



Forecasting Our World in Data

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About Metaculus

[Metaculus](#) is an online forecasting platform and aggregation engine that brings together a global reasoning community, delivering machine learning-optimized aggregate forecasts on topics of global importance. The Metaculus forecasting community is often inspired by altruistic causes, and Metaculus has a long history of partnering with nonprofit organizations, university researchers and companies to increase the positive impact of its forecasts.

Metaculus so far has elicited and aggregated more than one million individual forecasts on over 7,000 questions. In the process, Metaculus has gathered extensive experience not only in facilitating large-scale forecasting projects and tournaments but also in communicating results to partners, policymakers, and the public. All forecasts made on Metaculus are probabilistic forecasts, meaning that forecasters provide full predictive distributions. These forecasts are more useful to policymakers than point forecasts, as they allow them to quantify the forecasters' uncertainty around what they believe are the most likely scenarios.

Metaculus has fostered a large community of forecasters with extensive experience and known track records, enabling us to weight aggregate forecasts by past performance. In addition to hosting open tournaments, we have also worked with selected Pro Forecasters with an excellent track record on key projects. For projects like this, we provide numerical predictions and elicit and summarize forecasters' reasoning, enabling the communication of rich context that helps readers to navigate the forecasts.

Executive Summary

The *Forecasting Our World in Data Tournament* is a collaboration between Metaculus and Our World in Data aimed at forecasting key measures of human progress over various time horizons. In 2022, Metaculus received a grant to launch a series of questions asking forecasters to predict on important metrics of progress provided by Our World in Data over the next century. These metrics were selected to create a better understanding of future trends in technological advancement, global development, and social progress. The collaboration aims to provide valuable insights for Our World in Data and to compare the insights derived from these forecasts with other sources. Metaculus has forecasted the trajectory of 30 Our World in Data metrics on its platform using both a public tournament and a group of Pro Forecasters. Both accuracy and transparency in reasoning were considered essential to the project. The public tournament was available to the platform's full community of over 2,000 forecasters, while the private forecasting space was intended for a small group of the top 2% of Metaculus's most accurate forecasters. Combining both approaches allows for a variety of perspectives and a broad discussion, as well as ensuring that predictions are of the highest quality. With

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substantive discussions surrounding this tournament's 30 forecasting questions, Metaculus has been able to better understand: (1) approaches and methods adopted by elite forecasters, (2) rationales driving their prediction for each time period, and (3) a composite perspective into our world 100 years from now.

Our World in 2122

In the year 2122, the global population is expected to be around 8 or 9 billion, with a chance that number reaches as high as 20 billion due to technological and economic advancements.

Lifespans are expected to be significantly longer, especially in the G7 countries, thanks to the achievement of longevity escape velocity. Reproduction is anticipated by some to primarily utilize ectogenesis technology, though some may choose to avoid it for personal or ethical reasons. The decline in population is expected to slow, but there remains uncertainty as to whether it will level off or decrease further.

On the economic front, GDP per capita is believed to be quite high and will likely continue increasing. In fact, most economies are expected to be as advanced as present-day Scandinavian countries, with energy being inexpensive and the price of most goods and services being close to zero. Productivity is forecasted to significantly increase, with advanced artificial intelligence playing a major role in GDP growth. The United States economy is anticipated to continue growing, potentially transitioning to a more service-based industry and experiencing changes in government structure. However, the concept of the United States as we know it may be fundamentally different by this time. Instead, it is possible that global governance will be implemented and the number of sovereign states will drastically decrease. Wealth distribution remains a key uncertainty — while it's possible that a small group could control a significant portion of resources, a shift toward more equitable distribution may win out.

Even with global governance, many pressing challenges will remain. Despite drastic cuts in carbon dioxide emissions, climate change is expected to be a major concern — sea levels will rise and extreme weather events will become more frequent. Nevertheless, renewable energy is also expected to increase in parallel, with the potential for advanced technologies, like nuclear fusion, to power a significant portion of the global economy. Even though the precise global energy mix remains uncertain, transportation will undergo major electrification, with an anticipated shift towards both zero emissions and autonomous vehicles.

Technology will continue expanding at a rapid pace and play an even greater role in daily life. The use of robots is predicted to increase and revolutionary innovations like brain-computer interfaces could fundamentally change daily life as we know it. Education is therefore expected to become more personalized and virtual, as will the healthcare system. The latter will undergo many transformations as artificial intelligence opens the door for hyper-personalized treatments

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and precision medicine. The concept of work will change too, becoming far more flexible and remote. Leisure time is expected to increase, with virtual reality and space tourism becoming popular for many.

Despite great uncertainty and persistent challenges, 2122 is expected to be a time of great advancement and possibility.

Background

Contributing to a more desirable long-term future requires a better understanding of the problems the world faces. To understand the issues that affect billions — spanning from the present moment all the way to the next century — we need data. More precisely, we need to methodically and rigorously measure the trends we consider most critical and make the results accessible and transparent to the public. Doing so allows anyone to consider the present state of our world and track where progress has, or has not, been made.

In 2022, the FTX Future Fund provided [Metaculus](#) with a grant to launch a series of questions asking forecasters to predict on important metrics of progress — provided by [Our World in Data](#) (“OWID”) — over the next century. The metrics and their corresponding forecasting questions were selected to create a better understanding of future trends in technological advancement, global development, and social progress. Policymakers, and anyone concerned with humanity’s long-term future, will have a natural interest to know how these trends may evolve into the future. Well-calibrated forecasters can play a critical role in helping us understand not only how such trends may continue, but also how certain we should be of their trajectory, and where key sources of uncertainty are.

Through the *Forecasting Our World in Data Tournament*, Metaculus gathered forecasts from both a selected group of 20 Pro Forecasters and a public tournament, which remains open to its larger community. Using both of these approaches creates visibility and engagement by inviting a great variety of different perspectives and a broad discussion. Engaging a select group of exemplary forecasters also ensures that predictions are of the highest possible quality, allowing us to elicit and summarize forecaster reasoning in detail. By comparing community predictions and professionals, Metaculus aims to improve the accuracy of these important forecasts and obtain a better understanding of sources of disagreement.

Metaculus has also been very fortunate to collaborate with OWID on this initiative. Over the past 10 years, their platform has become one of the largest open online repositories of data that describes the world we live in. Collecting information from thousands of data sources and using elaborate visualizations, they aim to make visible the trends that define our past and present and will shape what lies ahead. OWID’s charts provide a valuable source of information about

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humanity's progress and its greatest challenges. For this project, Metaculus worked with OWID to identify and use a set of key metrics for forecasting time horizons of 1, 3, 10, 30, and 100 years into the future.

This collaboration also aims to provide valuable, previously unavailable insights for OWID. Through this tournament, OWID will be well positioned to compare the insights derived from these forecasts with the other sources they currently use. For example, traditional sources often don't take into account existential risks, the potential of a singularity, or other Black Swan events and paradigm shifts. By contrast, these are considerations that the Metaculus community frequently acknowledges. As a result, most forecasts from other sources are more conservative than those produced by Metaculus. With this tournament, OWID and Metaculus may be able to envision a window of possibilities that is much larger than what traditional institutions consider.

Methodology & Solution

Metaculus has forecasted the trajectory of 30 OWID metrics on its platform, using a combination of a public tournament and a smaller cohort of Pro Forecasters. The list of specific metrics for forecasting was determined in collaboration between Metaculus, OWID, and the initiative's funders, according to a set of criteria (e.g. contribution to a broad understanding of the world's progress, availability of robust historical data, relevance to EA and longtermist research, etc.). Expert guidance was instrumental in the final selection.

Our organizations determined that both epistemic rigor and reasoning transparency — in addition to accuracy — were essential components of this project. Therefore, our team designed both public and private forecasting spaces to enable clear comparisons between our two cohorts of forecasters and their respective aggregations. The main distinction between these cohorts was quality and quantity. As this report will further explain, the private forecasting space was intended for a small group of professionals who represent the top 2% of Metaculus's most accurate forecasters. On the other hand, the public tournament was available to the platform's full community of 2,000+ forecasters, with questions receiving predictions from 19 unique forecasters on average.

Combining both approaches has several advantages. Public tournaments create a lot of visibility and engagement with the broader community, inviting a great variety of different perspectives and a broad discussion. Conversely, engaging Pro Forecasters ensures that predictions are of the highest possible quality, which allows us to elicit and summarize forecaster reasoning in detail. Comparing community-wide and professional predictions may allow us to improve accuracy and obtain a better understanding of sources of disagreement.

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Forecasting challenges

Considering OWID's mission of using evidence to help us better understand the world, this project's aims present a worthy challenge. In their work, everything is based on evidence. In fact, it's often difficult to say "forecasts of the future are very valuable" if there's not much evidence to support them. In practice, when a forecaster predicts a development 30-100 years in the future, there is always a fair amount of skepticism as to their methodology. OWID and its peers will often question whether a forecast is based on linear extrapolation, intuition, or actual calculations. Therefore, their team is interested in better understanding the calculations forecasters use to arrive at their predictions.

However, predicting the far future is no easy task. In the context of short-term time scales, many of the key unknowns can be accurately predicted with conventional forecasting and data-driven projections. But the accuracy with which we can predict trends degrades as we go further into the forecast horizon. So, when our time horizons are pushed far beyond the limits to which traditional methods are best suited, we can no longer use once-reliable tools with such certainty. In the context of medium- and long-term models, which extend 30 to 100 years into the future, we must depend even further upon others to sense-check assumptions and provide previously unconsidered information.

While forecasters on Metaculus consider long-term possibilities every day, the complexity and rigor of identifying and quantifying their uncertainty cannot be overstated. For even the most well-calibrated members of our community, attempting to forecast dynamic global trends on 100-year scales is no small feat. In this collaboration, Metaculus and OWID made the important decision that a lack of data — or a lack of confidence in the data — should not stop us from generating long-term forecasts. Instead, we set out to do the best we can with the tools we had available to us.

Metric selection

The *Forecasting Our World in Data Tournament* combines Metaculus's forecasting community and OWID's visual datasets to probe the long-term future and 30 of the most important trends that will define it. Through this tournament, we have delivered predictions ranging from one to 100 years on topics like the amount of computation used in AI training, the cost of sequencing the human genome, global CO₂ emissions, total nuclear warhead stockpiles, and much more.

Based on the timeframes that were of greatest interest to our stakeholders, Metaculus elicited forecasts for a variety of intervals — 1, 3, 10, 30, and 100 years out from the year 2022. For each OWID metric that Metaculus and the initiative's funders selected, this tournament created grouped questions that asked forecasters to give their predicted value of that metric in the years

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2023, 2025, 2032, 2052, and 2122. With such an array of time horizons, the tournament takes a less common forecasting approach that allows for direct comparison between short-term and long-term predictions.

Metaculus also worked closely with OWID to carefully select the specific metrics for forecasting. Our selection was largely determined by each metric's value for providing novel insights into human progress. Together, we placed a particular emphasis on selecting metrics that reflected technological innovation, the benefits and risks associated with it, and humanity's overall progress toward sustainable development.

With input from OWID and our stakeholders, Metaculus began by developing a list of metric categories to ensure sufficient diversity and comprehensiveness of its forecasts' thematic areas; these were:

1. Global health and development
2. Animal welfare
3. Space exploration
4. Health and tech advances
5. Climate change
6. Global violence
7. Social progress and stability
8. Disasters and existential risk
9. Population and economic trends

In addition to the importance of their thematic areas, metrics were also selected using the following criteria:

1. The underlying OWID data was frequently updated (i.e., current as of 2018 or later)
2. The corresponding questions would be plausible for 1, 3, 10, 30, and 100-year windows
3. Forecasts for both short and long timeframes would be equally compelling and insightful
4. The scope of a metric would be global, as opposed to specifically focused on the US
5. A metric would have a single trendline that could be incorporated into fan graphs

Metaculus then applied the above criteria to rank 20+ metrics while ensuring each category had representation in the top 15. An overview of this ranking and categorization is show below:

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Primary Category	Total	# in Top 10	# in 11 to 15	# in 16 to 20	# in > 20
Global health and development	9	4	1	2	2
Animal welfare	1	1	0	0	0
Space exploration	2	1	0	1	0
Health and tech advances	1	1	0	0	0
Climate change	2	0	2	0	0
Global violence	3	1	0	0	2
Social progress and stability	3	1	0	1	1
Disasters and Existential Risk	1	0	1	0	0
Population and economic trends	3	1	1	1	0

Ultimately, Metaculus and OWID identified over 30 such metrics that satisfied these criteria. Using this method to select of questions resulted in two groups:

1. For Pro Forecasters, Metaculus used its 10 top-ranked metrics, plus a separate batch of 10 selected by another grant recipient, [Good Judgment](#) (20 in total).
2. For the public tournament, Metaculus added in the metrics ranked 11th-20th (30 in total).

Resolution criteria

On Metaculus, questions are carefully specified so that forecasters understand beforehand and afterward the real-world conditions and outcomes required for resolving them, and which are not. Forecasters then give precise probabilities that measure their uncertainty about these outcomes. A key component of a well-written forecasting question is its resolution criteria. Strong criteria contain clarifying language that, if properly crafted, removes ambiguities as to how a question will resolve. Questions are designed to usually resolve positively or negatively

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(in the case of binary forecasts) or to resolve with a quantity (in the case of numerical ones). More information about how resolution criteria were determined can be found in the [Appendix](#).

Tournament structure

Metaculus's public tournaments aim to deliver high-quality forecasts, insightful analyses, and effective communication on questions organized around a central topic or theme. By forecasting on shared sets of questions, participants can sharpen their skills and test their mettle in head-to-head competitions that help to inform decision makers — and the broader public. Cash prize pools and other rewards are provided for accurate forecasts and other valuable contributions.

Scoring forecasts according to their accuracy allows Metaculus to build statistical track records for each forecaster and for the community as a whole. Different methods work better in different situations. There is no single best way for a forecaster to forecast. The most accurate and well-calibrated forecasters are given more weight in the optimal aggregation of the Metaculus community's predictions, known as the Metaculus Prediction.

As mentioned previously, one of Metaculus's two forecasting spaces was a public tournament. The public tournament was intended to provide a set of forecasts aggregated from a very large pool of forecasters (i.e., the entire Metaculus community), which would complement the smaller group of Pro Forecasters described in the following section.

For the *Forecasting Our World in Data* tournament, Metaculus offered an \$8,000 prize pool for 1-year duration questions that would be distributed based on forecast accuracy, and another \$8,000 for the 3-year questions. In addition to the prizes for the 2023 and 2025 forecasts, we also offered a commenting prize pool of \$4,000 for the questions asking about 2032, 2052, and 2122.

Pro Forecasters

For many projects, Metaculus engages a team of expert forecasters (hereafter referred to as "Pros"), who come from a variety of backgrounds, but are connected by the common characteristic of having excellent track records. Indeed, Pros have proven their exceptional forecasting ability — they represent the top 2% of forecasters on the platform out of thousands of competitors worldwide. In fact, Pros are selected from a forecasting community that in aggregate performs significantly better than chance. Most Pros have many years of experience and have forecasted hundreds of questions. In addition to numerical predictions, they provide detailed information about their reasoning and the thought process behind their forecasts.

Pros are comprised of selected individuals who meet the following criteria:

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- have scored in the top 2% of all Metaculus forecasters
- have forecasted on a minimum of 75+ questions that have been resolved
- have experience forecasting for a year or more
- have forecasted across multiple subject areas
- have a history of providing commentary to explain their forecasts

Metaculus projects leverage the talents of Pros at times when accuracy and calibration are of the utmost importance. Metaculus anticipated that Pros would be well-suited to provide real-time, high-quality forecasts and commentary on how a wide variety of technological, demographic, and social changes will play out over time scales up to 100 years. Their higher likelihood of delivering accurate forecasts and demonstrated ability to provide insightful commentary would arguably be a societal benefit. More than anyone, their forecasts could help guide policymakers and serve to inform the public.

This *Forecasting Our World in Data* tournament engaged nearly 20 Pros to both forecast and write commentary explaining their reasoning, with at least 10 Pros participating in every question.

Results & Findings

Throughout this project, Metaculus observed notable differences in predictions and forecasting approaches between and within the public tournament participants and the Pros. There were also numerous comments of interest made by forecasters in each space, which this report will explore in further detail.

Overview of questions

Metaculus published 30 questions to be used across both forecasting spaces within the *Forecasting Our World in Data* project. These included 20 for private forecasting and an additional 10 exclusively for the public tournament. All 30 questions are listed below in alphabetical order with links to their respective pages in the public tournament. The 20 questions that were also answered by Pros are marked with an asterisk.

1. [Active UN Peacekeeping Missions](#): How many active United Nations peacekeeping missions will there be in the following years?
2. [Annual Number of Objects Launched Into Space](#): What will be the annual number of objects launched into space in the following years?*
3. [CAGR GDP Growth Per Capita](#): What will world real GDP growth per capita be in the following years?*

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4. [Chickens Slaughtered for Meat](#): How many chickens will be slaughtered for meat globally in the following years?*
5. [Cost of Sequencing Whole Human Genome](#): What will be the cost (in 2021 USD) of sequencing a full human genome in the following years?*
6. [Death Rate From Infectious Disease](#): What will be the global annual death rate (per 100,000 people) from infectious disease in the following years?
7. [FLOPS of Fastest Supercomputer](#): What will be the speed (in FLOPS) of the fastest supercomputer on record in the following years?*
8. [Global CO2 Emissions](#): What will global carbon dioxide (CO₂) emissions (in tons) be in the following years?*
9. [Global Conflict Death Rate](#): What will be the rate of deaths (per 100,000 people) from global conflict in the following years?
10. [Global Fertility Rate](#): What will be the global total fertility rate in the following years?*
11. [Global Homicide Rate](#): What will be the global rate of homicide deaths per 100,000 people in the following years?*
12. [Global Nuclear Warhead Stockpiles](#): How many nuclear weapons will there be in world stockpiles in the following years?*
13. [Global Poverty \(<\\$10 2011 INT USD per day\)](#): How many people in the world will live on \$10 (2011 INT USD) or less per day in the following years?*
14. [Greatest Computation Used in AI Training](#): What will be the highest estimated computation (in FLOPs) used in large AI training runs by the following years?*
15. [Life Expectancy at Birth in the G7](#): What will the population-weighted average life expectancy at birth be in the G7 countries in the following years?*
16. [OECD Trust in Government](#): What will be the reported trust in government averaged across (Organization for Co-operation and Economic Development (OECD) countries in the following years?*
17. [People Affected by Natural Disasters](#): What will be the rate of people (per 100,000) affected by natural disasters in the following years?
18. [People Living in Liberal Democracies](#): How many people will be living in liberal democracies in the world in the following years?*
19. [Per Capita Primary Energy Consumption](#): What will be world per capita primary energy consumption (in kWh) in the following years?*
20. [Primary Energy from Nuclear Power](#): What percent of global primary energy will come from nuclear fission or fusion power in the following years?
21. [Share Living Where Same-Sex Marriage is Legal](#): What will be the share of people living in countries where same-sex marriage is legal in the following years?*
22. [Share of Primary Energy From Fossil Fuels](#): What percent of the world's primary energy will come from fossil fuels in the following years?

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23. [Share of World Population Using the Internet](#): What percent of the world population will use the internet in the following years?
24. [Total Annual Investment in AI Companies](#): What will be the total annual investment (in 2021 USD) in AI companies in the world in the listed years?*
25. [Total Global Fatalities from Terrorism](#): What will be the total number of fatalities from terrorism in the world in the following years?*
26. [Under 5 Years Child Mortality Rate](#): What will be the global mortality rate (in percent) for children under the age of 5 in the following years?
27. [US GDP Per Hour Worked \(Productivity\)](#): What will productivity be in the United States in the following years?*
28. [World DALYs Lost Due to Lead Exposure](#): What will be the total global disease burden (in DALYs) due to lead exposure in the following years?
29. [World Population](#): What will the world population be in the following years?*
30. [World Rice Yield](#): What will be the world rice yield (in tonnes per hectare) in the following years?

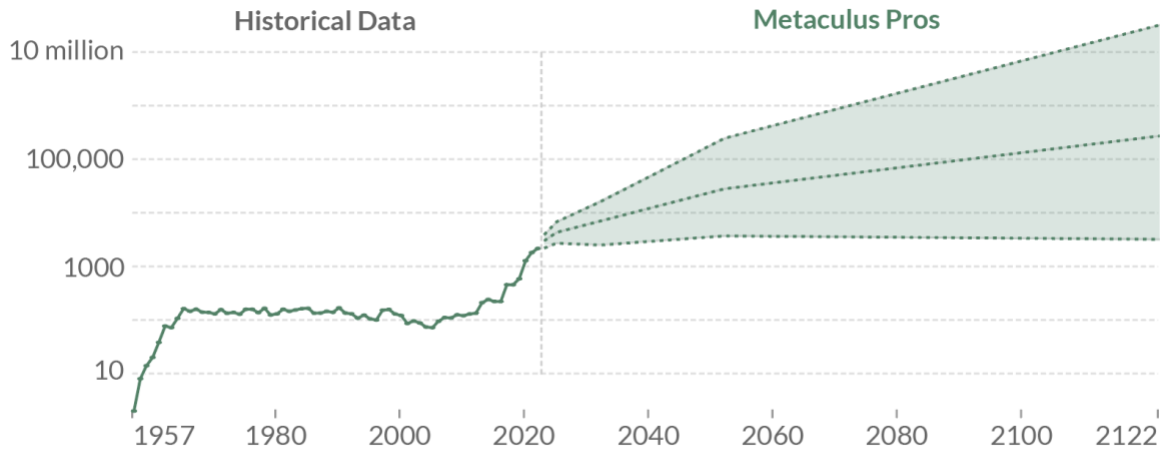
Summary of key forecasts

This section includes summaries and analysis of the 20 questions that were forecasted by both Metaculus's Pro Forecasters and participants in the *Forecasting Our World in Data* public tournament. These summaries include the numerical predictions made at each of the five time horizons (2023, 2025, 2032, 2052, and 2122) as well as a synthesis of the Pros' commentary for each of those years. For forecasts from the public tournament, this section only displays the Metaculus Prediction (see [Appendix](#)). For forecasts from the Pros, the median of their predictions is used.

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Annual Number of Objects Launched Into Space



Source: United Nations Office for Outer Space Affairs, Online Index of Objects Launched into Outer Space (2023), Metaculus (2023)
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	Pros	Public
2023	3,000 (<i>objects</i>)	2,700 (<i>objects</i>)
2025	4,300	4,000
2032	7,000	20,000
2052	28,000	50,000
2122	271,000	859,000

2023: Forecasters expect that there will be an increase in satellite launches in 2023, with the majority being driven by the continued success of the Falcon 9 rocket and the deployment of the Starlink constellation. Additionally, the first Kuiper Systems satellites are expected to launch in 2023, contributing to the overall growth in launches. However, there is both a risk of a Falcon 9 failure that could impact SpaceX's launch cadence, as well as the possibility of Kuiper launches not occurring, due to continued unavailability of their intended launch vehicles. Forecasters have also accounted for the possible failure of Starship, which is experiencing slower than expected development, throughout their predictions. Most launches in 2023 are anticipated to be Falcon 9s, with only a handful of launches on Starship expected.

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2025: Forecasters expect that the number of satellites launched into space in 2025 could range from 3,900 and 9,200, with the majority of these launches conducted by SpaceX for its Starlink constellation. The actual number of satellites in the Starlink constellation is uncertain, as the company has recently raised doubts about the need for the 42,000 satellites it had previously requested permission to launch and operate. Furthermore, CEO Elon Musk has spoken of a redesigned version of the satellite that will offer greater throughput per unit. Forecasters also expect the Kuiper constellation will be in full operation by this time. As launch costs across the industry are driven down by increased competition and the entry of new launch vehicles into the market, they anticipate further interest in small-satellite launches with other providers.

2032: Forecasters expect the initial Starlink constellation to be complete, which would require a comparatively lower number of launches for replacing failed or deorbited satellites. It is uncertain whether any other megaconstellations will be under construction at this time, including those from China. There is potential for significant growth in overall launches due to decreased launch costs, as fully reusable systems like Starship are expected to be fully operational for several years by this point. Most launches are expected to deploy satellites to the low earth and medium earth orbit regimes, but there is potential for significant expansion beyond these orbits depending on government investment in space science and exploration. It is expected to be economically viable to establish a handful of commercial or government-owned space stations and there will probably be between four and 12 independent space stations in orbit. There are even expectations for one small permanent lunar base, operated primarily by the United States. Forecasters acknowledged the possibility of near zero launches in 2032 to account for a Kessler syndrome disaster that renders launching either impossible or very challenging.¹

2052: For 2052, forecasters expect launch costs to be significantly lower than current levels, which, coupled with increased world affluence, will enable a thriving space tourism industry. They anticipate the existence of dozens of private space stations and multiple government-owned and privately-owned settlements on the Moon and Mars. There may be a limited number of long-term bases in other locations, potentially in orbit around Venus or in the Venusian clouds, but this seems less likely. Again, predictions are weighed down by the possibility of a Kessler syndrome outcome, as discussed for the 2032 timeframe. In fact, forecasters estimate that the risk of Kessler syndrome is around 10% by this time, but it could be lowered by the success of new technologies like laser brooms. There is likely an upper limit on yearly launches for 2052 attributed to fuel constraints and limited launch opportunities from available pads, but forecasters think it's unlikely that space elevators or maglevs will be in play.

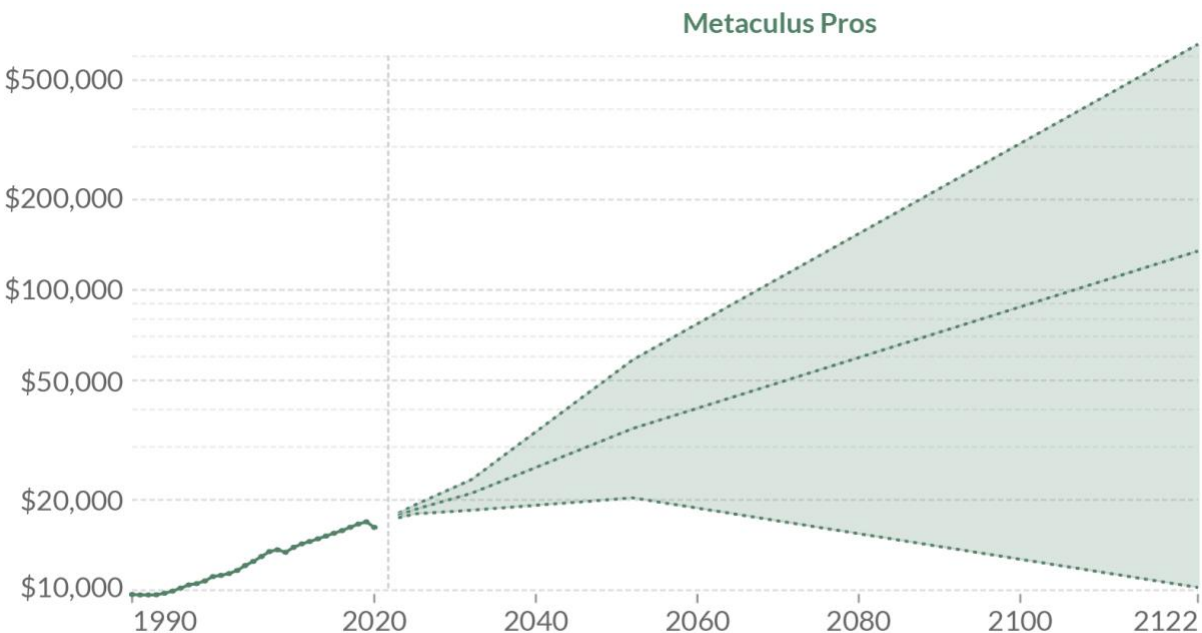
¹ Kessler syndrome refers to a phenomenon where, “past a certain critical mass, the total amount of space debris will keep on increasing. Collisions give rise to more debris and lead to more collisions, in a chain reaction.” [The Kessler Effect and how to stop it, European Space Agency.](#)

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2122: Forecasters expect that space travel will be accessible to most humans, but the general public's level of interest and preferred methods remains unclear. They believe that there will be human settlements on various bodies throughout our solar system, as well as the construction and operation of large space colonies. It is estimated that tens to hundreds of millions of humans will live off-Earth for a sizable part of the year. In addition to human spaceflight, forecasters also expect that humans will have the technological capability to send automated probes throughout the galaxy at significant fractions of the speed of light for various purposes. These include scientific research, the identification of locations for future human or robotic exploration, and colonization. Forecasters note the possibility that going to space could be as easy as taking a bus and that materials and people will be regularly sent to extra-global ventures using efficient engineering. The possibility of self-replicating probes is also mentioned, which could lead to a reduction in launches if the technology becomes available.

CAGR GDP Growth Per Capita



Source: Data compiled from multiple sources by World Bank; Metaculus (2023)

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Note: This data is adjusted for inflation and for differences in the cost of living between countries, and expressed in international-\$ at 2017 prices.

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	Pro Forecasters	Public Tournament
2023	3.10%	2.80%
2025	2.80%	2.60%
2032	2.20%	3.30%
2052	2.40%	5.40%
2122	2.10%	3.90%

Note that forecasters predicted in terms of compound annual growth rates (CAGR), which was converted to 2017 international-\$ for the chart.

2023: According to forecasters, who have used the International Monetary Fund's (IMF) projections as an anchor, the economic outlook for 2023 looks relatively poor. They attribute this to significant geopolitical instability, high inflation, and rising interest rates. Many developed countries are expected to experience a recession in 2023, though it is not expected to be as severe as the recession in 2008. GDP per capita growth is expected to be slow due to various setbacks affecting economies, such as increased food prices, unstable supply chains, and damage to the workforce as a result of the COVID-19 pandemic.

2025: Forecasters expect the world economy to recover from their expected 2023 recession at a moderate rate in 2025. While there is potential for technological advances — particularly in the field of artificial intelligence — to lead to early productivity improvements, there is also a risk of prolonged economic damage and further geopolitical instability. Forecasters consider the IMF's projections for 2025 to be well-considered, with a strong probabilistic analysis that emphasizes the possibility of low growth. The IMF also provides a plausible downside scenario that would result in lower global GDP growth rates in 2023 and 2024. Beyond a short-term time horizon like 2023, it is difficult to predict how chain-weighted GDP growth might respond to transformative technological advances, such as AI, and how it might be affected by spikes in productivity.

2032: Forecasters expect a range of potential outcomes for GDP growth over the next few decades, with the most likely scenario being a continuation of observed trends, including the adoption of automation technology, lower energy costs, and improved health and educational outcomes. There is also potential for a mean reversion or stagnation scenario, with technology development slowing down and potentially disrupted by external factors, such as wars or pandemics. Some forecasters expect a boost in productivity due to AI and labor automation, with GDP per capita growth increasing as AI transforms the world economy. Overall, the most common forecast is for a "business as usual" scenario, with widening tails for the more distant future.

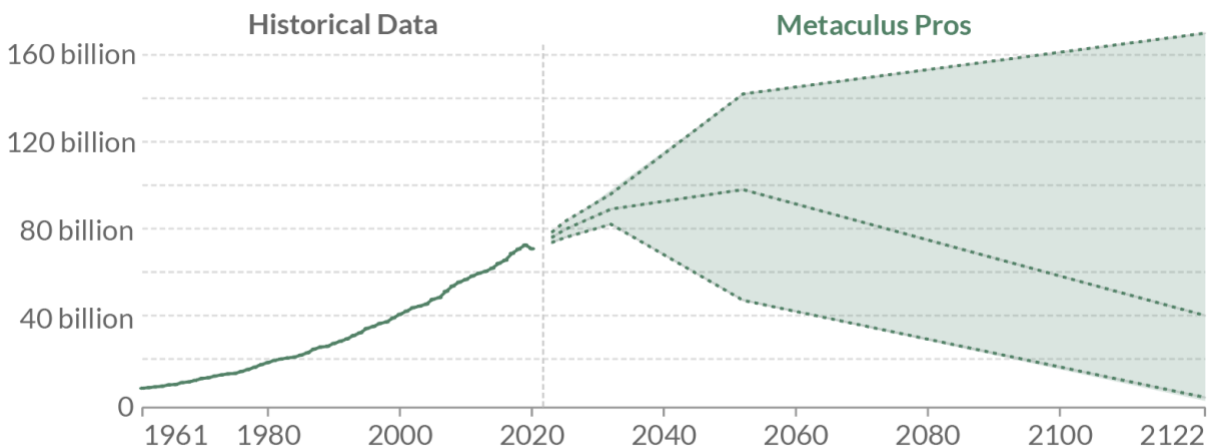
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2052: Forecasters expect that in 2052, there is potential for a significant increase — or a “light take-off” — in economic growth due to the adoption of automation technology, lower energy costs, improved health and educational outcomes, and the arrival of new technologies that increase the intensity of productive activities. It is also possible that technology that enables cognitive enhancement will be available by this time. However, these gains in productivity may be offset in GDP terms by potential deflation, if widespread automation makes many goods and services cheaper. Some expect world GDP per capita to reach around \$60,000 by 2052, but this would require a CAGR of 4.2%. Forecasters also acknowledge the possibility of every country in the world being as rich as the richest countries are today, with some suggesting great prosperity and material growth under an aligned AI singleton.

2122: By and large, forecasters expect GDP per capita to continue increasing and for most countries to have economies that are as advanced as present-day Scandinavian countries. They speculate that, by this point, most basic technologies that will ever be invented have already been invented and will have been in use for some time. Energy is expected to be inexpensive and the price of most goods and services is likely to be close to zero. Nevertheless, there is some uncertainty surrounding other realms of technological progress, particularly in the realm of artificial intelligence. With that in mind, some forecasters have calculated a CAGR as high as 40% through 2122, which would result in an average production of 78 thousand times the current global GDP per person.

Chickens Slaughtered for Meat



Source: Food and Agriculture Organization of the United Nations; Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	75.9 (<i>billions</i>)	74.7 (<i>billions</i>)
2025	79.6	78.2
2032	89.0	80.0
2052	98.0	68.0
2122	40.0	0.2

2023: Forecasters expect global chicken production to recover from the COVID-19 pandemic lows. They do not anticipate a significant impact from economic recession or technological advances like cultured meat on this timescale, but there is a small possibility of a major disease outbreak affecting production. As global affluence increases, meat consumption is expected to continue to rise, with chicken consumption increasing at an even faster pace, mainly due to its relative ecological efficiency compared to other animal proteins. Some countries may experience a reduction in meat consumption but not enough to counter the worldwide increase in meat consumption and growing share of poultry in diets.

2025: Forecasters generally expect that global chicken consumption will continue to grow in the next few years. Their expectations are based on extrapolation of the data from 2019, with the assumption that there will not be any major changes in consumer attitudes towards animal ethics, tastes, or disease outbreaks. Forecasters anticipate that meat alternatives, such as lab-grown or plant-based options, may start to have an impact on the industry by 2030, but are not expected to significantly change the data for 2025. Forecasters also acknowledge the potential for: (1) improved standards of welfare to decrease consumer preference for poultry and (2) genetic engineering to increase yields at lower cost. However, the feasibility, regulatory permissiveness, and consumer preferences for the latter trend remain uncertain.

2032: Overall, forecasters expect global chicken consumption to continue to grow over the next decade. While they do not expect a significant global cultural shift towards lower meat consumption on this timescale, they do anticipate a limited decrease in highly developed countries to be more than offset by significant increases in consumption in less wealthy countries, as the latter's populations become wealthier. Forecasters expect the economic growth of the last decade to slow only slightly over the next, but some do expect annual global growth to stall at some point between 2032 and 2052. This would arguably lead to a stark reduction in chicken consumption.

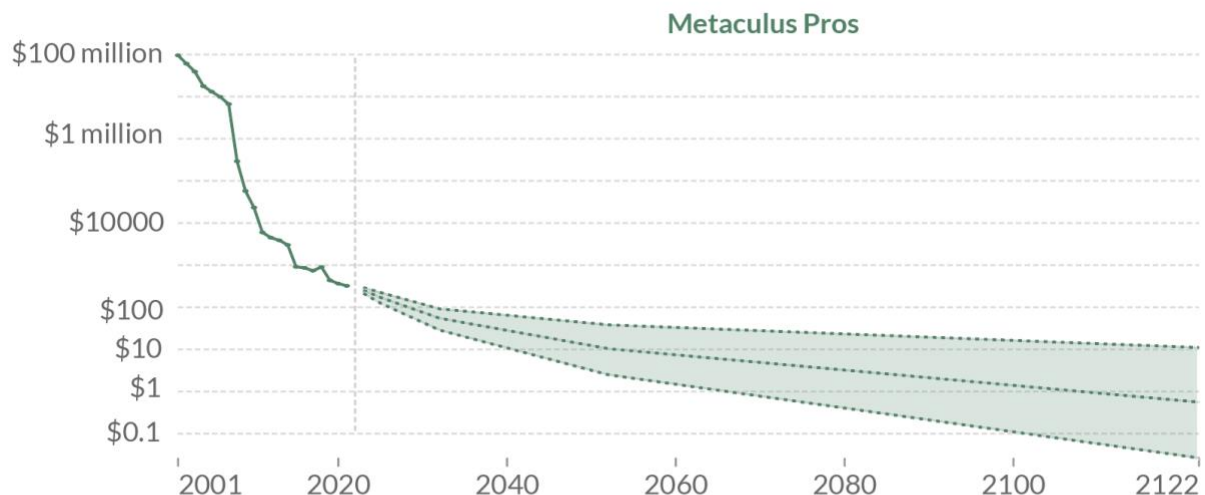
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2052: Forecasters expect that affluence and population increase will lead to a continuation of the trend of increasing chicken demand per capita and total chicken production. However, they also expect that cultured meat and other technological advances may have a material impact on meat consumption, particularly in highly developed countries. In fact, many predict that lab-grown or plant-based alternatives will dominate the market by this point. Beyond 2052, forecasters express much more uncertainty, but expect that meat alternatives and artificially grown meat will continue to replace the majority of chicken meat obtained by slaughtering chickens. They project that the rate of growth will slow as population growth slows, leading to a plateauing of chicken consumption while the cost of raising more chickens increases. Notably, they expect that ethical concerns will play only a minor role globally by this time.

2122: With a long-term horizon of 100 years, forecasters expect technological advances in meat alternatives to lead to a massive decrease in chicken consumption. They predict that, by 2122, global energy consumption will be pulled in two directions, there will be: (1) both a demand for better energy efficiency and lower consumption overall and (2) cheaper and more abundant electricity as renewables continue to fall on the cost curve. Therefore, it is highly likely that cultured meat will have been cost-competitive with traditional meat for decades. There are some forecasters who expect the global chicken population to be around half of its peak and, given the availability of cheap, high-quality cultured meat, there's a chance that the number of slaughtered poultry may fall close to zero.

Cost of Sequencing Whole Human Genome



Source: National Human Genome Research Institute (2022); Metaculus (2023)

Note: Forecasts are expressed in 2021 US dollars.

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	Pro Forecasters	Public Tournament
2023	\$357.00	\$303.00
2025	\$244.00	\$191.00
2032	\$81.00	\$56.00
2052	\$16.00	\$11.00
2122	\$0.93	\$0.45

2023: Forecasters predict that the cost of sequencing will continue to drop by about 15% per year due to technological improvements and the amortization of equipment costs, with 2023 being no exception. The main uncertainty at this timescale is the adoption rate of Illumina's new sequencing device by the National Human Genome Research Institute's funded sequencing centers. Forecasters also anticipate some volatility next year, mainly due to supply chain challenges as consumables used during sequencing make up a significant portion of the total cost. Most forecasts for 2023 are based on a business-as-usual scenario, but still consider the possibility that Illumina's \$200/genome machine could be in effect by 2023.

2025: Forecasters anticipate the potential adoption of Ultima Genomics devices, which claims to become commercially available in 2023, could offer significant cost reductions in the years that follow. However, it is unclear just how interested labs will be in acquiring expensive devices from a company with zero market share and the extent to which Illumina may try to discourage potential customers from buying elsewhere. While Ultima's technology is not revolutionary, it is believed to offer medium reductions in sequencing cost and has the main benefits of running faster and using raw materials more efficiently than Illumina machines, though it is currently more error-prone.

2032: Forecasters expect the cost of genome sequencing to continue to decrease in the short to medium term, with the possibility of reaching the long-promised \$100 mark around 2030. They predict that the cost will continue to decline at least down to this mark, with healthy competition in the market and several key patents set to expire in the coming years. For 2032, forecasters anticipate the next generation of \$100 sequencers to have been in service in the US for a few years, with the benefits of these devices realized. However, they do not expect a paradigm shift beyond this to result in \$10 genomes. There's a prevailing expectation that healthy competition in the market will continue to drive costs down, while a few forecasters cautioned that there will always remain a risk of anticompetitive behavior.

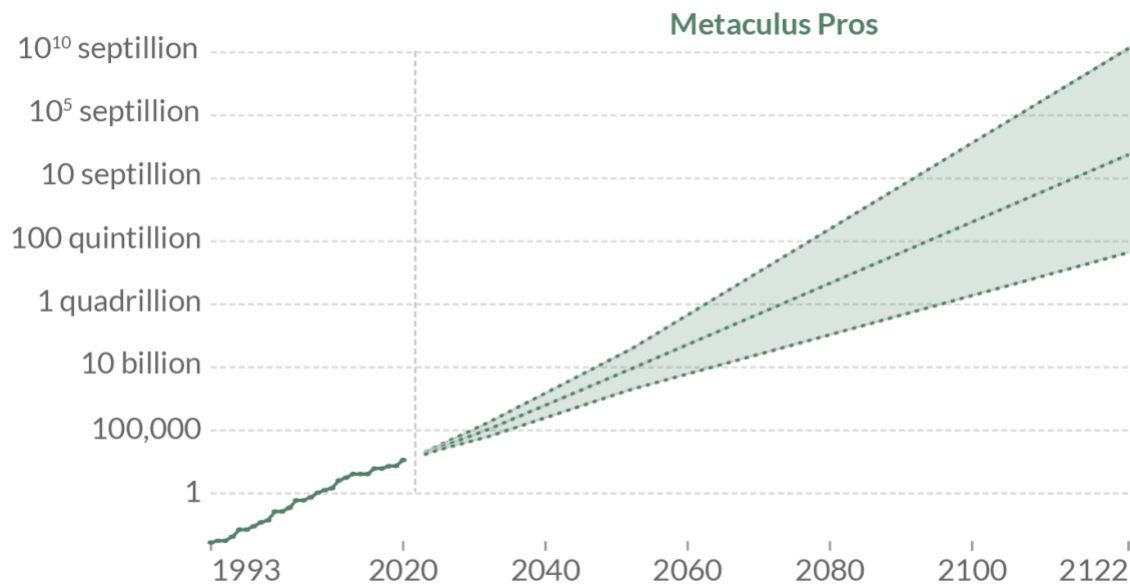
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2052: Forecasters predict that the benefits of the next generation of \$100 sequencers will have been realized by 2032 and will be a near certainty by 2052. In fact, most forecasters expect sequences will fall below the \$50 mark by this time. That said, they do not expect a general technological revolution or a significant paradigm shift in genome sequencing to occur just yet. They estimate that costs will generally reduce at a rate of -10% per year around 2052. Variations in forecasters' predicted costs can be attributed to their different expectations of an AI-led general technological revolution and whether that will significantly decrease the cost of most goods and services.

2122: Forecasters are confident that, by 2122, AGI will have existed for decades and will have drastically changed the human condition. The base case is that most goods and services, including healthcare services, will be extremely cheap by this time. Even without the tailwind of AGI, they believe that the cost will continue to fall more or less indefinitely due to the large amount of research and medical value in bulk genome analysis. Several forecasters expect that the marginal costs of DNA sequencing will come mostly from energy costs, which will be close to the theoretical limits associated with sequentially distinguishing among DNA bases.

[FLOPS of Fastest Supercomputer](#)



Source: TOP500 Supercomputer Database (2021); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	1.5×10^{18} (FLOPS)	1.3×10^{18} (FLOPS)
2025	4.1×10^{18}	4.5×10^{18}
2032	1.2×10^{20}	7.8×10^{19}
2052	7.4×10^{24}	3.6×10^{24}
2122	7.7×10^{41}	1.5×10^{43}

2023: Forecasters note that Frontier, a 1.102 exaflop system, currently holds the title of the fastest according to TOP500, but there is a possibility that Aurora or El Capitan could surpass it in the coming year. However, it is worth mentioning that these systems may not enter service running at their full capacity and may require several months of tuning to reach their maximum performance. There is also uncertainty surrounding the potential for China to publish benchmarks of its rumored exascale systems, but it is unlikely that these will surpass Aurora and El Capitan so quickly. The crowd forecast for 2023 is relatively consistent, with the lower limit taking into account Frontier's current standing.

2025: Thinking beyond 2023, the yearly increase in top speed has been slower this past decade compared to previous ones, but it is expected that more money will be invested in faster supercomputers as the race for artificial intelligence heats up. Forecasters estimate that, by 2025, Aurora and El Capitan will be running at their full capacity and that there will likely be at least one Chinese system with similar capabilities. While there have been reports of US plans to create supercomputers that are "5 to 10x more powerful than Frontier" by 2025-2030, it is considered unlikely that they will be operational by 2025. Forecasters attribute this to an observed pattern of US government projects taking longer than anticipated. Instead, such systems are more likely to be available in the late 2020s.

2032: It is uncertain how the exponential trend in processing power will evolve, but it is possible that it will continue in the coming decades. That said, some expressed concern over the possibility of a freeze in development due to an economic crisis or a potential Chinese invasion of Taiwan that would affect the supply of semiconductors. It is likely that China will also be developing similar systems at this time, but there is uncertainty surrounding funding for US efforts and the ability of China's domestic semiconductor industry to catch up with advanced manufacturers. The performance growth rate is expected to increase somewhat due to AI-related hardware and software efficiency gains, with a 20% chance of a zetta-scale machine being on the list in 2032 and a 75% chance of reaching yotta-scale by the 30 year timeframe.

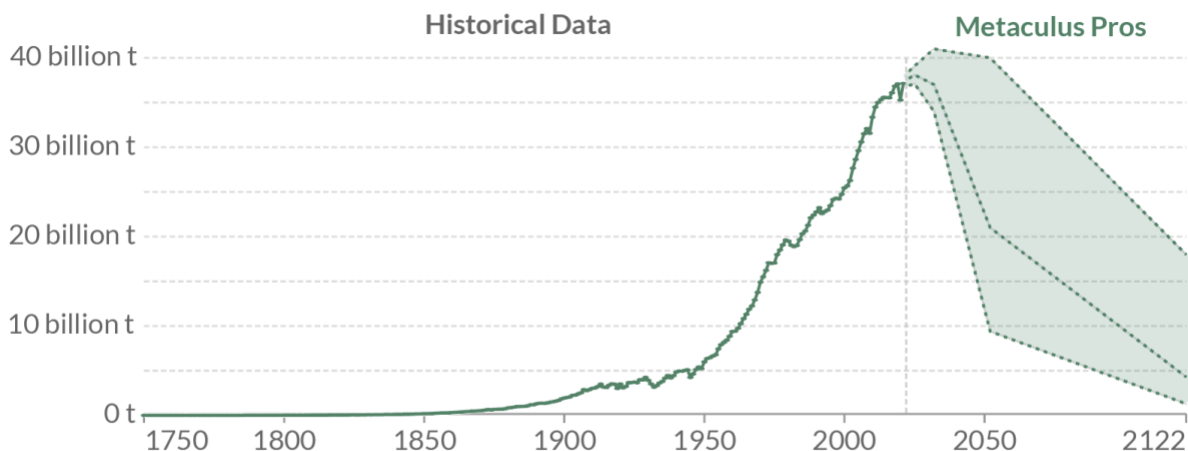
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2052: Forecasters acknowledge there is significant uncertainty in their estimates due to the potential for AI-driven advances, which would lead to more demand for compute. There is also potential for upside if there are better-than-expected designs and manufacturing processes for computer hardware and power generation methods that can support such systems. Overall, there appears to be a consensus that maximum computer speeds will still be following the current rate of growth at this point.

2122: Forecasters' estimates for 2122 vary significantly, but even the lowest ranges exceed the forecasted ceiling of 50 years prior. That said, a few did acknowledge that physical limits and other practical considerations could potentially render further development of massive unified systems undesirable or inefficient. In fact, in the long-term, it is possible that there may not be a clear distinction between individual computing systems. Instead, there may be numerous highly efficient, modular computing devices that can be easily assembled together in a distributed manner to perform large computations and then dismantled into smaller "systems" when no longer needed. These devices may be similar to computronium (i.e., programmable matter) and can be combined in various numbers, sizes, and shapes.

Global CO2 Emissions



Source: Our World in Data based on the Global Carbon Project (2022);
Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	37.7 (<i>billion tonnes</i>)	36.4 (<i>billion tonnes</i>)
2025	38.1	36.2
2032	37.0	32.0
2052	21.0	17.0
2122	4.3	4.4

2023: Forecasters believe that the electricity transition is already underway and that most sources of renewable energy can be stored with dedicated batteries, batteries of idle EVs, pump hydro, and overbuilding. In the next 1-2 years, they consider it unlikely that geoengineering efforts will take place on a large enough scale to significantly impact outcomes. Instead, they expect that geoengineering approaches may be more impactful in the medium term if certain climate goals are seen as unachievable and the cost of climatic change is high. For 2023, forecasters expect a recovery from the COVID-19 induced lows of 2020, but this may be tempered by persistently high energy prices and a likely recession in 2023. China's continued zero-COVID stance may also put downward pressure on the numbers.

2025: Forecasters believe that this question is best answered by asking whether CO₂ emissions are at their peak or still rising slightly. In the case of 2025, they expect that near-term economic conditions and high energy prices will somewhat constrain the growth of CO₂ emissions, but a large deviation from the trend is unlikely. That said, they largely believe that we are at or near the peak of CO₂ output. This is mainly explained by the rapid growth of solar and wind energy, as well as electric transportation ground vehicles (with electrification of air and sea travel on its way). They expect that future economic incentives and regulation will have a large impact on the speed of the transition, but the trend is nevertheless in place: renewables are coming and fossils are on the way out.

2032: Forecasters expect that CO₂ emissions will level off in the next ten years, with a peak between 2030 and 2025. They expect a material increase in world population, GDP, and energy demand by 2032, but the pace of adoption of clean energy generation and transportation is somewhat uncertain. They also anticipate significant progress in the commercialization of nuclear fusion by 2032, and do not expect it to have a material effect on overall emissions. They do, however, expect solar and wind power generation prices to continue to decline, along with the price of batteries. There's agreement that the transition to electricity and alternative fuels like hydrogen will be well underway by 2032 and mostly complete in the 15-20 years that follow. A

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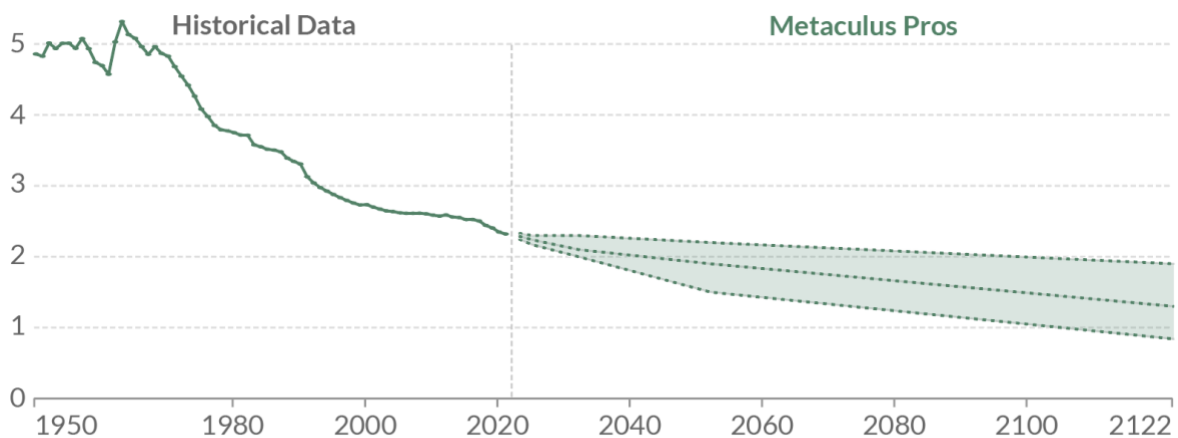
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key question for this time horizon is the amount of capital investment in new, energy-generating infrastructure and how seriously governments will commit to expediting the process.

2052: Forecasters predict that CO₂ emissions will level off or peak in the next 10-15 years and that targets for 2052 will likely be met, with a shift towards the use of solar, wind, and nuclear energy, as well as the electrification of most forms of transportation. Most expect a rapid acceleration of low-carbon energy adoption once the all-in cost of low-carbon energy undercuts the cost of fossil energy, which is expected to happen around the median timeframe of 2052. They also anticipate a lower population than currently predicted, which will contribute to lower CO₂ emissions. Forecasters are not confident that cultured meat will be cheap and widely available by 2052, but they do consider the possibility of carbon capture and storage to limit CO₂ in the atmosphere without showing up in emissions figures.

2122: There is still quite a bit of uncertainty around the 100-year mark, but forecasters expect the transition away from fossil fuels to be well underway by this time. In fact, they really see this question as asking about how complete the already-established transition will be. In fact, many expect the clean energy transition to be all but complete, with cultured meat becoming cheap and widely available in much of the world and major polluting industries either eliminated or moved off-world. However, there is significant uncertainty about the level of CO₂ emissions that will be considered ideal in the future, as preferences may change significantly over the next century. Some forecasters also expect that direct air capture and other methods of reducing CO₂ in the atmosphere may be in use by 2122, and that synthetic fuels may still have a role to play in certain industries that require chemical energy or where it is difficult to convert to electric.

Global Fertility Rate



Source: United Nations - Population Division (2022); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	2.29 (<i>children per woman</i>)	2.23 (<i>children per woman</i>)
2025	2.24	2.20
2032	2.10	2.09
2052	1.90	2.00
2122	1.30	2.00

2023: Forecasters expect fertility rates to continue to decline at a consistent pace in the next few years, with little chance of significant deviation from this trend. Specifically, they predict fertility rates to be lower than the UN estimates for both the years 2023 and 2025, mainly due to concerns about economic growth and the effectiveness of pro-natalist policies in low-fertility regions. Forecasters noted that improved medical treatment, self-determination, education, and economic opportunities for women and girls will continue to drive fertility rates downward — in 2023 and beyond.

2025: As in the previous time horizon, forecasters expect the trend towards lower fertility to continue at a similar pace through 2025, with little chance of a significant departure from most reputable projections. In fact, forecasters generally use two approaches for their baseline 2025 forecasts: either taking the UN forecast as is or extrapolating current trends. Many believe that it is very unlikely for the birth rate to increase and have made the right tail of their distribution as short as possible. Forecasters were notably surprised by their tendency to predict a lower total fertility rate than the UN projection for this year and others.

2032: Forecasters expect that there will not be a significant departure from current trends in the world's population by 2032, but they are slightly biased towards a lower population due to their optimism about economic growth leading to lower birth rates. There was also widespread pessimism about the effectiveness of government efforts to increase the birth rate in low-fertility regions. Most anticipate the projected decrease in fertility rate to accelerate after 2032 rather than to abate or level off. There is some possibility of a disaster affecting the fertility rate between now and then, but it is not certain that it would lower rather than raise the rate.

2052: Forecasters predict that by 2052, fertility rates will have declined significantly due to improvements in health, education, and economic development. The normalization of not having children in highly developed countries, the availability of more interesting activities, and the increased fertility window through assisted reproductive technology are all expected to contribute to this decline. While ectogenesis technology may be available in some countries by

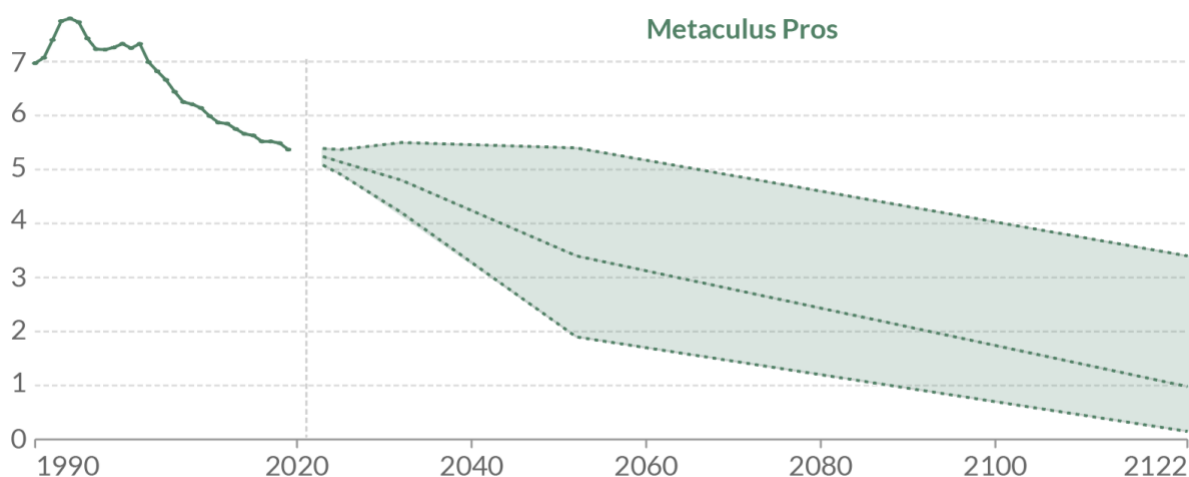
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this time, it is uncertain how quickly it will be adopted and many labeled that factor to be more of a “wildcard” than a driving force.

2122: Some forecasters expect that, by 2122, most human reproduction will use ectogenesis technology, but a non-trivial population of humans will choose to avoid it for ethical or personal reasons. One forecaster also expects human lifespans to be functionally indefinite by this time, allowing for an indefinite delay in childrearing. In terms of population trends, forecasters believe that the decline in population will slow, but it is uncertain if it will level off or continue to decrease. They have considered a variety of factors that could influence population trends, such as housing crises, work from home trends, economic prosperity in developing countries, and government attempts to address fertility rates.

Global Homicide Rate



Source: IHME, Global Burden of Disease (2019); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	5.24 (per 100k)	5.32 (per 100k)
2025	5.14	5.26
2032	4.80	4.90
2052	3.40	3.60
2122	0.98	0.56

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2023: Forecasters expect that the trend of decreasing homicide rates will continue in the near future, but at a slightly slower rate due to recent geopolitical instability and economic concerns. There is uncertainty around the potential for increased violence in less developed countries that may be more vulnerable to political instability and civil unrest if food prices continue to escalate. Forecasters also note the potential for decreasing homicides in Latin America as more narcotics are legalized, but believe it is unlikely that broad-enough legalization will occur by this point to have a significant impact on the global homicide rate.

2025: Forecasters expect that the trend of decreasing global homicide rates will continue over the next few years, but they are slightly biased towards the possibility of an increase in violence in the event of localized economic weakness or political instability, particularly in less developed countries. The declining trendline is expected to be close to linear, consistent with the observed decrease of about 0.7 per year over the past 10 years and about 0.5 per year over the past 4-6 years. Forecasters do not anticipate that worldwide economic fluctuations will significantly impact the trend in the short term.

2032: They also predict that the trend of annual declines in homicide rates will continue to slow slightly by 2032. This prediction is influenced by the growing population in regions with already high levels of violence, as well as the lack of significant new crime detection or prevention technology. While better standards of living, more engaging entertainment systems, and better surveillance and crime prediction could prove to be a countervailing force, forecasters do not expect these factors to prompt a dramatic reduction in the homicide rate. Forecasters also consider the potential for conflict and mass casualties due to access to dangerous technologies, as well as the impact of cultural changes on violence.

2052: Forecasters expect homicides to decline substantially due to improvements in material conditions, education, healthcare, and technology that reduce the propensity for violent crime and decreases the probability that offenders can cause harm or death. The main risk at this timescale is the potential for large-scale mass casualty events enabled by advances in technology, such as weaponized drones and robots, lethal autonomous weapons systems, new types of bioweapons, and weaponized molecular nanotechnology. Forecasters also suggest that anticipated waves of drug legalization will continue to have a positive impact. Notably, many predict that a large gap will exist between homicide rates in the most- and least-developed countries, potentially larger than the gap that exists today.

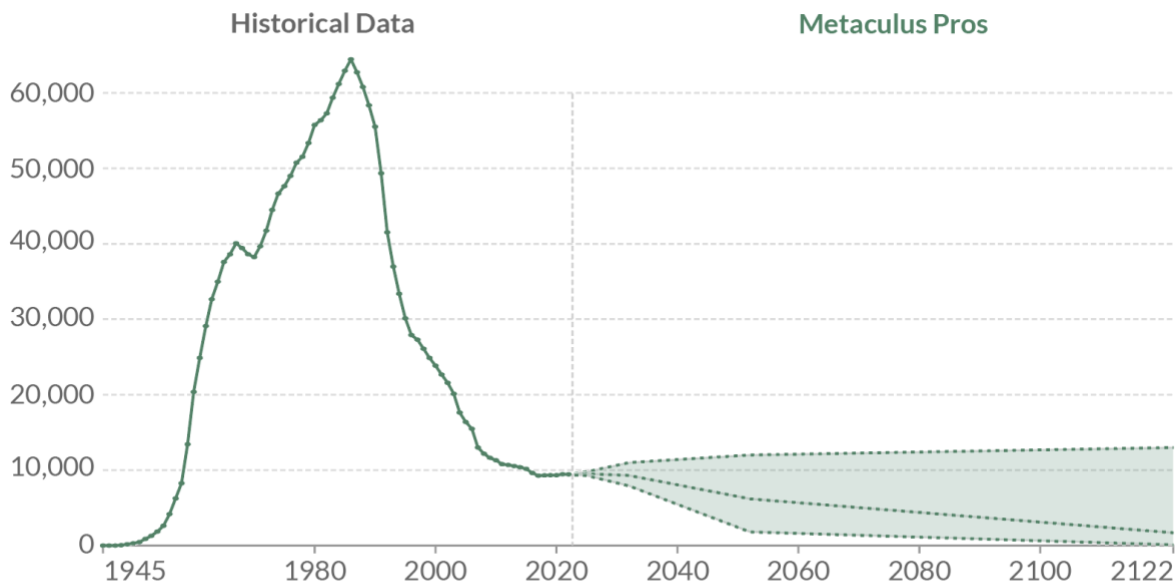
2122: Forecasters expect that, by 2122, there will be even greater improvements in material conditions, education, healthcare, and the adoption of technology that reduces the likelihood of violent crime and increases safety. Some forecasters believe that new technologies, such as surveillance systems and medical treatments, could help reduce the homicide rate, while others

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believe that other technological advancements could potentially make it even easier to commit mass killings. The impact of climate change on global stability is also a concern, as it may lead to increased levels of violence in regions affected by ecological disruption. Other factors that may influence the homicide rate include the prevalence of drug use, the adoption of liberal democracies, and the availability of interventions that increase intelligence or cognitive capacity.

Global Nuclear Warhead Stockpiles



Source: Federation of American Scientists (2022); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	9.46k	9.40k
2025	9.52k	9.38k
2032	9.30k	9.00k
2052	6.20k	7.10k
2122	1.70k	2.20k



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2023: Forecasters' distribution is quite narrow because they do not expect significant increases or decreases in the number of nuclear weapons in the next year. Instead, they believe that a median close to the most recently reported numbers makes the most sense. However, they do consider it somewhat more likely that there will be a net increase in the number of nuclear weapons than a significant decrease. Forecasters also believe that, in the short term, the biggest sources of uncertainty in predictions for the number of nuclear weapons are changes in measurement and whether China will have completed any new warheads by this time. For example, forecasters have provided an estimate for the Chinese warhead stockpile that is higher than the "low-200s" listed in the Pentagon's 2020 China report. This is because the Pentagon estimate is from late-2019 and only includes "operational" warheads, while the forecasters' estimate also includes warheads produced for missiles in the process of being fielded.

2025: Forecasters do not expect there to be realistic prospects for a large change in the number of nuclear warheads over the next few years. In fact, they predict the number to continue increasing slightly, as minor nuclear powers add a few more weapons. The prevailing wind is away from disarmament, with Russia unlikely to surrender any geopolitical edge it might have and China apparently planning to ramp up its nuclear arsenal. The US and Russia are thought to be fine with having around 4,000 warheads, which they see as sufficient for global strategic deterrent. Forecasters believe that some countries, such as the UK and France may see themselves as possessing too few warheads in their arsenals and are over-reliant on assurances from the US.

2032: Forecasters do not expect much change in the number of nuclear weapons over the next 10 years, except perhaps for China growing its arsenal up to 700-1,000 warheads. They believe that the US and Russia are increasingly entrenched in their positions and unlikely to change course. They also expect the minor Western nuclear powers (UK and France) to maintain their stockpiles rather than significantly increase or diminish them. The other minor developed nuclear powers (India, Pakistan, and Israel) are expected to somewhat increase their stockpiles, with India and Pakistan doing so in response to China's growing arsenal and to keep pace with each other, and Israel primarily in response to the threat from Iran. Another possibility on this timescale is Taiwan obtaining nuclear weapons, either through an indigenous development program or through a technology transfer agreement with an existing nuclear power, most likely the US. If the Chinese government continues to pose a threat to Taiwan and Taiwan is not invaded by China before the 2030s, some forecasters currently believe it is about 60% likely that Taiwan will possess nuclear weapons by 2032.

2052: Forecasters expect that nuclear weapons will become less important to the security of great powers and that norms against nuclear weapons will help to keep the number of weapons relatively low. They do not expect a return to Cold War stockpiles, especially because a second-

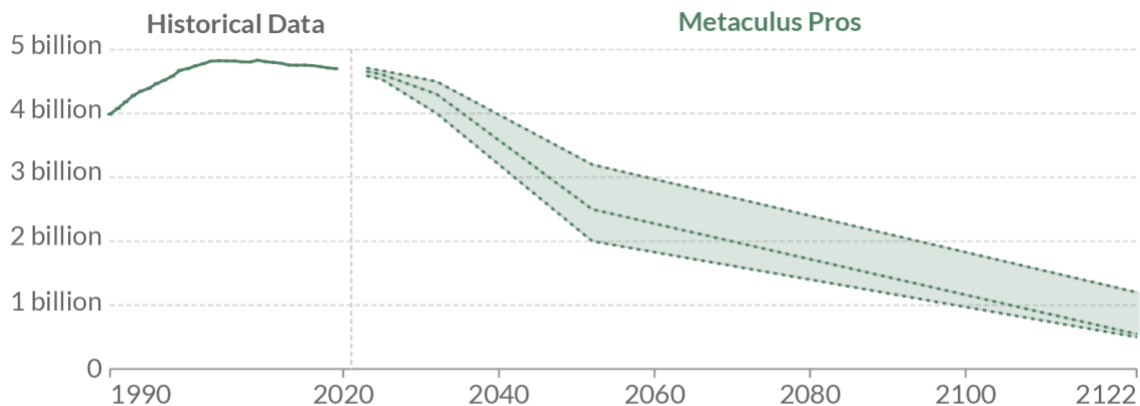
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strike deterrent will likely make even less sense in the future. Forecasters expect that the US, China, and Russia will each have something in the range of 2,000-4,000 weapons. While a world without nuclear weapons would be more tenable in the long term, it would require an extraordinary amount of international coordination over the next 30 years, which is considered unlikely. Forecasters did acknowledge the possibility of another nuclear arms race as a wildcard, but it is generally considered improbable.

2122: Following 2052, forecasters' uncertainty has increased substantially, and by 2122, they have little expectation that the number of warheads today will have much relation to the number in 100 years. Forecasters expect that the world will be more multipolar, but nuclear weapons will still be used as a component of deterrence in a select few cases. However, for the most part, they do not expect nuclear weapons to be very practical in the long run. Instead, forecasters are hopeful that material abundance will lead to a different international system that is not based on a balance of military power. Forecasters also expect other, more precise countervalue weapons to be far more important for international security. The distribution of the world's largest cities and the number and distribution of counterforce and countervalue targets around the world will also be important factors in determining the number of strategic weapons.

[Global Poverty \(<\\$10 2011 INT USD per day\)](#)



Source: World Bank Poverty and Inequality Platform; Metaculus (2023)

Note: This data is adjusted for inflation and for differences in the cost of living between countries, and is measured in international-\$ at 2011 prices.

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	Pro Forecasters	Public Tournament
2023	4.66 (<i>billions of people</i>)	4.67 (<i>billions of people</i>)
2025	4.61	4.61
2032	4.30	4.40
2052	2.50	3.80
2122	0.55	2.00

Note that the lower bound input range for 2122 was 500 million people. Metaculus Pros predicted a 44% chance the number of people living on less than \$10 2011 INT USD per day would be less than 500 million. The limitation on the range input creates the “pinched” appearance of the 2122 forecast for this chart.

2023: Forecasters are more pessimistic about the number of people living in poverty in the next decade due to the lingering economic effects of the COVID-19 pandemic, which is expected to push many more people into extreme poverty and have negative effects on the rest of the income scale. Other negative factors include significant inflation, currency devaluations, increases in geopolitical instability, and rapid interest rate increases that are expected to cause a global recession in 2023. Overall, forecasters expect the pandemic to have produced a 3-year setback in reducing poverty.

2025: As with 2023, many forecasters are somewhat pessimistic about the potential for a significant decline in poverty in the next few years. They expect continued global economic problems and climate adaptation challenges to slow progress in poverty reduction over this period. That said, others are generally optimistic about the eventual eradication of poverty, acknowledging the potential a four-fold increase in the rate of decline between now and 2032.

2032: Forecasters believe that poverty levels will continue to decrease over the next 10 years due to technological advancements in AI and automation, which will likely be concentrated in the most advanced countries but also have some benefit throughout the rest of the world through increased trade. Several are particularly optimistic about this timeframe and expect less than 25% of the global population to fall into the poverty category within the next 10-20 years. Other forecasters do worry that technological advances may not lead to an overall uplift of living conditions across all nations and have added components to their models to account for scenarios where wealth is accumulated in the hands of a few, leading to large portions of the population living in poverty.

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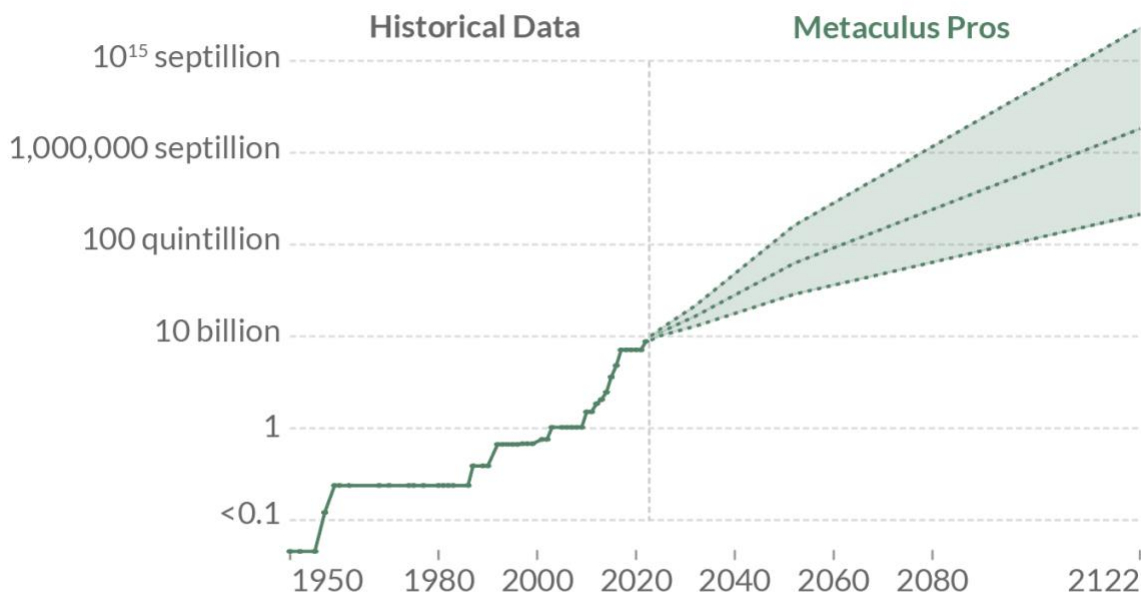
2052: Forecasters predict that significant technological advancements, including AI, will likely lead to a significant reduction in the number of people living in poverty by the 2050s. While forecasters are optimistic about the potential for AI to solve issues such as climate change, aging, and resource depletion, they also account for scenarios where such technological progress fails to materialize due to global conflict or other disasters. Forecasters also expect a lower world population in the coming decades, due to lower fertility rates and expect the majority of population growth to occur in poorer countries in Africa. In the further future, forecasters see three main scenarios: a continuation of the current trend, a utopian outcome where smarter-than-human AI leads to the elimination of poverty, or a dystopian outcome where the benefits of AI are concentrated among the rich and powerful, resulting in worsening poverty for the majority.

2122: Advanced technology will have greatly reduced global poverty, with most forecasters estimating at least a 25% chance that poverty will be universally eliminated in the next 100 years. Many are very confident that poverty will be universally eradicated — except for a few anomalous pockets — yet there is still a concern that wealth could be distributed very unequally. Some forecasters, however, have factored in scenarios where transformational technological progress does not occur due to an authoritarian lock-in, disaster, or other unforeseen difficulties.

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Greatest Computation Used in AI Training



Source: Sevilla et al. (2022); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	6.50×10^{24} (FLOPS)	1.30×10^{25} (FLOPS)
2025	2.90×10^{25}	6.60×10^{25}
2032	1.60×10^{27}	4.80×10^{27}
2052	9.40×10^{32}	8.20×10^{36}
2122	3.90×10^{47}	8.00×10^{47}

2023: Forecasters note that there is currently a lot of momentum towards larger models in the field, and they believe it is likely — but not guaranteed — that a model larger than Minerva will be released in the near future. They also mention that there was a significant jump in model size between 2020 and 2022, and they expect the next big model to also show a significant increase in size. Forecasters considered that GPT-4 is expected to be released by the end of 2023, but

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details about the computation used are not public. They also discussed the costs associated with running large models, including the capital and energy costs.

2025: Forecasters expect significant growth in compute utilization by 2025, with no signs of this trend abating. However, the forecast is less certain due to the possibility of major slowdowns and difficulties in scaling many more orders of magnitude. The longer term forecasts for 2032, 2052, and 2122 are all significantly less certain than that of 2025. Forecasters expect a doubling time of around 10 months for at least the next few years, with the possibility of a rapid increase in the size of future AI training runs due to recursively self-improving AGI systems, though the duration and peak rate of this increase is uncertain.

2032: Forecasters maintain a belief that investment in and enthusiasm for AI will continue to be very high at this time, which could enable larger investments in compute resources. However, they also note that it is difficult to accurately project exponential growth and they are uncertain about most predictions beyond 2025. Several forecasters mentioned that they expect the exponent of growth to slow after 15-20 years due to physical limits and diminishing returns on increasing the number of operations, but they also mention the possibility of a runaway scenario of increasing computation. They also discussed the possibility that the current regime of adding more compute might give way to other approaches, such as using compute more efficiently or running out of data to train on in certain domains. In the long run, forecasters expect growth in AI compute to revert to the slower growth rate of GPU or CPU price-performance, possibly starting around 2025 to 2040.

2052: Forecasters have provided a range of predictions for the cost and availability of computing resources in 2052. They believe that there is a reasonable chance that technical advances occurring before 2052 will decrease the cost of compute, possibly through improvements in design or manufacturing processes, which will drive demand for larger amounts of compute resources. However, they also recognize the possibility of diminishing returns being realized earlier or cost reductions failing to materialize. They expect that eventually, compute will scale similar to the growth rate of CPU and GPU price-performance due to limits on runtime and cost. Forecasters have also considered the possibility that the largest computing systems will be used for training or improving superintelligent AIs.

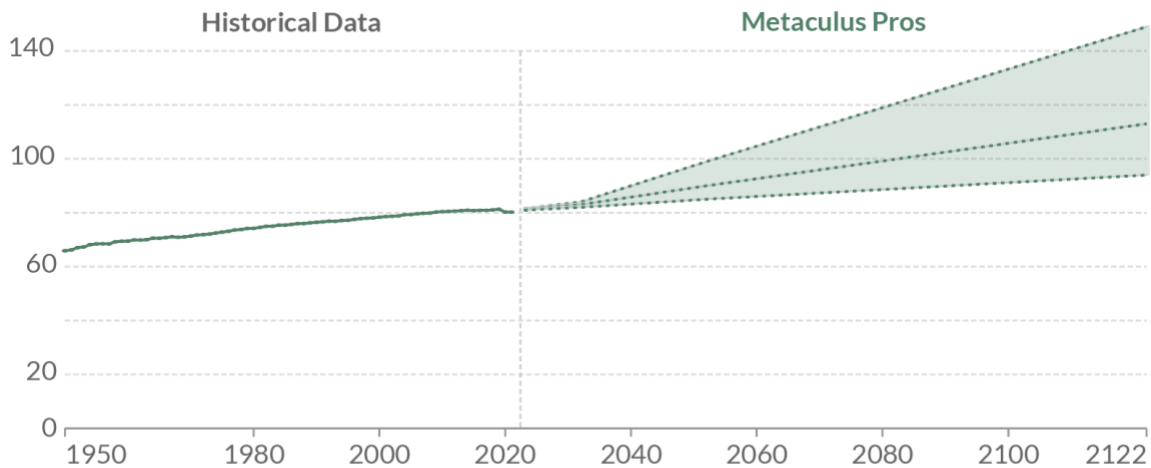
2122: Forecasters have provided a range of predictions for the cost and availability of computing resources in 2122. They recognize that their predictions are highly uncertain given the time horizon, but overall do not have strong disagreement with each other's estimates. For many of the more optimistic predictions, they tended to bet on continued exponential growth. However, they still recognize the possibility of diminishing economic returns, carrying capacities, and laws of physics leading to S-curves rather than J-curves. Forecasters have also noted that, according to Wikipedia, Ray Kurzweill cites a calculation that the entire mass of the universe is

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capable of about 10^{90} operations per second, which may suggest a ceiling to some extremely optimistic predictions.

[Life Expectancy at Birth in the G7](#)



Source: United Nations World Population Prospects (2022); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	81.4 (years)	81.2 (years)
2025	81.7	81.1
2032	83.0	82.3
2052	90.0	89.0
2122	113.0	118.0

2023: Forecasters frequently took into consideration the World Population Prospects forecast when making their predictions. The negative impact of COVID-19 is expected to continue to have a significant effect on life expectancy in the short term, but improvements in treatment protocols and a return to more normal living circumstances may reverse some of the negative effects on life expectancy. According to many, there is even a chance of a slight increase in life

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expectancy for the G7 countries in the next few years, driven by the US potentially experiencing a return to pre-COVID levels.

2025: Over the next few years, forecasters believe that medical technology will continue to improve, potentially leading to an acceleration in life expectancy improvements due to reduced mortality rates for common diseases. They are particularly optimistic about the potential for mRNA technology to prevent and treat various illnesses. Forecasters do anticipate that COVID-19 may still continue to have a modest impact on mortality rates, but to a lesser extent than it currently does. They also expect that, over the next 5-10 years, there may be a slight dip in life expectancy at some point, due to economic headwinds and ongoing negative effects of the pandemic. These effects would likely show up as long-term health issues and changes in behaviors that negatively impact health.

2032: Forecasters also expect significant increases in life expectancy as a result of improvements in medical technology, including the possibility of cancer vaccines by 2032. Notably, they suggested that anti-obesity treatments, such as Tirzepatide, will become more widely available and have a bigger impact on increasing life expectancy over the longer term. Many of them have added greater downside tails to their forecasts, mainly to account for the small risk of brief periods of increased mortality from pandemics or war. Comparatively, forecasters predict that the poor performance of US life expectancy will continue to drag on the G7 average for another decade or so.

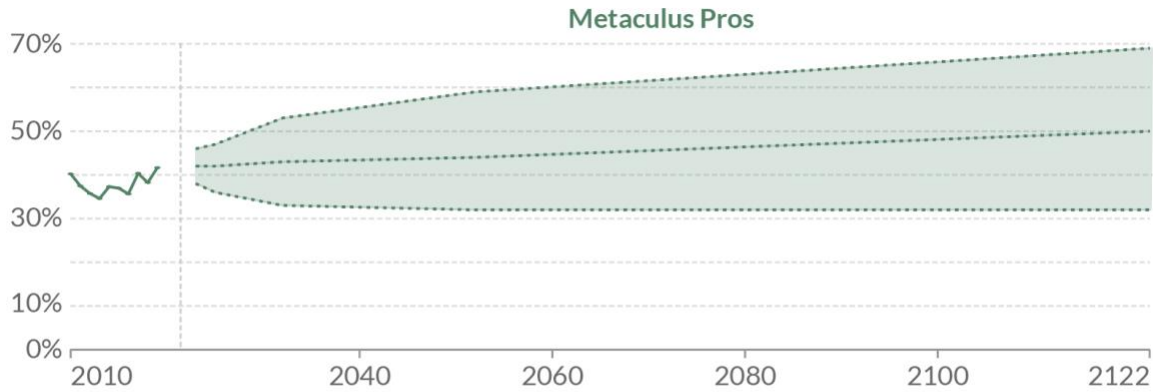
2052: Forecasters expect that over the next few decades, advanced countries have a small chance of achieving *longevity escape velocity* — the point at which medical technology is adding longevity at a faster rate than time is passing. This is attributed to medical improvements that address the hallmarks of aging. Average life expectancy will have significantly increased, but there remains a possibility of people failing to thrive as a result of a catastrophe or worsening climate or economic conditions. While most are optimistic about the possibility of radical life extension, they acknowledge that, even in this case, life extension will be uneven and people will still die due to violence.

2122: Some forecasters anticipate that the benefits of longevity technologies may be widely distributed, due to the economic and political necessity to ensure wide access. Driving many of their forecasts was an expectation that the human species would be very different by this time. Some also believe that longevity escape velocity could be reached by 2122, especially in the G7 countries. With this in mind, several adjusted their life expectancy estimates for 2122 based on the existing UNData forecast for 2100 and then added an increase of 10+ years (25 additional years in some cases). Some research suggests that the hard cutoff for human life expectancy is 150 years, but forecasters are skeptical of this claim. They give it some weight, but also allow for the possibility of even longer lifespans. Overall, many expect the right tail of their distribution to be significantly longer than the left tail, indicating a higher probability of longer lifespans.

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OECD Trust in Government



Source: OECD (2022); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	42% (<i>pop. reporting trust</i>)	43% (<i>pop. reporting trust</i>)
2025	42%	41%
2032	43%	46%
2052	44%	59%
2122	50%	73%

2023: Forecasters expect that the level of trust in government in the OECD countries in 2023 will be similar to the levels reported over the last few years — in the range of 40-50%. Some have a slight bias towards the lower end of this range due to anticipated negative economic factors in the OECD countries. While these conditions could lead to unusually low levels of trust in government, they will not be unprecedented, as any recessions are likely to be moderate in severity. Forecasters also expect increasing amounts of domestic instability in the biggest military powers, including America, Russia, and China. These countries are dealing with domestic instability and the OECD, as well as the rest of the world, is expected to see similar trends as commodity prices increase.

2025: Forecasters expect the level to dip slightly lower due to anticipated negative economic factors in the next two years. They still do not expect this to lead to an unusually low level of

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confidence, given that recessions are relatively frequent and any near-term ones are not expected to be especially severe. Nevertheless, forecasters are less optimistic that the rest of the OECD will move closer to countries like Switzerland and Denmark in terms of trust in government anytime soon, as they believe cultural factors will likely play a role. Forecasters also acknowledge that probable international tensions and wars may affect trust in national governments in the future.

2032: Forecasters expect trust in government in OECD countries to vary significantly — roughly between 30% and 60%. The forecast is less certain for this timescale due to the sensitivity of trust in government to political and economic factors, which are difficult to predict 10 years out. Forecasters use a bimodal distribution to represent two large classes of scenarios: one with increasing social unrest and obsolescence of national governments, and another where a variety of factors lead to increases in trust. They are slightly more optimistic about trust in government in 2032 due to a probable economic recovery and a return to more stable times; but they still worry about political polarization, which could depress trust in government numbers.

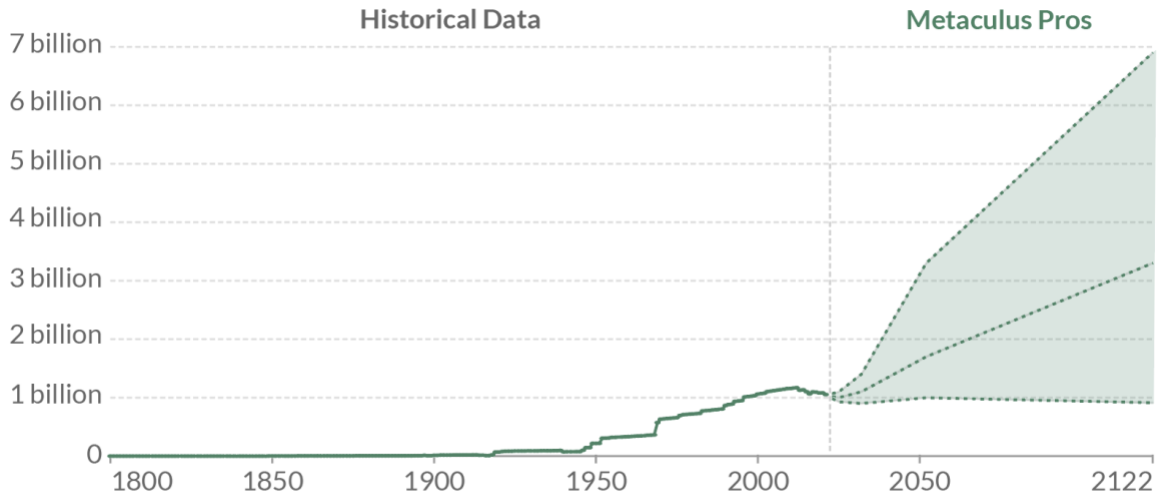
2052: Forecasters are much more uncertain about their predictions this far out, due to the subjective nature of trust and a lack of historical long-term trends. Forecasters believe that trust in government may decline over time due to increasing political polarization and heterogeneity in societies. Conversely, they also recognize that trust may increase in the face of global conflicts or other crises that may act as a unifying force. Most countries in the OECD are expected to have quality-of-life levels comparable to the Scandinavian countries, which would contribute to higher levels of trust.

2122: Forecasters consider the possibility that the OECD and its nation states are unlikely to still be in existence in 2122, which complicates their predictions. Forecasters believe that if our societies have made it to 2122 without experiencing significant negative events, trust in governments could be quite high. However, in negative scenarios, trust could be low. Generally, forecasters are uncertain about making a forecast for trust in governments on a 100 year timescale, since they believe that this approach is largely a random walk with a slight tendency to revert to the recent mean.

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People Living in Liberal Democracies



Source: OWID based on V-Dem (v12) and Lührmann et al. (2018); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	1.02 (<i>billions of people</i>)	1.05 (<i>billions of people</i>)
2025	1.00	1.10
2032	1.10	1.00
2052	1.70	1.60
2122	3.30	2.30

2023: Forecasters expect the population living in liberal democracies in 2023 to remain relatively unchanged. They do have a slight bias to the downside, due to the perceived fragility of the status of 'liberal democracy' and the potential for short-term political developments to cause some countries to fall from this category. Forecasters also note that immigration can contribute significantly to the population of liberal democracies and may also encourage liberalization in the home country.

2025: Forecasters' estimates remain relatively unchanged for 2025, with the prediction biased towards the downside due to the potential short-term political developments that could cause

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countries to slip out of the liberal democracy category. The prediction is based on the assumption that the world will continue to recover from the COVID-19 pandemic, with the possibility that the 2024 elections could generate political turmoil in the US, thereby causing it to lose its 'liberal democracy' status. Forecasters also believe that major countries such as Brazil, China, India, Indonesia, Pakistan, Russia, and Ukraine could all make the transition to liberal democracy in the medium term, but none of them seem to be on the cusp at the moment.

2032: Forecasters predict that the population living in liberal democracies in 2032 will be modestly higher, with a possibility of India becoming a liberal democracy, but a low probability of China becoming one. They expect the slowly decreasing trend of the last decade to flatten out and potentially begin to increase over the next 10 years. However, there is more downside risk than upside as it seems easier to move away from liberal democracy than into it. They also predict that the definition of a liberal democracy may become more stringent in the coming years.

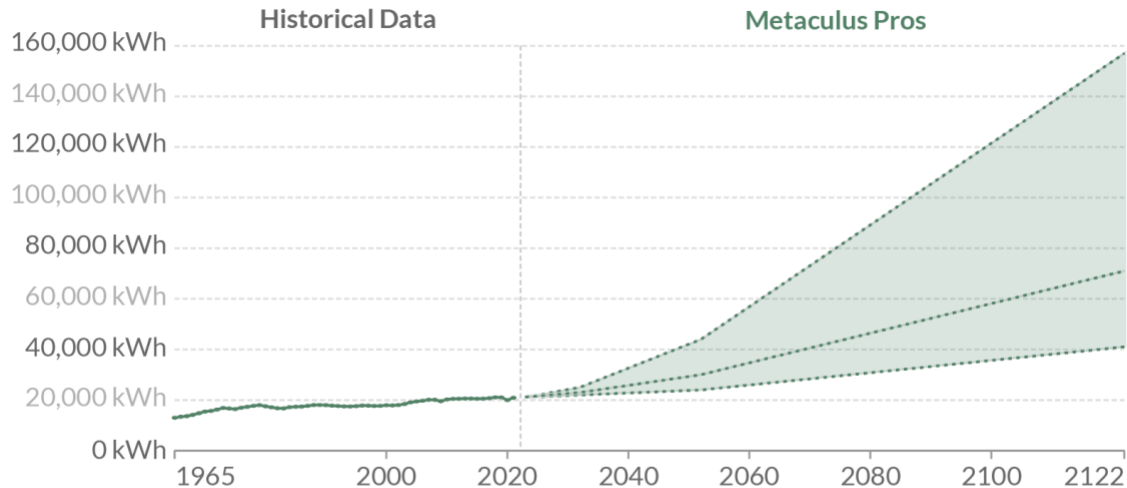
2052: Forecasters predict that in 2052, the number of liberal democracies will increase over time as levels of affluence and education rise, and as states and their polities mature. They expect that India will have become a liberal democracy, and that most 2022 liberal democracies will still exist, especially those with longer histories under this label. There is a significant chance that the world will lose a number of its liberal democracies as a result of parties controlling advanced technologies. Such parties would wield substantial leverage over world affairs, such that they are in a position to impose their political will on others. There is a small chance that the number of these democracies will decrease due to other technological disasters or the inability to keep up with technological progress.

2122: Forecasters predict that in 2122, there are three main scenarios for political arrangements. The most likely scenario is that most people will live in a settlement similar to liberal democracy, but with a somewhat less extensive role for government due to technological improvements. The second scenario is one in which there is a greater variety of political systems available for individuals to choose from based on their ethical preferences. The final, least likely scenario is an authoritarian lock-in in which a small population of humans is oppressed by a powerful entity.

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Per Capita Primary Energy Consumption



Source: Our World in Data based on BP & Shift Data Portal; Metaculus (2023)

Powered by ourworldindata.org

Note: Energy refers to primary energy – the energy input before the transformation to forms of energy for end-use (such as electricity or petrol for transport).

	Pro Forecasters	Public Tournament
2023	21,200 (kWh)	21,100 (kWh)
2025	21,600	21,400
2032	23,000	22,000
2052	30,000	73,000
2122	71,000	93,000

2023: Forecasters expect world electricity consumption to either remain stable or slightly increase in 2023, with a slight bias towards the downside due to increased energy costs and the possibility of a global recession. They also anticipate that the current rate of growth in per capita energy use, which was 0.4% per year in the twelve years prior to the pandemic, will continue in the immediate term, although energy efficiency will play a role in increasing effective electricity consumption. In the short-term, forecasters expect little change in energy consumption, with a chance for a drop in the next year due to high energy prices and a lack of supply.

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2025: Forecasters expect energy consumption to increase over the next few years as the economy recovers from a recession and energy prices decline. However, there is a slight bias towards the downside due to the possibility of lingering economic damage and energy-saving habits becoming entrenched. Forecasters have also included small, wide components in their predictions for the possibility of war or other catastrophes affecting countries with currently high energy consumption. It is also expected that as incomes increase, electricity demand will also increase, but not at the same rate, leading to a rise in electricity demand worldwide as the world becomes wealthier. Looking ahead, they note the possibility that extremely cheap renewables could lead to high electricity consumption, especially if storage technology does not improve at a similar rate.

2032: Energy prices are expected to be significantly lower and there will be fewer people without access to affordable electricity, mainly due to the adoption of declining price energy sources such as solar photovoltaic and wind energy. Forecasters also anticipate material increases in nuclear energy generation, particularly in China, and to a lesser extent in Europe and the US. Supported by these factors, forecasters predict a moderate increase in average energy consumption by 2032 and expect the trend of the last decade to continue as per-capita primary energy consumption slowly increases. In the longer term, forecasters believe this metric will begin to increase at a faster pace as developing nations approach the energy consumption of wealthy nations; as renewable energy infrastructure improves and expands, marginal energy costs should drastically fall.

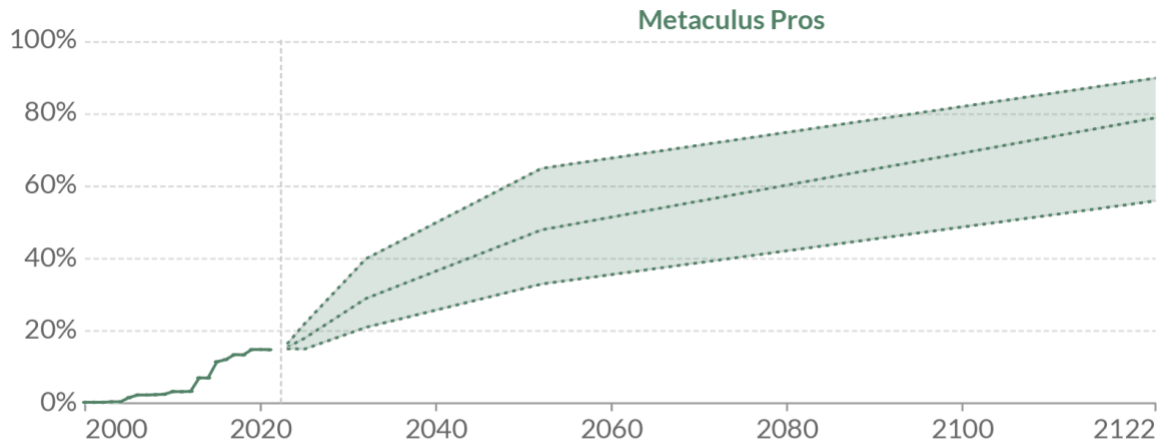
2052: Forecasters predict that global energy consumption will be influenced by two competing factors in the future: a demand for better energy efficiency — and lower consumption overall — and cheaper and more abundant electricity as renewables continue to decrease in cost. They expect technological developments to have decreased energy prices, and for most of the world population to have access to electricity. According to forecasters, there's a small chance that new forms of energy production, such as nuclear fusion, will become commercially available in economically advanced countries, leading to an increase in energy consumption.

2122: Forecasters expect that energy consumption in 2122 will be extremely inexpensive and universally available. There is a possibility of higher levels of energy consumption, if off-world living becomes more popular than expected or if people in general consume much more electricity than is currently feasible. Forecasters also suggest that fusion power will become a major source of primary energy by 2122. They are generally uncertain about the long-term outlook, with a wide range of possible outcomes including cheap, clean energy, stagnation or catastrophe, and the beginnings of a Dyson swarm or similar technology.

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[Share Living Where Same-Sex Marriage is Legal](#)



Source: Pew Research Center (2022); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	15.5%	15.3%
2025	18.0%	16.0%
2032	29.0%	21.0%
2052	48.0%	42.0%
2122	79.0%	91.0%

2023: Forecasters expect that the number of countries with legalized same-sex marriage will increase modestly over the next few years, with very low risk of backsliding in countries that have already legalized it. They have even accounted for the possibility of surprises in countries like India, which seems to be inching closer to judicial legalization. Most agree that most of the transformation towards increased legalization of same-sex marriage will happen within a generation as younger generations replace current more socially conservative leaders. That said, others suggest this could take up to two generations in more conservative parts of the world, with some holdout countries 100 years from now. Forecasters have also included a component for the possibility of a new wave of fundamentalism linked to the rise in authoritarianism.

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2025: Forecasters reaffirmed their prediction of a modest increase and a low risk of backsliding over the next few years. Several anticipate that by 2032, Thailand, Japan, and India will have legalized same-sex marriage, and there is a 50-50 chance that the Philippines will have also done so. As a general rule, they suggest that as the world becomes wealthier, restrictions on human behavior are expected to decrease. China, which makes up about 18.5% of the world's population, will have a major impact on the forecasts for same-sex marriage legalization if they legalize it in the near future.

2032: While it is still unlikely that China will have legalized same-sex marriage by this time, the probability is much higher than it was in 2025. Elsewhere, forecasters expect that same-sex marriage will be legal for the majority of people in the world by 2052. There is continued optimism that little to no backsliding will occur after legalization. Instead, forecasters are more pessimistic about progress in low-income countries and those with authoritarian governments. Generally, forecasters expect that the number of jurisdictions around the world with legal same-sex marriage will continue to increase, and that the share of the population living in these areas will increase as well. Beyond this, the future will be much harder to predict, considering that the majority of population growth over the next 30 and 100 years is expected to occur in Africa.

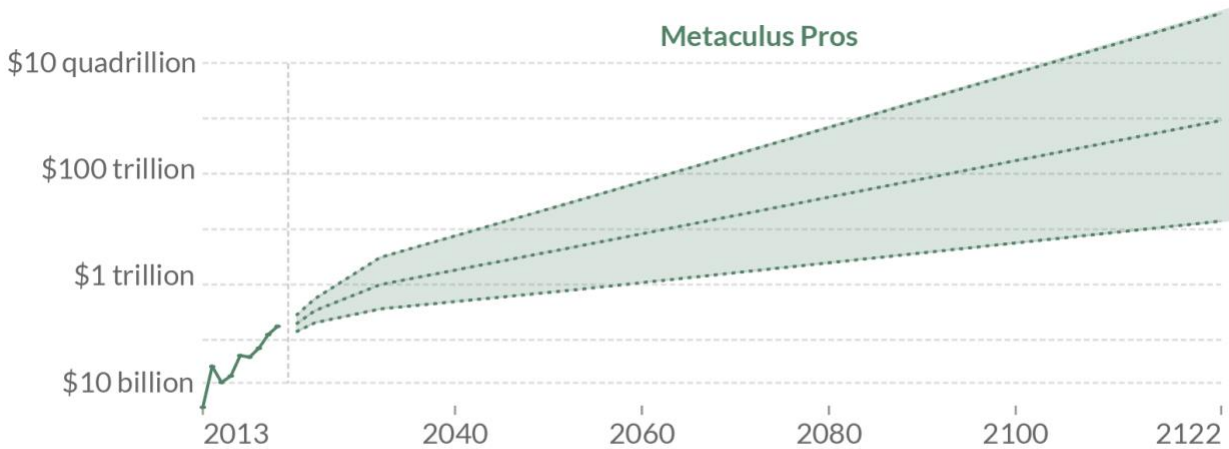
2052: Forecasters predict that by 2052, same-sex marriage will be legalized in India, China, Latin America, Europe, and much of Southeast Asia. There is uncertainty about the legalization of same-sex marriage in Africa, with Kenya being a likely candidate for legalization and the situation in Nigeria, Ethiopia, the Democratic Republic of Congo, Tanzania, and Uganda still unclear. Forecasters expect Western media to continue to be influential and contribute to the acceptance of homosexuality and same-sex marriage across the world. There is also a possibility of a disaster or authoritarian lock-in scenario that could impact the legalization of same-sex marriage, but this is considered unlikely.

2122: Forecasters expect that by 2122, that global political consolidation and an evolving definition of human biology will result in one of two outcomes for same-sex marriage. It will either be legalized worldwide or no longer recognized as a legally recognized relationship. The rationale behind this is that many forecasters hypothesize that current notions of marriage and sex will no longer be relevant in most places. In fact, there may even be scenarios where most people are uploads and most biological persons are not considered "human," leading to culturally and/or biologically conservative regions potentially holding on to traditional notions of marriage.

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Total Annual Investment in AI Companies



Source: AI Index Report (2022); Metaculus (2023)

Powered by ourworldindata.org

Note: Data is expressed in constant 2021 US\$. Inflation adjustment is based on the US Consumer Price Index (CPI).

	Pro Forecasters	Public Tournament
2023	195 (billion USD)	282 (billion USD)
2025	340	489
2032	1,000	1,300
2052	4,500	2,700
2122	920,000	95,000

2023: Forecasters are divided in their predictions for global corporate investment in AI companies in the very near term. Some are optimistic about the potential for AI to drive economic growth and increase productivity, while others are more cautious due to macroeconomic conditions and uncertainty about the future of the technology. Forecasters also expect the rate of growth to slow down at some point, potentially as AI investment becomes a larger portion of the global economy.

2025: Forecasters predict that investment in AI companies will still continue to grow over the next few years, with their expectations for growth ranging from somewhat slower to explosive. Factors that may impact this growth include technological advancements in AI, the presence of

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more mature businesses that require more investment, and shifts in the definition of what constitutes an "AI company." Some forecasters are more optimistic, citing the transformative potential of AI, while others are more pessimistic due to economic conditions and market sentiment. Some expect investment to slow in the near term due to economic challenges and the impact of the COVID-19 pandemic, but to pick up again in the longer term as AI becomes more widely adopted and mature businesses require more investment to scale up and roll out products.

2032: Forecasters expect that by 2032, there will be a significant increase in investment in AI companies due to technological advancements and the presence of more mature businesses that require more investment to scale. However, there is also uncertainty about how AI companies will be defined in the future as AI becomes a widely-used technology and the definition may shift significantly. For the short-to-mid term forecasters still expect many companies to describe themselves as 'AI companies' or companies that make extensive use of AI due to the perceived benefits. Others expect the rate of investment will eventually slow after so much growth, likely by 2052.

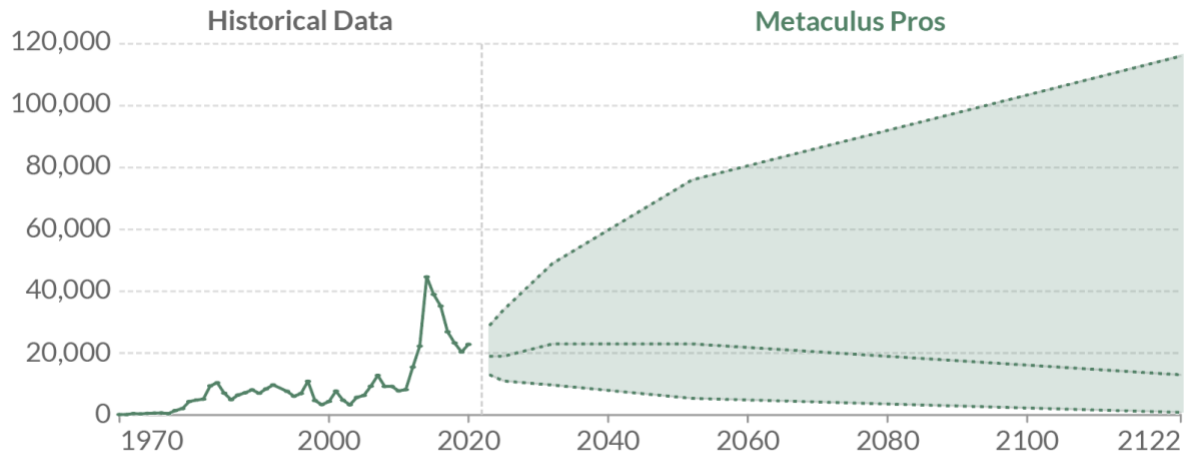
2052: Forecasters expect high uncertainty for 2052 due to the possibility of a change in the definition of AI companies and the small chance of AI being "done" or technological society becoming degraded or collapsed. In fact, some believe that the term 'AI company' could mean virtually anything by this time. By this point, they suggest that AI will be a near-universally adopted technology among all companies of non-trivial size. Forecasters also anticipate that this question will (in theory) resolve as ambiguous in 2052 and 2122, due to transformational scenarios where it may no longer make sense to talk about investment in AI companies.

2122: This forecast was highly speculative for many and influenced by the belief that the definition of an "AI company" may need to be exceptionally narrow in 2122. Additionally, forecasters took into account the possibility of technological regression or the idea that AI may not require any additional investment at that time. Forecasters are also not confident that the concept of "investment" will be relevant in 2122, especially if transformative AI arrives in the mid-21st century. They largely still believe their prior claims for 2052, which expect that most companies will be AI companies in a broad sense.

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Total Global Fatalities from Terrorism



Source: Global Terrorism Database (2022); Metaculus (2023)

Powered by ourworldindata.org

	Pro Forecasters	Public Tournament
2023	19.0k	20.0k
2025	19.0k	20.0k
2032	23.0k	19.0k
2052	23.0k	17.0k
2122	13.0k	8.5k

2023: Forecasters noted that predicting terrorism fatalities is difficult due to the highly noisy and long-tail nature of the existing time series, potential changes to reporting methodology, advances in technology that can both enable new attack methods and improve preventative and investigative techniques, and the potential for wider availability of bioengineering and chemical weapons. They expect that the number of terrorism fatalities will continue to decline in 2023, but there is uncertainty about the stability of the situation in Afghanistan and the increasing situation in sub-Saharan Africa and South Asia. They also suggested that conflicts over resources will worsen over the next few years and lead to an increase in terrorism fatalities.

2025: Despite the downward trend predicted by most, a few believe that the level of terrorism will continue to rise in the short term, due to the deteriorating situation in sub-Saharan Africa,

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South Asia, Afghanistan, and Iraq. They also expect there to be an increasing risk of terrorists obtaining and using biological agents, with the possibility of this becoming a relevant factor by 2023. Nevertheless, most forecasters predict that, beyond 2025 the trend will continue upwards. This is based on a shared assumption of continued growth of the global population and the potential for climate-related migration and conflict to contribute.

2032: Forecasters expect terrorism to continue at a similar level to the current rate in the short term, but with a higher number of fatalities in the next decade. They cite ongoing instability in certain regions, the potential for an increase in terrorism in the West with non-traditional motives, and the possibility of terrorists obtaining WMDs as the main factors. In the long term, forecasters expect terrorism to decline as the world becomes wealthier, more democratic, and more peaceful. Although there is still a risk that fatalities will increase with greater accessibility of powerful and destructive technologies, particularly in the field of biological engineering. However, advances in medical technology and surveillance tools may also help to mitigate this risk. Forecasters also anticipate a growing threat of bioterrorism in the next decade.

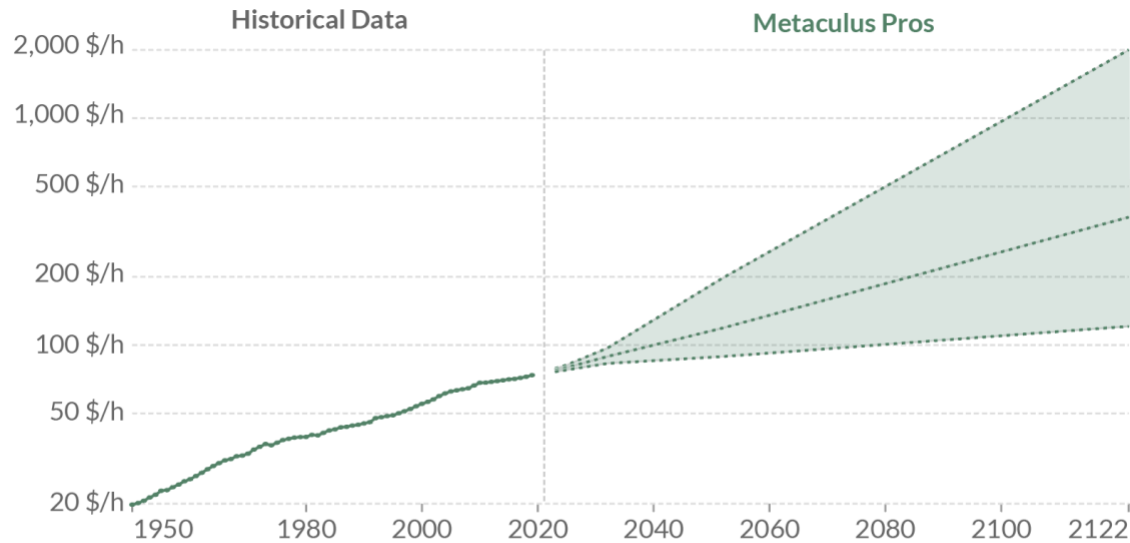
2052: Forecasters predict that the level of terrorism will vary significantly by mid-century. For 2052 some expect that terrorism will wither away almost entirely, while others are concerned about the potential for terrorists to obtain access to weapons of mass destruction or to use emerging technologies like AI or synthetic biology as weapons. Overall, the wide array of predictions about the future of terrorism can be categorized into two camps: one camp of forecasters expects it to decrease significantly over time and another is concerned about the potential for it to increase or to take on new forms.

2122: Forecasters' predictions are based on two scenarios, a "good ending" and a "bad ending," which are both currently seen as equally likely. The "good ending" involves achieving a high level of control over dual-use materials and technologies that could be used for terrorism, while the "bad ending" entails failing to do so. Forecasters are currently not confident that this high level of control will be achieved, leading them to believe that actors with malicious intent may be able to cause unprecedented levels of destruction. While forecasters recognize that throughout history things have generally muddled along, they are torn between the possibility that things will either get very good or very bad in the next 100 years. However, they find it easier to imagine that the motives for terrorism will simply wither away rather than significantly worsen in the next century.

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US GDP Per Hour Worked (Productivity)



Source: Feenstra et al. (2015), Penn World Table 10.0; Metaculus (2023)

Powered by ourworldindata.org

Note: Productivity is measured as gross domestic product (GDP) per hour of work. This data is adjusted for inflation and for differences in the cost of living between countries.

	Pro Forecasters	Public Tournament
2023	\$77.60 (<i>per hour</i>)	\$76.60 (<i>per hour</i>)
2025	\$79.60	\$78.40
2032	\$89.00	\$90.00
2052	\$119.00	\$246.00
2122	\$366.00	\$3,700.00

2023: Forecasters expect productivity to increase significantly over the next few years as a result of the efficiency gains from remote work and the incorporation of AI into the workflow. They predict that productivity growth will average about 2.5% annually for the foreseeable future, higher than the average of 1.07% from 2015-2019 but lower than the average of 2.31% during the dot-com boom in the 1990s.

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2025: Forecasters expect productivity in the US to increase in the next few years due to the adoption of automation and AI tools, though the rate of increase is uncertain and may be limited by evolutionary rather than revolutionary developments in AI. Forecasters also anticipate downside risks in the near term, such as a mild recession and increased unemployment, though past recessions have had only minor and transient impacts on hourly productivity. In the longer term, forecasters expect higher productivity due to the automation of many jobs, though this could also lead to a decrease in the number of people working.

2032: Forecasters believe that over the next two decades, there will be significant increases in productivity due to AI making those who still have jobs more productive. They think that most of the biggest changes to the world economy caused by AI will occur in the next two decades, but are unsure if this growth will continue after that. They are more optimistic about the potential for productivity gains in 2032, but think that these will be evolutionary rather than revolutionary. They also have factored considerations in their forecasts for 2032 that reflect trends as usual, with the potential for some slowdown.

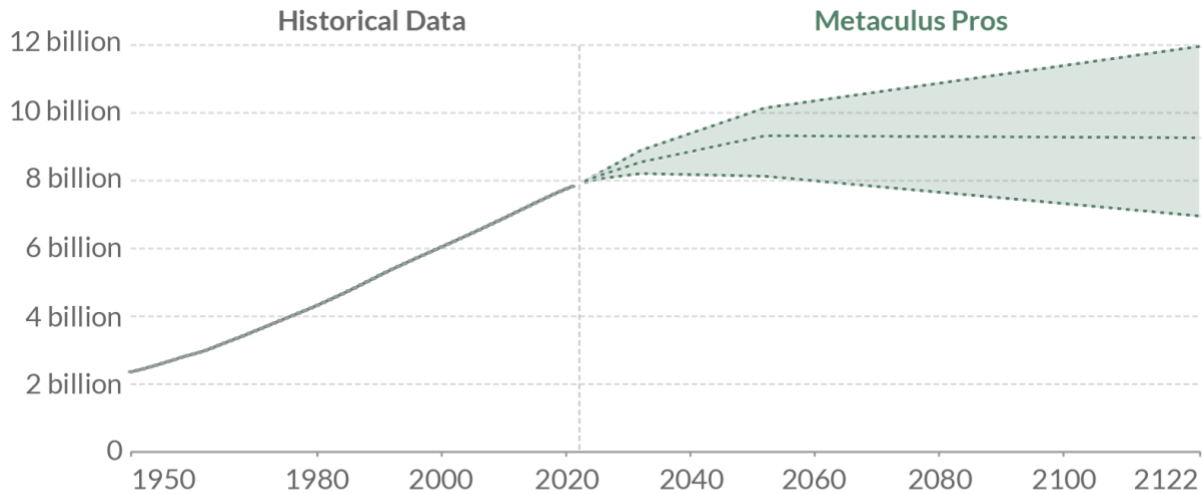
2052: Forecasters expect that by 2052, the US labor force will be significantly smaller, with low-complexity tasks being heavily automated and more complex tasks involving at least some level of AI assistance. They also expect that if people are still working, they will be much more productive than in 2022. Forecasters do account for the possibility that the US economy could be severely hampered by negative political developments, a major conflict, or a major disaster that cripples the economy. They also expect that work by biological humans will become increasingly redundant as AGI or sped-up uploads can do everything that biological humans can, but better and faster. For the economy as a whole, many expect "productivity" increases to be even larger than those for GDP per capita. This is because the number of hours of work per human is expected to decrease more sharply than any likely increase in the biological population.

2122: Forecasters expect that productivity will be significantly higher in the next 100 years, with some estimating growth rates over double the current rate of 1.6%. However, it is difficult to predict exactly how high productivity will be as technological developments over the next century are expected to have a profound impact. Forecasters expect that advanced artificial intelligence will be responsible for producing a significant portion of GDP by the turn of the 22nd century. In fact, productivity may become uncorrelated with factors such as the number of biological humans or the number of hours they work. Some even expect that the current government in the United States will not exist in 2122 or that a successor government will not have a political capital in the United States as required by the question.

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World Population



Source: United Nations World Population Prospects (2022); Metaculus (2023)

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	Pro Forecasters	Public Tournament
2023	8.04B	8.06B
2025	8.18B	8.21B
2032	8.60B	8.65B
2052	9.40B	9.40B
2122	8.40B	10.00B

2023: Forecasters expect the world population to be around 8.05 billion in 2023, which is in line with the United Nations' medium forecast. The growth rate of the population is slowing at a predictable rate, and the main factors affecting population growth, including total fertility rate, childhood mortality, and longevity, are not expected to change significantly in the short term. While there is some uncertainty around how much the COVID-19 pandemic affected population growth, forecasters do not expect it to be a major factor. Many believe that the biggest

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uncertainty around population projections comes from potential revisions to population estimates in areas where data is currently uncertain.

2025: Forecasters expect that by 2025, the world population will hover around the United Nations' (UN) medium forecast of 8.19 billion. While the probability of a disaster significantly decreasing the population on this timescale is low, forecasters do expect recession in the next 1-3 years, which may have a negative effect on fertility in developed countries. Forecasters also do not expect the risk of a global nuclear war to be significant in the next few years, though they do expect it to be more significant by 2032.

2032: Forecasters expect that by 2032, the world's population will be slightly below the UN's projections, due in part to more optimism about the pace of economic growth in developing countries and pessimism about the effectiveness of government efforts to increase fertility rates in countries with already low fertility rates. However, there is a small chance of a moderately severe disaster that could significantly decrease the population, such as a regional nuclear war or a global pandemic. There is also a small chance of an extreme scenario, like a war between China and NATO, that could result in a very severe decline in the population.

2052: Forecasters expect the world population in 2052 to exceed 9 billion, but still remain lower than the UN's medium estimate of 9.79 billion. They attribute this to faster economic growth that will likely suppress the fertility rate and the availability of contraception and abortion. There is also a significant chance of a negative outcome in which the world population declines dramatically due to risks such as nuclear war, AI-related mishaps, and failure modes of currently speculative technologies such as advanced molecular nanotechnology and synthetic biology. Long term trends such as technological advancements in life extension and fertility rate declines may also have an impact on population forecasts further out.

2122: Forecasters predict that by 2122, the global population could range from as low as 500 million to as high as 20 billion. Factors that could impact the population size include technological development, economic changes, and global catastrophic events or extinction events. That said, the baseline expectation for most is that the population will return to around 8 or 9 billion. Forecasters have taken into account various projections and predictions, including those from the UN, IASA, and IHME, as well as the community's prediction and their own guesses for the likelihood of various events. While the range of possibilities is wide, forecasters have suggested a 16% chance that the human population will fall below 500 million by this time.

Observations of forecasters

In addition to the commentary that both cohorts of forecasters provided directly, Metaculus was also able to learn a great deal from how forecasters cooperated with one another. There were

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several noteworthy patterns of behavior that forecasters exhibited. This section identifies the most common such behaviors, supported by direct quotes taken from the Metaculus platform. Listed below, they are:

- [Referencing peers' comments and predictions](#)
- [Referencing other Metaculus forecasts](#)
- [Extrapolating from growth rates](#)
- [Anticipating exogenous shocks](#)
- [Acknowledging uncertainties](#)

Referencing peers' comments and predictions

The most frequently observed behavior among forecasters, notably Pros, was to refer to their peers' rationales in comments and make updates to their predictions accordingly. By sharing this, in turn, prompted others to follow suit and make updates of their own. The result is a shared understanding of why a certain prediction was made, an evolving aggregate forecast, and, sometimes, a convergence of the group.

"...as pointed out by [Metaculus user] in an earlier comment, it appears [supercomputing] systems don't always enter service running at their full nameplate capacity and it may take several months of tuning/refinement to reach max performance, so I think it's reasonable to expect something a little below two exaflops in 2023."

"[Metaculus user] notes the IEA sees CO2 emissions increasing by ~300M in 2022 compared to the ~2B jump in 2021 (which brought emissions back up to 2019 levels), which helps keep my 75th percentile down around 38B for 2023. China's aggressive zero covid policy and a possible world recession also lower my growth expectations through 2025. [Metaculus user] reference to an analysis of the new IEA outlook sees global CO2 emissions peaking in the next five years due in part to the current energy crisis, accelerated by the Ukraine conflict. This is a major update based on recent developments."

In several cases, forecasters found themselves weighing conflicting or divergent insights from two or more of their peers:

"As [Metaculus user] points out, it took this metric three years after Illumina introduced its \$1000 genome sequencer to reflect that price. It seems there is healthy competition in this market, and Illumina has several key patents expiring in the next few years that will allow further innovation. However, [Metaculus user] tempers my optimism a bit by reminding me of the risks of anticompetitive behavior in this market."

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“As [Metaculus user] points out, the world is easily capable of increasing the nuclear stockpile by over 4000 annually, though I think that’s unlikely to happen again as technology advancements increase the strategic value of each warhead. [Metaculus user] notes that many countries rely on the US for nuclear deterrence, and if that understanding changes they will have incentive to build their own arsenal. Beyond strategic stockpiling, there is also the possibility tactical nukes become more widely-considered, or as [Metaculus user] brought up, nuclear explosions can be useful outside of military use.”

Some forecasters even solicited their peers’ input directly:

“I would also be interested in any takes on whether there's anything technically unappealing or potentially troublesome about Ultima's engineering approach to the machines that might cause labs to be hesitant about buying its devices; or if any claims that have been made by the company about its technology strike you as implausible or unlikely ... I am keenly aware of my own ignorance on the engineering side of things, so if anyone has any insights related to potential issues there, I would be interested to hear them.”

Referencing other Metaculus forecasts

Pros are prolific forecasters on Metaculus and, therefore, exceptionally familiar with other related questions on the platform. Many opted to bring in existing predictions on similar metrics to inform and justify their own approaches.

“A related Metaculus question not mentioned in the post is this on when the first supercomputer will be able to perform 10^{21} FLOPs. The [community median \(n=22\)](#) is currently at late 2038, which is roughly in line with the projections of the report above.”

Forecasters didn’t always agree with other predictions on the site, but nonetheless opted to explain how their own predictions differed.

“There are also some inconsistencies in the predictions of a couple of the Metaculus questions on supercomputer performance in 2030 which I pointed out in [a previous] comment, so I find it [too] difficult to lean heavily on these for the 10 year forecast.”

“One Metaculus question has a 2% chance of a rather substantial 100 gigagrams sulphur injection into the atmosphere. A second Metaculus question asks about the numbers of international treaties relating to geoengineering (by the end of 2024), currently sitting at around 15 at the median. Now, to me these time-horizons seem way too short, as I think that geoengineering approaches may be especially impactful (if

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used) in the medium term if certain climate goals are seen as unachievable and the cost of climatic change as exceedingly high, which is where these considerations may become relevant with respect to forecasting on this question.”

Extrapolating from growth rates

One of the most common approaches that forecasters used to arrive at a prediction was estimating a growth rate for a given OWID metric and then applying it to the observed trends.

“... in the 10+ year range I'm expecting the ~1.5x per year performance growth rate to increase somewhat due to AI-related hardware and software efficiency gains, though it's hard to say by how much. I'm giving around 20% for a zetta-scale machine being on the list in 2032 and I expect with ~75% confidence that yotta-scale will be reached by the 30 year timeframe, though these point-estimates could easily end up being very wrong.”

In other cases, forecasters opted for forecasting based on exponential growth, as opposed to an arithmetic growth rate.

“I think the 2+ EFLOPS they're targeting is a theoretical peak performance and they are unlikely to perform that well on the benchmarks (though we don't have much precision here anyway). China could also submit benchmarks from their rumored exascale computers. Longer-term, I don't see why the exponential trend shouldn't continue. It's hard to wrap my head around the immense range of possibilities 30+ years out, and I have high uncertainty like the crowd here.”

Furthermore, forecasters not only applied different growth rates for different years, but also different growth rates for each end of their inter-quartile range (IQR). Below, one Pro details his approach for doing this. Although quite detailed, the excerpt has been kept to roughly its original length to elucidate the level of thought behind their methodology.

“I extrapolated from the 2022 value of 1.1e18 using a growth rate of 1.53x per year for my median prediction, and a growth rate of 1.74x per year for my 75th percentile. Those numbers represent the average growth rate from 2011 to 2022, and the average growth rate from 1993 to 2022, respectively ... I spent some time thinking about favoring a 1.53 growth rate vs a 1.74 growth rate. Since in the past Moore's law for transistor density has held, but now it's no longer true but we try to make up for it by having larger and more cores, it makes sense to me that the growth rate has slowed down. In the Wikipedia chart for transistor density, from 1994 to 2004 it actually exceeded 2x per 2 years, growing by 45x in 10 years. But in the next 10 years, growth was only 26x, and in the last 10 years, 20x. From researching the compute of the largest AI training run question, the growth in GPU and CPU performance/cost in 2006-2021 is similar at 1.35x

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per year ... A [1.53, 1.74] growth rate would require a cost increase of about [20%, 40%] a year, assuming price-performance improves at (1.35x per year or 20x per 10 years). 20% a year makes more sense to me than 40% a year for cost increase ... For the later predictions 2052 and 2122 I still used the same growth rates for my main component, but added 3 orders of magnitude more than expected for 2052 and +18 orders of magnitude for 2122 ... For the later predictions my 25th percentile corresponded to a 1.3 growth rate, while I eyeballed it for 1 and 3 years out. The 2122 prediction includes a component for growth stalling from 2052."

Anticipating exogenous shocks

For many forecasters, assigning dynamic growth rates may still not be enough to account for the unknown. Many will also take into account the possibility that exogenous events could fundamentally change their mental models. Below, a Pro lists a few such shocks:

"My second component for 2032 is centered on a significantly lower level to account for the possibility of a freeze-up in development that results from some kind of economic crisis, and in particular the possibility that the supply of semiconductors is severely affected by a potential invasion of Taiwan, which looks quite plausible in the mid-to-late 2020s."

"It seems quite likely that China will be developing similar-scale systems at this time; there's upside potential if a real rivalry develops between the US and China and significant resources are devoted to maintaining supremacy in this domain. However, it's unclear to me how much attention US policymakers will be paying to this, and so there is some uncertainty around whether US efforts will be well-funded or not. On the China side, there is uncertainty around how significantly their efforts will be impaired by lack of access to the latest chips if their domestic semiconductor industry fails to catch up with the most advanced manufacturers, and if import/export restrictions remain in place."

In fact, as many of these metrics were about technological subject matter, the most common exogenous shocks identified by forecasters were technological in nature.

"One further factor that I haven't seen discussed here is the possibility of geoengineering/climate interventions. Even at COP27, this topic's formal discussions on geoengineering, particularly with regard to the ethical considerations involved, remain rather latent and preliminary. In the best-case-scenario, however, these approaches may lead to a reduction in climate risks without accompanying decline of CO2 emissions (above and beyond a certain point), though that does come with serious scientific and moral risks."

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Acknowledging uncertainties

A characteristic of an adept forecaster is awareness of one's own uncertainties — and the ability to accurately quantify that uncertainty whenever possible. Throughout this project, forecasters were transparent and frequently shared their blindspots with peers.

“The real cost of sequencing is dropping around 15% a year right now. The exact amount could fluctuate from year to year, but we're likely to see continuing cost decreases even if the technology isn't improving as the amortized cost of equipment gets phased out of the calculation. In the short term the major uncertainty seems to be whether Ultima goes online and lives up to its hype (my guess is that it will start up later and somewhat short of its promises because that's just how things go).”

“In the short term, the biggest sources of uncertainty are changes in measurement: I'm very close to the consensus for 2023 and 2025. I'm in a narrower band for 2032 (8.9-9.5-10k) because I don't expect the number to have changed much between 2025 and 2032 - some increases from China but nothing drastic. By 2052, my uncertainty has increased substantially, and by 2122, I'm fairly close to uniform and have little expectation that the number of nukes today will have much relation to the number of nukes then.”

The further out forecasters predicted, the more uncertainties arose. For both the 50-year and 100-year horizons, forecasters shared a great deal about their assumptions and their limitations.

“This far out, my prediction is quite uncertain; there seems to be significant upside potential if AI-driven advances have led to both considerably more demand for compute and materially better than expected designs and/or manufacturing processes for computer hardware, and methods of power generation that could economically power such systems. On the other hand, it seems like there is greater potential for a major disaster to occur by 2052 that either curtails progress in this domain, perhaps severely, or eliminates the ability to maintain or operate supercomputers. My median is weighed down somewhat by an additional component to account for the possibility of such severe negative developments.”

“A world without nuclear weapons is much more tenable over longer terms, but would require an astonishing amount of international coordination over the next 30 years. And I mean astonishing literally--I give it quite low credence, on the order of continuing with the status quo. Which leaves radical swings upwards: are we going to have another nuclear arms race? This also seems improbable, but it's the real wildcard. Stasis and decline are both bounded predictions, where a nuclear arms race scales awfully. So I end up with a muddy pair of predictions for 2052 and 2122: both bimodal in precise disagreement with the team.”

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For the 100-year forecasts, these uncertainties became even more pronounced and often resulted in very wide tails.

“A century out, my prediction feels very speculative, but I think there are three main scenarios. My base case is that progress continues up to roughly 10^{42} , but that at some point physical limits or practical considerations render further development of massive unified systems undesirable, economical, impractical, or inefficient relative to distributed systems. However, I'm not confident that such considerations will exist, or cannot be overcome by AI-enabled advances over the next century, and so I give substantial probability on the very top end of the range. However, I also give non-trivial probability to a result at the very bottom end of the range, in view of the possibility of a technological regression that doesn't cause extinction or complete economic collapse, but does eliminate human civilization's capacity for maintaining and operating supercomputers.”

“My 2122 forecast is super speculative. I'm not very confident about this, but I don't think nuclear weapons will be super useful 100 years from now (although I can see having a relatively small number of weapons for asteroid deflection). I am hopeful that abundance will mean the international system will no longer be based on the same balance of terror. I'm also optimistic that nuclear weapons will be virtually banned by that time. I also suspect that other, more precise countervalue weapons will be more important to international security. But my IQR here is very broad.”

In some cases, however, uncertainties could be resolved by asking questions, and many forecasters were willing to speak out if they needed clarification.

“Finally, what would clarify as “whole genome sequencing”? ... I know that artificial intelligence techniques have now made it more efficient to decode DNA, even if there is missing or imperfect information, so I am unsure if previous protocols (depth of 30 in 2013, etc.) are as necessary anymore.”

Conclusion

The *Forecasting Our World in Data Tournament* strongly aligns with Metaculus's mission to develop epistemic infrastructure that enables the global community to model, understand, predict, and navigate the world's most important and complex challenges. In fact, this was a strong example of how new collaborations can deliver on that mission for the public benefit. The tournament probed the long-term future, delivering predictions on topics like global investment in AI, world life expectancy, carbon dioxide emissions, and more — on time horizons from one to 100 years. Much like Our World in Data's approach with its metrics, covering all of these

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forecasts in one resource makes it possible to understand how long-run global trends are interlinked.

Of the many learnings that can be gleaned from Metaculus's forecasters, one in particular stands out — the same principles of forecasting can often be applied across a variety of subject areas. What makes a well-calibrated forecaster is not always intimate knowledge of the subject matter at hand, but analytical thinking and utilization of the forecasting community, which the excerpts above illustrate. Moreover, the diversity of perspectives and considerations that Metaculus's Pros brought to their work enabled a thorough, holistic, and well-reasoned assessment of our world decades from now. This benefit is particularly evident when considering the scope and detail of the comments and responses Pros wrote.

Metaculus is grateful for the enthusiastic commitment of these Pros and its broader forecasting community. We are especially proud of the rigorous, valuable insights they have produced and their potential to support decision making for the long term. However, the *Forecasting Our World in Data Tournament* is only the beginning; there is much more work to be done predicting long-term horizons. For organizations and individuals inspired by Metaculus's work, our team welcomes additional collaborations to expand upon the foundations established by this initiative. We invite you to work with us advancing forecasting and creating useful information for the public benefit.



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Appendix

Specifying resolution criteria

In specifying the resolution criteria, as well as potential edge cases, Metaculus sought to create a shared understanding of possible outcomes among the forecasters. To accomplish this with such long-term horizons, the resolution criteria needed to account for extreme outcomes. Notably, this involved the careful acknowledgement of humanity's extinction risk (see Appendix). Below is example resolution criteria language from a question asking about the number of people living in liberal democracies. This language is typical of most questions from the tournament, with some variations to address considerations that are unique to this subject.

How many people will be living in liberal democracies in the world in the following years?

This question will resolve as the absolute number of people living in liberal democracies in the world in the listed year, according to [Our World in Data](#). For example, this figure was 1.05 billion in 2021.

The resolution for each year will be determined by the earliest credible data reported by Our World in Data; later updates or revisions by OWID will be irrelevant to the question resolution.

If data reported by OWID contains a significant error (aside from typical adjustments from scheduled data releases), Metaculus may re-resolve the question at their sole discretion. If OWID no longer reports data for a relevant year, Metaculus may use an alternative credible source of data at their discretion, or resolve as **Ambiguous**.

If humanity goes extinct or ceases to have a developed society prior to a listed year, that sub-question will resolve as **Ambiguous**.

Fine print

- If humanity establishes off-Earth colonies and Our World in Data adds a "Total Humanity" measure (or equivalent) to the chart, that measure will be used instead of the "World" measure.
- The number of people will include humans only, where "humans" will be defined as members of a species with enough biological similarity to reproduce with typical 2022 humans with medical assistance which could be available in the year 1900.
- For the purposes of this question, humans (as defined above) will be considered to be extinct if the total human population is less than 5% of their previous peak population.

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- "Ceasing to have a developed society" will be defined as world GDP declining to below 100 billion USD (in [2021 USD](#), with adjustments for [Purchasing Power Parity](#))

Accounting for extinction

With 100-year time horizons, the possibility of human extinction was salient to some forecasters. Metaculus therefore specified that all questions would resolve as ambiguous in the event humanity went extinct or ceased to maintain an industrial society. Two notable exceptions were the questions about total human population and GDP. This question was succinctly written to resolve as the total number of humans alive each year. For example, if forecasters anticipated humanity's extinction by the year 2122, they could make a prediction of less than 500 million and theoretically receive an unambiguous positive or negative resolution. As a result, this question was unique in that it could provide information about the forecasted likelihood of human extinction. By contrast, other questions asked for forecasts without accounting for extinction, to solicit forecasters' view of a future without an extinction event.

Metaculus also felt that it would be best to specify what constitutes extinction or a scenario where humanity no longer exists in a developed society. Such specificity could give forecasters a shared picture of these scenarios when making their predictions. For this project, extinction was defined as either (1) the human population declining to 5% of its peak population or (2) a technological paradigm like widespread human synthesis with machines or extreme genetic modification.

The latter case was further specified as a scenario where the remaining number of humans who could reproduce with 2022 humans dropped below 5% of the peak human population. While a future where human minds existed entirely in machines could arguably be a beneficial one, opting for clarity and simplicity guided us to exclude this potential future from forecasters' consideration. Furthermore, the lack of a developed society was defined as a massive reduction in world economic activity. This decision was intended to exclude potential futures where the human population exceeded 5% of its previous peak, but was no longer technologically capable of tracking the relevant data about itself.

For most questions, Metaculus also allowed for the possibility of off-Earth development, as many of the metrics being forecasted pertained to human activity *overall*, not only activity which took place on Earth. In other cases, such as with global CO₂ emissions, questions were explicitly planetary in scope.

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Setting input ranges

Due to the longer-term nature of these forecasting questions, it was important to address how extreme scenarios could occur. The input ranges were quite broad in the longer term, in order to allow for a similarly broad range of possibilities. Where applicable, the upper and lower bounds were left open and log scales used to allow forecasters to specify out-of-bounds resolutions. However, this alone could not cleanly account for the possibility of extinction, due to the difficulty in distinguishing extremely good outcomes from extremely bad ones.

For example, if forecasters expected there to be zero fatalities from terrorism in 2122, it would be difficult to distinguish whether forecasters expected humanity to be extinct, thus precluding the possibility of terrorism, or if forecasters expected a more ideal world void of political violence. Forecaster's comments would help to distinguish this, but it would not fully eliminate the ambiguity involved in interpreting the forecasts. This is why extinction outcomes were removed from consideration for all but two questions.

The Metaculus Prediction

The Metaculus Prediction is the Metaculus system's best estimate of how a question will resolve. It's based on predictions from community members, but unlike the Community Prediction, it's not a simple median. Instead, the Metaculus Prediction uses a sophisticated model to calibrate and weight each user, ideally resulting in a prediction that's better than the best of the community.

For questions that resolved in 2021, the Metaculus Prediction has a Brier score of 0.107. Lower Brier scores indicate greater accuracy, with the MP slightly lower than the Community Prediction's Brier score of 0.108. You can see some of the fine details on our [track record page](#). For all forecasts that Metaculus displayed in this report, the median of Pro Forecasters' predictions were used; the Metaculus Prediction was only shown for the public tournament's forecasts.