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UNDP

FLAGSHIP PUBLICATION 4

ADVANCING THE SDG PUSH WITH EQUITABLE LOW-CARBON PATHWAYS

This report was developed by UNDP's SDG Integration team with the Pardee Institute.

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See also the associated reports:

First Flagship Report | Pursuing the sustainable development goals (SDGs) in a world reshaped by COVID-19

Second Flagship Report | Leaving No One Behind: Impact of COVID-19 on the Sustainable Development Goals (SDGs)

Third Flagship Report | SDG Push+ Accelerating universal Electricity access and its effects on sustainable development indicators

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Executive Summary

UNDP's 2023/24 Human Development Report calls for reevaluating the evolving global interdependences. It outlines four critical areas for action: facilitating the supply of planetary public goods for climate stability; fostering digital global public goods for greater equity in harnessing new technologies; implementing new and expanded financial mechanisms (e.g. humanitarian aid and development support) for low-income countries; and adopting new governance approaches to reduce political polarization, combat misinformation and enhance people's voices in deliberation. A limited collective action to advance our response to climate change, the digital divide, poverty and inequality not only hinders progress in human development, but also exacerbates polarization and further erodes trust in people and institutions worldwide.

The recently adopted Pact of the Future, an inter-governmentally negotiated, action-oriented Pact,[1] reaffirms the importance of accelerating action during this critical decade in line with the goals of the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC). This commitment is based on the best available science, reflecting equity and the principle of common but differentiated responsibilities and respective capabilities, taking into consideration national circumstances, sustainable development and efforts to eradicate poverty. This report calls on developing targeted actions to accelerate progress towards the Sustainable Development Goals (SDGs) and to advance countries' climate ambition that is fair and equitable globally, and aligned with the principle of differentiated responsibilities.

The defining challenge of our time is balancing human development outcomes and environmental sustainability. Over 700 million people still live in extreme poverty or suffer from malnutrition while global greenhouse gas (GHG) emissions continue to rise. These intertwined challenges require coordinated global action and cooperation to ensure integrated sustainable solutions.

The path forward requires consistent and coherent policy response as envisaged in countries' Nationally Determined Contributions (NDCs) to the Paris Agreement, Long-term Low Emission Development Strategies, and National Development Plans contributing to their SDGs. The preamble of the Paris Agreement further underscores the close links between climate action and sustainable development, and calls for a transition that is by design, fair and just for the people and the workforce, by facilitating the creation of decent and quality jobs for all.

[1] Pact for the Future. www.un.org/en/summit-of-the-future/pact-for-the-future

A central question guiding this research is: **How can the global development path be further refined to chart a course that is in line with the *leave no one behind* principle with respecting planetary boundaries?** This foundational research updates the UNDP flagship publication, Leaving No One Behind: Impact of COVID-19 on the Sustainable Development Goals (SDGs), which identified the main drivers behind the fair and sustainable recovery from the COVID-19 pandemic, closely aligned with the SDGs. It examines an integrated set of policy strategies that accelerates climate actions while promoting human development.

This report presents an integrated scenario that builds on the ***SDG Push*** and offers a framework for transitioning towards a low-carbon society in a fair and equitable manner for all. It ensures that the benefits and burdens of the transition are shared fairly, particularly for workers and communities dependent on fossil fuel industries. The report also prioritizes policies that move us closer to achieving a comprehensive set of development targets. Key elements of the scenario include improved governance, broader access to social protection, sustainable agriculture and digital advancements to enhance human development. It also differentiates the choices required by different countries, emphasizing energy efficiency for wealthier nations, and providing lower-income countries with space to increase energy demand and a transition to cleaner energy sources.

This scenario captures equity in the solution to keeping the global temperature below 1.5 °C with a common but differentiated approach. It aligns with the ambition of the Convention of Biological Diversity (CBD) within the green economy pillar of the SDG Push and sustainable consumption, specifically, the following goals of the CBD (1) The conservation of biodiversity, (2) Sustainable use of the components of biodiversity, and (3) Sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable manner. This integrated approach benefits all income groups by enhancing energy efficiency in wealthier nations and encouraging developing countries to improve efficiency while empowering lower-income nations to meet their growing energy demands. It facilitates a transition to cleaner energy sources while ensuring that growth rates remain sufficient to keep global temperature rise within safe limits.

This scenario is evaluated using the International Futures integrated assessment model developed by the Frederick S. Pardee Institute for International Futures at the University of Denver. In this model, mutual interactions of multiple systems (e.g. economy, population, education, health, environment) are analysed. The model generates long-term projections for several environment and socioeconomic indicators, making it a valuable tool for understanding the implications of current development dynamics on future outcomes. It is calibrated to a rich data foundation capturing interlinkages between different economic sectors, market agents and countries. Scenario simulations enable to conduct a ‘what if’ analysis of alternative policy interventions across different SDGs, and to examine their possible impacts on our future.

The main findings from the analysis of a **broad spectrum of economic, social and environmental indicators** at the global, regional and national levels in 188 countries are as follows:

- **Monetary poverty reduction:** An additional 60 million people could be lifted out of poverty by 2030, and over 175 million by 2050, with the greatest impacts on sub-Saharan Africa. One in three households in extreme poverty could be lifted from poverty through the collective action of multiple stakeholders, including increased efforts to influence policy and institutions that can help alleviate poverty.
- **Human Development Index (HDI):** Low HDI countries (below 0.550) could reach 0.70 by 2055, transitioning to high human development countries, reaching an HDI level of 0.90 by 2100. This transformation marks significant progress for disadvantaged nations, closing health, education and income gaps, and raising these nations to the highest development standards.
- **Carbon emissions:** GHG emissions from fossil fuel use could fall to 3.4 billion tonnes by 2050 and to 0.6 billion tonnes by 2100, i.e. a 65 percent reduction compared to a business-as-usual scenario by 2050.

Improvements in energy mix and energy efficiency are crucial for guiding countries toward a 1.5 °C pathway. As countries commit to increasing their ambition for the NDCs in 2025, the proposed set of integrated policy choices could lead to a new harmonization of national interventions within a broader sustainable development framework. This would lead to more cooperative solutions to break the current gridlock of growing inequality to scale up collective action.

The research shows that fair and equitable low-carbon pathways mitigate environmental impacts, boost economic growth, and advance the 2030 Agenda for Sustainable Development while building resilience and supporting adaptation. Incorporating higher climate ambition into an equitable scenario **helps countries focus on policy choices towards achieving the SDGs.**

Charting pathways that reflect the national and local context and that are nationally owned is essential for the findings in this research to meaningfully impact policy choices. Harnessing opportunities and overcoming constraints in financing key development transitions are also essential. These require enhanced multilateral cooperation and commitments to support and enhance national efforts. Together, both levels of action are needed to unlock progress, ensuring that strategies are adapted effectively, resources mobilized, and benefits distributed fairly.

1. Introduction

UNDP's 2023/24 Human Development Report calls for reevaluating the evolving global interdependences. It outlines four critical areas for action: facilitating the supply of planetary public goods for climate stability; fostering digital global public goods for greater equity in harnessing new technologies; implementing new and expanded financial mechanisms (e.g. humanitarian aid and development support) for low-income countries; and adopting new governance approaches to reduce political polarization, combat misinformation, and enhance people's voices in deliberation. Limited collective action to advance our joint response to climate change, the digital divide, poverty and inequality not only hinders progress in human development, but also exacerbates polarization and further erodes trust in people and institutions worldwide.

Understanding the underlying dynamics and interaction between different development systems is crucial for the promotion of policies that advance the Sustainable Development Goals (SDGs). Demographic changes affect the demand for education and health services, which in turn impact fiscal space, pensions and productive capacities. Economic systems drive government resources and material inputs for development, but reliance on fossil fuels can lead to climate change. This research represents these deeply interconnected systems.

Given the interconnectedness of human, social and environmental futures, this report evaluates alternative pathways for climate change mitigation within the broader context of accelerating progress towards the SDGs. A large integrated model is used to simulate the impacts of the alternative, mitigation policies that can support progress towards the national goals development within the Nationally Determined Contributions (NDCs) under the Paris Agreement. Additionally, this report presents a scenario that examines how an ambitious yet achievable set of policies can enhance long-term patterns of human development.

Specifically, the key elements of the SDG Push scenario include improved actions on governance, social protection, sustainable agriculture and digital advancements to enhance human development. In addition, the ***SDG Push 3.0*** advocates an increase in energy efficiency for wealthier (high-income or advanced) nations earlier in this century and an increase in energy demand for lower-income countries, and supports the transition to cleaner energy sources.

The report shows that a better path forward is possible if interventions under the SDG Push scenario are complemented with activities to achieve climate and environmental goals (i.e., the *SDG Push 3.0* scenario). With this pathway forward, the world would see fewer cases of extreme poverty, malnutrition and conflict while also enhancing energy efficiency and developing additional renewable energy capabilities. It is possible to achieve these outcomes, but concerted efforts must be made to change the current development path.

The scenario has broad impacts across economic, social and environmental indicators globally, regionally and in 188 countries. For instance, the report highlights the following outcomes:[2]

An additional

175 million

people could escape poverty by 2050.

3.4 billion tonnes

of GHG fossil fuel emissions by 2050, a reduction of 65% compared to a no-action scenario.

an HDI of 0.7

is projected to be achieved by countries with low human development by 2055.

Similarly, the distribution of benefits generated by the *SDG Push 3.0* varies by HDI group. Compared to 2025 baseline levels, this scenario will help low HDI countries reduce the percentage of the population living below US$2.15 per day by about 4.5 percentage points in 2030 and 18.1 percentage points by 2050. This has significant implications for addressing the global inequity and poverty alleviation agenda. The medium and high HDI countries also benefit from the reduction of the share of households living below $2.15.

This report uses the International Futures (IFs) model, developed by the Frederick S. Pardee Institute at the University of Denver. This powerful quantitative tool integrates economic, demographic, educational, health and environmental systems, offering a comprehensive approach to analysis. By enabling 'what if' scenario evaluations, the model allows policymakers to assess how various interventions can influence progress towards multiple SDGs and help to effectively tackle complex global challenges.

The report begins with background information on the relationship between human development and climate change, highlighting that fossil fuels as a major energy source plays a role of expanding development and contributing to climate change, environmental degradation, air pollution and ecosystem damage. The scenario development is explained in the methodology section, outlining and discussing its strengths and limitations. The report concludes by discussing policies and priorities that can unlock SDG achievements while mitigating human impacts on natural systems. The ability to balance these two dynamics will define sustainable development for future generations.

[2] Monetary poverty reduction: An additional 60 million people could be lifted out of poverty by 2030, and over 175 million by 2050, with the greatest impacts on sub-Saharan Africa. One in three households in extreme poverty could be lifted from poverty through the collective action of multiple stakeholders, including increased efforts to influence policy and institutions that can help alleviate poverty.

Human Development Index (HDI): Low HDI countries (below 0.550) could reach 0.70 by 2055, transitioning to high human development countries, reaching an HDI level of 0.90 by 2100. This transformation marks significant progress for disadvantaged nations, closing health, education and income gaps, and raising these nations to the highest development standards.

Carbon emissions: Greenhouse gas (GHG) emissions from fossil fuel use could fall to 3.4 billion tonnes by 2050 and to 0.6 billion tonnes by 2100, i.e. a 65 percent reduction compared to a business-as-usual scenario by 2050.

2. Background and context

2.1 Human development and climate change: how did we get here?

Patterns of human development contribute to climate change through a set of specific economic, social, and technological activities that lead to GHG emissions, land-use changes and resource depletion (IPCC, 2021). Negative externalities such as pollution costs and natural resource mismanagement, and ineffective policies that promote fossil fuel use combined with the absence of carbon pricing further intensify climate change. As societies evolve and expand, the increased consumption of natural resources and energy, together with rising waste generation, lead to higher GHG emissions and inefficient resource use further accelerate climate change. This creates a dual challenge of promoting sustainable development while minimizing environmental degradation.

Economic development has historically been associated with increased GHG emissions, primarily due to industrialization, which relies heavily on fossil fuels. These fuels are the primary source of carbon dioxide (CO_2). While high-income countries have begun decoupling economic growth from emissions through energy efficiency improvements and a shift towards renewable energy, many developing countries in Asia and Africa remain on a carbon-intensive growth path. This is driven by expanding industrial bases, transportation networks and urbanization, which continue to rely on fossil fuels (Le Quéré *et al.*, 2020). As these countries strive for economic growth, they face the dual challenge of sustaining development while transitioning to low-carbon energy systems (Friedlingstein *et al*. 2022).

Rapid urbanization is a significant driver of climate change due to land-use changes and increased energy demands met through an unsustainable energy mix. The expansion of urban areas often involves clearing natural landscapes such as forests and wetlands, which releases stored CO_2 into the atmosphere and reduces the planet's capacity to absorb CO_2, a phenomenon known as ‘carbon sequestration loss’ (Seto, Güneralp and Hutyra, 2012). Urban areas typically have higher per capita emissions due to concentrated economic activities, transportation and consumption patterns. Moreover, the ‘urban heat island’ effect, where cities are warmer than their rural surroundings due to human activities, further increases energy demand for cooling, thereby elevating GHG emissions (Santamouris, 2020).

Human development has driven a significant agricultural expansion to meet rising food demands, particularly in developing regions. This often occurs at the expense of forests, which serve as critical carbon sinks (Beuchle *et al*., 2023). Land clearing for agriculture, such as cattle ranching, palm oil and soy cultivation, releases stored carbon and reduces the earth's capacity for CO_2 sequestration. Additionally, intensive agricultural practices such as increasing the use of synthetic fertilizers and mechanization, emit potent GHGs such as nitrous oxide and methane. Livestock farming is a particularly significant source of methane and nitrous oxide (IPCC, 2021).

Industrialization, a critical enabling component of human development, has significantly increased energy use and GHG emissions. Key industries, such as manufacturing, mining and construction, are energy-intensive and often dependent on fossil fuels. The production of goods to meet growing consumer demand further contributes to CO_2, methane and other GHG emissions. For instance, the steel, cement, and chemical industries are among the largest global emitters due to their high energy consumption and carbon-intensive production processes (International Energy Agency, 2022). Additionally, the global supply chains that support industrial development involve extensive transportation networks, particularly in shipping and aviation, which have expanded significantly in recent decades and contribute substantially to CO_2 emissions and other air pollutants (European Commission Joint Research Centre, 2019).

Changes in consumption patterns, closely linked to human development, directly impact climate change. As incomes rise, consumption shifts towards more energy- and resource-intensive goods and services, such as automobiles, electronics and processed foods. The production and disposal of these goods contribute significantly to GHG emissions. For example, the global production of electronic goods, which relies on rare earth elements and energy-intensive manufacturing processes, has a substantial carbon footprint (Hertwich and Roux, 2011). Additionally, waste generation, especially in urban areas, poses a significant challenge for climate change mitigation. Landfills and waste treatment facilities are major sources of methane, a potent GHG (Goonetilleke *et al*., 2014). Poor waste management, growing urbanization and rising consumption increase emissions, and inadequate recycling systems and the energy demands of waste processing further hinder mitigation efforts.

Transportation is a critical sector where human development intersects with climate change. The rise in private vehicle ownership, increased air travel and expanded shipping networks are direct outcomes of economic development and globalization. The transport sector accounts for around 23 percent of global energy-related CO_2 emissions, with road transport being the largest contributor (International Energy Agency, 2022). As developing countries urbanize and their middle classes expand, vehicle ownership is projected to rise, leading to increased emissions unless there is a significant shift toward sustainable transport solutions, such as electric vehicles, public transport and non-motorized transport (Creutzig *et al*., 2016).

2.2 Climate change and human development: what does the future hold?

Building on these historical patterns, the future of human development will depend largely on how effectively countries respond to the escalating climate crisis, among other challenges. Without significant mitigation and adaptation efforts, climate change is poised to exacerbate inequalities, disproportionately affecting the most vulnerable populations through disruptions in food security, water availability and public health systems. Rising temperatures, erratic weather patterns, and increasingly frequent extreme events such as floods and droughts are already displacing communities and increasing poverty. These trends represent the 'most likely' path forward and are reflected in the business-as-usual scenario in this research, where the world fails to meet critical development goals, deepening the gap between rich and poor nations, and undermining progress in the most climate-sensitive regions.

Climate change will significantly influence future trends in human development. According to the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (IPCC, 2022), the intensifying effects of climate change will particularly affect Africa as one of the most vulnerable regions. The IPCC report projects that by 2050, crop yields in certain regions could fall by up to 46 percent, undermining food security and deepening poverty, particularly in countries already grappling with high levels of hunger and malnutrition. This decline is driven by erratic rainfall, prolonged droughts and shifting growing seasons, threatening the livelihoods of millions of rainfed farmers.

The 2024 Human Climate Horizons report also highlights how changing temperature and rainfall patterns will reduce staple crop yields by 2050, impacting global food security. Losses will be greatest in the world's top-producing bread baskets, such as the United States of America, China, Brazil and Russian Federation, where agriculture has thrived under optimal conditions but is ill-prepared for climate change. This shift poses significant risks to global food security, impacting both major producers and subsistence farming regions, particularly in Africa, where climate-related agricultural damages account for a substantial share of GDP.

The water crisis is escalating as a direct result of climate change. Globally, an estimated 3.6 billion people already face water scarcity, which is expected to rise to 4.8–5.7 billion by 2050, leading to unprecedented competition for water resources. Droughts, decreasing freshwater supplies, and increasing salinity of water sources are disproportionately impacting rural communities that lack efficient water management infrastructure, exacerbating social inequities and threatening progress toward achieving goals on clean water and sanitation (UNESCO, 2018).

Climate change is projected to substantially raise health risks and premature deaths from climate-sensitive diseases. By 2050, over 250,000 excess deaths annually are expected due to heat, malnutrition, malaria and diarrhoeal diseases, with more than half occurring in Africa (IPCC, 2022). Additionally, extreme weather events, such as floods and storms, are exacerbating waterborne diseases like cholera and diarrhoea, further straining already fragile healthcare systems.

Migration is a critical aspect of climate change's impact on human development. As environmental conditions deteriorate, many will be compelled to leave their homes in search of safer areas. Without timely climate and development interventions, up to 216 million people globally could be displaced internally by 2050 due to slow-onset climate change impacts, with 86 million in sub-Saharan Africa alone. This internal migration may intensify competition for resources, destabilize local economies, and increase conflict, further impeding human development (Clement *et al*., 2021).

Climate change is anticipated to significantly impact economic growth and livelihoods, particularly in low- and middle-income countries that depend on climate-sensitive sectors, such as agriculture, fisheries and tourism. Rising temperatures could lead to a significant decline in global GDP per capita, with potential reductions of up to 23 percent by 2100 if high emissions continue (Burke, Hsiang and Miguel, 2015). It is also projected to increase the number of people living in extreme poverty (Moyer *et al*., 2023).

3. Methodology

3.1 What is the International Futures model?

This study uses the International Futures (IFs) forecasting system for scenario analysis and long-term projections (Hughes, 2019). IFs is an integrated assessment model covering 188 countries, with the ability to forecast trends up to 2100. The platform includes numerous interconnected sub-models representing agriculture, civil conflict, demographics, education, economics, energy, the environment, gender, governance, health, infrastructure, international politics and technology. It is available as open-source software, accessible online, or downloadable for offline use (see pardee.du.edu).

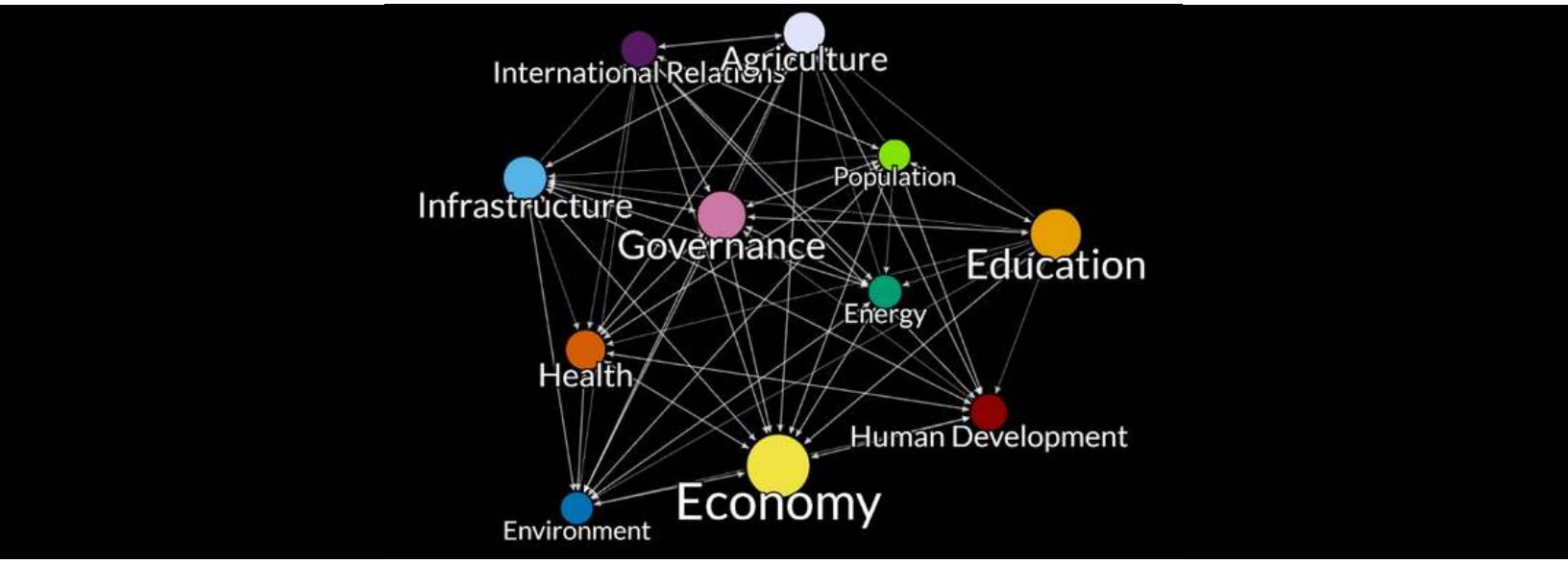

Figure 1: Domains and interactions represented in the International Futures (IFs) modeling platform (Hughes 2019).

Analysis undertaken using IFs often begins with the *Current Path* scenario, which aims to model the most likely trajectory of development across various sectors and countries. This 'middle of the road' scenario is not an extrapolation, but rather, a dynamic representation of development within and across the systems highlighted in Figure 1, including nonlinear model behaviour[3] and dynamic changes; however, the scenario does not include significant tipping points or dramatic changes to patterns of human, social or natural system development. It is generally in line with projections from other groups, including scenarios such as those of the United Nations Population Division or the IPCC's Shared Socioeconomic Pathway 2 scenario.

3.2 How is the SDG Push Operationalized?

The SDG Push scenario, initially developed by Hughes *et al*. (2021) and expanded by Hanna *et al*. (2024),

[3] Non-linear behaviour refers to the rate of progress toward a target that is not constant; it accelerates in the early years and then decelerates as the target is approached.

focuses on pursuing a world where improved policy strategies enhance the ability to 'leave no one behind'. The scenario was created in the wake of COVID-19, with the aim of making long-term projections that reasonably describe the types of policies that could enhance SDG achievement and their long-term effects: *What would global development look like if the world were more focused on maximizing progress towards the SDGs?*

The SDG Push scenario consists of the following elements:

- *Dietary shifts:* The scenario envisions a global move away from meat-heavy diets towards more plant-based ones. This shift has implications for both human health and environmental sustainability, as meat production is associated with high resource use and GHG emissions.
- *Agricultural improvements:* The scenario assumes increases in agricultural yields and reductions in food loss and waste across the entire supply chain. These measures aim to enhance food security and ensure that sufficient calories are available to meet the needs of a growing population.
- *Improved calorie distribution:* The scenario addresses the issue of food insecurity among vulnerable populations by incorporating policies to ensure more equitable access to food, potentially through mechanisms such as cash transfers or food subsidies.
- *Increased social spending:* Governments in this scenario prioritize spending on crucial areas for human development, including infrastructure, education, health (with a focus on family planning), and research and development. This reflects a commitment to investing in the long-term well-being of citizens.
- *Enhanced access to basic services:* The scenario assumes expanded access to clean water, sanitation, information and communication technology, and electricity, along with a reduction in the use of traditional cookstoves. These improvements contribute to better health and overall quality of life.
- *Improved governance:* The scenario includes measures to enhance the effectiveness of government spending and promote more democratic institutions. This aims to create a more accountable and efficient system of governance.

The SDG Push scenario emphasizes a multifaceted approach to sustainable development, combining interventions in food systems, social sectors, governance, energy and the environment. The overarching goal is to create a world where poverty and hunger are eradicated, human well-being is enhanced, and environmental sustainability is ensured.

3.3. What is the SDG Push 3.0 scenario?

The *SDG Push 3.0* is an equitable, low-carbon pathway that brings the world significantly closer to the 1.5 °C target through investments in sustainable development actions across digital, green economy, social protection and governance (Figure 2).

Specifically, the scenario introduced in this report follows general principles outlined in equitable low-carbon pathways to shape future patterns of energy use, energy efficiency and renewable energy technology. It does so by focusing on the following three areas of equity that are essential to balance the outcomes outlined in this report.

First, it is sensitive to the historical actors who have largely been responsible for the global climate crisis (high-income countries). Most high GHG-emitting countries come from the Global North, and this scenario asks these countries to shoulder the earliest and heaviest burden in this energy transformation.

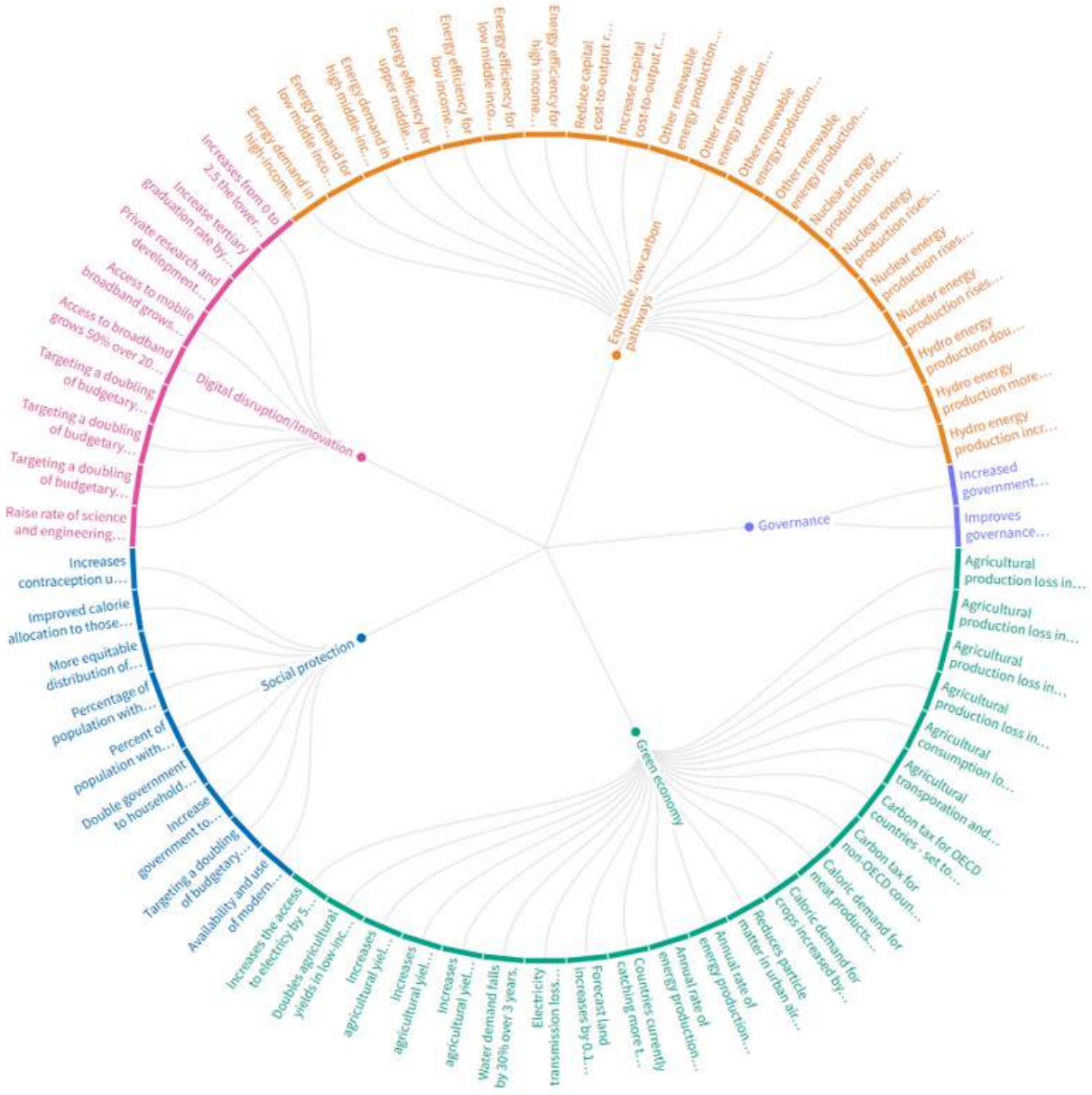

Figure 2: *UNDP's new flagship SDG Push 3.0 scenario: combining governance, social protection, green transition, and digital investments with energy demand convergence, cleaner transitions, and energy efficiency gains – See the scenario grouping in the Annex.*

Second, it addresses current inequities in per capita energy consumption, driving convergence across income groups and time. An equitable future is one where all countries have access to clean and renewable energy technologies, and where less developed countries are able to see their per capita energy consumption increase, while the Global North sees their per capita energy consumption decrease, driven by improving energy efficiency-related policy strategies and changes in individual behaviour.

Third, the interventions in this scenario are staggered across income group thresholds: high-income economies are asked to do the most the earliest; upper middle-income countries are asked to follow by improving energy efficiency and driving up renewable energy production; low middle-income country interventions are staggered after upper middle-income countries, and low-income countries actually see increases in their energy consumption compared to the *Current Path* across time. For details on the parameters modelled under this scenario, see the Annex.

3.4 How does climate change affect development in International Futures?

Climate change in IFs is driven by GHG emissions, which accumulate in the atmosphere and trap heat, preventing it from escaping into space. This process leads to rising global average temperatures, which in turn alters precipitation and rainfall patterns (Moyer *et al*., 2023). These changes impact economic activity in the IFs model, particularly in the agricultural and economic sectors.

Carbon emissions, temperature and precipitation all have impacts on agricultural yields. The model assumes increases in carbon emissions will result in global decreases in agricultural yields (Rothman, Hughes and Narayan, 2017), leading to changes in agricultural production patterns. These changes may impact development by increasing food prices and, consequently, the cost of food baskets.

Within the IFs economic model, rising temperature also affects development through changes in production and the capital stock. The model uses a damage function that models a decrease in production from an increase in temperature (Hughes, 2015, 2019). This decrease in production then has negative effects on development, i.e. decreasing economic growth and increasing inequality (Moyer *et al*., 2023).

4. Results

The *Current Path* of global development is characterized by uneven improvements in socioeconomic development indicators and worsening environmental conditions. The world population is expected to increase by an additional 2 billion people over the next five decades, primarily in East and West Africa and South Asia. Additionally, a significant increase in economic activity is also projected from 2025 to 2050. In this scenario, all regions increase in their HDI values, but convergence across regions in key development indicators such as education, health and income remains slow or does not occur.

Under the *Current Path* scenario, global extreme poverty is expected to persist, with approximately 685 million people living on less than US$2.15 a day by 2030. This figure is projected to decline to 525 million by mid-century, down from 732 million today, with most of the remaining poverty concentrated in sub-Saharan Africa and South Asia. In percentage terms, the poverty rate is anticipated to decrease from around 9 percent today to over 5 percent by mid-century.

In this scenario, malnutrition remains a significant issue, with around 500 million people still affected and infant mortality at 23.5 deaths per thousand live births by 2030. While these figures are projected to improve by 2050, where malnutrition declines to 268 million and infant mortality to 15.6 deaths per thousand, significant challenges will persist. Despite expected progress by 2050 in areas such as access to education, water and sanitation, and governance, the *Current Path* scenario still projects pockets of underdevelopment and conflict. These factors will continue to hinder the achievement of the SDGs by 2030, and even beyond, by mid-century.

The growth in this scenario comes at the cost of significant damage to the environment, with increasing GHG emissions and continued patterns of air pollution that have characterized human economic activities for decades. This scenario leads to an increase in global average temperature by 3.2 °C by 2100 compared to pre-industrial levels. It also contributes to increases in surface and water pollution, land degradation and biodiversity loss. Not only does this increase in global average temperature negatively affect the natural system, but it will also hinder development across the world, where some of the most underdeveloped regions will experience the greatest impacts. It is likely that diseases like dengue and malaria will become more prevalent, and that heat-related deaths become more common (IPCC, 2022). This temperature change will also lead to a greater risk of malnutrition and food insecurity in Africa, and to water security in Africa, Asia, and small island nations (Dickerson, Cannon and O'Neill, 2021).

The *Current Path* scenario does a poor job of balancing human development with environmental costs, and outcomes for both sets of indicators perform poorly by mid-century. However, if the global community prioritized a broad set of development indicators and committed to the human development-related SDGs,

how much progress could be made toward these global goals?

To explore this, a new scenario is introduced that focuses on a multidimensional improvement in policies associated with human development. Under the SDG Push scenario greater improvements are observed in development indicators associated to health, education, poverty and hunger than under the *Current Path* scenario. There are 160 million fewer people in extreme poverty by 2050 and 149 million fewer people suffering from undernourishment in 2050. This improvement to health under the SDG Push scenario improves infant mortality by 17 percent by 2050 compared with the *Current Path* scenario, and educational attainment and life expectancy grow.

However, the *SDG Push* scenario in this report does not include any interventions related to energy systems and the environment. By focusing policies on lifting people out of poverty, and undernutrition, and providing access to improved governance, education, health and infrastructure, the climate crisis only worsens. The SDG Push without energy interventions leads to an increase in temperature change compared to the *Current Path* because more people have more resources to consume and produce on a largely fossil fuel-based energy system (3.3 °C versus 3.2°C in the *Current Path*).

The improvement in development at the cost of the environment motivates the final scenario, the *SDG Push 3.0 scenario*. Under this scenario, energy efficiency improves globally by 28 percent by 2050 and 93 percent by 2100 compared to the *Current Path*. Energy intensity in high-income countries improves the most in the short term, decreasing by 9 percent compared to the *Current Path* by 2030 and by 33 percent by 2050. Low middle- and low-income economies do not significantly improve their energy efficiency until later in the century, and upper middle-income economies follow a trajectory closer to high-income countries after the 2030s. This reduces the global need for energy. By 2050, there will be 11 percent less energy demand compared to the *Current Path*, even in a scenario with higher GDP.

Today, high-income countries consume 21 times more per capita energy than that of low-income countries. Under the *SDG Push 3.0* scenario, however, income group per capita energy consumption converges later in the century. Energy consumption in high-income countries is expected to decrease from 27.6 barrels of oil per capita per year in 2025 to 15.8 barrels by the end of the century, while low-income per capita energy consumption will grow from 1.3 barrels of oil per year today to around 17.8 by 2100 (Figure 3).

Deployment of renewable energy also grows significantly. Under the *Current Path*, renewable energy is set to grow from 8.7 percent of total global energy production in 2025 to 32 percent by 2050 and 79 percent by 2100. Under the *SDG Push 3.0* scenario, it grows much faster, achieving 69 percent of total energy production by 2050 and 94 percent by 2100. This leads to a significant reduction in emissions, which decline from 9.8 billion tonnes in 2025 to 3.4 billion tonnes in 2050 and 0.6 billion tonnes in 2100. This causes the build-up of GHG emissions in the atmosphere to peak at 470 ppm in 2050 and decline by the end of the century. This caps growth in global average temperature change to 1.6 °C across the modelled time horizon (Figure 4).

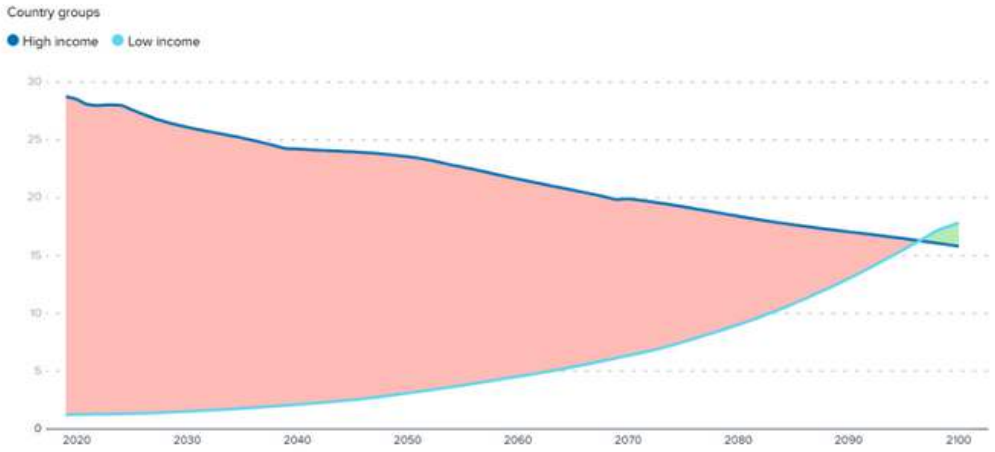

Figure 3: *Total energy demand per capita under the SDG Push 3.0 scenario: high vs. low-income groups (barrels of pil per year)*

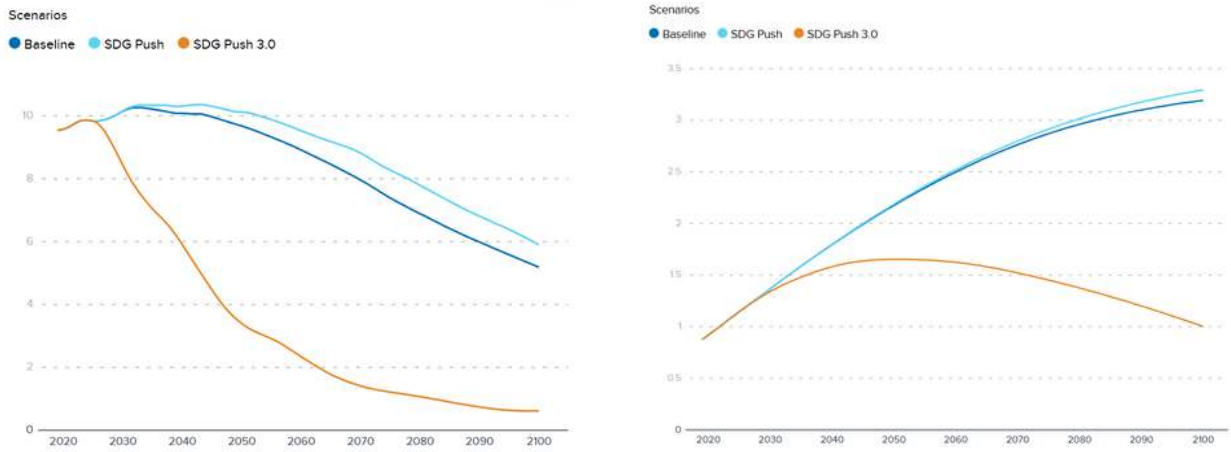

Figure 4: *Carbon emissions from fossil fuels (billion tonnes) (left) and temperature change (°C) under the Current Path (baseline), the SDG Push, and the SDG Push 3.0 scenarios (right)*

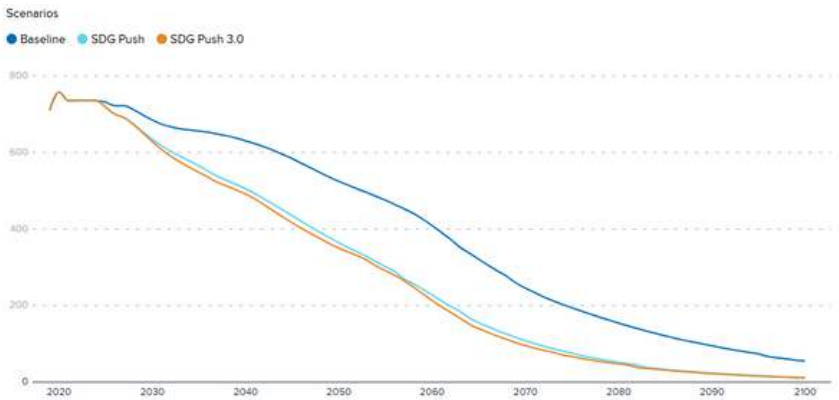

Figure 5: *Population living on less than US$2.15/day over time (million) in the Current Path (baseline), the SDG Push, and the SDG Push 3.0 scenarios*

In this scenario, there are also significant development gains. Compared to the *Current Path*, approximately 60 million additional people could be lifted out of poverty by 2030 and around 175 million by 2050 (Figure 5), with the greatest impacts on sub-Saharan Africa. One in three households in extreme poverty could escape poverty through collective action.

Beyond economic benefits, there are steady social improvements, particularly regarding the HDI, as equitable, low-carbon pathways elevate living standards across all development categories. The rate of improvement is slightly higher than under the SDG Push scenario. Countries with currently low human development (HDI below 0.550) could still achieve an HDI of 0.70 by 2055, reaching the threshold for high human development and showing marked progress. By 2100, they could advance to an HDI of 0.90, entering the highest HDI category and significantly narrowing development gaps.

5. Conclusion

This report underscores the complex relationship between human development and climate change, highlighting the urgent need for integrated approaches that exploit synergies through simultaneous responses to both challenges. The *SDG Push 3.0* scenario offers a compelling vision of a future where poverty, hunger and environmental degradation are significantly reduced. It demonstrates that when combined with targeted investments in human development, ambitious climate action can substantially improve well-being, equity and sustainability.

The findings of this research are clear: remaining on the *Current Path* will not suffice. It is characterized by persistent poverty, widening inequalities, and escalating climate impacts, which threaten to derail progress towards the SDGs. However, the *SDG Push 3.0* scenario presents a viable alternative, showcasing the transformative potential of policy interventions that prioritize social inclusion, economic diversification and environmental stewardship.

By 2050, this integrated approach could lift approximately 175 million people out of poverty, significantly reduce malnutrition, and improve various health and education indicators. Moreover, it would substantially reduce carbon emissions, limiting the rise of global temperature, and mitigating the adverse effects of climate change. These outcomes highlight the synergistic benefits of aligning climate action with the broader sustainable development agenda.

The transition to a just and sustainable future will undoubtedly require bold leadership, innovative solutions and global cooperation. It will also require a shift from fossil fuel dependence towards clean and renewable energy sources, combined with investments in sustainable infrastructure, social protection programmes and equitable access to essential services. It will also call for enhanced international collaboration to support developing countries in their efforts to achieve both climate and development goals.

The *SDG Push 3.0* is a road map for a better future. It demonstrates that a world where human development flourishes in harmony with a healthy planet is within reach. By embracing this integrated approach and taking decisive action, it is possible to ensure a more prosperous, equitable and resilient world for generations to come.

It is important to acknowledge that the scenarios presented here estimate the benefits of achieving equitable, low-carbon development pathways but not the cost. For national-level policy, the benefits analysed in this report can be compared with the cost of implementation to estimate the full cost-benefit that can drive investment decisions.

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Annex: SDG Push 3.0 parameter list

Description	Parametric intervention (all interventions begin in 2025 unless otherwise noted)	Geography
Digital disruption/innovation		
Increased rates of tertiary graduates with science and engineering degrees	edterscienshradd increased from 0 to 10 over 13 years	World
Increased government spending on education	gdsm for Education increased from 1 to 2 over 13 years	World
Increased government spending on research and development (R&D)	gdsm for R&D increased from 1 to 2 over 13 years	World
Increased government spending on infrastructure	gdsm for Infrastructure increased from 1 to 2 over 13 years	World
Increased access to broadband	ictbroadm increased from 1 to 1.5 over 20 years	World
Increased access to mobile broadband	ictbroadmobilm increased from 1 to 1.5 over 20 years	World
Increased spending on research and development	randdexpm increased from 1 to 1.2 over 13 years	World
Increased tertiary graduation rates	edtergradm increased from 1 to 1.5 over 24 years	World
Accelerated growth in lower secondary graduation rates	edseclowrgradgr increased from 0 to 2.5 over one year	World
Equitable, low-carbon pathways		
Energy demand falls for World Bank High-Income Countries	endemm decreased from 1 to 0.8 over 15; then 0.8 to 0.6 over the next 20 years; finally, from 0.6 to 0.5 over 30 years	World Bank High Income Countries

Annex: SDG Push 3.0 parameter list

Energy demand gradually increases then gradually falls for Low-Middle-Income Countries	endemm increased from 1 to 1.15 over 33 years; then decreased from 1.15 to 0.863 over 42 years	World Bank Low-Middle-Income Countries
Energy demand falls for World Bank High-Middle-Income Countries	endemm decreased from 1 to 0.88 over 10 years; then to 0.6 over 10 years; then to 0.58 over 10 years; finally, to 0.3 over 40 years	World Bank High-Middle Income Countries
Energy demand to GDP ratio is held to simulate energy efficiency gains	enrgdpgr held at -1.344 for 15 years and then increased at the base rate	World Bank Upper-Middle Income Countries
Energy demand to GDP ratio is held to simulate energy efficiency gains	enrgdpgr increased at its normal rate and then held at -1.06 from 2055 to 2061 to 2074	World Bank Low- Income Countries
Energy demand to GDP ratio is held to simulate energy efficiency gains	enrgdpgr increased at its normal rate and then held at -1.1 from 2078 onword	World Bank Low-Middle Income Countries
Energy demand to GDP ratio is held to simulate energy efficiency gains	enrgdpgr held at 1.344 for 30 years, and then increased at its base rate after	World Bank High-Income Countries
Decreased capital costs-to-output ratio for renewable energy	qem for OthRenew decreased from 1 to 0.5 over 30 years	World
Energy production of renewables not including hydro or nuclear is increased	enpm (other renewables) increased from 1 to 2.3412 over 75 years	World Bank Low-Middle Income Countries
Energy production of renewables not including hydro or nuclear is increased	enpm (other renewables) increased from 1 to 5 over 75 years	World Bank Upper-Middle Income Countries, and China

Annex: SDG Push 3.0 parameter list

Energy production of renewables not including hydro or nuclear is increased	enpm (other renewables) increased from 1 to 3.6275 over 75 years	World Bank Low-Income Countries
Energy production of nuclear is increased	enpm (nuclear) increased from 1 to 2.975 over 75 years	World Bank Low-Income Countries
Energy production of nuclear is increased	enpm (nuclear) increased from 1 to 2.55 over 75 years	World Bank Upper-Middle Income Countries
Energy production of nuclear is increased	enpm (nuclear) increased from 1 to 2.14 over 75 years	World Bank High-Income Countries
Energy production of nuclear is increased	enpm (nuclear) increased from 1 to 4.375 over 75 years	World Bank Low-Middle Income Countries
Energy production of hydro is increased	enpm (hydro) increased from 1 to 2 over 25 years	World Bank Low-Middle Income Countries and World Bank Low-Income Countries
Energy production of hydro is increased	enpm (hydro) increased from 1 to 2.065 over 75 years	World Bank Upper-Middle Income Countries
Energy production of hydro is increased	enpm (hydro) increased from 1 to 1.475 over 75 years	World Bank High-Income Countries

Annex: SDG Push 3.0 parameter list

Governance		
Increased government participation as defined by the Polity Project Index	democm increased from 1 to 1.3 over 13 years	World
Improved government effectiveness	goveffectm increased from 1 to 1.3 over 13 years	World
Green Economy		
Reduced agricultural losses in all stages of production, transport and consumption	aglossprodm, aglosstransm and aglossconsm are interpolated from 1 to 0.7 over 30 years	World
Carbon tax is introduced at US$200 per ton for Organisation for Economic Co-operation and Development (OECD) countries	carbtax interpolated from 0 to 200 over 13 years	OECD countries
Carbon tax is introduced at US$50 per ton for non-OECD countries	carbtax interpolated from 0 to 50 over 13 years	Non-OECD countries
Reduced caloric demand for meat products	clpcm for Meat interpolated from 1 to 0.8 over 30 years	World
Increased caloric demand for crops	clpcm for Crop interpolated from 1 to 1.106 over 13 years	World
Reduction in residential PM2.5 levels	envpm2pt5m decreased from 1 to 0.7 over 36 years	World
Reduction of the annual rate of energy production cost reduction for coal	etechadv for Coal decreased from 0.004 to 0.002 in one year	World
Acceleration of the annual rate of energy production cost reduction for renewable energy	etechadv for OthRenew increased from 0.008 to 0.01 over one year	World

Annex: SDG Push 3.0 parameter list

Reduction in fish catch for countries currently catching more than 2 mmt of fish per year	fishcatchm decreased from 1 to 0.75 over 50 years	China, Indonesia, Japan, Myanmar, Peru, Russian Federation, Thailand, United States of America
Increase in forested land area	forestm increased from 1 to 1.0015 over 1 year	World
Reduced electricity transmission loss	infraelectranlossm decreased from 1 to 0.8 over 30 years	World
Reduced water demand	waterdemandm decreased from 1 to 0.7 over 33 years	World
Increased crop yields	ylm for upper-middle- and high-income economies increased from 1 to 1.2 over 15 years	High-income economies, Upper-middle-income economies
Increased crop yields	ylm for lower-middle income economies increased from 1 to 1.5 over 50 years	Lower-middle-income economies
Increased crop yields	ylm for low-income economies increased from 1 to 2 over 50 years	Low-income economies
Increased electricity access	infraelecaccm increased from 1 to 1.5 over 24 years	World
Social Protection		
Increased availability and use of modern cookstoves	cookstovesadd for Improved increased from 0 to 500 over 13 years	World
Increased government spending on health	gdsm for Health increased from 1 to 2 over 13 years	World

Annex: SDG Push 3.0 parameter list

Increased government welfare transfers to unskilled households	govhhtrnwelm for 1 Unskilled increased from 1 to 1.5 over 13 years	World
Increased government welfare transfers to unskilled households.	govhhtrnwelm for 1 Unskilled increased from 1 to 2 over 13 years	Low-income economies
Increased access to improved sanitation	sanitationm for Improved increased from 1 to 2 over 30 years	World
Increased access to improved water	watsafem for Piped increased from 1 to 2 over 30 years	World
More equitable distribution of calories	clpccvm decreased rom 1 to 0.85 over 15 years	World
Improved calorie allocation to those most in need	malelimprecisesw switched from 0 to 1 in one year	World
Increased contraception use	contrusm increased from 1 to 1.15 over 25 years	World

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