

## **A NATURAL APPROACH TO AQUATIC REBALANCING**

Often treatment of water bodies is directed at eradicating a symptomatic condition (e.g. eliminate unsightly algae). Frequently, this is by chemical means and no attempt is made to address the underlying cause of the eutrophic condition which prompted the problem situation to develop in the first place. Penergetic w works to naturally re-establish the ecological equilibrium in an aquatic environment in order to return it to a healthy state, so that any previous detrimental conditions are overcome and avoided in the future.

In some cases it has taken a pond, dugout or lake years to reach the “tipping over” point – meaning the point where eutrophication sets in and it is no longer able to support itself in a natural balance. Each situation is unique. In some cases, it will also take time for the water body to re-establish itself – realistic expectations are warranted.

### **Factors that may potentially influence the effectiveness of penergetic w**

- Water body already in a highly advanced stage of eutrophication
- Sludge (including organic matter on bottom) exceeds 50% of total volume of water body
- Uncontrolled exposure to nutrients from an external source (e.g. runoff from fertilizer application, animal wastes or other sources)
- The complete absence of aquatic plants in the littoral shore zone (upper 2 metres) of the water body
- If treatment is initiated during summer period of stagnation after water body circulation has been stratified

### **PRODUCT FORM - Product Type**

Penergetic w for water remediation is available in three different forms, serving three specific purposes:

#### **A) Penergetic w for surface water / stabilization**

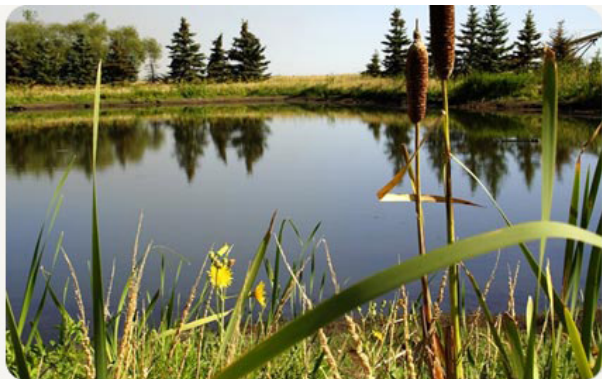
- Re-establishes oxygenation and pond microorganism activity
- use during vegetation phase at water temperature above 8°C
- best applied in the Spring / early Summer, when full water layer circulation/mixing evident

#### **B) Penergetic w for waste water / mud reduction**

- promotes natural decomposition of organic material(e.g. bottom debris)
- provides aquatic resource with self-cleaning capabilities
- use during vegetation phase when water temperature is not more than 12°C
- best applied in early Spring or in the Autumn – once full water layer circulation/mixing is re-established

#### **C) Penergetic w for groundwater**

- for control of water borne germs and bacteria
- can be applied at any time
- may be used in conjunction with AquaKat for water vitalization



### Application

Applied between Spring and Autumn  
Initial application (based on surface area)

up to 10 m <sup>2</sup>	(110 sq. ft.)	5.0g/m <sup>2</sup>
up to 100 m <sup>2</sup>	(1,100 sq. ft.)	3.0g/m <sup>2</sup>
up to 1000 m <sup>2</sup>	(11,000 sq. ft.)	2.0g/m <sup>2</sup>
up to 2000 m <sup>2</sup>	(22,000 sq. ft.)	1.5g/m <sup>2</sup>
over 2000 m <sup>2</sup>	(22,000 sq. ft.)	1.0g/m <sup>2</sup>

### Subsequent Applications

Use 1.0 g per m<sup>2</sup> for all further applications

### Volume Based Application Measurement

In cases where the average depth of the water body is >2.0 m and there is little or no vegetation in the littoral (shore) zone, an application rate based on the volume (m<sup>3</sup>) may be more suitable to use.

### Frequency of Use

Following the initial application, subsequent applications should be every 3 to 4 weeks until the water body stabilizes.

### Other Tips

- following a heavy rain, top up dosage by 1g/m<sup>2</sup>
- in hot weather reduce time between applications.
- self-cleaning process can be accelerated by pouring a bucket of water and sediment from a healthy pond into the water to be treated.

## **POND / DUGOUT REMEDIATION**

### **Surface Water Treatment**

Treatment should be carried out according to the time of year and the specific problem to be addressed. The initial dose should be applied as specified above. To more precisely calculate the dosage refer to the penergetic w logarithmic table (dosage to water surface area). If treatment with penergetic w (for surface water), at the normal application rate, does not reduce algae to normal levels, penergetic w (for mud reduction) can also be used as a supplementary agent.

### **Sludge Deposits**

In mid-Autumn (October to beginning of November – depending on location) the water should be treated with 2 g of penergetic w (for mud reduction) per m<sup>2</sup>.\*\* Sludge and accumulated organic matter in natural bodies of water are broken down naturally at the lower temperatures which prevail during the cooler time of the year (including over the winter). Treatment with penergetic w (for mud reduction) will result in the accumulated biomass to be processed more quickly and the sludge broken down. Then in the Spring, treat with penergetic w for surface water every 2 to 4 weeks should commence.

\*\* Warning: Caution should be exercised in using penergetic w (for mud reduction) in water containing fish. If fish are raised for food and are to be harvested, they should be removed before using “w” for mud reduction. However, if at the owner’s discretion it is decided to use penergetic w (for mud reduction) with fish in the water body, in order to reduce organic matter content, it should be used at a reduced dosage of 0.5 g/m<sup>2</sup>. A higher dosage may lead to an oxygen deficiency for the fish as a result of the stimulated sludge breakdown process, especially if a hot spell occurs. [Penergetic w (for surface water) is safe, even beneficial, for fish as it acts as a catalyst increasing the water’s oxygen supply.]

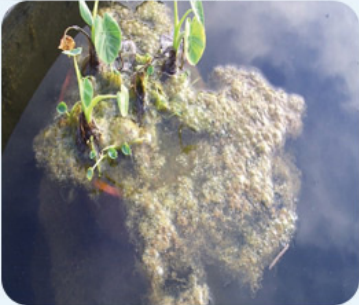

### **Additional Support for Water Remediation (for Larger Bodies of Water)**

For larger bodies of water – with a surface area greater than 1.0 ha (2.5 acres) the aquatic regenerative effects of penergetic w may be supplemented by using a submersible XXL Large AquaKat® specifically designed for water remediation. In some cases, a Penergetic Water Module (or water unit) – containing two XXL AquaKats in it – may be used instead. This is a more powerful form of treatment than the single XXL AquaKat. Should an XXL Large AquaKat® or water unit be used the calculated quantity of penergetic w powder(s) may be reduced (by up to 50%).



Furthermore, in specialized situations – where there is a particular aquatic condition needing to be addressed – Penergetic can custom-design an application to re-balance the water body’s ecology. For more details on the applicability of the XXL Large AquaKat, water module and customized approaches to water remediation contact Penergetic India directly.

## SAMPLE RESULTS

### CONTROLLED TEST RESULTS WITH PENERGETIC W

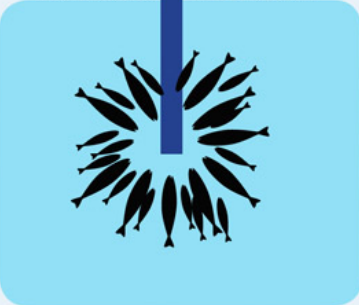
<p>CONTROL</p>  <p>Evidence of algae</p>	<p>PENERGETIC TREATED</p>  <p>No algae present</p>
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### TURBIDITY EXAMINATION

 <p>Control sample = murky</p>	 <p>Penergetic w treated = clear</p>
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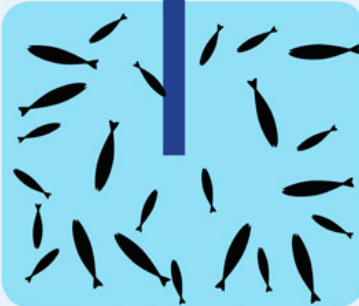
### PENERGETIC SYSTEM IMPROVES A FISH POND

PREVIOUS SITUATION



Fish densely packed below fresh water intake pipe

AFTER USING PENERGETIC



Fish evenly dispersed as water now self-oxygenating

### Practical Example: Lake Bad Balyersoi, Bavaria, Germany

Size: 200,000 m<sup>2</sup> (50 acres) part in a nature reserve

Nature of Problem: Excessive plant growth in the lake, unaesthetic appearance & hazardous for swimmers.

History of past attempts at eradication: A boat mounted mower was used to cut the aquatic plant/weeds in the lake and the Village contracted to have a swimming channel dredged through the weed growth in the lake. Very expensive and the problem always returned.

Penergetic Solution: Two (2) AquaKat water modules and 160 kg of penergetic w per year.

Result: Lake regained its natural ecological balance. Plant growth in the lake is now controlled naturally.

The Village and swimmers are both happy. The focus has now shifted to treating upland sources of nutrient loading with other penergetic products.



## OTHER USES FOR PENERGETIC W

### Groundwater Treatment

Water wells, springs, cisterns and drinking water reservoirs can often lack a self cleaning ability to biologically-convert various potentially-contaminating substances; in which case they can be characterized by:

- Poor water quality
- Nutrient contamination (i.e. ammonium, nitrite, nitrate)
- Presence of iron or manganese
- Contaminated with harmful bacteria
- Lack vitality

### Penergetic w (for groundwater):

- vitalizes groundwater
- supports the natural decomposition and self-cleaning capacities in the groundwater
- biologically stabilizes the water supply
- activates the natural life processes in the water
- assists in metabolizing various nutrients and contaminants in the water
- addresses issues related to nitrogen build-up

\*\* For maximum effectiveness where water is to be used for domestic water supply, for livestock or other uses requiring a high quality of water, penergetic w (for groundwater) should be used in conjunction with an AquaKat®.

**Application Rates:** depended on the nature and type of water source, volume of usage and initial versus subsequent rates of application. Contact your Penergetic distributor for details.





## Wastewater Treatment

Due to the presence of an anaerobic condition in the system and an inability of the wastewater to establish its own self cleaning capacity, sewage lagoon and sewage treatment facilities can often have problems associated with: odours, excessively high BOD and COD values, low microbial activity, poor treatment efficiency, high sewage processing costs, sedimentation build-up, poor aesthetic appearance and standard level of quality of effluent for submission into receiving waters.



### **Penergetic w (for waste water):**

- supports the natural decomposition and self-cleaning capacity in sewage
- stimulates an aerobic process and activation of microorganisms
- reduces the quantity of organic matter and nutrients
- moderates and controls BOD and COD levels
- stabilizes the system's microbiology
- curtails odour occurrences
- creates a more homogenous wastewater

\*\* In addition to municipal (local government) systems, the penergetic approach to wastewater treatment can also be used in commercial or industrial settings where there is a lagoon or wastewater stream requiring treatment.

\*\* Can also be used in toilet systems (e.g. parks, rest areas, recreational property) to reduce odour and activate decomposition process.

**Method and Rate of Application:** Contact your Penergetic distributor for details.

# AN INTRODUCTION TO WATER REMEDIATION

The following is the account of a graduated physicist, Karl Shuster, who was involved in research on the application of the Pengergetic energy system on aquatic systems. He talks about his perspective of the efficiency of the Pengergetic approach to water remediation.

"Outside, about 100 metres off our farm on a small hill, there is a fishing pond. The water pours out of a spring and flows down to the pond. On the outlet of the pond we have a grid, which keeps back the trout. Our great grandfather is said to have constructed the pond eighty years ago, and since then every year the pond has been stocked with young trout. Grandfather would feed the trout with natural food like the trout like, such as freshwater shrimp. Later my father substituted these natural substances with commercially-manufactured fish pellets. He also cut down the trees around the pond because the leaves falling into the water caused him extra work.

Three years ago the summer was very hot; the burning raised the water temperature in the pond and the spring dried out. Subsequently, one by one, the trout died off. "Your water has tipped over" a neighbour said. That autumn, with the rain, the spring ran again, the water turned clear and we stocked the pond with trout for another season. But, once again all of the young fish died -- this time after only a short time. The next year the same thing happened again.

By this time we had heard of a potential means of reactivating ponds and lakes.

## Water and its Specialties

Modern science has acquired a lot of fundamental knowledge about water. It is readily known that water has uncommon physical and chemical properties and is capable of reacting to "information". Water consists of tiny particles, called molecules, which behave like little magnets. These particles can, for example, attract each other and form small groups called clusters. These groups (or clusters) are dissolved when the water is heated. Water can generate an endless variety of compositions of such groups. It is claimed that water can assume an infinite number of structures because of its special elastic characteristics. The transformation is performed by "information" coming in contact with the water (e.g. air, soil) and due to the influences of dissolved substances in the water.

There are dissolved substances, which cause an increase in the density of the water structure and those that cause a reduction in the water's density. Some of the substances that increase the density of water include: inorganic acids and bases, salts and various organic substances such as sugar and urea as well as most of the ions. Examples of substances that reduce the density of water include: ether, benzyl, and especially gases such as oxygen, nitrogen and carbon dioxide. The density-increasing substances especially affect the structure of the water. Through the influence of the density-decreasing substances hollows are formed in the water. In these hollows gas molecules such as oxygen are able to perform free vibrations in the micro-range, thus storing the information (like in a computer) about the structure created by the density-increasing substances. So the water has a sort of "memory". Even if it is chemically cleaned (such as through filtration), there will still be gaseous molecules in the hollows. In other words, water retains information despite purification.

## How Does Oxygen Get Into Water?

Oxygen can penetrate into water in three different ways:

- 1) Algae and water plants produce oxygen directly through photosynthesis
- 2) Organic substances in the water can produce oxygen by their metabolism
- 3) Oxygen can enter the water from the air

The pressure of the atmosphere on the liquid surface of water is caused by the mass of the air above the water surface and by the temperature-dependent movement of the gaseous particles. As the pressure of the air decreases with altitude, the pressure of the water increases with depth. The penetrating air (e.g. oxygen particles)

collides with the water particles creates the hollows, referred to above, and loses energy (e.g. velocity). Only those particles with maximum velocity penetrate deeper into the water. Oxygen can be absorbed at the water surface as long as the pressure of oxygen in the water equals the pressure of the atmosphere above the water surface. Equilibrium is achieved once the water is saturated with oxygen. In bodies of water, such as a lake, the oxygen is dispersed by the wind and the waves; in this way a larger quantity of oxygen is able to penetrate into the water's depth.

## What is an "Ecological System"?

Organisms in the water, including animals living on small organisms, on water plants and on algae, are consumers of oxygen in the water. So all life in the water is interlinked in a close network, where the circulation of substances combines the different components into an interrelated ecological system. When the system is well-balanced it is in a state of biological equilibrium. The ecological system is able to maintain a biological equilibrium as long as it retains a self-purification capability. For instance, oxygen-breathing bacteria play an important role by transforming dead organisms, leaves and other forms of organic matter into sediments in a form which can then be absorbed again by aquatic plants in the cycle of the ecological system.

## What Does "Tipping Over" of Water Mean?

If too many organisms in the water die as a result of outside influences, such as too much wastewater getting into the ecological system, the system's biological equilibrium can become totally disrupted. This can lead to the excessive growth of algae, water plants and other organisms. In the presence of large quantities of algae the available oxygen is no longer sufficient for the bacteria, which transform organic substances into sediments. This will lead to the growth of putrefactive bacteria and the water begins to tip over. The oxygen necessary for this process is reduced from nitrates / sulphates by simultaneously producing gaseous ammonia and hydrogen sulphide. Both of these latter two gases are toxic and consequently lead to fish dying. The putrefaction continues until the total biological death of the water occurs. Since the water body is no longer able to recover on its own, support from an outside source ("information") becomes necessary to revive it.

## Information Controls the Biological Processes in the Pond

The above-described process that leads to the biological death of the water is simply controlled by information. In the beginning primarily the "oxygen" information is retained in the hollows of the water. This information preserves the biological equilibrium so long there is enough dissolved oxygen in the water to provide the oxygen consuming organisms with a ready supply. However, strong external disturbances, such as if the water temperature gets too high, (such as due a too much exposure to direct solar radiation), or if effluent (wastewater) enters the water, will result in the water body no longer being able to sustain itself in equilibrium via its own ecological system. The aquatic system simply cannot react adequately and is thus not able to properly fulfill its functions. At this point, the ecological system is totally disturbed by "external information", the process of putrefaction sets in, and the water consequently "tips over".

## Adequate Information Saves the Pond

Any influences from outside, which have been introduced into the ecological system by way of information, can only be eliminated through measures undertaken at the information level.

Even if the water is completely dead, all the elements required for regeneration are still present. Although the putrefaction process starts from the bottom of the water body, there is an area directly beneath the surface where enough oxygen particles are available from the pressure of the air. Here hollows surround the oxygen particles but now reverberate with the "putrefaction information". Consequently, if information from "oxygen" can be transmitted to the large quantities of oxygen particles remaining in the pond, this essential information will spread spontaneously throughout the entire water body. This will extinguish the 'putrefaction information' and, in a short time, lead to the putrefactive bacteria being killed off. The



healthy circulation of the ecological system will start up again, and the biological balance will become re-established.

This is how it was explained to us. While we didn't fully understand all of it, we realized this much: our pond was obviously dead and this seems to explain what had happened to it and how it could potentially be revived.

After several days a man with a boat on a trailer arrived at our property. He went out to the deepest spot in the lake, with a measuring gear attached with a cable and mounted to a long pole in order to measure the oxygen content at various levels in the pond. On the very bottom of the pond the device indicated "zero" - no oxygen at all. As the device was raised to increasingly higher levels in the pond, the oxygen concentration also increased, until just below the surface it indicated a reading equal to the oxygen pressure in the air immediately above the water surface. Then he took a sample of water from the bottom of the pond. By an in-situ chemical testing device he measured the concentrations of nitrogen and hydrogen sulfide. He reported that: "According to the measuring data, your pond has tipped over and is dead. It is no wonder the young trout did not survive."

He explained the principle of his "energy carriers", which were long, cylindrical shaped units with weights attached to them: "These energy carriers [Note: now referred to as "AquaKats" for water remediation] are used to transfer information from 'oxygen' into the pond. Through this process, the 'putrefaction' information will initially be pushed to the outer extremities of the pond and then later will be eliminated entirely. Within a short time any putrefactive bacteria will die." This made me wonder: "Why does this pond not recover by itself, since it has a freshwater intake from the spring?"

Even though the pond had a freshwater intake in the form of a spring it was unable to rebalance itself. The reason for this is that once the pond had lost its biological equilibrium, and the "purification information" had spread over the entire pond area, the information also arrived at the source of its water supply, thus infected the spring as well. This is the reason why the pond could not simply recover through the supply of fresh water.

After this, every day I checked out the pond to see if I could observe any changes. Soon the water was clear, but the bottom was dirty, even looked mouldy -- a gray layer covered every stone. Still there were no signs of life in the pond. Then, after one week we detected signs of vegetation as the water plants were starting to grow again. I also scooped up some pond water in a glass and held it up to the light. I could see small green algae, and after a fortnight I detected other signs of life, such as tiny jumping crabs; the pond was obviously starting to recover.

After three weeks the man returned. He walked around the pond and examined it carefully. I told him that the plants were growing again and that we had a lot of crabs. The man answered that the gray layer on the stones would slowly disappear as well. We took the boat to the same spots in the pond as before in order to repeat our measurements of three weeks ago. The measurements revealed that now there was oxygen on the bottom of the pond, and hydrogen sulphide could no longer be detected. The nitrogen concentration had also gone back to its normal level. As a result, once again young trout could be put into the pond.

We were happy. Before departing he advised us that to help the pond maintain its equilibrium let the reeds and the bushes grow in, have only one access to the pond and plant trees on the south side of the pond.

For more information on an ecological approach to water remediation contact:

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## REHABILITATING A POPULAR TROUT FARM

Josef Wolf, a fish-breeder in Bavaria, located near Lake Kleiner Arbersee in the Bavarian Forest, has been breeding mountain trout for twenty years. The restaurants of this tourist region wouldn't want to miss Mr. Wolf's delicate products. Even visitors from the North Sea are enthusiastic about the tender meat of the fish. Wolf is constantly trying to maintain and improve the high quality of the trout. But, the vicinity of the Kleiner Arbersee presents problems: in this acid biotope, with a pH-value of 5 or less, fish cannot survive. A pH of about 7 is ideal for human beings as well as for fish and other animals. Especially when the snow is melting, Mr. Wolf has to pay particular attention to his pond as melt waters from the snow are polluted in such a way that the pH drops to 4, and in this case he has to intercept the supply of acid water and prevent it from entering into the pond.

### Midsummer Nightmare

But even in summer Mr. Wolf has a lot of troubles. When the temperatures are high and the pond is also used for recreational swimming, the trout in the small ponds have a hard time. They nearly die from their own secretions and the low oxygen concentration in the water. They can be observed in the water in a small circle under the shower of the supply pipe where the falling water produces a small amount of oxygen. In addition to the heat, the small low oxygen supply and the ammonia produced by the secretions, algae also threaten Mr. Wolf's trout. Algae are also consumers of oxygen; the water becomes muddy, the meat takes on a stale (muddy) taste and it turns a yellow colour.

### The Tests in Lake Kleiner Arbersee

Mr. Wolf learns about a series of tests conducted in the Kleiner Arbersee, where a number of people were actually attempting to breed fish again. He meets the test team and is informed about the energy modules, which stimulate the self-purification of the lake and restore its ecological equilibrium in order to re-establish the proper living conditions for fish. Wolf inquires if it wouldn't be appropriate to apply the same system to his fish ponds, which are easy to supervise. And from the very beginning Wolf hopes that his breeding problems will be solved. From a breeding institute, Wolf buys 1.5 cm long trout, which might be sold in 1½ to 2 years time. He takes them from an institute in the vicinity to make sure that the trout are more likely to be acclimatized to the acid water. In the past he had already watched thousands of trout acquired from more distant institutes not survive in his ponds.

### A Striking Result

And then there was the day, a hot day in July, when the "water man" arrived with the energy modules. Mr. Wolf reports: "Immersing the modules was done in a few minutes. The water man plunged three energy-carriers into a pond 25 x 35 m. At that time when they were installed, the trout would stand densely crowded under the shower of the supply pipe. That summer Mr. Wolf had had a lot of trouble because of the extended period of persistent hot weather. Next morning, when he went down to the pond, Mr. Wolf could not believe his eyes. The fish were now evenly spaced over the whole area of the pond. As the days passed he continued to check and never saw them congregating around the water supply as they used to. It seemed as though the oxygen information had spread so rapidly that the fish now felt comfortable in any part of the pond. He began to feed them carefully. Obviously he was able to satisfy the increasing appetite of my mountain trout."

### Surprising in the Following Year

During the following winter, Mr. Wolf recognized that the trout in the energized ponds - three out of nine ponds were energized - were much livelier than the ones in non-energized water. He also recognized a very evident reduction of algae growth in these ponds. While the ugly concentrations of algae in the non-energized ponds were not only visible on the bottom of the pond, but even up to the surface, the water in the energized ponds was completely clear and free of ammonia."

It is important to look at this situation from the perspective of the fish breeder. He makes his livelihood from his small fish breeding operation, where hungry tourists come to buy the delicious grilled trout directly from him and eat them on a small, inviting porch. Every day he is feeding and watching his fish. The clear water of the energized ponds fascinates him most. How is something like that possible? Which forces operate in the energy modules?

And then finally there were the first comparison of growth. Wolf was astonished to see that the trout in the energized waters did not only feel better, but they also grew faster. They reached their normal size four months earlier. Wolf very proudly presented us the completely white meat of his trout from the energized ponds. At noon, when we tried them, we were impressed by their delicious taste. The hotel's housekeeper, who has known Mr. Wolf and his trout operation for many years and was aware of the energy modules being used, said: "These trout definitely taste better; my clients are sure about that. The meat is tender, although it does not fall apart, and it has a delicious taste."

### Red Potatoes – Mr. Wolf's Favorite Meal

Fish breeders also have their own favourite meal, and in Mr. Wolf's case it is red potatoes; the kind that are dug out of the soil and have a firm, red skin. In the same manner as any farmer tries to compost dung from his own animals, Mr. Wolf puts the layer of sludge (from the bottom of his ponds (approximately 10 - 15 cm thick) on his garden. Prior to putting it on the garden he puts it in a compost heap to decompose.

However, in spite of many attempts, he has so far not been to successfully grow his own red potatoes, because they did not grow satisfactorily in the sludge compost. Instead, the potatoes he plants showed signs of early rot and the harvest yielded nothing but white potatoes. However, when after one year, Mr. Wolf drained the pond basin containing the energy modules he recognized a significant difference, even in the sludge layer. In the past, he used to have to use a broad device, similar to a snow shovel, to dig up the sludge, as it was so liquidy to remove properly with a normal shovel. Yet, in contrast, the sludge from the energized ponds could be dug out with an ordinary spade. It was remarkably drier and, above all, there was no smell. So Wolf had finally gotten rid of his last big problem: both tourists and neighbours, alike, had complained about his compost heaps -- the smell of which forced them to close their windows as they past them. Such a sludge layer has its own odour on sunny days.

Formerly Wolf had to wait up to six months before he could plant his potatoes. Now he found he was able to plant potatoes into the sludge removed from the energized ponds after just eight days! Furthermore, at the time of the harvest this sludge yielded delicious tasty red potatoes.

Joseph Wolf is satisfied and looks forward to a good season.

To learn more about rehabilitating damaged ponds, dugouts and water bodies contact:

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**Product:**  
Penergetic-w



**User:**  
Allweier Baustoffe  
D-Denkingen

## User Report

**Supplier:**  
d. plocher, katalytic systems

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### Garden Pond

Size of the pond: 35 m<sup>2</sup>  
Water plants: Reed, water lily, different water plants  
Age: 17 Years

Problems: Intensive algae growth, floating algae, fish mortality.

Treatment: Started on August 5th with Penergetic-w stabilization / surface water. Total of 175 grams diluted in water was applied.

Additional treatment on the floating algae with a mixture of quartz meal and Penergetic-w stabilization at a ratio of 700:70 g. Mixture was applied directly onto the floating algae.

Two more applications of 70 g of penergetic administered at periodical intervals.

After the floating algae disappears, two additional applications of 70 g of penergetic w indicated.

Effects: The floating algae disappeared after 6 weeks. Over time, the pond gets clearer, until it achieves a state where it has crystal-clear water.

[SEE BEFORE AND AFTER PHOTOS ON PAGES 2 and 3.]



BEFORE: Situation on May 8<sup>th</sup>





AFTER: Situation at June 22<sup>nd</sup>

