Food and animal feed from renewable energy, air, and water

Cultivation of feed in agriculture is one of the largest contributors to the production of greenhouse gases, especially due to the use of nitrogen-based fertilizers. In addition, agriculture consumes large amounts of energy and resources.
The example of amino acids demonstrates how the replacement of feeds, like soy, with fully synthetic amino acids could reduce the consumption of energy and drinking water, the use of pesticides, and greenhouse gas emissions by up to 99 percent. This is especially true if the energy for synthetic production of amino acids comes from renewable sources.
The information below explains the correlations and the connection to the greenhouse effect and climate change and shows alternatives.

Essential and semi-essential amino acids

Amino acids are vital for humans and animals because they are the building blocks of all proteins found in animals and humans. Altogether, there are more than 20 different amino acids, most of which the body produces itself.
Eight amino acids are essential for humans, that is, they are absolutely necessary for building the body's own protein. Since they are not synthesized by the body, they must be obtained from food. Two additional amino acids are essential only for children. They are identified in the following list as "semi-essential."

Amino acids	Sources
Arginine (semi-essential)	Hazelnuts, Brazil nuts, almonds, grains, meat, fish
Histidine (semi-essential)	Tuna, pork fillet, beef fillet, chicken breast, soybeans, peanuts, lentils, salmon, wheat germ, Emmental cheese
Isoleucine	Wheat germ, tuna, peanuts, salmon, beef, veal, chickpeas, cottage cheese, rice
Leucine	Wheat germ, tuna, peanuts, salmon, beef, fillet, chickpeas, cottage cheese, rice
Lysine	Parmesan, fish, pork fillet, beef fillet, soybeans, wheat germ, lentils, peanuts
Methionine	Fish (salmon, shrimp), meat, broccoli, green peas, Brussels sprouts, spinach, eggs, whole-grain bread, rice
Phenylalanine	Soybeans, vegetables, nuts, seeds, wheat germ, dairy products, meat, fish
Threonine	Wheat germ, soybeans, lentils, brown trout, mutton, sunflower seeds, chicken, peanuts, cottage cheese, eggs
Tryptophan	Cheese, poultry, beef, eggs, peas, nuts, potatoes
Valine	Wheat germ, tuna, peanuts, salmon, beef, veal, chickpeas, cottage cheese, rice

Biological significance for people

We take in amino acids by eating foods containing protein. In the digestive tract, the protein molecules are broken down into amino acids, which the body then uses to build its own proteins. All proteins in the human body are built from amino acids – no matter whether in the muscles, hair, or skin. That's why we rightfully refer to them as the building blocks of life. Altogether, there are more than 20 different amino acids, most of which the body produces itself. However, there are exceptions. Eight to ten so-called essential amino acids cannot be produced by an organism, so they must be obtained through food. Amino acids must be consumed daily because they can be stored only to a limited extent and are easily converted to fat if nutrition is unbalanced. The body remains healthy and productive only if essential amino acids are consumed with food every day. Otherwise, protein synthesis comes to a halt and life-threatening deficiency symptoms may occur, such as immune system and pigment disorders, anemia, or nutritional edema.

Significance for animal feed

Livestock must also obtain their amino acids with their food. Since not all feed plants contain the same or sufficient amounts of the essential amino acids, today primarily soy is used for fattening animals, but also as concentrated feed for dairy cattle. This is not only because of the high protein content of this plant, but also because of the relatively high, balanced content of essential amino acids, which is rare in any other feed plant. Due to the use of soy as feed, soybean cultivation has risen dramatically around the world and has led to the deforestation of primeval forests, especially in South America. In addition to local problems like soil erosion and regional climate change, this deforestation contributes to global climate change due to the resulting greenhouse gas emissions.

Enormous savings of energy, drinking water, greenhouse gases, and pesticides through the use of fully synthetic amino acids

More "industrial" agriculture is not only a major producer of greenhouse gases, it also uses huge amounts of water and energy and heavily pollutes water. Aside from the reduction in meat consumption, the use of synthetic amino acids could provide relief.

All essential (vital) amino acids (like methionine, lysine, threonine, and tryptophan) can be produced fully synthetically from **air, water, and renewable energy**.
Therefore, we could spare ourselves the steps of crop cultivation (for example, soy) and animal fattening (pigs, cattle, poultry). One kilogram of synthetic methionine replaces 160 kilograms of soy meal in feed, for instance, thus eliminating the need for corresponding imports. And 750,000 tonnes of synthetic methionine could free up the use of 15 million hectares of farm land. Each tonne of artificially produced methionine reduces CO_2 emissions by 23 tonnes. The amount of ammonia and nitrate released into the environment due to fertilization could be reduced to 1/25 and 1/7, respectively.

If synthetic amino acids were used not only as a feed supplement but also directly for human nutrition, the consumption of energy and water and the use of pesticides and fertilizers could actually be reduced by approximately 99 percent.