

The SolarBee can enhance or supplement your existing facultative system. The SolarBee reduces effluent BOD, TSS, ammonia (N), phosphorus (P), and pH, as shown below. In addition, it can help solve problems involving overloading, odors, and sludge buildup. A major upgrade can often be avoided by just enhancing the system already in place.

INFLUENT, containing high Carbon BOD (CBOD), high Nitrogen (N), and high Phosphorus (P)

### Primary Cell

**ACTION:** Add SolarBee(s) to enhance the facultative process.

**DIRECT RESULTS:** During the day, the gentle and continuous mixing brings nutrients to the surface of the pond to promote an increased and highly-beneficial algae growth. The algae produces energy-free pure DO, up to 250 lbs of O<sub>2</sub> per acre per day. A high pH also occurs near the surface. The high-DO and high-pH water is continuously and thoroughly mixed throughout the pond, instead of being mostly under-utilized as in natural ponds. The higher DO throughout the pond will result in a 70%-90% reduction of BOD while maintaining an odor cap on the pond.

Whenever there is a DO deficit at the surface, surface reaeration caused by the Solar Bee can also add up to 225 lbs of O<sub>2</sub> per acre per day. For heavily loaded ponds, a night-time shore power kit can also be added to increase the DO.

Carbon is usually algae's growth-limiting nutrient in municipal ponds. Carbonic acid is created as a result of aerobic biomass respiration. High algae growth strips the CO<sub>2</sub> from the carbonic acid, then drains down the entire carbonate alkalinity buffering pool, ultimately raising the pH and causing a shortage of carbon. This eventually leads to an algae die-off. The carbon (50% of dry weight) that is tied up in dead algae cells that fall to the bottom of the pond is no longer available as an algae nutrient. The dead algae cells are mostly digested anaerobically through methane fermentation. Most of the carbon they contain leaves the pond as CH<sub>4</sub> gas, a non-nutrient. A smaller portion of the methane fermentation carbon re-enters the buffering pool as CO<sub>2</sub> converted to either carbonic acid or carbonates. This is usually referred to as "nutrient feedback" from the sludge.

**FURTHER RESULTS, due to the higher average pH:** More ammonia (N) is transformed from the liquid ammonium ion state to the ammonia gas state, and is stripped from the pond by the mixing. More precipitation of phosphorus (P) occurs at the higher pH and with the mixing. Better anaerobic sludge stabilization occurs at the higher pH, which relieves the "stuck digester" conditions that commonly occur when acid-former bacteria get ahead of the methane-producer bacteria. As the sludge is stabilized, the volume of sludge is reduced.

↓ Less Algae, Less Carbon, less Ammonia (N), and less Phosphorus (P)

### Secondary Cell(s)

**ACTION:** Add SolarBee(s) to enhance the facultative process.

**RESULTS:** Just as in the primary cell, beneficial algae growth causes large reductions in the carbon, N, and P nutrients, so less of them are passed on to the final cell. Effective ponds in series compound the beneficial effect. When both the primary and secondary cell achieve a 70% reduction of these nutrients, the amount that is passed on to the next cell is 30% x 30% = only 9%. So the Solar Bee reduces carbon, N, and P nutrients in all front end cells to minimize the problems related to algae, BOD, TSS, N, and P in the final cell.

↓ Virtually no Algae, Carbon, Ammonia (N), or Phosphorus (P)

### Final Cell

**ACTION:** Add SolarBee(s) to enhance the facultative process.

**RESULTS:** In the final cell, there is not enough carbon, ammonia (N), or phosphorus (P) to cause permit problems for these nutrients, or to support enough algae growth high enough to result in BOD and TSS problems. And the pH is well under 9.0 due to low algae growth. Removing most of the carbon, N and P in earlier cells prevents problems in this cell. If there is a sludge nutrient buildup here due to past algae problems, there may be a feedback of carbon. The feedback carbon nutrient will become less as the sludge is stabilized, and algae growth will be low.