Alternative proteins provide a sustainable, secure, and prosperous path to the future

Investing in improving the quality, affordability, and accessibility of alternative proteins should be a top priority for policymakers.

The Paris Agreement's climate target is impossible without a protein transition

Global protein production must change to prevent the worst effects of a warming climate. The current system of industrial animal agriculture is responsible for 20 percent of annual greenhouse gas emissions, more than the entire transportation sector, and demand for meat is set to double by 2050 as the global population grows.[1,2] Even if all fossil fuel emissions stopped immediately, animal agriculture alone would push the planet past 1.5˚C of warming.[3]

Alternative proteins reduce greenhouse gas emissions by up to 97 percent by creating the characteristics of animal products using plants, fermentation, or animal cell cultivation.[4, 5] Pastures and fields of feed crops currently occupy nearly a third of Earth's land, so in addition to reducing emissions, a transition to alternative proteins would also unlock hundreds of millions of square miles of land for carbon sequestration, with potential sequestration as high as 26 Gt/year,[6] which is roughly half the annual human production of CO_2-eq.

Alternative proteins are a scalable, market-based solution to agricultural emissions

Like renewable energy and electric vehicles, alternative proteins are a market-based solution. Just as the goal of renewable energy and electric vehicles is to eventually produce energy and vehicles that win in the marketplace, the goal of alternative proteins is to create products that taste the same or better than conventional meat and cost less. With more research and development to improve the taste and price, alternative proteins could soon be adopted by a broad base of consumers.

Alternative proteins offer public health and food security benefits

Antibiotic resistance is a serious medical threat that already leads to 1.3 million deaths per year.[7] With 70 percent of all antibiotics given to farm animals, industrial animal agriculture substantially contributes to this growing phenomenon.[8] Further, according to the United Nations Environment Programme, two of the most likely causes of the next pandemic are increased global meat consumption and the

20% *of greenhouse gas emissions come from animal agriculture*	up to 97% *reduction in GHG emissions by switching to alternative proteins*	$1.1 trillion *projected value of the alternative protein industry by 2050*	9.8 million *jobs created in the alternative protein industry by 2050*

industrial method of meat production, both of which increase the likelihood of zoonotic diseases spreading to humans.[9] Because they do not require antibiotics or involve live animals, alternative proteins eliminate protein production's contribution to antibiotic resistance and zoonotic disease risk. Further, by minimizing animal agriculture's land footprint, alternative proteins can help protect fragile ecosystems from deforestation and repurpose existing cultivated land for human crop consumption. As the global population grows, reducing pandemic risk and ensuring adequate food supply will be matters of critical concern.

Economists and executives see alternative proteins as the food of the future

According to a study funded by the UK's Foreign, Commonwealth & Development Office and the ClimateWorks Foundation, alternative proteins could support 9.8 million new jobs and bring $1.1 trillion to the global economy by 2050.[10] The industry has taken note: all five of the world's largest meat corporations are developing or investing in alternative proteins.[11] With the major corporate players open to investing their resources into developing the field and a plethora of permanent jobs available to ease the economic transition, alternative proteins face a markedly easier path to global implementation than many other climate fixes.

The international race to become the alternative protein powerhouse is on

Just as renewable energy has become cheap and abundant due to research and development in many different countries, advances in alternative proteins in one country can quickly be adopted globally.[12] However, emerging industries tend to coalesce around research hubs, with scientists, entrepreneurs, and investors gathering around centers of shared activity. Just as Silicon Valley sprang up around the original ARPANET hub at Stanford University, the alternative protein industry's economic potential will most benefit the governments that provide it with public research funding, knowledge centers, infrastructure, and regulatory support.

Governments in Israel, Japan, Germany, India, Singapore, Canada, and the Netherlands have invested in alternative protein R&D, recognizing the opportunity to lead in a burgeoning field, and China has been quietly allocating significant funding to help the sector scale up since at least 2020.[13, 14] While the United States still leads the world in the number of alternative protein companies and capital investment in the industry, the center of gravity is quickly shifting.[15] The United States has lost this battle to China with respect to solar panels and lithium-ion batteries but can still make the most of its lead in alternative proteins.

> *"If [the United States doesn't] facilitate the invention of these ideas, we're going to see these technologies go to places around the world that are more conducive to their development, and frankly China may be one of those."*
>
> Former U.S. Secretary of Agriculture Sonny Perdue[16]

References

1) Xiaoming Xu, Prateek Sharma , Shijie Shu, Tzu-Shun Lin, Philippe Ciais, Francesco N. Tubiello, Pete Smith, Nelson Campbell, Atul K. Jain. "Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods." *Nature Food* 2 (2021): 724–732. https://doi.org/10.1038/s43016-021-00358-x.

2) P.J. Gerber, Henning Steinfeld, Benjamin Henderson, Anne Mottet, Carolyn Opio, Jeroen Dijkman, Alessandra Falcucci and Giuseppe Tempio. *Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities.* Rome: Food and Agriculture Organization of the United Nations (FAO), 2013.

3) Michael A. Clark, Nina G. G. Domingo, Kimberly Colgan, Sumil K. Thakrar, David Tilman, John Lynch, Inês L. Azevedo and Jason D. Hill. "Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets." *Science* 370, no. 6517 (Nov. 2020): 705-708, https://doi.org/10.1126/science.aba7357.

4) Wiebe Saerens, Sergiy Smetana, Leen Van Campenhout, Volker Lammers, Volker Heinz. "Life cycle assessment of burger patties produced with extruded meat substitutes." J*ournal of Cleaner Production* 306, 127177 (April 2021): https://doi.org/10.1016/j.jclepro.2021.127177.

5) The Good Food Institute. *Plant-based meat for a growing world.* June 2019. https://gfi.org/wp-content/uploads/2021/02/GFI-Plant-Based-Meat-Fact-Sheet_Environmental-Comparison.pdf.

6) Matthew N. Hayek, Helen Harwatt, William J. Ripple, Nathaniel D. Mueller. "The carbon opportunity cost of animal-sourced food production on land." *Nature Sustainability* 4 (September 2020): 21-24, https://doi.org/10.1038/s41893-020-00603-4.

7) Antimicrobial Resistance Collaborators. "Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis." The Lancet 399, no. 10325 (February 2022): 629-655. https://doi.org/10.1016/S0140-6736(21)02724-0.

8) The Pew Charitable Trusts. *Antibiotics and Animal Agriculture: A Primer.* February 2018. https://www.pewtrusts.org/-/media/assets/2018/02/arp_antibiotics_and_animal_agriculture_a_primer.pdf.

9) Delia Grace Randolph, Johannes Refisch, Susan MacMillan, Caradee Yael Wright, Bernard Bett, Doreen Robinson, Bianca Wernecke et al., *Preventing the Next Pandemic- Zoonotic Disease and How to Break the Chain of Transmission.* Nairobi, Kenya: United Nations Environment Programme and International Livestock Research Institute, July 2020. https://www.unep.org/resources/report/preventing-future-zoonotic-disease-outbreaks-protecting-environment-animals-and.

10) *"Global Innovation Needs Assessment: Protein Diversity."* United Kingdom Foreign, Commonwealth and Development Office & ClimateWorks Foundations, November 2021. https://www.climateworks.org/wp-content/uploads/2021/11/GINAs-Protein-Diversity.pdf.

11) *2021 State of the Industry Report: Cultivated Meat and Seafood.* The Good Food Institute, April 2021. https://gfi.org/resource/cultivated-meat-eggs-and-dairy-state-of-the-industry-report/ and *2021 State of the Industry Report: Plant-Based Meat, Eggs, and Dairy*. The Good Food Institute, April 2021. https://gfi.org/resource/plant-based-meat-eggs-and-dairy-state-of-the-industry-report/.

12) Gregory Nemet. *How Solar Energy Became Cheap: A Model for Low-Carbon Innovation.* Oxfordshire: Routledge, 2019.

13) *2021 State of Global Policy Report.* The Good Food Institute, 2022 (forthcoming).

14) Ryan Huling. "Look closer: China is quietly making moves on cultivated meat," The Good Food Institute (Blog), October 25, 2021. https://gfi.org/blog/china-is-making-moves-on-cultivated-meat/.

15) The U.S. share of global capital investment has declined from 95% in 2015 to 68% in 2021. *2021 State of the Industry Report: Cultivated Meat and Seafood.* The Good Food Institute, 2022. 33 https://gfi.org/resource/cultivated-meat-eggs-and-dairy-state-of-the-industry-report/ and *2021 State of the Industry Report: Plant-Based Meat, Eggs, and Dairy.* The Good Food Institute, 2022. 53 https://gfi.org/resource/plant-based-meat-eggs-and-dairy-state-of-the-industry-report/.

16) Secretary Sonny Perdue, BIO Virtual Fireside Chat (Sept. 22, 2020), https://bit.ly/3toJOv3.