

German Innovation Award for Dusseldorf-based Engineering Start-Up

**Sludge recycling instead of expensive disposal:
Gain energy and recover nutrients**

The Dusseldorf-based engineering company TerraNova Energy won the 2015 German Innovation Award. On March 21, the NRW Justice Minister Thomas Kutschaty, under the auspices of the Federal Ministry for Economic Affairs and Energy as well as of Education and Research presented the award to the company founder, Dipl.-Ing. Marc Buttmann. His technology for sewage sludge recycling is much more energy efficient than the common methods used nowadays and ensures that valuable raw materials such as phosphorus are recovered, yet pollutants destroyed or disposed of safely.

Every year around 10 million tons of sewage sludge accumulates in Germany. Up to now, sludge has primarily been disposed of in energy-intensive and expensive processes. However, sewage sludge is an energy-rich and nutrient-rich biomass that can be easily and sensibly recycled. For this purpose, TerraNova's award-winning method provides an economical solution.

The process is similar to the natural formation of coal. In fact, in the facilities of TerraNova Energy, a high-energy, CO₂ neutral bio-carbon is produced. But what takes millions of years for mother nature to accomplish only requires a few hours here. This is based on hydrothermal carbonization (HTC) of the sludge. This was described in 1913 by the German chemist Friedrich Bergius, who, for this reason, received the 1931 Nobel Prize in Chemistry.

The "TerraNova® Ultra" method utilizes this technology and starts at the weak points of today's sludge disposal: It requires 70 percent less energy, reduces the operating costs of the wastewater treatment plant, produces a CO₂ neutral fuel and simultaneously makes the phosphorus that is "stored" in the sludge available to a large extent.

The Award

The German Industry Innovation Award is the first innovation award in the world and is organized into four categories. For the 34th time now, the partners of the first innovation award in the world has again honored the most important scientific, technological, entrepreneurial and intellectual innovations of the German industry. The award is under the auspices of the Federal Ministry for Economic Affairs and Energy and the Federal Ministry of Education and Research.

TerraNova® Ultra: The strengths at a glance

Function and advantages of the award-winning method of TerraNova Energy are evidenced by the results of tests run at various treatment plants and by scientific research. Afterwards, TerraNova® Ultra has, in every respect, shown significant improvements compared to the procedures presently being used for sludge disposal.

Energy balance: 70% energy saving

Sewage sludge consists of a high amount of water and has to be dried before it can be burned. This is very energy-intensive and expensive.

TerraNova® Ultra decisively improves the energy balance and thus the efficiency of wastewater treatment plants: sewage sludge is not simply dried, but is transformed into an energy-rich bio-carbon. This production requires about 70% less energy than drying the sewage sludge. The resulting bio-coal thus has a 6-fold higher energy content than the initial sludge.

As CO₂ neutral fuel, the bio-coal can be used in cement plants or coal power plants and replaces fossil coal. In addition, the sludge that still has a high water content is very often transported across Germany, which will no longer be necessary – and that will save time, money and prevent the emission of pollutants by trucks.

Material balance: use raw materials – destroy pollutants

Current technology does not allow for the nutrients contained in the sludge – especially phosphorous that is so important for fertilizers – to be economically viable. Part of the sludge is therefore used nowadays as a fertilizer. It is cheaper than drying and incinerating, but can be dangerous to humans and the environment: through the agricultural spreading of sewage sludge, pollutants such as heavy metals, pharmaceutical residues or hormones may seep into the groundwater and surface water. Therefore, using sewage sludge as a fertilizer is about to be stopped through political measures in the future.

By contrast, pollutants stored in sludge are destroyed by TerraNova® Ultra or safely incinerated with the bio-coal. Additionally, this method produces a valuable liquid fertilizer. This fertilizer contains a large part of the valuable raw materials stored in the sewage sludge. Above all, phosphorous, which is becoming scarce and is indispensable as a basic element for fertilizers, will be recovered to more than 50 percent.

Environmental balance: As effective as a forest the size of 1,000 soccer fields

The environmental balance of the TerraNova® Ultra procedure has been confirmed through several studies. If the entire volume of sludge from a city of 500,000 inhabitants were to be treated with TerraNova® Ultra, about 7,000 tons of CO₂ emissions could be saved per year through the replacement of lignite. This corresponds to the "capacity" of more than seven square kilometers of forest, an area the size of nearly 1,000 soccer fields.

By using the liquid fertilizer product, the essential phosphorus is again made agriculturally usable, without an increase in farmland pollution. Phosphorus is in limited supply; according to current estimates, the reserves will only last another 100 years.

Liquid fertilizer also has an advantage over mineral fertilizers: Due to its organic components it supports the development of humus. This not only increases the yield from poor soil, but also helps to bind CO₂ for the long-term.

The demonstration facilities in Germany, France and Slovenia have consistently confirmed these calculations in practice. A system that was able to process the sludge accumulation of a town with 20,000 inhabitants was used. Further applications are currently being worked on at the Dusseldorf/Germany treatment plant: TerraNova Energy engineers are involved in a research project for the Federal Ministry of Agriculture and Food to examine the production of a highly efficient soil additive from sewage sludge and agricultural residues.