

Plant-based meat manufacturing capacity and pathways for expansion

A summary of recommended policy stakeholder actions

A [report](#) by the Good Food Institute and Bright Green Partners quantifies existing global plant-based meat capacity and evaluates the potential for and trade-offs of retrofitting existing facilities to build additional capacity. This summary uplifts key insights from the study and outlines considerations and actions for policymakers.

Contents:

[Overview and motivation for public support](#) / [Policy action recommendations](#)

[About the author](#) / [About GFI](#)

Key findings

To meet the Paris Agreement’s 1.5°C target, we must considerably reduce emissions from food and agriculture. Protein production accounts for roughly half of all food system emissions, and meat demand is projected to double by 2050. Plant-based meats offer a high-protein product with a significantly smaller carbon footprint and require far less land and water and fewer pollutants to produce.

A global protein transition with more plant-based sources can help us reach climate goals. However, for plant-based meats and other alternative proteins to become a climate strategy, more capacity is necessary beyond the 2.2 million metric tons (MMT) currently available for plant-based meat production, which would capture only 0.5 percent of the projected 398 MMT global meat market in 2030. Given the nascency of the plant-based meat industry, private investments and demand have varied year-to-year. Government support and incentives are needed to fill capacity where investors alone cannot.

The analysis by the Good Food Institute and Bright Green Partners quantified global plant-based meat manufacturing capacity and evaluated the potential for and trade-offs of retrofitting existing facilities to build additional capacity. The following are key insights:

- In 2022, the estimated global plant-based meat production capacity was ~2.2 MMT, with the majority found in Europe (41%) and North America (34%), some in Asia-Pacific (16%), and little in the rest of the world (9%). Although current capacity is well-utilized, even moderate market growth may outstrip the industry’s ability to serve demand and lead to a capacity shortage if expansion is not adequately planned.
- To expand capacity, there are significant potential benefits of retrofitting existing suitable facilities, which requires, on average, a third of the lead time and a fifth of the capital expenditure (i.e., Capex, up-front costs such as building preparation) compared to greenfield (i.e., new facility) construction.
- Facilities from incumbent industries (e.g., pet food, pasta, cereals, dry snacks, conventional meat processing) are well-suited for retrofitting to produce plant-based meat.
- The report modeled two pathways to build plant-based meat manufacturing capacity: (1) 50 percent greenfield and 50 percent retrofitted construction and (2) 100 percent greenfield construction. In both hypothetical scenarios, incremental production grows from 2.2 MMT in 2022 to 10 MMT in 2030. The models demonstrated that 100 percent greenfield construction would cost 60 percent more than the first scenario (\$17.5 billion total vs. \$10.4 billion total, respectively).

Full report: [Plant-based meat manufacturing capacity and pathways for expansion](#)

Policymakers should provide public support for plant-based meat capacity expansion to enable more sustainable global food and agricultural production.

Policy action recommendations

1 Governments should offer financial incentives for greenfield construction that increase production of plant-based meats.

While plant-based meats are rising in popularity, sales remain a small percentage of overall meat sales, with less than 1 percent of the global 350 MMT meat market. For plant-based meats to become a scalable climate and food security solution that meaningfully improves the sustainability and diversity of our agriculture and food systems, capacity must expand. Our analysis demonstrates that the current capacity, even if optimized for utilization, will not be sufficient within a few years.

Governments have the opportunity to de-risk the production of plant-based meats while investors and manufacturers develop more confidence in the plant-based meat market.

The Global Innovation Needs Assessment: Protein Diversity, funded by the ClimateWorks Foundation and the UK's Foreign Commonwealth and Development Office, notes that "Public support should be focused on creating an environment in which the private sector can invest with greater confidence and at a lower cost... Though the public sector needs to ensure that it does not crowd out private investment, it has a role in ensuring technologies have sufficient access to finance to scale at the required pace to achieve climate targets." Governments can reduce private sector risks through a number of actions that have been deployed in other industries.

"Public support should be focused on creating an environment in which the private sector can invest with greater confidence and at a lower cost... Though the public sector needs to ensure that it does not crowd out private investment, it has a role in ensuring technologies have sufficient access to finance to scale at the required pace to achieve climate targets."

– The UK's Foreign Commonwealth and Development Office

Governments should map costs, benefits, and risks for tax incentive-driven deals and employ debt financing for large infrastructure projects for plant-based meats. Similar tax breaks, financing, and other incentives have been leveraged for other climate-forward industries. Examples include the electric car industry, where [Rivian received a \\$1.5 billion package](#)

with Georgia to build a 7,500-job, \$5 billion electric vehicle plant, and the solar photovoltaics industry, where [Tesla's SolarCity pledged \\$5 billion](#) and the creation of 5,000 new jobs through a new solar panel plant and received \$750 million from New York state to build it in Buffalo.

Recently, government funding for the alternative protein industry has rapidly increased. As of the end of 2021, there was approximately \$360 million in all-time global public alternative protein R&D funding, more than a quarter of which came in 2021. Some of this funding is allocated for plant-based meat infrastructure:

\$19.5 million

has been invested across Canada by one of Canada's five Innovation Superclusters, [Protein Industries Canada](#), with private industry for plant-based protein projects, including infrastructure.

\$113 million

has been [funded](#) by the Australian government to [Australia Plant Proteins](#) who is leading a project to build three new plant protein manufacturing facilities.

\$91 million

was partially funded by [The Swedish Environmental Protection Agency](#) for Lantmännen's new large-scale pea protein production facility.

For a deeper look into public support for alternative proteins, see [GFI's Alternative Proteins: State of Global Policy report](#).

While this uptick in public funding is promising, much more is needed to make alternative proteins a scalable climate solution. Our report demonstrates that the estimated costs for facility construction to produce 10 MMT or hold 2.5 percent of the global meat market volume share are in the 10s of billions, even with the significant Capex savings provided by retrofitting existing facilities. With [global plant-based meat, seafood, eggs, and dairy private investments totaling \\$7.8 billion from 2010 to 2022](#) and high year-to-year variance in investments, more stable, public investments will be necessary to de-risk plant-based meat capacity expansion. For greenfield construction, lead time should be taken into consideration when deploying incentives and funding, offering incentives at least three years before anticipated capacity is needed to account for construction lead time.

2 For regions where there are suitable facilities to retrofit, governments should offer additional incentives and financing for new contract manufacturing partnerships and other retrofits that support plant-based meat production.

Our report estimates that retrofitting existing suitable facilities would require, on average, a third of the lead time and a fifth of the capital expenditure compared to a greenfield project. As a result, tax incentives and debt financing for retrofit projects could expedite and lower the costs of plant-based meat capacity expansion. These incentives would also de-risk company product portfolio diversification, allowing pet food, pasta, breakfast cereals, dry snacks, and processed meat makers to include additional manufacturing lines. In regions where these incumbent industries have flat or slow growth, as is mostly the case in North America and Europe, companies will be more amenable to retrofitting for plant-based meat products if aided by their governments. Governments have the opportunity to help their domestic businesses who may be hindered by market declines and competition to retrofit their facilities to produce climate-smart plant-based meat products. This also offers a pathway for regions that are keen to become alternative protein hotspots to build capacity at a faster and more affordable rate. Moreover,

incentivizing retrofit can boost regional economies by creating or retaining critical manufacturing jobs and skilled workers.

Governments can also consider additional incentives for contract manufacturing to build new partnerships between plant-based innovators and other organizations. Especially in areas where current plant-based meat production capacity is lower than in North America and Europe, like Asia-Pacific, governments should create partnerships that encourage companies with free capacity to open their production lines and function as contract manufacturers. Contract manufacturers can add capacity to the plant-based industry when demand is high and switch to other products when demand is low. This will help plant-based meat products get to market without large infrastructure investments.

Finally, programs that help manufacturers find suitable buildings to retrofit and encourage energy-efficient retrofits would motivate manufacturers to consider a retrofit over greenfield construction.

3 Governments should lead and leverage public-private collaborations between private companies and academic institutions that support the scale-up of climate-smart solutions like plant-based foods.

The recent *Bold Goals for U.S. Biotechnology and Biomanufacturing* report notes, “Partnerships between private companies and academic institutions allow them to use a portion of their infrastructure for R&D and to take advantage of existing knowledge to scale up new products. Such collaborations are critical in incentivizing investments, creating new jobs and market opportunities, and boosting sustainability.” One example of such a partnership is the U.S. Bioproduct Pilot Program, which aims to improve the scale-up of sustainable bioproduct manufacturing to provide low-cost alternatives to conventional products by having the USDA partner with at least one other institute. A number of universities, including California Polytechnic State University, The Ohio State University, and ETH Zürich currently offer contract pilot-scale facilities for plant-based meat manufacturing. Financial incentives from the government to leverage and improve academic infrastructure for commercial technology transfer would help companies de-risk the development and scale-up of novel plant-based meat formulations. In addition to providing more infrastructure and opportunities for optimizing scale-up, public research from these collaborations would reduce industry-wide research duplication by sharing foundational solutions with a wider audience.

4 Policymakers can provide mechanisms and incentives for capacity transparency.

To capitalize on potential contract manufacturing opportunities, governments can collect and maintain data about their region’s capacity in plant-based meat facilities or those involved in other suitable industries. A more comprehensive and regularly updated inventory of production and capacity information would allow industry participants to identify contract manufacturing solutions. The information would also help participants understand where infrastructure bottlenecks exist and how best to address them.

About the author

Dr. Panescu's role at GFI accelerates the plant-based meat industry by analyzing the plant-based protein landscape, identifying emerging technological solutions and bottlenecks, and communicating with other scientists about advancing alternative protein research. Dr. Panescu earned bachelor's degrees in chemistry and math from the University of California, Santa Cruz, as well as a master's and a doctorate in organic chemistry from the University of California, Los Angeles. Prior to joining GFI, Prieria spent almost a decade focusing on polymer, formulation, and materials chemistry research, honing these skills for food security applications by creating novel sustainable agriculture materials and compounds.

Prieria H. Panescu, Ph.D.

Lead Scientist, Plant-based Specialist, The Good Food Institute

 prierap@gfi.org  [Prieria Panescu](https://www.linkedin.com/in/PrieriaPanescu)  [@chempreaction](https://twitter.com/chempreaction)

About GFI

The Good Food Institute is a 501(c)(3) nonprofit working internationally to make alternative proteins like plant-based and cultivated meat delicious, affordable, and accessible. GFI advances open-access research, mobilizes resources and talent, and empowers partners across the food system to create a sustainable, secure, and just protein supply.

This report, as well as all of GFI's work, is made possible by gifts and grants from our global family of donors. If you are interested in learning more about giving to GFI, please visit [here](#) or contact philanthropy@gfi.org.