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# THE GLOBAL FUTURE OF NUCLEAR ENERGY

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## THE REVISED AMERICAN PROMISE – CLIMATE CHANGE GOALS REIMAGINED

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In declaring his intent to withdraw the United States from its role in the Paris Agreement in June 2017, President Donald Trump sent a signal to the rest of the world that the administration's outlook on the realities of climate change were in direct conflict with the opposing views held unanimously by all other nations on earth. However, in the months that followed the withdrawal, it became rapidly clear that an overwhelming majority of Americans did not share those views on climate change and further, that they would actively reject the proposal to sweep the issue under the rug (Figure 1). In an unprecedented wave of enthusiasm for reaching—and in some cases, surpassing—previously established emissions-related goals, states, cities, institutions, businesses, and organizations both large and small, banded together to rebuke the administration's decision to leave the Paris Agreement in a concerted effort to let the rest of the world know: "We Are Still In".<sup>1</sup>

As of today, an amalgamation of over 3,500 organizations, corporations, and U.S. states have now joined force by developing movements aimed at either meeting or surpassing America's previously-established targets in the Paris Accord. As noted in Bloomberg's *Fulfilling America's Pledge*<sup>2</sup> report, these real economy actors wield an astounding financial footprint in that they represent over half of the American population; an economy totaling a staggering \$11.4 trillion. To put that figure into perspective, \$11.4 trillion could also represent the third largest world power's nominal GDP (Figure 2). More importantly, it is estimated that over 35% of annual greenhouse gas emissions are produced by

this slice of the U.S. population.

Therefore, continued real economy action is crucial in order for state-level governments, businesses, and organizations to continue doing their part to tackle the woes of global climate change. Most importantly, a boost in these efforts may ultimately help to spur on technological innovations by highlighting the necessity to expand on public-private partnerships in the energy sector. However, while a rapid expansion of intermittent renewables is a vital—and welcome—component in our collective attempts to curb future emissions, it should be understood that the U.S. and other global leaders can only realistically meet or surpass the goals set forth in the Paris Agreement by implementing an expansion of nuclear energy. In summarizing the recent 2018 MIT study, *The Future of Nuclear Energy in a Carbon-Constrained World*, Study Co-chair, Jacopo Buongiorno declared that their "... analysis demonstrates that realizing nuclear energy's potential is essential to achieving a deeply decarbonized energy future in many regions of the world."<sup>3</sup>

## THE NUCLEAR (ENERGY) OPTION – THE GLOBAL NEED FOR SMART REFORM

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Given the current wave of public opinion trends that continue to hinder a future expansion of nuclear energy<sup>4</sup>, developing and actioning strategies to substantially expand future investments in nuclear power plants is complicated. Further, to cement nuclear energy as the *cornerstone* of a global plan to tackle growing carbon emissions is even more challenging, and would require more than a lukewarm public reception if such a plan were to withstand the rigors of public acceptance. With the public's dwindling trust of energy and utility companies—coupled with their concerns for safety and ballooning energy costs—new public-private partnerships must be developed in order to usher in a more forward-thinking vision for our energy needs. Through necessity, this vision must place reverence on an expansion of nuclear energy. In addition, increased public knowledge and trust of new reactor technologies should serve as the anchor of any plan to boost the possibility of sparking a renewed global embrace and much needed celebration of nuclear energy.

While current public opinion trends hint that nuclear energy within the United States should have a limited, albeit continued space in the future of our grids, these views are largely formed in reaction to unfounded safety concerns regarding the generation 2, and 3 reactors that largely comprise the current fleet today (Figure 3). Furthermore, seeking feedback from a public that are largely uninformed of the needs and immense benefits that nuclear energy provides, is an undeveloped art form at best.

However, as is highlighted in their 2017 *Energy and Environment Poll*, the Center for Energy, Security, & Society gathered data which returned a surprisingly favorable outlook regarding the matter of expanding the current nuclear fleet. While respondents largely remained split on expanding nuclear power plants—whether on pre-existing sites or otherwise—41% did support developing and building new generation small modular reactors (SMR's).<sup>5</sup> While this figure sounds uninspiring at the outset, only a small share of 31% of respondents opposed new generation SMR's, with 28% being unsure (Figure 4). Therefore, it is easy to see that the public are amenable to considering an expansion of nuclear energy if efforts appease the various barriers that have saturated previous efforts.

### **Small Modular Reactors – Scaling Down Size While Optimizing Returns**

New generation small modular reactors (SMR's), propose a striking number of positive attributes. Through offering logistical flexibility—coupled with striking simplicity—SMR's serve as an exciting alternative and/or addition to intermittent renewables, regardless of their geographical positioning. As a pioneer of this breed of technology, NuScale Power became the first company in the United States to make an appearance in the SMR market, and initiated the pre-application process with the Nuclear Regulatory Commission (NRC) in 2008. Moreover, in recent months NuScale became the first SMR manufacturer to complete the Design Certification Application (DCA), phase 1 of the NRC's review.<sup>6</sup> However, it is perhaps the extensive catalogue of accolades and partnership that NuScale Power has developed with the U.S. Department of Energy that merit real spotlight:

*In 2013, NuScale Power was selected as the sole winner of the second round of the Department of Energy's competitively-bid, \$226 million, five-year, financial assistance award to develop nuclear SMR technology, and subsequently in 2015, the DOE awarded a \$16.6 million award to NuScale Power for the preparation of a combined Construction and Operating License Application (COLA) for NuScale's first customer, the Utah Associated Municipal Power Systems' (UAMPS) Carbon Free Power Project (CFPP). In 2018, in a sign of continued support, the U.S. DOE's Office of Nuclear Energy awarded NuScale \$40 million in cost-sharing financial assistance under its "U.S. Industry Opportunities for Advanced Nuclear Technology Development" funding opportunity.<sup>7</sup>*

### **But what are the Benefits of Small Modular Reactors?**

**Safety:** NuScale's SMR is the first self-protecting small modular reactor. Without emergency AC or DC power—or additional water—the design can shut down and self-cool with no action from an operator. Given the

high barometer level of public interest in safety, this is a boon for SMR expansion. Additionally, safety and maintenance instruments—for all twelve incrementally-installed reactors—are accessed via a singular, streamlined control room.

**Simplification:** The current NuScale SMR design incorporates a plethora of pre-assembled components. This will allow for ease in the commercialization process, and will cut down heavily on high labor costs through automation in the factory-build process.

**Size:** Small modular reactors are ideal for appeasing our growing energy needs. SMR's typically produce under 300MWe, while NuScale's new generation SMR caps out at 60MWe. While this figure seems modest, as many as twelve SMR's can be added incrementally on each site producing up to 540MWe, making it an ideal financial solution for myriad economies. In addition, given that no AC/DC power is required for safety mechanisms, the technology can easily be placed on off-grid locations.

## SMALL MODULAR REACTOR PROLIFERATION – A TASK FOR THE ARMED FORCES

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Trust in our institutions continues to present daunting issues for myriad nations; especially while attempting to cement a plan to tackle global emissions. Largely excepting China, the results of the 2018 Edelman Trust Barometer unveil that:

*People's trust in business, government, NGOs and media remained largely unchanged from 2017 — 20 of 28 markets surveyed now lie in distruster territory, up one from last year. Yet dramatic shifts are taking place at the market level and within the institution of media.<sup>2</sup>*

However, the global trust in one pillar of society remains largely unscathed – that of the armed forces. According to a Pew Research Center poll conducted in early 2018, results showed that trust in the military tops those of almost all other institutions in the U.S. and western Europe.<sup>2</sup> For example, trust in the military returned at 84% in France, 82% in the United Kingdom, and 80% in the United States (Figure 5). Therefore, mobilizing a plan to establish nuclear power expansion—by means of small modular reactors positioned

on military bases—seems a possible solution to allow for an expanded military role in our energy needs.

In early August this year, congress successfully included a provision in their 2019 National Defense Authorization Act (NDAA) bill, which allocates future funds to site a test SMR at a Defense Department, or Energy Department facility. NuScale, beating out the competition will happily find a home for its first 12-module SMR plant at Idaho National Laboratories. Therefore, NuScale's new generation SMR will be fully functional by the mid-2020's. This is clearly a public-private partnership model that works, and could become easily replicable at military facilities across the globe given the ease in which many concerns could be mitigated. In addition, by supplementing operations within our military partnerships, we may be able to boost favorable ratings for our most important institution, government. For example:

- Security and proliferation issues would be allayed given the high level of security required on military facilities.
- Modular, offsite factory assembly would mitigate many of the long-term construction concerns and would—again—quell anxieties directed toward security.
- The Department of Defense, or Department of Energy could potentially develop Power Purchase Agreements (PPA's), to offset building and maintenance costs, while ensuring the future longevity of the nuclear energy power plants.
- Supplemental energy production could be filtered into surrounding communities, and in turn provide palatable public financial incentives.
- Furthermore, supplemental energy production can be stored and used for new Emergency Operation Centers (OEC's), developing electric vehicles, modernizing security facilities, or powering new data centers.<sup>1,2</sup>

## GLOBAL REQUIREMENTS – OUR COLLECTIVE MANAGEMENT OF A CLIMATE CRISIS

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In conclusion, it is important to recognize our global responsibilities. Article IV, Section 2 of the Nuclear Non-proliferation Treaty declares that:

*All the Parties to the Treaty undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy. Parties to the Treaty in a position to do so shall also co-operate in contributing alone or together with other States or international organizations to the further development of the applications of nuclear energy for peaceful purposes, especially in the territories of non-nuclear-weapon States Party to the Treaty, with due consideration for the needs of the developing areas of the world.* <sup>11</sup>

Therefore, it is not only financially palatable to engage non-nuclearized states; it is our collective responsibility to assist friendly nations in the hope that they incorporate healthy, safe, accountable, and prosperous nuclear energy components in their energy mix. Given the grave conclusions for the future of our world's climate, no energy source—other than nuclear energy—can be proliferated quickly enough to seize carbon emissions in a satisfactory time span.

Proactive efforts by businesses can be seen appearing all over the globe today. For example: given the United Kingdom's security of supply, carbon emissions goals, and competitive costing, NuScale Power has already commenced discussions with Westminster and in 2017, produced a U.K. action plan in an attempt to shed light on how SMR technology would appease their growing energy needs.<sup>12</sup> An SMR nuclear renaissance is not just an exciting prospect for public-private partnerships in the global market; it is currently the most actionable and socially responsible solution that holds the key to curbing our future emissions, in keeping with our Paris Agreement goals.

# APPENDIX

Figure 1: Washington Post-ABC News Poll: Most American's Oppose Trump's Withdrawal from the Paris Accord. June 2-4, 2017.



Figure 2: U.S. States, Cities, and Businesses Supporting the Paris Agreement Make Up a Large and Growing Footprint – Bloomberg, Fulfilling America's Pledge Report.

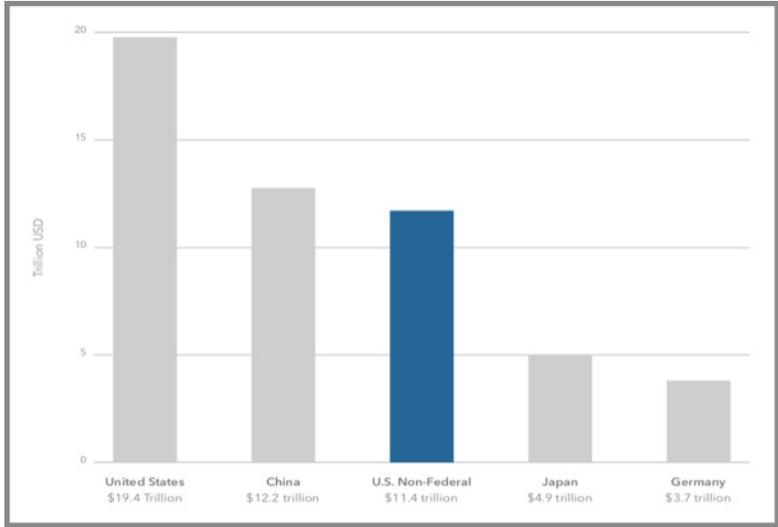


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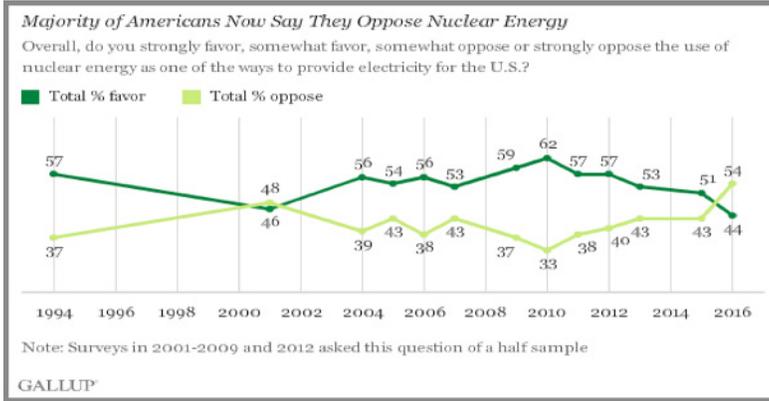


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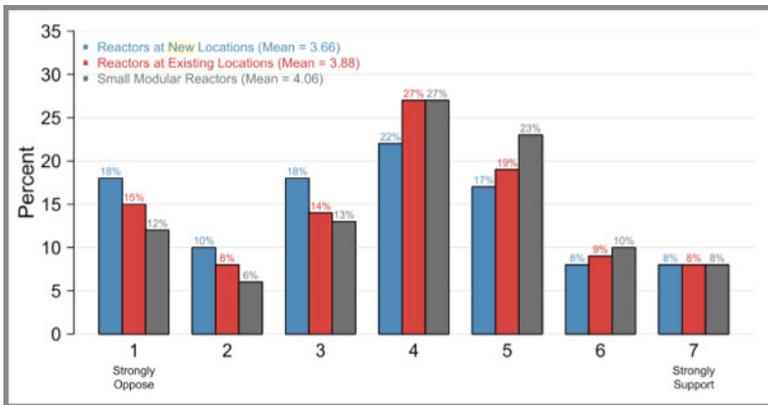
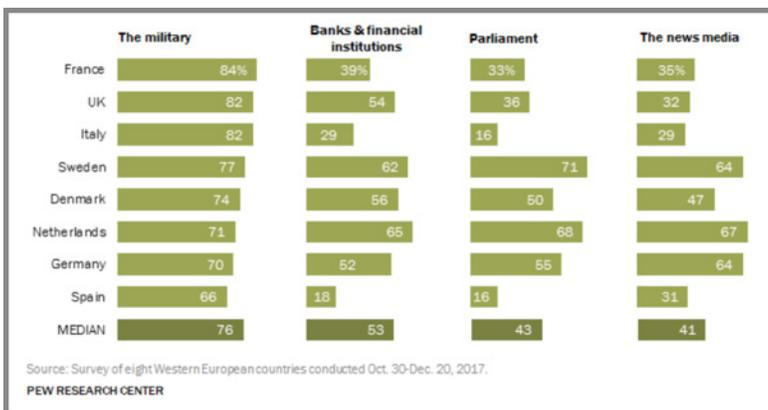


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