

Shared Socioeconomic Pathways

IAM SSP Scenarios

Integrated Assessment Modeling (IAM) Consortium has developed a set of alternative pathways that they believe span the range of different futures the world may experience over the next century or two. These are based on five different narratives of the future, which are referred to as Shared Socioeconomic Pathways, usually abbreviated SSPs.



IAM Scenarios

Scenario Analysis is one of the key recommendations under TCFD. The key components of strategy with regards to Scenario Analysis, and emphasized by the TCFD, are time horizons and outcome variance. Climate-related risks and opportunities vary significantly over the short-, medium-, and long-term, and organizational strategy-setting and ERM processes to address climate change need to examine different time horizons separately.

In order to predict future climate change, we must first project how much greenhouse gas society will emit in the future. Because of the difficulty of making a single, confident projection of the future, a group known as the Integrated Assessment Modeling Consortium has instead developed a set of alternative pathways that they believe span the range of different futures the world may experience over the next century or two. These are based on five different narratives of the future, which are referred to as Shared Socioeconomic Pathways, usually abbreviated as SSPs.

The SSPs are labeled SSP1, SSP2, SSP3, SSP4, and SSP5, and they each represent a different way the world may evolve in the future. The numbers 1–5 in the name do not correspond to any particular parameter in the scenarios; rather, they are arbitrary labels assigned to each scenario. Furthermore, SSP4 is rarely used as the same is not a plausible scenario in the climate literature.

One can think of these different scenarios as mainly differing in the amount of economic growth and the amount of climate-safe energy that is being deployed, which leads to different amounts of carbon dioxide emitted into the atmosphere each year. Given these emissions scenarios, the resulting atmospheric concentrations of carbon dioxide can be calculated and, from this, the amount of climate change under each scenario can be estimated by inputting atmospheric carbon dioxide into a computer simulation, known as a global climate model, sometimes referred to by its initials as a GCM. The different scenarios describe very different worlds:

- SSP1 is a sustainable world where the world's economies gradually shift towards a more environmentally friendly path. Because of strenuous efforts to adopt renewable energy, emissions are currently peaking and expected to decline throughout the rest of the century. In fact, SSP1's emissions go negative around 2075, meaning that humans are pulling more carbon out of the atmosphere than they are releasing. The low emissions associated with this scenario lead to temperature increases of 2°C/3.6°F above the pre-industrial climate.
- SSP2 is a world that follows the trends of our world today, leading to generally declining emissions over the twenty-first century due to widespread adoption of renewable energy (although slower than in SSP1). Economic growth is similar to SSP1. The carbon dioxide emissions associated with this scenario lead to temperature increases of 3°C/5.4°F above the pre-industrial climate.
- SSP3 is a world where economic inequality gets worse, leading to increasing conflict between regions. Because of this, economic growth is slow and adoption of new energy technology is also slow, leaving the world almost entirely dependent on fossil fuels. The combination of these leads to carbon dioxide emissions increasing throughout the century, reaching around double today's values in 2100. Temperature increases in this world are 4.5°C/8°F above the pre-industrial climate.
- SSP5 is a world similar in many ways to SSP1, but it is one that emphasizes economic growth rather than sustainability. As a result, economic growth in this world is very high and fossil fuels power a significant fraction of this growth. This leads to carbon dioxide emissions increasing throughout the century, reaching more than triple today's values in the late-twenty-first century. Temperature increases in this world are 5.5°C/10°F above the pre-industrial climate.

No one can predict with certainty which emissions trajectory will turn out to describe reality because emissions will be determined by political decisions that have not yet been made. However, it seems likely that real emissions will

fall somewhere in the range defined by these scenarios, so you can expect that our future climate will be similarly constrained.

While the warming of the next few decades is largely already determined by past investments in fossil-fuel infrastructure and inertia in the climate system, we control the amount of warming experienced during the second half of the twenty-first century, and there is nearly a 4°C difference in temperature between the lowest (SSP1) and highest scenario (SSP5). Because many people alive today might live well into the second half of the century, this has relevance for many people who are alive today, and all future generations.

With human activities estimated to have caused warming of approximately 1.0°C above pre-industrial levels, and where climate models predict a clear trend of further warming to come, with the main variable being the amount of greenhouse gas emissions humanity continues to release into the atmosphere. Under a high-emission scenario, temperatures are predicted to rise by at least 4°C by 2100, whereas under a low-emissions scenario, they will stabilize around 1.5–2°C.