclear.

Again, as defined by the Global Impact Investing Network (GIIN),[91] "Impact investments are investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return." So, while ESG-screening involves assessing environmental, social and governance factors largely to reduce the financial risks of investments, impact investments "proactively target positive impact." Impact investments can be made into and by publicly-traded companies but much of our focus here will be on smaller, private companies and projects.

The impact investment market was approximately $715 billion at the end of 2019, according to the GIIN.[92] While there are some large, multi-billion dollar impact funds (i.e. in the Asset Manager category in the chart below), we believe the median fund size is only a couple tens of millions of dollars.

[91] The GIIN is a leading consortium of investors, philanthropists, and others that is a "champion of impact investing, dedicated to increasing its scale and effectiveness around the world".

[92] https://thegiin.org/assets/GIIN%20Annual%20Impact%20Investor%20Survey%202020.pdf; note that most of the data is self-reported and there is no uniform definition in how, for instance, philanthropic organizations might report which of their assets fall into an "impact" investing bucket versus some other type of classification.

GIIN Chart of AUM by Organization Type:

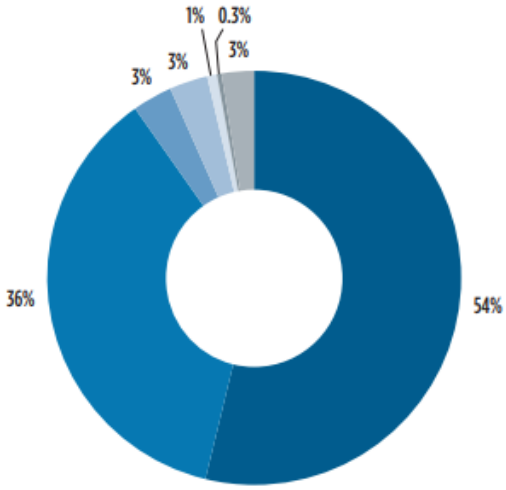
n = 1,728. Figures represent direct investments only, as of the end of 2019.

Percent of respondents

54%	Asset managers
36%	DFIs
3%	Pension funds and insurance companies
3%	Diversified financial institutions
1%	Foundations
0.3%	Family offices
3%	Others

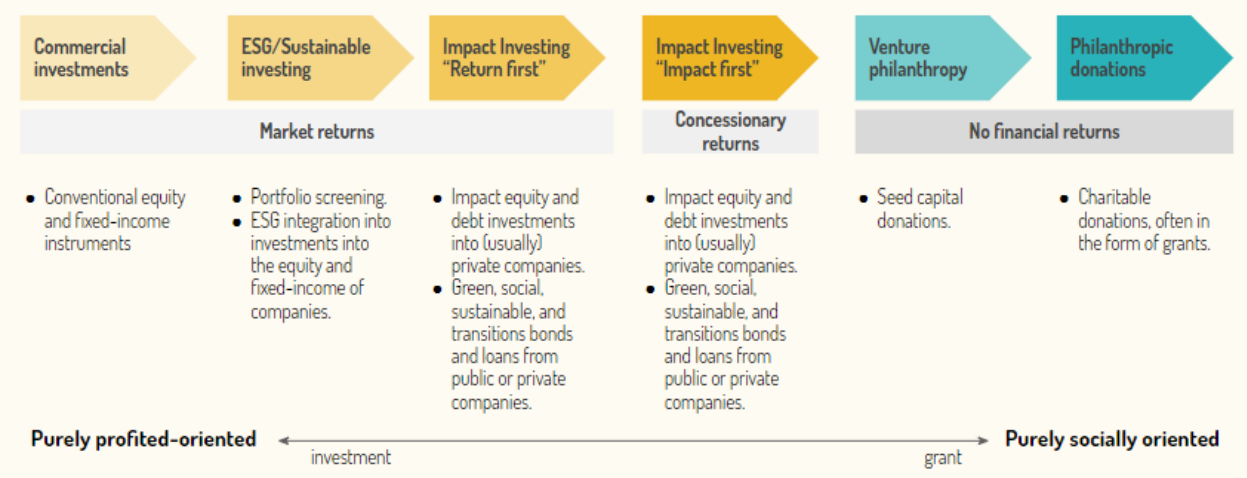
Note: Total AUM represented is USD 621 billion, which is based on the database AUM before estimating for organizations not included in the database. (See the methodology on the following page for details). 'Other' includes corporations, community development finance institutions (CDFIs), and non-governmental organizations.

Source: GIIN



This following graphic, which we adapted from Credit Suisse, is helpful in visualizing the relative importance of financial returns versus social impact across various investing strategies (throughout our discussion of impact investing, we are using "social" as shorthand for any societal benefit, whether that be related to nuclear, the environment, affordable housing, etc.).

On the left, we have commercial (aka traditional or conventional) investments where it's driven almost exclusively by the financial return - those investors want to attain a financial return commensurate with the risk they're taking. Second from the left, we have ESG investing where the investors putting their money to work may have a genuine concern for the environment and the like but are really most focused on just screening out risks that might hurt their financial return. Then to the right of that we have impact Investing, where financial return is sometimes more important than social impact and sometimes the opposite, but usually at a minimum the impact investors want to at least be able to get their investment back with at least some slight positive return… it just depends on the motivations of the particular investor. And then at the end we have pure philanthropy, which is of course more socially-minded (philanthropic funders do have the ability to deploy some of their program-related funds as an investment rather than a grant, albeit often targeting a below a market rate of return).



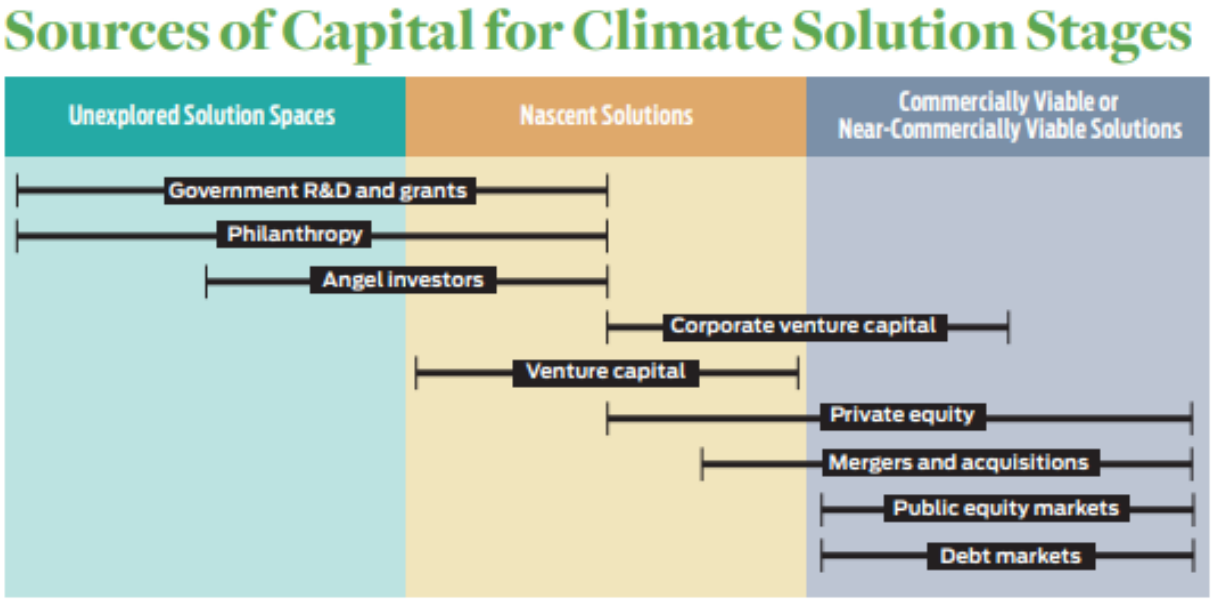
Source: Credit Suisse,[93] N Square

Another chart that is helpful for understanding the impact market comes from the Stanford Social Innovation Review which illustrates the different sources of capital for climate solutions at progressive stages of a project's life. While targeted at climate solutions, we believe it is useful for understanding funding for other new ventures as well, including those that might be built around nuclear risk reduction.

This chart shows that when trying to finance a new technology solution, where it's unknown if it works or has any chance of ever being profitable, it may require government or philanthropic funding. Then, as it becomes a little more hopeful that it will work and has the potential to be profitable, it is possible to bring in Angel investors - basically wealthy individuals, often tech entrepreneurs themselves - who invest in early stage companies. As the technology solution is further proven, then venture capital (VC) firms and later corporate VC arms and private equity (PE) firms will join the mix. After some further development and increasing prospects for the technology solution to work and be commercial, it's more likely the company can be sold or tap the public equity and debt markets for financing.

We note that the chart doesn't use the word "Impact Fund," but certain PE or VC funds or angel investors could fall into that category if, in addition to seeking a financial return, they are mission-driven. Aspects of the graphic are, of course, also open to interpretation or are case-specific, and the availability of certain types of funds can sometimes come earlier or later than is shown.

[93] https://www.credit-suisse.com/about-us/en/our-company/corporate-responsibility/banking/responsible-investments.html ; we classified green, social, sustainable and transition bonds as "Impact" as the proceeds are generally earmarked to be spent on something that is meant to generate positive societal impact but we note that they are often issued by large, publicly-traded companies and that they often attract ESG investors.



Source: Stanford Social Innovation Review, Winter 2018[94]

Funding Challenges and Concessionary and Catalytic Capital

In an earlier section we discussed the challenges of screening companies for nuclear issues relative to the screening of traditional ESG factors. Similarly, there are also many challenges when it comes to attracting impact investments targeted at nuclear risk reduction. A central challenge is the fact that it is probably much more difficult to devise for-profit business models related to nuclear risk reduction than it is for climate change and so many of the other ESG and sustainability-related issues. For so many of these non-nuclear issues, increased efficiency or availability of a service can lower costs or increase revenues, respectively, and benefit a company's bottom line; examples from outside of nuclear include increasing efficiency of water use, reducing CO_2 emissions or pollution, increasing employment, building affordable housing, and access to financial services for the unemployed/poor/unbanked, etc.

Part and parcel of the challenges of devising for-profit business models around nuclear risk reduction are:

- The very complex geopolitical aspects of nuclear risk.
- The fact that most nuclear activities are highly regulated and must conform to existing laws and governments' foreign policies at any given point in time.
- And the general issue that it is not always easy to find customers for a product or service that reduces nuclear risks.

All that said, we believe there are a number of novel nuclear risk-reduction projects that could help reduce nuclear risks – some of which will be non-profits but many others that can be for-profit initiatives. We will give some potential examples later in this section. More importantly, we hope through this report to get those in the nuclear non-proliferation and impact investment communities,

[94] file:///C:/David/Nsquare/Reference%20-%20Interesting%20Reports/Stanford%20Social%20Innovation%20Review%20Winter%202018%20Discussing%20the%20Need%20for%20Philanthropic%20Capital%20to%20Fund%20Early%20Stage%20Climate%20companies.pdf ; p. 32.

along with other funders of for-profit and non-profit enterprises, to increase the dialogue around potential new projects.

Like high-risk, novel climate technologies, as shown in the preceding table, new projects and companies aimed at nuclear risk reduction will require a range of funding strategies. We will define some of the relevant terms and comments briefly here, then later in the report we will detail some additional non-traditional sources of capital that might be used in the nuclear space.

Concessionary funds are philanthropic in nature,[95] provided to generate a positive social impact but without an expectation of receiving a financial return commensurate with the risk (and frequently the funds provided are outright grants). In many cases these concessionary funds might be the only funds available to a project that is very early stage and yet to scale, is an unproven technology, or for which ever building a profitable business is highly uncertain. Often concessionary capital is used in **Catalytic** fashion to de-risk a project and incentivize additional capital seeking a higher financial return.

This additional capital could be **Impact** capital that it is seeking to have a positive social impact but which is also seeking a financial return (often at a full market-based return commensurate with the risks but in some cases at something less). The additional capital being catalyzed could also be **Commercial/Conventional/Traditional** capital which is seeking market-based financial returns commensurate with the risk and for which the social mission is not a critical component.

While terminology can vary, **Blended Finance or Blended Capital** is this concept of blending together concessionary capital,[96] used to get a nascent project to a later, more investable stage, with impact or commercial capital requiring a higher financial return. Just as blended finance can be used to bring an individual project to fruition, it can also be used when pooling assets to create an investment fund.

Catalytic capital can take a wide range of forms normally associated with philanthropic capital, including:

- **Grants** – money given with no expectation of getting any of it back.
- **Recoverable Grants** – there are many permutations of how this could be set up, but, depending on the ability of the grantee over time, it may pay back some or all of the grant and with or without some interest rate.
- **Guarantee** – a form of credit enhancement where an organization like a foundation uses its financial strength to guarantee, say, a loan incurred by a borrower with a weaker balance sheet; the foundation commits to paying back the loan if the borrower taking out the loan cannot pay it back.

Catalytic capital can also take more traditional investment forms commonly used in for profit-entities, such as Equity (i.e. common equity or common stock), and convertible and non-convertible Debt and Preferred Equity **-** but in a way that accepts disproportionate risk and/or concessionary returns (in terms of expected return, seniority, interest rate, etc.). **First-loss or subordinated capital**, for example, is

[95] Concessionary funds often come from private philanthropic organizations but can also come from, among other sources, governments/development institutions, corporate philanthropies, and from certain buckets of Impact funds. On the latter, we note that Prudential is willing to deploy 20% of its Impact fund in a concessionary way, often to catalyze the potential for it to deploy the remaining 80% of its Impact portfolio in a very impactful way (not just delivering a social impact but also a full market-type financial return). See https://www.prudential.com/links/about/corporate-social-responsibility/impact-investing/active-capital

[96] Of course, in some cases concessionary capital might also just be traditional philanthropic capital funding a non-profit, not intended to catalyze Impact or other capital that is seeking any sort of financial return.

where a funder agrees to bear first losses on an investment such as equity or debt in order to incentivize other investors to participate in a deal.[97]

Strategies for Increasing Funding for Nuclear Risk Reduction

As one might expect, most funding for nuclear risk reduction has historically come from a handful of large foundations and billionaires, along with other philanthropically-minded organizations and governments. The entities that have historically been funded have been not-for-profit and been heavily-focused on such things as:

- Educating the general public, government, and industry about nuclear policy and nuclear risks around the world;
- Writing research, advocating changes in policy, and innovating new ways to reduce proliferation and the other risks associated with nuclear risks;
- Convening parties together to conduct discussions, determine best practices, and hopefully enter into multilateral agreements to reduce nuclear risks.
- On the ground disarmament work, including so much of the work done by the likes of NTI.

Many of these organizations have done great work – the above list does not capture it all - and will continue to do great work and should continue to be funded.

The reality, though, is that there is much more capital in this world seeking a financial return than there is purely philanthropic capital.[98] As such, our goal is to expand the pipeline of projects – in terms of both type and quantity – that can get funded from outside the historical funding sources for the non-proliferation community and/or better leverage those historical funding sources as part of a blended finance solution. Beyond building awareness of the concept of nuclear risk among impact funds and other investors, which is quite doable, the much bigger obstacle to attracting impact funds and others to invest is really just putting ideas in front of them that realistically can deliver profits.

Here we provide some suggestions, some of which will lend themselves to being for-profit and others that are more cutout for non-profits. Importantly, even if projects are unlikely to turn a profit but can at least have a model for generating revenues, that can open such projects up to impact investors and other investors seeking a financial return. Such projects might be funded through a blended finance solution involving concessionary capital, which would fund losses and stand to lose some or all of its investment, combined with capital that is seeking a financial return and can be paid out of revenues.

Media/Entertainment

The most obvious for-profit ideas tend to be geared around media/entertainment. While certainly not easy businesses, in many ways these are some of the more straightforward propositions – it is easy to comprehend how a media or entertainment project can generate revenues and potentially profits. Classic films like *Dr. Strangelove*, *War Games*, and *The Day After* have demonstrated the ability to attract an audience while conveying a message about the dangers of nuclear weapons. Notably, *The Day After* also affected Reagan's outlook on nuclear war and became part of the global conversation, reportedly

[97] Assorted definitions sourced from the Impact Management Project, Calvert Impact, and Tideline Consultants.
[98] For those who come from the non-profit world, we think it's important to recognize that, while non-profit funding is necessary for the space, for-profit capital is also not necessarily a bad word; it often creates both motivation and discipline, financially motivating the players involved, instilling accountability, and answering whether a need for the product exists and whether will anyone pay for it.

even facilitating progress made on nuclear arms control between Reagan and Gorbachev in the years that followed.[99]

The underlying subject matter also doesn't strictly have to be about nukes but rather can instead be centered around other themes that might help build ties between adversaries – for example, films with a positive message, trying to improve relations between India and Pakistan, the U.S. and Russia/China, or Iran and the West. This broadens the potential subject matter greatly relative to the often uncomfortable/limiting subject of nukes. Beyond film and television fiction, there is plenty of room for documentaries, recorded music, videogames (e.g. mobile, massive multiplayer online games, etc.), and live concerts that could target nuclear issues and at the same time potentially be profitable projects.

While there are some impact funds focused on media/entertainment, there is also no shortage of other Media & Entertainment companies that might get involved with such projects.[100] These include those that are driven almost exclusively by commerce and those that are very socially-focused - entities like Participant Media and Higher Ground Productions, which walked away with Oscars the past two years, or Games for Change, which tries to drive real-world change through games and also runs an accelerator.

In creating new projects, we think producers can capitalize by weaving in timely themes (e.g. the threats of AI and deepfakes), utilizing the brand value in existing titles (e.g. making sequels or remakes of *War Games* and/or *The Day After*), and targeting popular outlets/distribution channels (e.g. *Black Mirror* episodes or *60 Minutes*) where this a large audience.

We think it's also important to involve Japan, Europe, Bollywood, the Chinese and other foreign partners. Many countries without nukes may be the most receptive to doing films about the risks of nukes. The Japanese film industry may be a particularly good partner, with the popularity of anime among today's youth, Japan's unique nuclear history, and the country's embrace of Godzilla – a character deeply linked to the threat and horror of nuclear weapons.[101]

Dual-Use and Other Technologies and Products to Reduce Nuclear Risk

In the ESG-screening section, we discussed dual-use from a couple of different angles and particularly focused on the concept of dual-use technologies/products/commodities as those that could be used not only for commercial civilian purposes but also in the manufacture of nuclear weapons.

In this section of the report, which is focused on investing in nuclear risk reduction, we will focus instead on dual-use as meaning those technologies or products, whether military or civilian, that have a non-nuclear use but which can also be used for nuclear risk reduction.

It is our hope that impact investors and others (traditional VC's, corporate VC's, angel investors, etc.) will increase their investments into such potential dual-use technologies and products. At one end of the

[99] As Reagan wrote in his diary about the film - "It is powerfully done—all $7 mil. worth. It's very effective & left me greatly depressed... My own reaction was one of our having to do all we can to have a deterrent & to see there is never a nuclear war." [we recognize that there are widely varying views on deterrence strategy and we are not highlighting this quote for whether his view on deterrence was sound or not]. The quote from Reagan's diary is per https://thebulletin.org/facing-nuclear-reality-35-years-after-the-day-after/

[100] In terms of resources and approaches for impacting society through media, it is also worth checking out the Norman Lear Center at the USC Annenberg School for Communication and Journalism and the Skoll Center for Social Impact Entertainment at the UCLA School of Theater, Film and Television.

[101] https://www.thedailybeast.com/a-comprehensive-history-of-tohos-original-kaiju-and-atomic-allegory-godzilla

spectrum this could mean the invention of a brand-new technology,[102] while at the other end of the spectrum this would just be taking some off-the-shelf technology and using it, unchanged, in a new application for nuclear risk reduction. It is just that, though, a spectrum of possibilities – it is not binary – and many of the dual-use technologies we would hope could be utilized would fall somewhere in between and/or represent an improvement upon or innovative combination of existing technologies.[103]

Whether defined as a dual-use technology or not, and whether structured as a for-profit or non-profit, we note here a couple innovative uses of technology targeted at nuclear risk reduction:

- The Stimson Center recently launched a new program, Blockchain in Practice, that will explore the application of distributed ledger technology (i.e. blockchain)[104] to be able to track chain of custody and "detect diversion, unauthorized access, loss or theft of dual-use materials and technology."

- Datayo is a new open source platform, using commercial satellite imagery and other data sets "to increase security for all States by ensuring that nuclear decision makers have access to high quality, shareable, open-source information which enables them to make the best decisions in the face of escalating conflict." Its purpose "is to ensure that nuclear weapons are not used in response to human or technical error, miscommunication, misinterpretation or misinformation."[105]

- Guardion, which went through the Techstars Air Force Accelerator and won a Gold Prize at the MassChallenge accelerator, is developing "detectors that exploit the quantum of properties of nanomaterials in order to build low cost, sensitive, and ultra-low power detectors that replace multiple expensive components with a single device." Guardion hopes to target both the government and industry as customers.

We know that others in the nuclear non-proliferation community are also looking at these technologies to deal with nuclear risks, and we believe there is probably room for even more players and further advancements in these types of potential solutions. At least some of them could develop into a for-profit, or at least revenue-generating, business model, whether that comes from customers for the nuclear application or from the repurposing of the solution to serve some other type of market. For instance, whatever models are being developed for using blockchain for nuclear safeguards might end up being the best model of using blockchain for one of the many other potential applications (e.g. settling stock trades, supply chain logistics, etc.).

[102] One classic such example from outside of the nuclear sphere would be GPS, which was designed by the US military but ended up having numerous commercial applications as well.

[103] And whether we define it as dual-use or not, we would hope that investors would have on their radar the expansion of governmental use of certain nuclear technologies (for example, certain detection equipment) into additional public or private areas where it may not currently be employed or, alternately, new nuclear risk reduction solutions that can serve both the government and civilian customers in similar applications.

[104] https://www.stimson.org/2020/stimson-center-launches-new-program-on-real-world-uses-of-blockchain-for-international-security/

[105] See Datayo.org or https://oneearthfuture.org/program/open-nuclear-network/about

Other potential technological solutions/applications needed to reduce nuclear risk (even if indirectly) include, to name just a couple:

- Technologies for keeping artificial intelligence in-check/dealing with the unknown potential ramifications of artificial intelligence. Among the potential risks of artificial intelligence is that it is given increasing control of nuclear-decision making or, even more likely, that advances in AI lead to instability because one country worries that another will use AI in a decapitation strike of its forces.[106]

- Technology for measuring the level of hostilities between pairs of nuclear adversaries – for instance, a big data or data scraping technology that scrapes belligerent terms across certain media outlets – in order to help predict if and when one of the nuclear powers might step over the nuclear threshold. We note, for instance, that data scraping/artificial intelligence technologies were used to predict the trajectory of coronavirus outbreaks and to potentially warn if new virus outbreaks before they might occur.[107]

And of course these technologies exist or are being worked on in various non-nuclear contexts today, but like most technologies they are constantly evolving and there is always new investment going into the space. To the degree such technologies are adapted for or perfected for nuclear applications, it could present new revenue streams and/or we may find that the solution devised for nuclear risks is also suitable for other non-nuclear applications.

In terms of companies that already work on AI and big data for other non-nuclear purposes, we believe that corporate VCs and corporate philanthropies often want their grants/investments to go to projects that build upon their platforms/technologies, have strategic importance to them, and/or burnish their reputations. So, in order to entice corporations to provide funding, it is important to show them how developing/applying their products for these nuclear purposes can check these boxes for them.

Moving on to technologies in the nuclear power space, we recognize that developing new reactor technologies and/or developing new nuclear power plants can require large sums of money and be quite controversial and challenging to get to the finish line. That said, impact investors - those that are climate-focused or those who are willing to take on the cause of reducing nuclear weapons risk -should have on their radar any new advanced reactor technologies that might be able to use spent fuel or otherwise reduce some of the proliferation, storage, and meltdown risks associated with existing nuclear power plant technology.

Separate from nuclear power, it is also worth keeping in mind that there are high risk radioactive materials used in areas like medicine, the oil & gas industry, food irradiation, and research, among others.[108] These materials cannot be used to make a nuclear bomb – they are not weapons of mass destruction. But some can be used to make a dirty or radiological bomb that could, in addition to causing some fatalities, theoretically disperse and contaminate multiple city blocks and create mass disruption. There has been significant progress in replacing some of these materials/technologies with new technologies, such as x-ray units, that do not require the use of such radioactive materials. However, more needs to be done, as many of these materials are still being widely used; these

[106] RAND Report "Security 2040, How Might Artificial Intelligence Affect the Risk of Nuclear War"; 2018
[107] https://time.com/5780683/coronavirus-ai/
108 Gretchen Hund, former Director of Pacific Northwest National Laboratory's Center for Global Security, points out that in many instances these are "sealed sources" that contain a radioactive element that can could be misused or abandoned.

radioactive materials that "are in widespread commercial use around the world and [have] the highest risk" include Americium-241 (Am-241), Am-241/Beryllium (Be), Cesium-137 (Cs-137), Cobalt-60 (Co-60), and Iridium-192 (Ir-192).[109] Clearly there can be both a profitable business case and positive social outcome for those companies that can help speed the transition and, as such, we think this is clearly an area ripe for impact investors.

Attracting Various Constituents to Provide Tech-oriented Solutions

Above we provided a few potential examples of technologies that can be leveraged to reduce nuclear risks, but what is really needed is a broad call to action to impact and other investors/funders, non-proliferation experts, technology companies, tech entrepreneurs, and scientists in government and academia. New ideas for nuclear risk reduction and capital need to come together, and that capital cannot all come from government funding and the handful of large foundations that currently fund most non-proliferation work.

Through a combination of education about nuclear risks and highlighting their relationship to achievement of the UN's Sustainable Development Goals, impact investors can hopefully be convinced to put a greater focus on financing innovation to reduce such risks. We also believe a wider swath of commercial investors including VCs and angel investors, which are used to financing early stage technologies, can be attracted if presented with a pipeline of for-profit ideas.

Non-proliferation experts, tech entrepreneurs, and scientists certainly have some existing ideas on nuclear risk reduction that they do not know where to bring for potential financing or, alternately, could come up with new ideas if educated as to the many individual nuclear-related problems that need to be solved. The various parties just need to be put together to a greater degree than is currently taking place.

There exist accelerators like the Techstars Air Force Accelerator that could be a good venue for for-profit technology ideas that target nuclear risk reduction, and it's important for entrepreneurs to know that such options are open to them. But that's not nearly enough. We believe that the time is ripe for an accelerator – from a Techstars, Y Combinator, MassChallenge, or the like – potentially done in partnership with a corporate or philanthropic funder if need be, that is strictly focused on projects geared towards nuclear risk reduction. Similarly, we think there is a need for prize philanthropy/competitions centered around nuclear risk reduction; the N Square Collaborative has hosted such prize competitions in the past, but there need to be additional, high-profile competitions, run by some of the major players in the prize space.

Meanwhile, the philanthropic, academic and non-proliferation communities need to help incubate some of these nascent projects to help get them to the stage where they can apply for some of the top-tier, aforementioned accelerators, or, alternately introduce them directly to impact funds, VCs, and angel investors.

FFRDCs and UARCs

Briefly, we just want to mention a few words about the Federally Funded Research and Development Centers (FFRDCs and the University Affiliated Research Centers or UARCs). The 42 FFRDC labs sit under various federal agencies (including the DOE, DOD, NSF, and others) and are owned by the federal

[109] https://www.nonproliferation.org/wp-content/uploads/2020/01/permanent_risk_reduction.pdf ; p 5. This piece also provides good background on the issues and where solutions are needed. The Nuclear Threat Initiative (NTI) is also a leader in transitioning out these old technologies/materials.

government but operated by contractors including universities and other private, non-profit entities. The FFRDCs conduct R&D in order to meet federal agency missions in a broad range of areas including energy, basic science, medicine, national security, and environmental stewardship, and they exist to tackle particularly difficult problems that fall beyond the capabilities of private industry or individual universities.[110,111]

The 14 University Affiliated Research Centers, or UARCs, are all under the Department of Defense with primary sponsors like the Army, Navy, and Stratcom. The UARCs are research programs associated with a university that have the purpose of making sure the engineering and technology capabilities of particular importance to the DOD are maintained.[112] Many of the following conclusions about collaborating around nuclear risk reduction would be similar whether with respect to the FFRDCs to the UARCs.[113]

The FFRDCs and UARCs shouldn't normally be thought of as a source of funds. Rather, they have talent and resources that can be leveraged through research partnerships, although much or any funding will often need to come from the outside.[114] Many or most of these entities also make their technology available for license.

While most of these entities do not have a nuclear focus, per se, in no way do we want folks to target only the small minority that do; many solutions to reducing nuclear weapons risk, as we suggested with our blockchain, AI, and big data examples earlier, will likely come from technologies and innovators from outside the nuclear space.

For entrepreneurs who might want to work with the FFRDCs or UARCs or capitalize on their technologies, they may find it useful to work with organizations like FedTech. FedTech is a for-profit business, funded by federal agencies and corporate partners, that takes technological breakthroughs from the labs and pairs them up with outside tech entrepreneurs to build businesses around that lab technology.

Small Business Technology Transfer (STTR)/ Small Business Innovation Research (SBIR) Programs

Other examples of public-private partnerships or the potential to capitalize on federally funded research are the STTR and SBIR programs of the U.S. government.

STTR – the Small Business Technology Transfer program – is designed to encourage small U.S. businesses to collaborate with and commercialize the innovations of certain U.S. research institutions. The program is offered by five U.S. agencies.[115]

[110] https://nationallabs.org/our-labs/what-we-do/
[111] https://fas.org/sgp/crs/misc/R44629.pdf
[112] https://www.arl.army.mil/business/uarcs/
[113] Recognizing of course that the conclusions would vary a bit based on the individual case, as the focus area, mission, and parent agency of the individual FFRDCs and individual UARCs each differ and that they sit under different agencies.
[114] Based on our conversations with folks in related fields, this will vary to some degree on the particular national lab or UARC though and the agency they are under. In some cases, it may be a bit easier to obtain some funding for a project by going directly to the "mothership" agency.
[115] https://www.sbir.gov/about/about-sttr

SBIR – the Small Business Innovation Research program – is designed to encourage small U.S. businesses to engage in R&D and incentivizes them to profit from its commercialization. This program is sponsored by twelve U.S. agencies.[116]

Phase I awards for the two programs are up to ~$150K and Phase 2 awards are up to ~$1 million. Phase 3 does not include any financial awards but provides special incentives/advantages for procuring the business of the U.S. government as a customer.

Neither of these programs are easy paths and there can be some restrictions/parameters around the use of funds, but they can certainly be useful sources of funds for entrepreneurs.

Additional Projects to Finance - Technology and Otherwise

Here we just provide some suggestions for additional avenues that might be pursued in terms of nuclear risk reduction projects. Maybe these trigger some additional ideas from readers or maybe they already have their own. Either way we look forward to hearing ideas from others and, where we can, provide suggestions or help with pushing those ideas forward.

- Tailoring cybersecurity software for any special needs – to the degree not already met - of nuclear power plants and the command and control infrastructure for the nuclear triad. The market for this, particularly in terms of nuclear power plants, is like many of the things we discuss probably larger outside the U.S. than within the U.S.

- Devising methods to track/limit the use of 3D Printing/Additive Printing for nuclear proliferation and other nefarious purposes.

- A Nuclear analogue to CoveringClimateNow (coveringclimatenow.org)
    - Covering Climate Now is a global journalism initiative, launched by the Columbia Journalism Review and The Nation, committed to bringing more and better coverage around climate change. While not the central focus, the website itself also serves as a repository of climate-related stories.
    - We think there is room for similar initiative covering nuclear-related risks and what needs to be done about them.

- Financial services companies/funds/business line expansions to work on and profit from reducing the threat:
    - Impact Fund created to fund (mainly small and private) companies/projects focused on nuclear risk-reduction.
    - A data service that researches and catalogs nuclear risks of existing companies for the benefit of ESG investors screening for such risks.
    - An ESG-fund (mainly into publicly-traded companies) that, in addition to traditional ESG factors, takes into nuclear weapons risks alongside other weapons of mass destruction/disruption and emerging technological dangers (e.g. AI)
    - Consulting services around incorporating nuclear risks into contracts and credit agreements/indentures for debt; for example, language that would excuse or delay a borrower's scheduled interest or principal payments in the event of a nuclear incident.
    - Underwriting of a new type of catastrophe bond tied to a nuclear incident.

[116] https://www.sbir.gov/about/about-sbir. VertueLab is another good source for SBIR and STTR information and can be found here: https://vertuelab.org/about-sbirsttr

    - Advising on how to structure balance sheets, portfolios, procedures of exchanges, etc., in order to increase resiliency in the aftermath of a potential nuclear incident.[117]
    - Advising on issuance of Transition Bonds (and potentially Social or Sustainable Bonds) related to nuclear. (see next bullet)

- An existing publicly-traded or private company (or government/municipal entity) could issue a Transition Bond (or loan) to lower nuclear risks. Transition Bonds are issued by "brown" companies trying to find a cleaner way to do business. It would be good for the issuer's reputation and the funding, because there are a lot of big investors looking to deploy funds into some of those high-profile deals, would likely be available at a reasonable cost. Potential issuers and uses could include:
    - A defense company/contractor could issue a Transition Bond with the proceeds earmarked towards reducing some of the risks associated with the existing nuclear arsenal or command and control infrastructure.
    - A utility or other nuclear power producer (e.g. a merchant power company) could issue a Transition Bond with the proceeds earmarked towards any issues associated with spent fuel, other aspects of their operations that may need to be cleaned up, upgrades to their cyber and physical security, upgrades to their resilience from natural disasters (think Fukushima), etc.
    - A miner of uranium could issue a Transition Bond with proceeds earmarked to clean up any reclamation liabilities it may have.
    - These would probably be smaller-sized issuers, but a user of radiological materials (e.g. hospital, food processor, oil & gas company, research facility) could issue a Transition Bond with the proceeds used to buy safer equipment.
    - We have included these Transition Bonds in this section on impact investing because it is money being raised with the proceeds earmarked specifically with making some social change. However, we note that many ESG investors that focus on or include bonds in their portfolio could also buy Transition Bonds.

- Businesses more geared for survival in the aftermath as opposed to prevention efforts. These don't address our central goal by any means, but we think it also makes sense for society to be better prepared for a nuclear incident, as long as companies helping to prepare are doing so in a responsible way and not selling the wrong solutions for irrational concerns.[118] More importantly, we think that such business ideas help to increase discussion and awareness of the risks and that can only be helpful to prevention efforts. Some examples might include:
    - Radiation-resistant seeds.
    - Manufacturers of bomb-shelters, meal kits, iodine tables and other survival gear.

- Goodwill endeavors that are not actually tied to nuclear but rather just build relations between adversaries. For instance, there could joint Indian-Pakistani tech companies or camps/schools in one of those countries or a neutral host country. This would be something akin to the actual sleep away camps and ongoing programs that Seeds of Peace[119] hosts for teens on both sides of

[117] For example, potentially expanding "contingent" debt/capital beyond European financial companies, where it is common practice, to financial companies across the world as well as into non-financial sectors. Should a nuclear or similar disaster take place, such debt could convert to equity or have its maturity extended and covenants relaxed.
[118] While we think, for example, that it can makes sense to own a small allocation of gold or gold miners in an investment portfolio (assuming a reasonably entry price, probably below the prices at the date of this report), we would look quite unfavorably on any hucksters on late night television telling viewers to put all their money in gold before an impending nuclear - or any other - apocalypse.
[119] See seedsofpeace.org; their approach is to begin with a camp session in Maine that "shifts attitudes and perceptions and builds respect and empathy," followed by ongoing relationship building and leadership training, which ultimately

the Palestinian/Israeli conflict, the Indian/Pakistani conflict, and other conflicts around the world.

"Lab for Nuclear Finance" - Novel Financing Sources & Economic Paradigms for Nuclear Risk Reduction

The Global Innovation Lab for Climate Finance, with a Who's Who list of funders and partners, including such groups as Rockefeller and Bloomberg Philanthropies, tries to identify, develop, and support transformative sustainable finance ideas in order to drive billions of dollars private investment towards a low-carbon, climate-resistant economy.[120]

The nuclear space needs a similar institutionalized approach to develop new financing sources and novel economic paradigms aimed at risk reduction. In addition to innovation from the philanthropic community, insights are also needed from nuclear and public policy experts, economists, game theorists, other academic leaders, business leaders, and banking and insurance professionals who design new products and are experts in risk. We hope this type of lab can be developed and will see if we can part of moving such an idea forward.

In the meantime, to go along with some of the ideas we mentioned earlier such as Transition bonds and revenue-based financing, below we suggest a few general paths for exploration by a new lab or others seeking to innovate.

- Rhino Bonds – The organization Conservation Capital is designing a ~$50 million outcomes-based model whereby a combination of philanthropic capital would be combined with funds provided by impact investors seeking a financial return. The impact investors' receipt on interest and principal would be a function of black rhino population growth in certain areas. Basically, the providers of philanthropic capital are willingly giving more money if the social mission is successful.[121] Philanthropists, impact investors, and others should explore whether there's a nuclear equivalent where philanthropic/concessionary capital and impact capital can be combined. In such a program, the philanthropic/concessionary capital would pay more for success on some criteria of nuclear risk-reduction; the impact investors are taking a risk in that they do poorly financially if risk reduction is not achieved but do well financially if nuclear risk reduction is achieved.

- We need to solicit ideas from economists and finance professors who have not historically focused on the nuclear problem. For instance, among other fresh concepts that they might come up with, it would be good to see if they can come up with an idea to get around the fact that society may be characterizing the impact of a future nuclear incident as being low in a present value sense (i.e. the future impact discounted back, potentially many years, at a high discount rate) and therefore not being able to justify action purely in financial terms.

- It should be explored among economists, climate finance professionals, and others whether we can port any economic paradigms/market-based mechanisms from other large problems like

enables alumni to "accelerate social, economic, and political changes essential for peace." Separately, we note that CNS hosts the nuclear-focused Critical Issues Forum, which brings together high school students (along with their teachers) to promote cross cultural understanding and to understand and propose solutions to the threats from WMD.

[120] https://www.climatefinancelab.org/?https%3A%2F%2Fwww.climatefinancelab.org%2Fcall-for-ideas%2F

[121] https://www.ft.com/content/2f8bf9e6-a790-11e9-984c-fac8325aaa04

climate change into the nuclear field. For instance, maybe folks have some ideas similar to carbon offset programs or cap and trade/ETS (Emissions Trading System).[122]

- Business leaders and strategists from the private sector, in the U.S. and overseas, should be invited to come up with ideas for business partnerships/joint ventures that might improve relations/strategic interests between countries (particularly the U.S.-Russia, the U.S.-China, U.S.-North Korea, South Korea-North Korea, India-Pakistan, Iran and the West) and thereby reduce nuclear risks. As part of that, we need feedback from them how their governments may need to change existing sanctions, trade and other laws and policies to allow those ideas to come to fruition.[123]

- Economists, game theorists, finance professionals, nuclear professionals, and others should explore new ideas like the U.S., UN, and/or Development Banks paying (or tying aid to) North Korea, Russia, India or Pakistan to reduce their number of weapons. Alternately, maybe a national government issues a special kind of sovereign/government bond to (i.e. raises money from) other national governments that are nuclear weapons states; the issuer only has to pay back the principle at maturity if the buyer doesn't, for example, engage in inappropriate behavior relating to nukes. The proceeds from the financing would be escrowed with a neutral third-party pending progress on some specified nuclear criteria.

Measuring Impact

While we think this is secondary to the challenges of building a for-profit business model (e.g. finding paying customers and the like), it is important to note for many nuclear risk reduction projects it is difficult to measure the actual social – i.e. non-financial – impact of the business.

Measuring the social impact of their investments is important for many impact investors, but coming up with realistic metrics for the impact of many potential nuclear risk reduction projects is not as easy as the metrics used for so many other types of impact investments – e.g. reduction in CO_2 emissions, increase in water efficiency, reduced nitrous oxide emissions, jobs created, affordable housing units built, etc. In most respects, it cannot easily be counted or otherwise quantified how much a given effort in the nuclear space reduces nuclear risks.

Of course, not all impact investors will require that impact be able to be quantified, plus we would never count out innovative folks in the impact and nuclear non-proliferation communities from coming up with clever ways of measuring impact. We also believe that if respected non-proliferation groups give their seal of approval on the merit of tentative risk-reduction projects that that will help allay any concerns impact investors have around potential impact. Further, we believe that some funders other than impact investors can be attracted to provide funding for certain projects, including various

[122] As defined by the Climate Finance Leadership Initiative, an Emissions Trading System is "a market-based policy mechanism that places a cap on total emissions in a specific country, region, or sector. Based on this cap, individual entities are allocated permits that allow them to produce a certain amount of emissions. These permits can be traded among emitters, allowing emitters that can reduce emissions at a lower cost to sell permits to emitters with higher costs. This market mechanism helps ensure cost-effective reduction of emissions."

[123] At the same time, we recognize that sanctions and other trade policies can be effective at reducing nuclear risks and do have a place; so we are not necessarily looking to replace existing approaches but rather hoping that new approaches can co-exist with and complement existing ones.

philanthropic funders plus traditional VC funds and angel investors, and that these funders likely won't require impact measurement.

We discuss additional non-traditional financing sources and tools in the appendix.

Conclusion

Ray Dalio, the famed investor who heads hedge fund giant Bridgewater Associates, has written that "My biggest mistakes in my career came from missing big market moves that hadn't happened in my lifetime but had happened many times before."[124]

Other than for testing, there has not been a nuclear detonation since the waning days of WWII. There had also not been a catastrophic global pandemic since just after WWI… until COVID-19.

It was a mistake for global leaders to ignore warnings over the last several years about a pandemic, with that resistance continuing even after the pandemic had begun. Similarly, it is a mistake to assume our 75-year run of luck in avoiding nuclear catastrophe will not run out, and clearly governments are not doing everything they can to head off nuclear conflict in the not too distant future.

As COVID-19 should also make abundantly clear, investors and the broader financial and business communities, along with academia and all corners of civil society, must not rely on governments alone to head off major potential catastrophes like pandemics, nuclear conflict, and climate change.

In this report, we have focused largely on the private sector, which could bring to bear vast resources, capacity for innovation, and influence in order to help prevent a nuclear conflict. But action has thus far been inadequate, almost non-existent.

Larger, mostly publicly-traded, companies must begin paying more attention to how their behaviors increase the risks of nuclear conflict and/or how they might implement new products or practices to actually lessen such risks. ESG investors need to help drive this change by instituting greatly expanded screens for how companies' operations and behaviors impact the likelihood of a belligerent nuclear detonation ever taking place. In this report, we tried to get the ball rolling by suggesting potential screens for a range of industries. We hope the ESG investment community, SASB, publicly-traded companies, and other stakeholders will work together to refine these screens and then implement them, so that a change in behavior can begin to occur.

We feel that the investment community and broader financial and business communities should all use their influence in certain capitals of the world to press for changes in policy to reduce risk, particularly where such changes are in-line with the beliefs and wishes of the citizenry. In the U.S., we believe that starts with extension of the New Start Treaty with Russia and explicitly prohibiting a U.S. president from being able to unilaterally – without Congressional approval – launch a first-use nuclear strike.

We also believe that the Impact investment community, particularly through investments in smaller and usually private companies/projects, should seek out potential investments that might contribute to reducing nuclear risks while also potentially being able to earn a financial return in the process. We laid out some potential paths of investment to explore, along with some novel financing structures and

[124] https://www.linkedin.com/pulse/changing-world-order-ray-dalio-1f/

strategies. Impact investors, non-proliferation experts, traditional venture capitalists, technologists, venture capitalists, and other innovators must now expand upon our ideas.

This author has spent considerable time over the last twenty years, including currently forgoing a traditional career on Wall Street, trying to warn the investment community about potential catastrophe that could create an incredible loss of life and untold human suffering while bringing down capital markets and the economy. Unfortunately, this author's focus had been on nuclear weapons rather than pandemics. Fortunately, COVID-19, despite all the pain it has wrought to lives, economies, capital markets and the ability to support social causes and the SDG's, is likely not nearly as bad as a nuclear catastrophe could be. Let us take COVID-19 as a warning that we must be proactive in heading off this grave nuclear risk.

Appendix

Novel Financing Sources/Stories Related to Sustainability Criteria

Here, for context, we provide some basics about Green Bonds and a range of other debt instruments used in the sustainable investing community. These instruments have mostly been created in the last few years and are frequently (although by no means exclusively) issued by larger, publicly-traded companies.

We note that these types of instruments can hold appeal for either the ESG or impact investing community. ESG investors that invest in debt often have an appetite for these types of issues.

Impact investors can also be attracted to Green Bonds and these other types of debt instruments where the proceeds are generally earmarked for specific purposes intended to create a positive social change. In many ways, it can be easier/be a bigger opportunity set to invest in these types of instruments when investing for impact in larger, publicly traded companies than it is to invest in the equities of these companies for impact. This is because many larger, publicly traded companies frequently need to raise more debt in order to rollover existing debt maturities, but they may not need to raise more equity often or, if they do, there is less precedent for such proceeds being earmarked for an environmental or social purpose.[125]

In the body of this report, we have suggested how certain of these instruments, such as Transition Bonds, could be used to finance change in the nuclear space. We would ask readers to think of other ways these various instruments might be used to incentivize innovation in reducing nuclear risks.

"Green Finance" - Green, Social and Sustainable Bonds[126]

- Green Bonds – a debt offering where the proceeds target climate or other environmental benefits.
- Social Bonds – a debt offering where the proceeds target social projects to, for instance, benefit disadvantaged populations.
- Sustainable Bonds – a debt offering where the proceeds target a combination of environmental and social causes.
- These bonds can be issued by private companies, public entities (countries, municipalities, etc.), or multilateral institutions (e.g. International Finance Corp, a sister organization of the World Bank). Many publicly-traded companies, including the likes of Starbucks, have issued these types of bonds with the proceeds targeting specific projects that quality under the Principles (see next bullet) or similar criteria.
- The International Capital Markets Association issues the Principles for Green, Social and Sustainable Bonds. The Principles are a set of voluntary process guidelines around the Use of

[125] Again, though, this is not to say that impact investments cannot be made into publicly-traded equities, particularly companies specifically associated with sustainability (e.g. clean energy companies, companies whose products are focused on increasing customers' efficiency in terms of water use, etc.)

[126] Definitions sourced from the International Capital Markets Association, Municipal Securities Rulemaking Board, and Climate Bonds Initiative.

Proceeds, Process for Project Evaluation and Selection, Management of Proceeds, and Reporting.[127,128] Not all such bonds in the marketplace follow the Principles.

- Types of each of these bonds:
    - Standard Use of Proceeds Bond: a standard recourse-to-the-issuer (i.e. the issuer itself is on the hook) debt obligation aligned with the Principles.
    - Revenue Bond: a non-recourse-to-the issuer debt obligation (i.e. the issuer itself is not on the hook) aligned with the Principles in which the credit exposure in the bond is to the pledged cash flows of the revenue streams, fees, taxes etc., and whose use of proceeds go to related or unrelated project(s). Revenue bonds should not be confused with revenue-based financing.
    - Project Bond: a project bond for a single or multiple Project(s) for which the investor has direct exposure to the risk of the project(s) with or without potential recourse to the issuer, and that is aligned with the Principles.
    - Securitized Bond: a bond collateralized by one or more specific project(s), including but not limited to covered bonds, ABS, MBS, and other structures, and aligned with the Principles. The first source of repayment is generally the cash flows of the assets.
    - Environmental Impact Bond (EIB): according to the MSRB, this is a bond that pays a return to the investor based upon how successful the project is toward meeting its goals. EIBs are often issued to finance experimental or unproven technologies and are a way for issuers and investors to share the risks and rewards of undertaking a project, as well as testing whether it will be effective at solving the environmental problem. EIBs are typically smaller in amount and privately placed.

Additional types of 'green finance' and Other Novel Debt Instruments

- Green, Social and Sustainable instruments can also be in loan form rather than bond firm [loans have various differences from bonds including that loans are often financed by banks, are more likely to be indexed to some floating rate like LIBOR, etc.]

- Sustainability-linked loans (SLL's), aka positive-incentive loans – the proceeds of such loans are usually for general corporate purposes as opposed to being earmarked for a particular sustainability goal. However, the terms of the loan such as the interest rate are linked to the corporation's performance on certain sustainability measures.[129] Example include:
    - CMS – according to Bloomberg, it was the first U.S. company to obtain a revolving credit line that offers lower interest rates if the utility meets sustainability goals, including carbon-reduction and renewable-energy targets.
    - JetBlue - issued sustainability-linked loan for which the interest rate is linked to JetBlue's ESG score according to a third-party provider of ESG research.[130]

[127] Recommended templates and other resources are available at the Resource Centre at https://www.icmagroup.org/green-social-and-sustainabilitybonds/resource-centre/.

[128] For green/climate-related bonds, the other international recognized set of standards is the Climate Bond Standard and Certification framework and the Climate Resilience Principles which it helped set. These are used by issuers, investors and other market participants to, among other things, assess whether a project contributes to addressing climate change.

[129] Loan Market Association

[130] https://www.marketwatch.com/press-release/bnp-paribas-and-jetblue-partner-to-close-first-sustainability-linked-rcf-for-the-airline-industry-2020-02-24

- Global Innovative Finance Team (GIFT) – part of the International Federation of Red Cross and Crescent Societies (IFRC) – works on innovative financial solutions to help the IFRC meet its humanitarian goals. One of the ways it's doing this is by sponsoring the world's first pure-volcano catastrophe bond that would pay out to the humanitarian organization based on the occurrence of a volcanic eruption (potentially only at certain volcanoes) that exceeds some parametric trigger measured by, say the column height of ash plume.[131] This would reduce the risk that the humanitarian organization would have the financial wherewithal to deal with the aftermath of such an event.

- Pandemic Bonds - in 2017, the World Bank issued Pandemic Bonds. Basically, they borrowed money that they would not have to pay back unless there were a pandemic meeting certain triggers, including type of virus, number of deaths, number of countries, etc. The rationale for such bonds is that the World Bank needs extra funds available to help low-income countries in the event of outbreaks.[132] The pandemic triggers were met in the spring of 2020 and the funds could therefore be allocated to low income countries dealing with the pandemic.[133]

- COVID-19 Bonds – Governments and other issuers have been issuing so-called COVID bonds with the proceeds earmarked towards dealing with the pandemic.

- Rhino Bonds – As we wrote earlier, the organization Conservation Capital is designing a ~$50 million outcomes-based model whereby a combination of philanthropic capital would be combined with funds provided by impact investors seeking a financial return. The impact investors' receipt on interest and principal would be a function of black rhino population growth in certain areas. Basically, the providers of philanthropic capital are willingly giving more money if the social mission is successful.[134] Philanthropists, impact investors, and others should explore whether there's a nuclear equivalent where philanthropic/concessionary capital and impact capital can be combined. In such a program, the philanthropic/concessionary capital would pay more for success on some criteria of nuclear risk-reduction; the impact investors would be taking a risk in that they do poorly financially if risk reduction is not achieved but do well financially if nuclear risk reduction is achieved.

- In October 2018, for instance, HSBC's Malaysian unit issued a Shariah-compliant SDG bond according to October. Shariah-compliant finance is finance activity that is compliant with Shariah (Islamic) law and the principles of the Muslim religion.

- Transition Bonds – as mentioned earlier, these are controversial and only a handful or two have been sold thus far from large companies. These bonds are essentially issued by "brown" companies trying to find a cleaner way to do business. These include:
    - Hong Kong power producer Castle Peak Power sold an energy transition bond last year;

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131 https://www.artemis.bm/news/red-cross-making-volcano-cat-bond-progress/

132 https://www.euromoney.com/article/b1klyqsykl0d0m/when-will-coronavirus-covid19-trigger-the-world-bank39s-pandemic-bond and https://www.worldbank.org/en/news/press-release/2017/06/28/world-bank-launches-first-ever-pandemic-bonds-to-support-500-million-pandemic-emergency-financing-facility

133 https://www.worldbank.org/en/topic/pandemics/brief/fact-sheet-pandemic-emergency-financing-facility

134 https://www.ft.com/content/2f8bf9e6-a790-11e9-984c-fac8325aaa04

- Marfrig, a Brazilian beef producer, committed to use it transition bond proceeds to only buy cattle from suppliers that had signed up to not destroy more rainforest.[135]
- Italian gas company SNAM committed to reduce methane emissions;
- Enel SPA, another Italian energy company, offered bonds that would increase in cost if the company missed a renewable energy target.[136]
- Cadent, a British pipeline company, committed to reduce methane leaks.[137]

Incubators vs. Accelerators

Here we provide some basic aspects of incubators and accelerators. It is important to recognize, however, that there probably fewer pure incubators than accelerators, that many entities fall somewhere in between or combine the features of the two, and that many market participants often use the terms inconsistently.

Incubator

- Often a non-profit – for example, a university hoping to commercial a technology or government organization trying to incentivize economic development or something for the social good.
- Often does not take equity.
- Focuses on coaching projects that are early stage before the technology and/or business plan is fully developed. Could require help putting leadership team in place, developing the business plan, etc.
- May provide a mentoring network, consisting of industry professionals.
- Usually offers co-working space.
- Timeline often open.
- Provides very limited funding (~$500 - $25K).

Accelerator

- Helps to accelerate/grow an already existing business.
- Provides more funding than an incubator but still limited, usually $250K or less and $120- $150K at some of the major accelerators.
- Provides a big mentoring network consisting of industry professionals.
- A cohort of entrepreneurs enters together and it's usually a regimented program that runs for several months.
- Only a few percent of applicants normally accepted to the very top accelerators.
- Very focused on the quality of applicants' management team including (depending on the business) both the technical and business/operational talent.
- Accelerator could be for-profit or non-profit (the same goes for the project being accelerated).
- For profit accelerators usually take an equity stake (6 – 10% is frequent).
- Helps entrepreneurs perfect their pitches for prospective funders.
- Exposes the project to VC's to hopefully provide financing.

[135] Reuters
[136] Bloomberg
[137] Wall Street Journal June 29, 2020; page B11.

Background on Structures for Non-profit and For-profit Initiatives

- 501c3 – an entity, corporate or otherwise, that is recognized by the IRS as being tax exempt because of its nonprofit purpose/charitable programs. All the money generated, either through revenues or donations, is used to meet the organization's objectives and keep it running. Donations are also tax-exempt for donors. This is a common non-profit structure in the industry, but there are many others inside and outside the U.S. Groups that lobby and/or perform various forms of advocacy may fall under 501c4.
- Corporation/Limited Liability Company/Partnerships – these are some basic entity types for for-profit business and there are multiple types of each. Each has different attributes in terms of shareholder structure, exposure to potential legal liabilities, tax attributes, etc. Many investment funds are structured as partnerships, with the general partner (GP) being the management organization running the fund/investing the funds and receiving a management fee and/or percentage of the returns. The limited partners (LP) provide outside capital for the fund; they have limited role in the day-to-day operations of the fund.
- Benefit Corporation – "A class of [for-profit] corporation that voluntarily meets higher standards of corporate purpose, accountability and transparency. The major characteristics of the benefit corporation form are: 1) a requirement that a benefit corporation must have a corporate purpose to create a material positive impact on society and the environment; 2) an expansion of the duties of directors to require consideration of non-financial stakeholders as well as the financial interests of shareholders; and 3) an obligation to report on its overall social and environmental performance using a comprehensive, credible, independent and transparent third-party standard. The enacting state's benefit corporation statutes are placed within existing state corporation codes so that the enacting state's existing corporation code applies to benefit corporations in every respect except those explicit provisions unique in the benefit corporation form."[138]
- B-Corp – A benefit corporation or any other type of for-profit entity – for example, a partnership - that is certified by B Lab. B Lab is a non-profit organization which created and awards the B Corporation certification to for-profit organizations – sort of a Good Housekeeping Seal of Approval indicating that it meets higher standards of transparency, accountability, and performance.[139,140]
- Social Enterprise – an organization or initiative that marries the social mission of a nonprofit or government program with the market-driven approach of a business; social enterprise refers to a business model, B Corp refers to a certification, and (public) benefit corporation refers to a legal incorporation type."[141]

While the previous structure types are not meant to be exhaustive and there are various permutations of these types of entities, the important takeaway is that there are wide range of structures for non-profit and for-profit initiatives. They can also be combined in order to achieve the desired goals from a legal and tax perspective. For instance, a holding company that wants to serve as an incubator for startups could be structured as a non-profit, while any investment partnership investing in the startups and/or the startups themselves could be structured as for-profit entities. As an aside, in order to maximize tax efficiency for, say, a for-profit Fund partnership, it is important to be aware of where LP's are located and what their preferences may be before determining the domicile of the fund.

[138] Impact Management Project.
[139] Ibid.
[140] https://consciouscompanymedia.com/sustainable-business/whats-the-difference-between-a-b-corp-and-a-benefit-corporation/
[141] https://socialenterprise.us/resources/news/b-corps-public-benefit-corporations/

The Basics of Crowdfunding

- The use of small contributions of funds from many individuals in order to finance a new business venture.
- Creator/Company/Campaigner/Fundraiser – the entity trying to raise funds.
- Backers/Funders/Participants/Crowds – the folks providing the funds.
- On some crowdfunding platforms, if the campaign falls short of its fundraising goals, the funds are returned to backers. On other crowdfunding platforms, the creator can still get access to the funds.
- Major Types:[142]
    - Rewards-based crowdfunding where the backers can get access to the product being created (i.e. they're essentially pre-ordering a new product) and/or special rewards. The projects on these sites can be for-profit (with a socially-mission or not) or non-profits. Examples include Kickstarter and Indiegogo.
    - Sites focused on patrons providing ongoing support for someone's work, whether that person is an artist, some professional doing important socially-minded work, or something else. Examples include Patreon, where the support is for the person rather than geared towards a specific project or entity like it might be for Kickstarter and Indiegogo.[143] Similar to those other sites, though, rewards can also be offered on Patreon.
    - Sites focused on personal causes like the need to fund medical expenses or a funeral. These include GoFundMe.
    - Peer-to-peer lending where backers lend money but get a below-market interest rate back, often zero percent. Kiva is the biggest. European sites include BabyLoan and Lendahand.
    - Equity crowdfunding where backers can get equity ownership in the venture. Equity crowdfunding is regulated by the Securities and Exchange Commission (SEC).

We dive into some greater detail on the following few pages.

Kickstarter[144]

- There are many types of projects funded on Kickstarter, with backers being able to make a pledge of as little as $10 and receive nothing in return. Sometimes Kickstarter and Indiegogo are termed "donation"-based models and much of the projects are purely supported by donations, but in many cases the money being raised on Kickstarter and Indiegogo is actually "reward"-based – i.e. if the pledge is above some certain threshold, the backer is entitled to a reward in terms of receiving the actual product being made, along with potentially some fringe benefits (e.g. a special model of the product, a free t-shirt, etc.).
- Doesn't allow equity crowdfunding.
- Projects can be non-profit or for-profit, with the latter usually not having any sort of social mission. "While nonprofits are welcome to launch projects on Kickstarter, projects can't promise to raise funds to donate to a charity or cause. Funds raised on Kickstarter must go towards facilitating the project outlined by the creator on the project page."

[142] Business Daily, Investopedia, and the websites of the various crowdfunding sites named.
[143] https://blog.patreon.com/patreon-kickstarter-indiegogo
[144] Kickstarter.com

- Only releases funds after the campaign has reached its funding goal.
- Kickstarter charges fees only on projects that reach their full funding target. Those fees are 5% plus any fees from Kickstarter's payments partners, i.e. credit card companies (3% plus $0.20 per pledge for any pledge over $10).
- Backers make their pledge but can cancel it at any time except for the last 24 hours of the campaign. Keep in mind that this puts the creator at some risk.
- Kickstarter points out it is not a store, that it is up to backers to investigate the projects and assess the risks and that Kickstarter does not issue refunds. Kickstarter emphasizes that the contract is really between the creator and the backers and that they need to work things out. Kickstarter provides some Terms of Use that everyone agrees to, including that the creator is "responsible for completing the project and fulfilling each reward to the best of their abilities" and that if they cannot that they "offer to return any remaining funds to backers who have not received their reward (in proportion to the amounts pledged), or else explain how those funds will be used to complete the project in some alternate form".
- There have been quite a number of nuclear-related projects on the site over time, including documentary and fiction films, card and board games, music, etc. Many of the films are about nuclear power, uranium mines, Fukushima and Chernobyl, etc. Many past films were not successful in raising funds but that also should not be particularly surprising. In addition to the challenges of raising enough funds for a quality film, particularly for a feature fictional film but also for a full-length documentary, is the issue of distribution. It's a bit of a chicken-or-the-egg scenario but it's generally important to have distribution lined up before going into production.
- Our sense is that something like a high-profile art project/installation[145] might garner better support on the likes of Kickstarter and Indiegogo than would something like a movie.

Indiegogo

- Similar to Kickstarter in many ways but with a little more flexibility for general fundraising for non-profits (i.e. the fundraising doesn't have to lead to a specific product or event from the non-profit).
- For personal causes (e.g. to fund a funeral or medical expenses), they refer people over to GoFundMe. Indiegogo had been involved in equity crowdfunding for a while but seems to have exited that segment.
- Allows the campaigner to receive funding "pro rata" or to wait until the funding goal is hit. Provides greater flexibility for campaigner but is higher risk for the backer.
- Fees – 5% platform fee plus credit card fees of 2.9% - 3.0% + $0.30 per transaction (if in dollars). There are no fees on Fixed Funding campaigns that don't meet their goal.
- After your crowdfunding campaign, you can extend your fundraising with their InDemand feature.
- Same conclusion as Kickstarter with respect to what types of nuclear projects might work.

KIVA and GoFundMe

- Through Kiva, the crowd can make micro-loans, usually with a zero percent interest rate. Kiva is a large platform, but generally used to fund overseas micro-loans in developing countries. It also

[145] While not financed on a crowdfunding platform, we point you to this article on an inflatable mushroom cloud installation as the type of project that might be well-suited for crowdfunding: https://thebulletin.org/arts-initiative/

serves the U.S. but the loans are small on average – only $5,000. It can be used for loans to for-profits or non-profits, but probably not a particularly suitable site for raising funds for nuclear-related issues.

- GoFundMe is very focused on donations for personal causes such as medical expenses and for funerals. Funds can also be raised for non-profits, but we haven't noticed any nuclear-oriented campaigns have had success on the site and Kickstarter and IndieGoGo may be better avenues for any nuclear-related issues.

Equity Crowdfunding

- Backers are investing for equity ownership in a for-profit business.
- Some sites, like AngelList, serve predominately accredited investors (individuals earning>$200K per year, couples earning >$300K per year, or individuals with >$1 million in net worth, excluding primary residence) and with higher minimum investments.
- Per the Jobs Act of 2012, in 2016 legislation went into effect making it possible to offer equity crowdfunding to non-accredited investors. Wefunder is one example of an equity crowdfunding site that has offerings for non-accredited investors (Reg A+ and Reg CF [Crowdfunding]) and additional offerings for accredited investors (Reg D). Wefunder's fees depend on the type of offering.
- Positives for startups include that these sites provide one more potential source of funds, while negatives include the additional complexities of dealing with many investors and meeting all the SEC requirements plus legal requirements of the crowdfunding site. Equity crowdfunding is worth studying further for any for-profit projects that can realistically offer solid financial returns (even if it requires some sort of concessionary capital/blended finance approach in order to try to catalyze that commercial, financially-driven, capital).
- Before doing anything with Equity Crowdfunding it is important to be aware of all the legal and tax issues and to solicit the advice of professionals (this author is not an attorney or accountant). For instance, from a tax perspective, it may be important to avoid frontloading revenues with expenses coming in a later year.[146,147]

'Regulation Crowdfunding' (Reg CF)

- Title III of the 2012 JOBS ACT established crowdfunding provisions that allowed U.S.-incorporated business (with primary place of business in the U.S. or Canada) to sell equity or debt securities to the masses. Previously there were much greater restrictions on how securities could be marketed and whether they were available to non-accredited investors.
- A few years later, the Securities and Exchange Commission (SEC) adopted **Regulation Crowdfunding (Reg CF)** to implement these crowdfunding provisions.
- Crowdfunding Portals and broker-dealers that are registered with the SEC and are members of the financial industry self-regulating body Financial Industry Regulatory Authority (FINRA) may sell securities on behalf of issuers to the investing public using crowdfunding. There were approximately four dozen such crowdfunding portals as of November 2019 and many times that number of broker-dealers.

[146] smallbiztrends.com/what-is-crowdfunding by Gail Gardner 08/6/19
[147] https://www.moneycrashers.com/equity-crowdfunding-sites-investors-entrepreneurs/

Limits on How Much People Can Invest (as of May 2017, but these figures will adjust slightly with inflation)

- If *either* your annual income *or* your net worth is less than $107,000, then during any 12-month period, you can invest up to the greater of either $2,200 or five percent of the lesser of your annual income or net worth.
- If *both* your annual income *and* your net worth are equal to or more than $107,000 then, during any 12-month period, you can invest up to 10 percent of your annual income or net worth, whichever is less, but not to exceed $107,000.

Other Factors

- As might be expected with any investment into a private company, liquidity on the securities could be extremely limited. There are also generally restrictions on the transferring of securities during the first year.
- The maximum that can be raised is ~$1.1 million.
- The size of the offering and whether it is the first time the issuer is offering securities determine whether the financial statements need to be reviewed by an independent public accountant, need to be audited, etc. There are also additional disclosure and reporting requirements.[148]

<u>Other Types of Private Securities Offerings</u>

- Title IV of the JOBS ACT enabled Reg A+ offerings, which. Like Reg CF, it is open to non-accredited investors. Some of the differences, though, include:
    - Reg A+ has somewhat different disclosure, reporting and registration requirements than Reg CF, including that Reg A+ offerings must be "qualified" by the SEC before the issuer may begin selling the securities.
    - Under a Tier 1 offering, a company can raise up to $20 million in any 12-month period.
    - Under a Tier 2 offering, a company raise up to $50 million in any 12-month period. Unlike for the Tier 1 offering, a purchaser cannot investor more than 10% of their net worth unless the investor is an accredited investor or the securities will be placed on a national exchange upon qualification.

- Reg D offerings existed prior the JOBS ACT but there were also updates made to it per the JOBS ACT.
    - A pre-JOBS version of Reg D still exists as Rule 506 (b). It allows issuers to conduct a private offering to a mix of accredited investors and up to 35 non-accredited investors. The offering cannot be advertised generally/investors solicited generally.
    - The updated version of Reg D, which is Rule 506 (c), allows advertising to / soliciting to the general public, subject to certain conditions. Only accredited investors are permitted to purchase the offering, though.
    - There are no limits to the amount than can be raised in Reg D offerings.
    - There are different disclosure, reporting and registration requirements for Reg D offerings relative to Reg CF and A+ offerings and different restrictions in terms of selling shares.
    - Reg D Rule 504 was updated with the JOBS act, increasing the amount that could be raised from $1 million to $5 million. Offerings done per Rule 504 are much more infrequent than those done through 506 (b) or 506 (c) but can still make sense if looking

[148] https://www.finra.org/investors/alerts/crowdfunding-and-jobs-act

to raise less than $5 million and wanting to target non-accredited investors, but within a very limited number of states.[149]

Lobbying for Change on Major Nuclear-related Laws, Policies, and Treaties

Earlier we discussed how we believed the investment community should require nuclear weapons manufacturers, for instance, to provide greater transparency about their lobbying activities.

Here we want to discuss lobbying from a different angle; we believe that the investment community and broader financial and business communities should lobby for changes in certain laws and policies and on certain treaties in order to reduce the threat of nuclear weapons.

For one, we believe that market participants should use their resources to help pass proposed legislation that would alter the U.S. President's ability launch a first-use nuclear strike without Congressional approval. A first-use nuclear strike is one that is not preceded by any sort of verifiable nuclear attack against the U.S. Another priority should be extension of the New Start Treaty with Russia.

Clearly there are other actions that the non-proliferation community and others in civil society believe that the U.S. government, among others, should take to reduce nuclear risks. These include a blanket policy of no-first-use even if Congressional approval were forthcoming, limits on new tactical (smaller payload) nukes, and a range of other measures. We agree with many of those views and would be happy to see further debate on and movement to address some of those risks. However, we home in on no-first-use without Congressional approval and extending the New Start Treaty not only because we think they are two very important and timely actions but because we think there would be wide support for them among American voters and American allies in addition to support from the non-proliferation community.[150]

Some folks will argue that these are political matters and that such matters should be left up to voters in terms of who they put into office. However, the investment community and broader financial and business communities lobby regularly on a range of issues that benefit their enterprises individually or collectively, and by extension their shareholders. If enterprises of all stripes can lobby on issues in their own interests, sometimes hurting society in the process, we believe they should also be able to lobby for a change in law that not only benefits them and their shareholders, but also all their stakeholders and broader society, by reducing the nuclear risk to the global economy and capital markets. The law as it exists today greatly imperils the global economy and capital markets.

We believe that such lobbying is consistent with corporate social responsibility/stakeholder capitalism. Companies can also do this lobbying through broad industry groups in order to avoid recrimination from anyone in the U.S. government being targeted at them individually.

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[149] https://www.sec.gov/smallbusiness/exemptofferings/rega
https://www.sec.gov/fast-answers/answers-rule506htm.html
https://blog.colonialstock.com/equity-crowdfunding-chart-comparison/
https://ithinkbigger.com/rule-504-need-know/

[150] We think that many in the non-proliferation community feel that a blanket policy of no-first-use (even with congressional approval) is even more important than no-first-use with congressional approval, however, we do not think that support from American voters or American allies would be as strong for the former.

Background on First-Use Without Congressional Approval

Again, the potential for a U.S. president to order a first-use nuclear strike against an enemy - whether that be Russia or, somewhat more likely, North Korea or Iran or another future hotspot - without first receiving Congressional approval is more power than any single individual should have. Although the power to declare war officially resides with the U.S. Congress, there has been a long trend of Congress ceding authority and the executive branch claiming greater authority in terms of the use of military force.

Regardless of one's interpretation of the precise requirements for a U.S. president to launch a first-use nuclear strike without Congressional approval, clearly there are many grey areas and the president has significant flexibility and authority on their use. It is also not clear whether any legal restrictions on presidential first-use authority, be they from Congress or relating to international humanitarian law, would be considered or respected by a U.S. president, his advisers, and those implementing the strike order, even if such order were unambiguously illegal.[151] This state of affairs just compounds the risks of nuclear catastrophe.

Strengthening the laws and procedures now to restrict such presidential power should not be thought of as a referendum on whether Trump is a good president or on his stances on defense, immigration, regulations, tax reforms, the economy, trade, or anything else. Rather, as should be recognized by even most Trump supporters, it would just be a referendum on whether we, generally, want such power to reside with a single person, including the question of whether Trump can be trusted with such responsibility. Regardless of people's views of Trump as a President, his impulsiveness, narcissism, and governance through Twitter[152] make this a particular dangerous state of affairs.

Importantly, while we think Donald Trump in the White House brings this risk to the fore, this is about more than Trump. It bears repeating the following from the beginning of this report: As author Garrett Graff notes in a 2017 Politico article, in the final days of Nixon's presidency when he seemed depressed and was drinking heavily, Defense Secretary James Schlesinger ordered that if the president gave any nuclear launch order that military commanders should first check with Schlesinger or Secretary of State Henry Kissinger before executing them.[153] Graff writes that Nixon had stoked fears when, among other things, he had reportedly said to a congressman that "I can go in my office and pick up a telephone, and in 25 minutes, millions of people will be dead".

Of course, Nixon must have also stoked fears a few years earlier in 1969 when, if the allegations are accurate, the drunken president had actually ordered that a nuke be dropped on a North Korean airstrip. The year was 1969 and North Korea had just fired a missile at a U.S. Navy reconnaissance plane, killing all 31 crew members. In his 2000 book "The Arrogance of Power: The Secret World of Richard Nixon," author Anthony Summers writes that the CIA's top Vietnam specialist, George Carver, "reportedly said" that ""Nixon became incensed and ordered a tactical nuclear strike... The Joint Chiefs

[151] https://media.nti.org/documents/The_President_and_Nuclear_Weapons_Authorities_Limits_and_Process.pdf, p 19.
[152] It has always been obvious that President Trump is, at the end of the day, going to tweet what he wants, even if his advisors advise otherwise. However, it is particularly notable, in our view, that Trump sent out a tweet congratulating the state of Kansas after the Kansas City Chiefs won the Super Bowl. If there had been any doubt prior, this seems to indicate that there really is no review process around his tweets; if someone had been reviewing his tweets, they probably would have corrected the President and told him the Kansas City Chiefs are a Missouri team and, because that is non-controversial fact not subject to interpretation or serving any political argument, he clearly would have accepted such a correction before tweeting. What happens if he has a bad dream and sleep tweets?
[153] https://www.politico.com/magazine/story/2017/08/11/donald-trump-nuclear-weapons-richard-nixon-215478

were alerted and asked to recommend targets, but Kissinger got on the phone to them. They agreed not to do anything until Nixon sobered up in the morning." Fortunately, no new nuclear strike went ahead.[154]

Unfortunately, though, there will assuredly be additional future instances of presidents suffering from poor judgment, intoxication, and or mental impairment. Without maligning all that Reagan achieved with Gorbachev in terms of stepping back from the nuclear brink, there has long been speculation that he demonstrated some mental impairment, at least intermittently, while in office. [155] As presidents tend to win their office later in life, he certainly won't be the last to demonstrate some of the effects of age. We don't think it's ageism, and it's certainly not a slippery slope, to highlight that the next president, Republican or Democrat, will be as old or even older than Reagan, at anywhere between their late 70's and mid 80's before leaving office. [156]

The risk of the largely unchecked power of a U.S. President to launch a first-use nuclear strike without Congressional approval clearly did not just start with Trump and, if the law is not changed, will not end with Trump. It is also not just about the U.S. There are certain other nuclear powers where a nuclear weapon could a nuclear weapon could be launched without any real collective deliberation.[157]

We think the growing prevalence of cyberterrorism, deepfakes, and global disinformation campaigns only magnifies the risks posed by the sole launch authority possessed by certain leaders and the hair trigger status of certain nukes.

Among other things, just knowing that a U.S. nuclear launch would require Congressional approval may mean all the difference in terms of how a foreign power interprets and responds to the data if and when it is next subject to a false alarm that it is under nuclear attack from the U.S.

Markey-Lieu

A bill exists on this subject. On January 29, 2019, Senator Ed Markey and Representative Ted Lieu and, both Democrats, reintroduced a bill – "Restricting First Use of Nuclear Weapons Act of 2019". This bill states that "Notwithstanding any other provision of law, the President may not use the Armed Forces of the United States to conduct a first-use nuclear strike unless such strike is conducted pursuant to a declaration of war by Congress that expressly authorizes such strike."[158] The bill had originally been introduced a couple years earlier. Neither time did the bill make it out of committee.

We believe the investment and broader financial and business communities should do their part to investigate then help move forward this bill or some other means of reining in presidential power on this issue, whether that be through some other legal mechanism or middle ground solution. An example

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[154] The Arrogance Of Power: The Secret World Of Richard Nixon, by Anthony Summers, with Robbyn Swan, published by Gollancz. Copyright Anthony Summers 2000.

[155] https://abcnews.go.com/Health/MindMoodNews/ronald-reagan-alzheimers-presidency/story?id=12633225

[156] We do not think it is ageism because there are clearly physical changes with age. Just as there is a correlation with susceptibility to the coronavirus and age, there is a correlation between dementia, which is caused by physical change in the brain, and age. We think it is rational policy to require checks and balances on what is arguably the most impactful decision that any leader could make. This author also believes that anyone who is confident that dementia would be recognized early enough to head off any ill-dated decision by a U.S. President has probably not witnessed the onset of dementia firsthand.

[157] https://www.nonproliferation.org/wp-content/uploads/2019/02/Finger-on-the-Nuclear-Button.pdf, p. 34

[158] https://www.congress.gov/bill/116th-congress/house-bill/669/text

of the latter might be to not require full Congressional approval but rather require just a handful of members from both sides of the aisle sitting on key committees.

Importantly, we believe that any effort would not run afoul of the views of Americans, who support a change in policy. A very detailed 2019 survey conducted by the University of Maryland's School of Public Policy indicates that 68% of voters "support Congressional legislation requiring that to use nuclear weapons first, the President would first have to consult Congress and it would have to issue a declaration of war on the country to be attacked with nuclear weapons". This includes 59% of Republicans, 73% of Independents, and 74% of Democrats.[159]

New Start Treaty

As we mentioned earlier in this report, the New Start Treaty between the U.S. and Russia, which limits their arsenals and contributes to transparency (through inspections and information sharing), expires in 2021. At this point there is significant risk that it will not be renewed. While Russia is currently indicating a willingness to extend it, it has also given many mixed signals, and the U.S. is somewhat uncomfortable that, among other things, the treaty does not cover China – a rising adversary.

Ultimately, we think there is broad consensus that it is critical that this treaty get extended. We think the investment community and broader financial and business communities can get behind it because it reduces the risks of nuclear catastrophe and all the risks that would entail for the global economy and capital markets. We also believe that extending it reduces what the U.S. might otherwise spend on nukes, which, all else equal, frees up spending for other initiatives that are so important to the global economy and capital markets (e.g. pandemic preparedness, which the coronavirus has made apparent as being currently insufficient).

Per the aforementioned University of Maryland survey, 82% of Americans support extending the New Start Treaty, including 89% of Democrats, 74% of Independents, and 77% of Republicans.[160]

[159] https://spp.umd.edu/sites/default/files/2019-07/Nuclear_Weapons_Report_0519.pdf; pp. 4, 24.
[160] https://spp.umd.edu/sites/default/files/2019-07/Nuclear_Weapons_Report_0519.pdf; p. 8.