

## The Nuclear Revival: Embracing a Clean, Reliable and Safe Source of Energy



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As the world gears up to tackle global warming, renewable energy sources such as solar, wind and hydro power are at the forefront of solutions offered to avert a climate catastrophe. Yet half a century after the environmental case for nuclear power first became clear, it is making a comeback, as a way to fight climate change.

Given the challenges in quickly scaling renewable energy sources like solar, not to mention the increased geopolitical concerns around energy independence, it appears policy makers are finally waking up to the promise of nuclear power. French president Emmanuel Macron recently announced a €1 billion package of funding in support of small nuclear reactors, in addition to a pledge to construct 14 new generation reactors.<sup>1,2</sup> Newly elected South Korean President Yoon Sukyeol is aiming for nuclear to account for 30% of total power generation, a reversal in policy from the previous president.<sup>3</sup> Japan, home to the 2011 Fukushima nuclear accident, recently restarted nuclear capacity.<sup>4</sup>

China intends to build more nuclear reactors over the next 15 years—150 in total—than the rest of the world combined has built over the last 35 years.<sup>5</sup>

Nuclear finally had a “seat at the table” during the recent UN Climate Change Conference in Glasgow<sup>6</sup> and, perhaps most importantly, the European Commission recently ruled that nuclear energy may potentially be included in the EU Taxonomy as a “green” sustainable activity, which may increase project financing for nuclear power.<sup>7</sup>

Public perceptions are changing as well: in 2018, only 37% of Democrats in the U.S. supported nuclear power; now a full 60% do.<sup>8</sup> Who would have predicted a few years ago that Germany’s decision to close down the last of its nuclear power plants would prompt the Washington Post editorial board to proclaim “What a mistake,” earlier this year?<sup>9</sup> This says nothing of the more recent sharp U-turn in attitudes towards nuclear by many European governments as they revisit their reliance on Russian fossil fuels:

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*Next Gen Emerging Markets is a strategy focused on overlooked markets, investing in outstanding businesses.*



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Britain reversed plans to shut down its nuclear plants by 2030, and Prime Minister Boris Johnson announced an aim to increase the nuclear share of electricity from 15% to 25%.<sup>10</sup> Belgium, which confirmed plans as recently as December of 2021 to close all nuclear reactors by 2025, similarly reversed course and decided to extend the life of its nuclear reactors an additional ten years.<sup>11</sup> Below we discuss the benefits of nuclear power, including why we believe public fears are misguided, and how investors can gain exposure to this structural theme. As Lux Capital’s Josh Wolfe has suggested, perhaps a re-branding of this “elemental” power is needed to overcome legacy perceptions.<sup>12</sup> It is time facts—not fear—drive our policy towards fighting climate change. Nuclear is carbon free, more reliable than other renewables, and possesses a strong safety track record, on par with solar and wind energy.

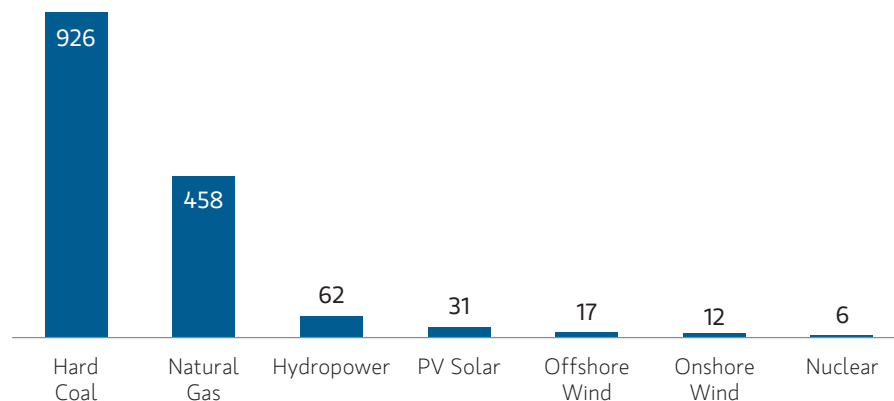
### Nuclear Is Net Zero

Like wind and solar, nuclear energy produces zero direct carbon or GHG emissions. In fact, nuclear has lower GHG emissions than solar and wind when we include not just direct but indirect—or Scope 3—emissions over its lifecycle (*Display 1*). Over the past 50 years, nuclear power has reduced CO<sub>2</sub> emissions by more than 60 gigatons, which is almost two years’ worth of global emissions.<sup>13</sup> Unlike solar and wind, nuclear has a proven track-record for historic decarbonization: three of the five fastest declines in the carbon intensity of energy occurred in countries that embraced nuclear power (*Display 2*).<sup>14</sup>

### Nuclear Is Reliable

Our energy system requires redundancy and reliability that is hard to achieve with renewables alone.

**DISPLAY 1**  
**Nuclear Lifecycle GHG Emissions Lower Than Wind or Solar**  
 Grams of CO<sub>2</sub> eq. per kWh of electricity



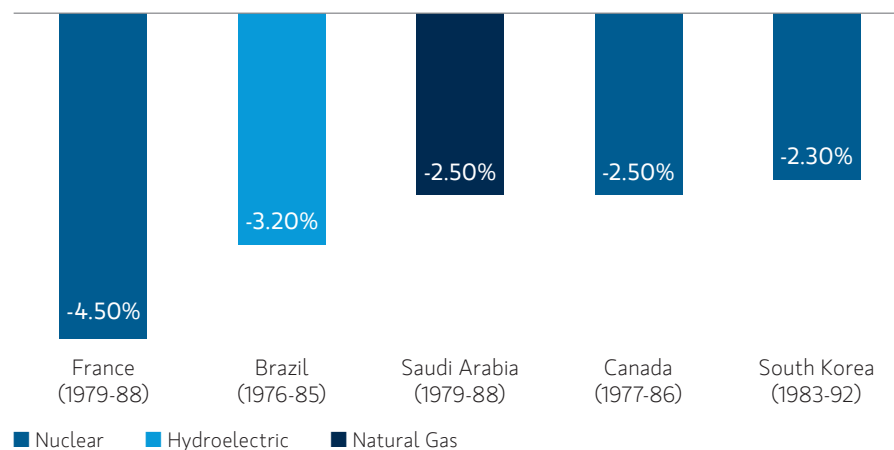
Source: UN Economic Commission for Europe, 2021, “Life Cycle Assessment of Electricity Generation Options”.

Although solar, wind and hydro have a carbon footprint similar to that of nuclear, they are much less reliable, given their dependence on weather conditions and seasonal cycles that limit consistent use. While battery technology is improving, wind and solar are not reliable “baseload” energy sources.

Nuclear power is currently the only carbon-free energy source that can reliably deliver electricity, day or night, to service providers like

hospitals or data centers 24/7, as illustrated by a higher capacity factor (92%) than any other energy sources including solar (25%), wind (35%) and natural gas (57%).<sup>15</sup> Nuclear plants also have a relatively small land footprint. For example, plants in Germany require 500x less land than solar and 415x less land than wind,<sup>16</sup> a factor which has recently caused “Germans to fall out of love with wind power,”<sup>17, 18</sup> given land constraints and NIMBY opposition.

**DISPLAY 2**  
**Nuclear Can Drastically Alter Carbon Footprint**  
 Five fastest declines in energy intensity of carbon



Source: The Breakthrough Institute (December 17, 2018). Retrieved from <https://thebreakthrough.org/issues/energy/the-green-new-deal-and-the-legacy-of-public-power>.

## Nuclear Is Safe

Despite being carbon free, with a proven track record for historic decarbonization, nuclear power's share of the global primary energy mix remains unchanged since the early 1980s at a little over 4%.<sup>19</sup> Why has the world been slow to adopt nuclear?

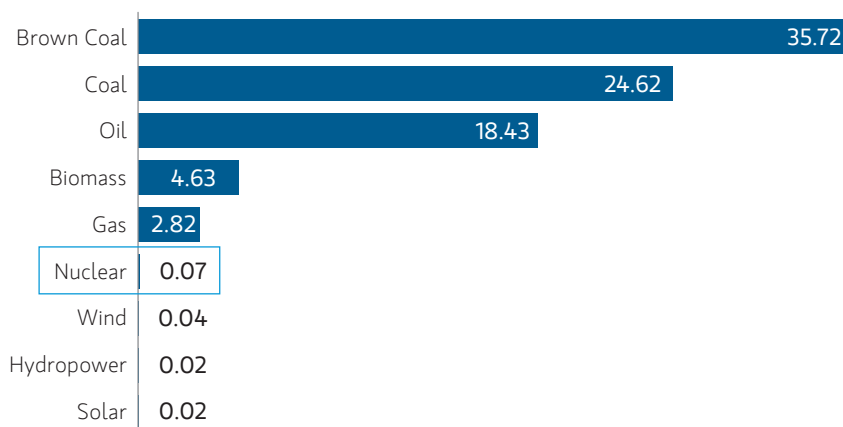
Arguably the biggest misconception about nuclear power is safety. High-profile accidents like Chernobyl and Fukushima have amplified long-standing fears around nuclear. Yet any serious analysis of energy safety would compare death rates per unit of energy produced across all sources of energy, including deaths brought on by accidents and pollution. Under this methodology, nuclear is one of the safest sources of energy in the world (0.07 deaths/TWH), on par with solar (0.02) and wind (0.04), and multiple magnitudes lower than coal (24.6), oil (18.4), or natural gas (2.8) (*Display 3*), according to research compiled by Hannah Ritchie and Max Roser of "Our World in Data." Deaths resulting from nuclear energy are 99% lower than deaths from coal and 97% lower than deaths from gas.<sup>20</sup> To provide context, deaths linked to the worst nuclear accident in history (Chernobyl) resulted in an estimated 4,000 premature deaths related to radiation exposure, according to the U.N.<sup>21</sup> While this is an unthinkable tragedy, researchers have estimated that as many as 4.5 million people died in a single year (2019) from exposure to air pollution caused by fossil fuels.<sup>22</sup>

What then explains the general public's fear of nuclear power? It would appear to us that it stems from a societal-wide case of "salience bias," or the tendency to overweight prominent or emotionally striking events, while underweighting less remarkable but possibly more serious events.<sup>23</sup> Deaths resulting from coal

### DISPLAY 3

#### Nuclear Safety Record on Par With Other Renewables

Measured based on deaths from accidents and air pollution per terawatt-hour (TWh)



Source: Markandya & Wilkinson (2007); Sovacool et al. (2016). <https://ourworldindata.org/grapher/death-rates-from-energy-production-per-twh>

and other fossil fuels are much greater and sadly chronic, yet many would be hard-pressed to name the last coal-related death. Nuclear accidents, on the other hand, seem to be seared into the public consciousness, as Margaret Harding, a nuclear engineer at General Electric for 27 years, notes: "You say, 'Three Mile Island, Chernobyl and Fukushima' and everybody instantly knows what they are."<sup>24</sup> While there are clear safety risks with nuclear energy, tradeoffs matter. The fear of low-probability accidents, which resulted in relatively few deaths compared to other energy sources, should not stop us from advancing and improving nuclear energy in order to tackle climate change. In nearly every case that a country has shut down nuclear power plants, carbon-free electricity has been replaced with "dirty" power.<sup>25</sup> For example, after Germany made the decision to shut down all of their nuclear power plants post-Fukushima, the country has witnessed the biggest rise in emissions since 1990, as the use of coal surpasses wind power to meet high electricity demand.<sup>26</sup> As a result, Germany has now missed emissions targets for two straight years and has indicated it will likely fall short in the

coming two years as well.<sup>27</sup>

Nuclear waste is a serious concern, but 90% of nuclear waste is low-level and only 1% radioactive.<sup>28</sup> Three percent of the waste is considered "high-level," but contrary to popular belief, it is dense and relatively small: by some estimates, the nuclear fuel waste generated in the U.S. over the past 60 years would "fit on a football field, stacked 20 feet high."<sup>29</sup> It is estimated that an American's entire lifetime of electricity generated by nuclear power would produce long-term waste that fits in a soda can.<sup>30</sup>

## Overcoming Costs

Beyond public perception, another key hurdle faced by nuclear energy is cost, as illustrated by the total levelized cost of electricity per MWh.<sup>31,32</sup> But perhaps a carbon-free and safe form of energy that can operate at a greater capacity should be more expensive.

Many experts have pointed out that the high cost of nuclear power plants are arguably a function of decades of stagnation and bad policies. To give one example, the U.S. Nuclear Regulatory Commission was created in 1975, yet as Stripe CEO Patrick

Collison noted recently, since then, no new nuclear plants have ever reached operation.<sup>33</sup> With regulatory red tape slowing the licensing process, it should be no surprise that costs have risen. Furthermore, incentives matter: the subsidies and tax breaks received by the different carbon-free sources of energy—wind, solar, nuclear—show a stark inequality. For example, in 2018 nuclear received a mere \$13mn in federal tax incentives per unit of energy produced, while wind received over \$2bn and solar over \$3.3bn or 250x that of nuclear.<sup>34</sup> Further, a wave of innovation in nuclear technologies is taking place all over the world, as entrepreneurs are seeking to solve a plethora of challenges, from using nuclear Korea fission and nuclear fusion to generate electricity, to designing small modular reactors (SMRs).<sup>35, 36</sup> Not only are SMRs designed to be significantly safer, but they will be much cheaper than current nuclear plants due to a smaller, simplified structure—SMRs can fit in a 20-foot container yet power 200,000 homes at once<sup>37</sup>—which allows them to be mass fabricated and assembled in factories, further driving down costs.<sup>38</sup>

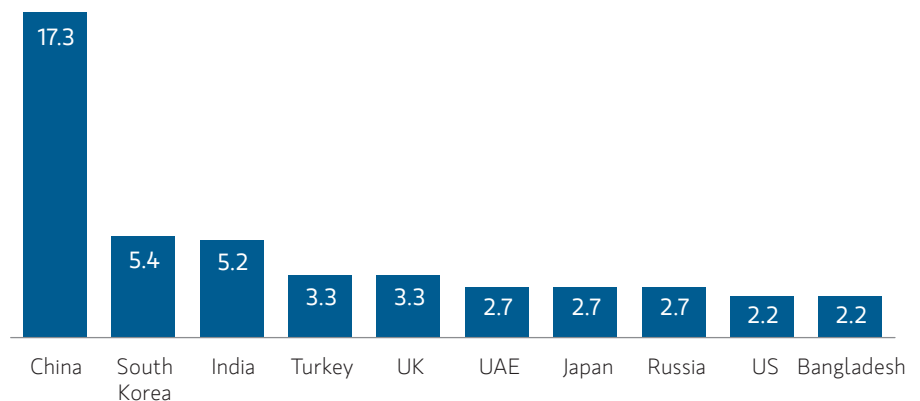
### Emerging Markets Are Leading the Nuclear Build-Out

Despite nuclear power being a reliable, safe, carbon-free source of energy, the biggest hurdle is political. For all the countries that are increasingly embracing nuclear power, Germany is targeting to phase out nuclear energy by 2022. Spain plans to phase out seven nuclear power reactors by 2035. The U.S. retired five reactors during 2021 and the Diablo Canyon Power Plant, the last in California, is poised to shut down

#### DISPLAY 4

### EM Leads New Nuclear Capacity Additions

Total under construction reactor net capacity (in thousands MWe)



Source: "World Nuclear Performance Report 2021".

in 2025. In fact, nuclear power output in advanced economies was down 6% from 2019 levels at the end of last year.<sup>39</sup>

In contrast, several emerging markets countries—including China, South Korea and India—which are earlier in their build-out of energy infrastructure, have demonstrated a much greater willingness to embrace nuclear energy (Display 4). Nuclear power output grew by 5% in 2021 and ended the year at 8% above 2019 levels.<sup>40</sup> China has emerged as the world's new champion for nuclear energy. President Xi Jinping considers nuclear as a key part of the "Made in China 2025" strategy, which is designed to bolster high-tech industries. China also announced the construction of the world's first commercial small modular reactor in South China's Hainan Province. After completion, the reactor will have an annual power generation capacity of 1 billion kilowatt hours, meeting the energy demands of 526,000 homes.<sup>41</sup>

### Our Outlook and Investing in a Nuclear Future

Given the challenges of achieving "net zero" through our current global energy mix, we expect nuclear to become a more favored alternative and play a key role in coordinated global energy transition. As investors in emerging and frontier markets, we believe nuclear power can play a role in helping developing countries achieve energy security without the need to rely on fossil fuels. In order to gain exposure to this theme, we invested in the world's largest, lowest-cost, and cleanest nuclear fuel (uranium) mining company over three years ago (see the following case study). There are an increasing number of listed vehicles for investors to gain exposure to nuclear power, be it large-cap nuclear fuel mining companies, or a number of listed uranium ETFs. Several hurdles remain including safety, cost and public support. But just as COVID led to seismic changes in how we work, perhaps climate concerns and geopolitical events will revive support for nuclear power: a safe, reliable and carbon-free source of energy.

**CASE STUDY****ESG Opportunities in the Nuclear Fuel Cycle**

The Next Gen Emerging Markets fund explores overlooked markets to seek out high quality business models. We avoid businesses that fail to integrate ESG considerations into their strategic planning or risk mitigation. We see actively engaging management teams on ESG risks as a vital step in our investment process.

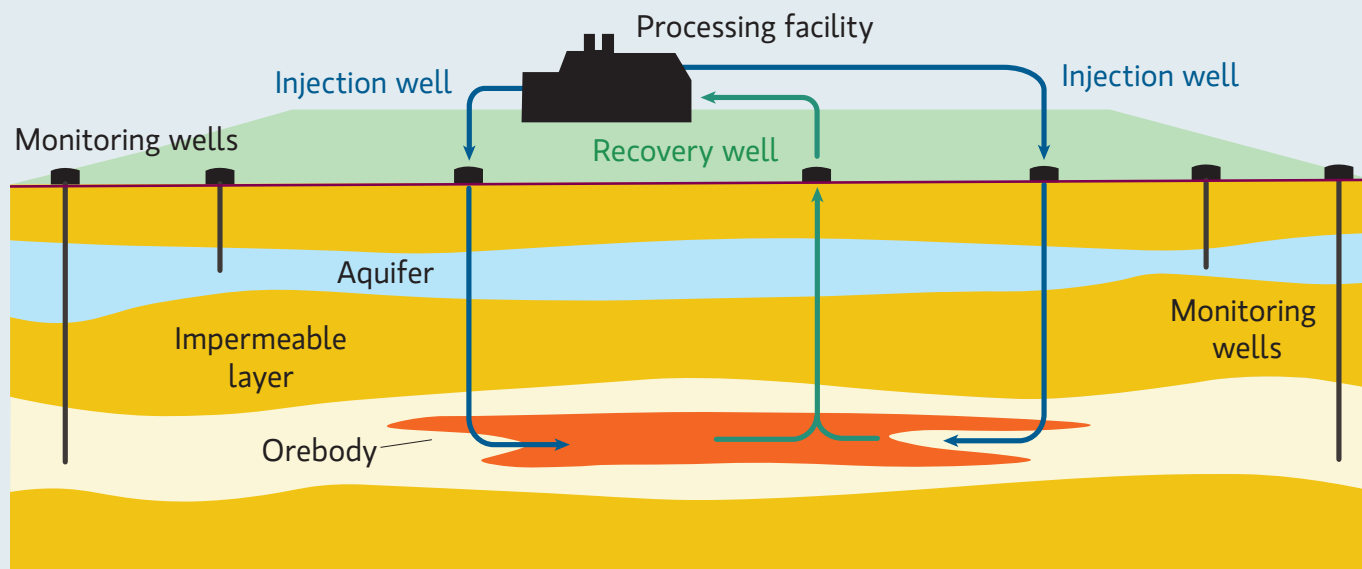
Given our long-held view that nuclear energy will need to play a larger role in efforts to fight climate change, in 2019 we became shareholders of a Kazakhstan-based company, which is the world's leading producer and supplier of natural uranium, the main fuel source for nuclear power plants.

As with most mining operations, conventional uranium mining can have harmful impacts on the environment and society writ large. This company utilizes a mining process referred to as "in-situ recovery" (ISR), which allows mining to occur with minimal amounts of physical excavation (as opposed to typical open pit mining) due to a closed-system water pumping and recycling method (Display 5). ISR is widely considered to be the safest and cleanest method of extraction given it is a closed system which requires no workers to go underground, nor blasting of rock or open cast digging. In October 2021, we engaged with the company's CFO and head of environmental safety on a number of material issues, including: emissions, energy consumption, water management, waste management, lifecycle management, worker safety, employee diversity, and board compensation as it relates to ESG metrics. While the company is still working to strengthen its ESG reporting, it already has many sustainability considerations embedded into its business model. The two-way dialog led to a number of follow-up items and we plan to continue our active engagements with the company in the coming quarters and years in order to track and measure their progress on key issues. We believe the company is well-positioned to benefit from the global efforts to transition to a lower carbon future.

This example is provided for illustrative purposes only. There is no assurance that the engagements will be successful and/or result in positive investment outcomes.

**DISPLAY 5****In Situ Recovery (ISR) Mining Process**

Total under construction reactor net capacity (in thousands MWe)



Source: Department for Energy and Mining, the Government of South Australia, In situ recovery (ISR) mining. Retrieved from <https://www.energymining.sa.gov.au/minerals/copyright>

## Risk Considerations

There is no assurance that a portfolio will achieve its investment objective. Portfolios are subject to market risk, which is the possibility that the market values of securities owned by the portfolio will decline and that the value of portfolio shares may therefore be less than what you paid for them. Market values can change daily due to economic and other events (e.g. natural disasters, health crises, terrorism, conflicts and social unrest) that affect markets, countries, companies or governments. It is difficult to predict the timing, duration, and potential adverse effects (e.g. portfolio liquidity) of events. Accordingly, you can lose money investing in this portfolio. Please be aware that this portfolio may be subject to certain additional risks. In general, **equities securities'** values also fluctuate in response to activities specific to a company. Investments in **foreign markets** entail special risks such as currency, political, economic, market and liquidity risks. The risks of investing in **emerging market countries** are greater than the risks generally associated with investments in foreign developed countries. Stocks of **small- and medium- capitalization companies** entail special risks, such as limited product lines, markets, and financial resources, and greater market volatility than securities of larger, more-established companies. By investing in **investment company securities**, the portfolio is subject to the underlying risks of that investment company's portfolio securities. In addition to the Portfolio's fees and expenses, the Portfolio generally would bear its share of the investment company's fees and expenses. **Derivative instruments** may disproportionately increase losses and have a significant impact on performance. They also may be subject to counterparty, liquidity, valuation, correlation and market risks. **Illiquid securities** may be more difficult to sell and value than publicly traded securities (liquidity risk). ESG Strategies that incorporate impact investing and/or Environmental, Social and Governance (ESG) factors could result in relative investment performance deviating from other strategies or broad market benchmarks, depending on whether such sectors or investments are in or out of favor in the market. As a result, there is no assurance ESG strategies could result in more favorable investment performance.

## ENDNOTES

<sup>1</sup> Alderman, L. (2022, February 10). France announces major nuclear power buildup. The New York Times. Retrieved from <https://www.nytimes.com/2022/02/10/world/europe/france-macron-nuclear-power.html#:~:text=President%20Emmanuel%20Macron%20announced%20a,its%20reliance%20on%20foreign%20energy>.

<sup>2</sup> Kar-Gupta, Sudip. (2021, November 9). Macron says France will build new nuclear energy reactors. Reuters. Retrieved from <https://www.reuters.com/business/energy/macron-says-france-will-build-more-nuclear-energy-reactors-2021-11-09/>

<sup>3</sup> Lee, H. (2022, March 9). South Korea's Pro-Nuclear President-Elect Boosts Atomic Stocks. Bloomberg.com. Retrieved from <https://www.bloomberg.com/news/articles/2022-03-10/south-korea-s-pro-nuclear-president-elect-boosts-atomic-stocks>

<sup>4</sup> Obayashi, Y. (2021, October 5). Japan Eyes Renewables, nuclear restart in race for 2030 climate goal. Reuters. Retrieved from <https://www.reuters.com/business/sustainable-business/japan-eyes-renewables-nuclear-restart-race-2030-climate-goal-2021-10-05/>

<sup>5</sup> Murtaugh, D. (2021, November 2). China's Climate Goals Hinge on a \$440 Billion Nuclear Buildout. Bloomberg.com. Retrieved from <https://www.bloomberg.com/news/features/2021-11-02/china-climate-goals-hinge-on-440-billion-nuclear-power-plan-to-rival-u-s>

<sup>6</sup> (2021, November 8). Nuclear energy gets a seat at COP26 table; to be part of solution to climate change. The Federal. Retrieved from <https://thefederal.com/news/nuclear-energy-gets-a-seat-at-cop26-table-to-be-part-of-solution-to-climate-change/>

<sup>7</sup> Abnett, K. (2022, February 2). EU proposes rules to label some gas and nuclear investments as Green. Reuters. Retrieved from <https://www.reuters.com/business/sustainable-business/eu-proposes-rules-label-some-gas-nuclear-investments-green-2022-02-02/>

<sup>8</sup> Hill, N. (2021, November 15). New American Climate Perspectives Survey. ecoAmerica. Retrieved from <https://ecoamerica.org/american-climate-perspectives-survey-2021-vol-v/>

<sup>9</sup> Opinion | Germany is closing its last nuclear plants. What a mistake. The Washington Post (2021, December 31). Retrieved from <https://www.washingtonpost.com/opinions/2022/01/01/germany-is-closing-its-last-nuclear-plants-what-disaster/>

<sup>10</sup> Jolly, J. (2022, March 21). Johnson announces aim for UK to get 25% of electricity from Nuclear Power. The Guardian. Retrieved from <https://www.theguardian.com/environment/2022/mar/21/johnson-announces-aim-for-uk-to-get-25-of-energy-from-nuclear-power>

<sup>11</sup> Belgium reaches agreement on Nuclear Exit. The Brussels Times. (2021, December 23). Retrieved from <https://www.brusselstimes.com/198947/>

[belgium-reaches-agreement-on-nuclear-exit](#)

<sup>12</sup> Twitter. Retrieved from <https://twitter.com/wolfejosh>

<sup>13</sup> IEA. (2019). (rep.). Nuclear Power in a Clean Energy System. IEA. Retrieved from <https://www.iea.org/reports/nuclear-power-in-a-clean-energy-system>.

<sup>14</sup> Fastest declines in carbon intensity of energy, as measure by how much carbon is emitted per unit of energy consumed, over a ten year period were: France (1979-1988), Canada (1977-1986) and South Korea (1983-1992). The other two were the result of hydro power adoption (Brazil – 1976-1985), which is only available to countries with ample water/rainfall, and Saudi Arabia (1979-1988) which transitioned from oil to natural gas.

<sup>15</sup> Mueller, M. (2021, March 24). Nuclear power is the most reliable energy source and it's not even close. Energy.gov. Retrieved from <https://www.energy.gov/ne/articles/nuclear-power-most-reliable-energy-source-and-its-not-even-close>

<sup>16</sup> Key Energy Topics . Environmental Progress. (n.d.). Retrieved from <https://environmentalprogress.org/energy1>

<sup>17</sup> Note: in the US, wind and solar energy are estimated to cover 7.1 million acres of land vs. 0.23 million for nuclear plants and uranium mining

<sup>18</sup> Buck, T. (2019, November 17). Germans fall out of love with Wind Power. Subscribe to read | Financial Times. Retrieved from <https://www.ft.com/content/d8b9b0bc-04a6-11ea-a984-fbbacad9e7dd>

<sup>19</sup> Statistical Review of World Energy: Energy Economics: Home. BP Global. (2021, July). Retrieved from <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>

<sup>20</sup> Ritchie, H., & Roser, M. (2020, November 28). Nuclear energy. Our World in Data. Retrieved from <https://ourworldindata.org/nuclear-energy#:~:text=We%20see%20massive%20differences%20in,hydropower%20are%20more%20safe%20yet>

<sup>21</sup> World Health Organization. (2005, September 5). Chernobyl: The True Scale of the accident. World Health Organization. Retrieved from <https://www.who.int/news/item/05-09-2005-chernobyl-the-true-scale-of-the-accident>

<sup>22</sup> Ritchie, H., & Roser, M. (2019, November 12). Outdoor Air Pollution. Our World in Data. Retrieved from <https://ourworldindata.org/outdoor-air-pollution?country=#citation>

<sup>23</sup> Salience bias - biases & heuristics: The decision lab. Biases & Heuristics | The Decision Lab. (2019, May 28). Retrieved from <https://thedecisionlab.com/biases/salience-bias/>

<sup>24</sup> Weinersmith, K. and Z. (2017). Soonish: The Lost Chapter. Saturday Morning Breakfast Cereal. Retrieved from <https://www.smbc-comics.com/soonish/lostchapter/index.html>

<sup>25,26</sup> Nordhaus, T. (2021, October 8). In global energy crisis, anti-nuclear chickens come home to roost. Foreign Policy. Retrieved from <https://>

foreignpolicy.com/2021/10/08/energy-crisis-nuclear-natural-gas-renewable-climate/

<sup>27</sup> Alkousaa, R. (2021, December 29). Germany will probably miss climate targets -environment minister. Reuters. Retrieved from <https://www.reuters.com/markets/commodities/germany-will-probably-miss-climate-targets-environment-minister-2021-12-29/>

<sup>28</sup> Radioactive Waste Management . Radioactive Waste Management | Nuclear Waste Disposal - World Nuclear Association. (2022, January). Retrieved from <https://world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-waste-management.aspx>

<sup>29</sup> Goldstein, J. S., & Qvist, S. A. (2019, January 11). Only nuclear energy can save the planet. The Wall Street Journal. Retrieved from <https://www.wsj.com/articles/only-nuclear-energy-can-save-the-planet-11547225861?ns=prod%2Faccounts-wsj>

<sup>30</sup> Harris, R. (2010, April 9). Nuclear waste may get a second life. NPR. Retrieved from <https://www.npr.org/templates/story/story.php?storyId=125740818>

<sup>31</sup> EIA estimated unweighted levelized cost of energy (LCOE) or levelized cost of storage (LCOS) for new resources entering service in 2026 (2020 dollars per MWh).

<sup>32</sup> U.S. Energy Information Administration. (2021). (rep.). Levelized Costs of New Generation Resources in the Annual Energy Outlook 2021. Retrieved from [https://www.eia.gov/outlooks/aeo/pdf/electricity\\_generation.pdf](https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf).

<sup>33</sup> Refers to entities whose initial application for a construction permit / operating license was filed with the NRC

<sup>34</sup> Bryce, R. (2020, December 27). Why is solar energy getting 250 times more in federal tax credits than nuclear? Forbes. Retrieved from <https://www.forbes.com/sites/robertbryce/2021/12/27/why-is-solar-energy-getting-250-times-more-in-federal-tax-credits-than-nuclear/?sh=36bb9d8721cf>

<sup>35</sup> Wade, W. (2021, November 5). Thiel-Backed Helion Targets 2024 Nuclear Fusion Breakthrough . Bloomberg.com. Retrieved from <https://www.bloomberg.com/news/articles/2021-11-05/thiel-backed-helion-targets-nuclear-fusion-breakthrough-by-2024?sref=EP6bV7CS>

<sup>36</sup> Chen, S. (2021, November 10). Chinese scientists strike early gold in race to nuclear fusion power. South China Morning Post. Retrieved from <https://www.scmp.com/news/china/science/article/3155546/chinese-scientists-strike-early-gold-race-nuclear-fusion-power>

<sup>37</sup> Azhar, A. (2022, March 30). Azeem Azhar's Exponential View . How To Make Nuclear Energy Safe (with Seaborg's Troels Schönfeldt). episode. Retrieved from <https://hbr.org/podcast/2022/03/how-to-make-nuclear-energy-safe-with-seaborgs-troels-schönfeldt>.

<sup>38</sup> Cho, A. (2019, February 21). Smaller, safer, cheaper: One company aims to reinvent the nuclear reactor and save A warming planet. Science. Retrieved from <https://www.science.org/content/article/smaller-safer-cheaper-one-company-aims-reinvent-nuclear-reactor-and-save-warming-planet>

<sup>39</sup> IEA. (2021). (rep.). Global Energy Review 2021. IEA. Retrieved from <https://www.iea.org/reports/global-energy-review-2021/nuclear>.

<sup>40</sup> IEA. (2021). (rep.). Global Energy Review 2021. IEA. Retrieved from <https://www.iea.org/reports/global-energy-review-2021/nuclear>.

<sup>41</sup> World's first commercial Linglong One onshore small reactor starts construction. CNNC. (2021, July 4). Retrieved from [https://en.cnn.com.cn/2021-07/14/c\\_642603.htm](https://en.cnn.com.cn/2021-07/14/c_642603.htm)

## DEFINITIONS

**"ESG" investment:** Environmental Social and Governance based investment is an investment approach which takes explicit account of the environmental, social and corporate governance aspects of all proposed investments.

## IMPORTANT INFORMATION

There is no guarantee that any investment strategy will work under all market conditions, and each investor should evaluate their ability to invest for the long-term, especially during periods of downturn in the market.

**A separately managed account may not be appropriate for all investors. Separate accounts managed according to the particular Strategy may include securities that may not necessarily track the performance of a particular index. A minimum asset level is required.**

**For important information about the investment managers, please refer to Form ADV Part 2.**

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