

# *Organic Resource Recovery through Advanced Anaerobic Digestion*

*Creating New Sources of*

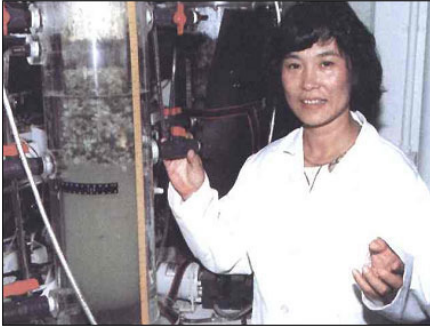
*Biohydrogen,  
Biofuels,  
Alternative Renewable Energy  
and  
Value Added Products*



**Anaerobic digestion is not new;** it has existed about as long as life has been present on earth. Anaerobic digestion, a naturally occurring process, is the bacterial breakdown of organic materials in the absence of oxygen. Anaerobic digestion is currently a worldwide-accepted technological process

# Advanced Anaerobic Phased Solids (APS) Digestion Technology

**Onsite Power Systems, Inc. (OPS)** is a privately held company, which has acquired the exclusive licensing agreement to a patented advanced anaerobic digester process. This Anaerobic Phased Solids (APS) digester process incorporates a new, high-rate bioconversion technology developed by Dr. Ruihong Zhang in the Biological and Agricultural Engineering Department at the University of California, Davis (UC Davis).



**Dr. Zhang's process** exhibits significant advantages over existing, anaerobic digestion technologies. These advantages stem from several innovative design features:

- Optimum environmental conditions for the system's microorganisms
- Significantly shorter retention time
- Efficient conversion of organic feedstock into biogas and beneficial value-added byproducts

**The APS system can process "high solids"** organic waste streams, typically 30% in comparison with other anaerobic digesters that typically handle up to 5% solids. This allows the APS system to digest a wide variety of organic materials including food processing waste, agricultural crop residues, animal waste, and municipal green and food waste streams.

**The APS process will convert 60 to 90% of the organic solids** to biogas. Any remaining solids have a value as a soil amendment or fertilizer additives.

**Compared to existing systems**, the APS digester system advantages include:

- Capable of handling non-homogeneous solids
- Requires less material handling equipment
- Exhibits lower operational energy consumption
- Requires smaller digester tanks resulting in reduced capital investments

**Biohydrogen and biomethane** are two types of gaseous biofuels that the APS digester produces from organic wastes. The biogas produced is a medium quality fuel ranging in energy value from 580 to 650 Btu per standard cubic foot

## **Potential California Market for APS Digester Systems:**

Information provided by California Integrated Waste Management Board reveals an estimated 6.7 million dry tons (approximately 22 million wet tons) per year of organic wastes are produced in California. Through the APS digester system, this volume of organic wastes can produce enough biogas fuel supply to generate approximately:



**895,000 Kg of biohydrogen per day**  
**1,363,000 gallons of gasoline equivalent bio-CNG per day**

**Multiple APS Digesters will reduce State's reliance** on imported oil by creating new sources of biohydrogen, biofuels and alternative renewable energy.

## ***The APS Digester System Design Advantages***



Most digester systems rely on mechanical mixing & stirring.

**The OPS Advantage:** Design incorporates a proven non-mechanical mixing system

Several current systems are "one-size-fits-all" and have a single sized capacity.

**The OPS Advantage:** System can readily be scaled to meet each facility's waste requirements

Most systems are designed for "high liquids"

**The OPS Advantage:** System was created to process very high solids waste streams

Many current systems rely on "custom" manufactured components.

**The OPS Advantage:** Construction incorporates commercially available equipment and components

# APS Digester Development & Commercialization

**First phase pilot digester development** was started in 1999 when OPS constructed an 1,800-gallon total reactor volume pilot APS digester plant on the UC Davis campus and successfully demonstrated the scalability of the system from the 4-liter laboratory reactors.

**System analysis of:**

Gas production  
Material processing  
Process controls  
Hydraulic mixing

**System design testing of:**

Material handling  
Circulation system  
System components  
Computer controls



**Second phase pilot digester development** started in 2002 when OPS dismantled the 1,800-gallon Pilot plant and constructed a larger 14,000-gallon total reactor volume pilot APS digester plant at the site of the new UC Davis wastewater plant. The primary function of the second phase pilot system was the evaluation of a variety of commercially available equipment and components.

**Engineering evaluation of commercially available:**

Material handling systems  
Material processing equipment  
Circulation system  
Drain system valves, pumps and piping



**Small scale APS digester commercial demonstration system** construction began in 2004.

**The designs and techniques incorporated** in the commercial APS digester system presently under construction at UC Davis follows commercially proven, industry standards. There are no dependencies upon unproven technological developments to successfully achieve the anticipated system operation. The complete system is being constructed using commercially available components.

**Design allowances** have been incorporated into the system for future demonstration of various other technologies that will enhance the APS process. Some of the planned technologies include:

- Reformer for biohydrogen production
- Compressed natural gas system (CNG)
- Non-combusting fuel cell generator
- Small liquefier for the production of liquid hydrogen (LH<sub>2</sub>)
- Liquefied natural gas (LNG) may be added to the system.



**Economic and technical viability of large-scale commercial APS digester systems**, validated with the completion and operation of the system at UC Davis, allows OPS to actively market the APS digester technology and establish large-scale commercial projects. Current waste disposal regulations provide OPS an excellent opportunity for the commercialization of the APS digester technology.

**Anaerobic digestion is currently accepted globally** as a necessary and viable organic waste handling process. The APS digester system advances this process to a new level, offering immediate and viable solutions to customer's waste handling problems and energy requirements.



## **Tomorrow's world will heavily rely upon organic resource recovery**

**To comply with the ever-increasing environmental regulations**, agricultural operations and municipalities can no longer rely on conventional waste disposal practices. They must seek cost-effective alternative solutions to address waste management and disposal issues.

**The APS anaerobic digester technology** offers these operations an efficient alternative method of handling these waste products effectively, increasing profitability and maintaining sustainability by providing a reliable renewable energy supply.



### ***Our Mission:***

Onsite Power Systems is dedicated to provide economically and environmentally sound solutions for organic resource recovery while creating alternative renewable fuels and value added products.

The company will take a leadership role in developing advanced anaerobic digestion technologies while shaping new models for resource recovery, renewable energy, and environmental sustainability.

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