100 kW Water and Energy Recovery or WER System

Commercialization Status Report

By

Johnny Kraczek

Paul Freeman

May 17, 2019

Wisdom Farms Technology Development Group LLC - WTD

The 100 KW Water and Energy Recovery System

What is it?

The 100 KW Water and Energy Recovery System (WER) developed by Wisdom Farms Technology Development LLC generates electricity from dirty water, bio slurries and/or biofuel gases. It's outputs are up to 100 Kilowatts of electricity and very pure water. It also completely eliminates the air born pollutions, toxins and smog makers associated with burning biofuel, frack well sour gas, land fill gases, or even natural gas. It can use sewer sludge, frack wastewater, or other liquid biofuels as a fuel source with no after airborne pollutions or odors. The system can also use wet biofuels like duck weed or slurry made from other fast-growing plants such as grass, kudzu, Egyptian reeds, king grass, sea kelp or unwanted fast-growing invasive species, without the requirement for pre-drying. Even sea water can be fed into the system with fuel slurries, and output as pure water.

How does the WER technology work?

Water containing hydrocarbons such as oils, or bioliquids are fed into a high temperature and pressure reactor. Natural gas, sour gas, or biogas may also be fed into the reactor.

Air is also pumped into the reactor under high pressure.

The water in the reactor is heated under pressure until it becomes supercritical. In this highly excited state, the water changes properties from a solvent to a catalyst and the hydrocarbons in the water begin to break down and react with the air as it bubbles through. This chemical reaction produces heat as hydrogen atoms in the biofuels break away from the carbon chains and react with oxygen in the air bubbles creating new water and heat. On the other hand, the carbon also reacts with the air. Long chain hydrocarbons, even carcinogenic compounds, break down into the most basic elements.

Since the reaction occurs underwater, there is no flue gas that needs to be filtered or scrubbed. The normal problems with biofuel gas, such as air born sulfur compounds, are eliminated.

Once the reactions begin to generate heat, the superheated water is fed into a Johnson Turbine. In the turbine, the supercritical water remains liquid until it passes into steam nozzles mounted on the ends of arms connected to the drive shaft. As the liquid hits atmospheric pressure, the liquid explodes into steam, which drives the arms turning the drive shaft.

As the water explodes to steam, the minerals that were in solution in the water are now left behind and are sprayed onto the turbine housing walls and collected in a sump. The steam leaves the housing and passes through a Johnson heat exchanger/condenser, where the pure water is condensed and is pumped to a pure water storage tank which can then be pumped out for use as distilled water or for whatever other purposes are required.

The drive shaft is coupled with a generator and can produce up to 100 kilowatts of AC electricity.

WER System Advantages

The WER system has significant advantages or traditional boiler or diesel combustion electricity generation systems. These include:

1. Higher energy to fuel conversion. The WER is more efficient than typical Carnot cycle engine generators

2. Extremely low maintenance costs when compared with diesels or gas generators, without engine rebuilds as required by traditional systems
3. Very short down time to trade out steam nozzles, the only significant wear part
4. By distilling the process water, the system can greatly reduce fresh water and dirty water treatment costs
5. May eliminate the need to haul out frack water from a well site or haul in diesel to drive remote generators and all the associated haul and truck costs
6. Significant if not total elimination of emissions and reduction in permitting costs
7. Strong potential for good PR

Approaching Completion

The engineering and technical teams at Wisdom Farms Technology development have been actively migrating the WER system from patent and concept to commercial ready equipment with UL listed controls and code compliant tubing and reactors. This extensive work has been completed over the last 9 months and represents thousands of engineering and technical hours. The first stage engineering and design work is now complete on the 100 KW WER Model. Substantial work has also been completed on a 500 KW model.

Current Assembly Status

All specified parts have been purchased and the 100 KW is currently in assembly and final fabrication. This work is being done by trained technicians and the progress is good. The teams expect to be completed with assembly in the next few weeks, with customer trial runs in the first weeks of June.

Current Manufacturing Agreements and Plans

Wisdom Farms Technology Development has agreements in place for the fabrication of additional units based on orders. Current fabrication and assembly partners feel they can produce up to 8 units per day given a set up ramp of two months for total production out of existing facilities around 2000 units per year.

As sales warrant additional capacity other available local facilities including one north of Ogden could be tooled up to produce 24 units per day or an additional 6000 units per year.

Wisdom Farms Technology Development Group has excellent contacts both nationally and internationally with machine shops and fabricators that support large car plants and other manufacturers that can be employed to tool up and start making additional units as larger sales demands grow.

Current Marketing Status

Markets

Looking at the US alone there are significant numbers of potential sites for the WER systems. Both electricity and water are the key building blocks for all communities and a significant portion of these communities produce sewage that could be used as a fuel stream for producing power and water.

Biogas

In the US alone it is estimated that there are more than 2,000 sites producing biogas. About 1/3 of these plants attempt to use the biogas as a fuel. Nearly all these plants require some electrical power, thus making them candidates for the WER systems.

Wastewater Treatment

There are well over 16,000 public wastewater treatment facilities in the US. These all require electricity for pumps and other equipment and using the WER systems could self-power these facilities. In many cases these plants are large enough to have potential to generate several Megawatts using the sewage sludge.

Food and Dairy Waste Streams

In the US there are an estimated 42,000 dairy farms with more than 10 head of cows, with an average herd size just under 200 cows. There are an estimated 69,100 swine operations. Wash down and clean up water on dairy and swine farms and post treatment is a significant cost in these businesses as is electricity. Manure is also an excellent energy stream for the WER systems. Each of these operations could self-generate power and provide pure water for animal drinking and clean up.

Frack Water Oil Well Sites

In the US alone there is an estimated 1.6 million frack water oil wells. While this number is staggeringly high, there are actually a significant number of these sites that produce more Frack water then oil. This means that those sites have to spend money transporting the water to frack water facilities. In addition, many of these sites also release sour gas, or methane with very high sulfur content. Currently this gas is flared on site adding to the problems of pollution and acid rain. However, the sour gas and frack water could be used to power the 100KW WER system reducing the cost of operating the well significantly.

Islands and Costal Communities Worldwide

There are about 22,000 inhabit islands worldwide and many times that the number of coastal communities worldwide.

Market Totals

Just looking at the US markets mentioned above there are more than 128,000 potential sites not counting frack water wells at more than 1.6 million oil well sites. Worldwide this is a very large market with strong demands.

Marketing Initiatives

Seasoned and experienced distributors have negotiated positions for selling the WER equipment. Discussions have already been conducted with major Biogas plant owners and major Frack Water well operators, as well as other manufacturing plants.

Sales Projections

Market need is strong in the potential sectors mentioned above. In many cases these sites use diesel generators to produce their power. CAT engineers estimate that dual fuel diesels running on biogas or frack gas have only a 20% life span compared to dual fuel diesels running on diesel and high-grade natural gas. This means that the generator rebuilds and turn over in this market is very high, so the potential to sell into the market is already built into client's financial models.

Even in the best cases the diesel generators are on a five to seven-year replacement cycle. This means that the entire market is buying new generators at least once in every ten years. Each of these turns represents an opportunity to sell a WER unit instead.

If the assumption is made to sell 10% of the 128,000 potential farm and biogas customers, the market is more than 12,800 units. If 1% of the frack well sites is captured, then the potential sales numbers are 160,000 units. Distributors who have requested the opportunity to sell into these markets feel that these numbers are actually low, and they plan on selling many times more.

The following table shows potential sales as various potential market percentages:

Potential Market for Bio and Food 128,000	
%of Market	Annual Unit Sales
1%	1,280
2%	2,560
3%	3,840
4%	5,120
5%	6,400
6%	7,680
7%	8,960
8%	10,240
9%	11,520
10%	12,800
11%	14,080
12%	15,360

Potential Frack Well Market 1,600,000	
%of Market	Annual Unit Sales
1%	16,000
2%	32,000
3%	48,000
4%	64,000
5%	80,000
6%	96,000
7%	112,000
8%	128,000
9%	144,000
10%	160,000
11%	176,000
12%	192,000

Financial Model

ROI and NVP for End Clients

100kW and 500kW WER Unit Financials		
	100 kW	500 kW
Cost of Electricity	$ 0.11	$ 0.11
Availability	95%	95%
kW Hours per Year	832,200	4,161,000
Dollars Offset per Year	**$ 91,542**	**$ 457,710**
Cost to Manufacture	**$ 298,200**	**$ 1,060,800**
Royal %	10%	10%
Johnson and AIUS Investor Royalty	$ 29,820	$ 106,080
Sub Total	**$ 328,020**	**$ 1,166,880**
Sales Commission %	6%	6%
Sales Commission	$ 19,681	$ 70,013
Total	**$ 347,701**	**$ 1,236,893**

Basic Assumptions and Key Information:

- $0.11 per kWh Cost of electricity
- 95% - Availability of the unit
- Equipment runs 24/7 throughout the year
- Fuel is byproduct such as sour gas, biogas, sewer, etc.
- These numbers do not include other benefits such as possible money saved in water treatment, sale of water, or the costs to dispose of the byproducts

Investment Numbers		
	100 kW	500 kW
Return on Investment - ROI	**26%**	**37%**
Discount Rate	10%	10%
Life Span of Unit (Years)	20	20
Net Present Value - NPV	**$ 1,316,699**	**$ 7,085,107**
Pay Back (Years)	**3.80**	**2.70**

Basic assumptions:

- 10% - Better than average return

- ROI - Rudimentary gauge of an investment's profitability, Higher than 12% is considered good by most investors
- NPV - The difference between the present value of cash inflows and the present value of cash outflows over a period of time
  - The amount of money made or lost over the money spent
  - This amount is in addition to the return rate of 10% annual
- Pay Back – Amount of years to break even

Potential Revenue and Royalty Dividends for Bio Market

The following table looks at the potential gross revenue and investor royalty dividend generated for the given percent of the bio market sold into. The revenue and royalty for the 100kW WER unit are used to be conservative:

Bio Market Revenue and Royalty

%of Market	Potential Market 128,000	Gross Sales $ 347,701	Royalty Dividend $ 29,820
1%	1,280	$ 445,057,280	$ 38,169,600
2%	2,560	$ 890,114,560	$ 76,339,200
3%	3,840	$ 1,335,171,840	$ 114,508,800
4%	5,120	$ 1,780,229,120	$ 152,678,400
5%	6,400	$ 2,225,286,400	$ 190,848,000
6%	7,680	$ 2,670,343,680	$ 229,017,600
7%	8,960	$ 3,115,400,960	$ 267,187,200
8%	10,240	$ 3,560,458,240	$ 305,356,800
9%	11,520	$ 4,005,515,520	$ 343,526,400
10%	12,800	$ 4,450,572,800	$ 381,696,000
11%	14,080	$ 4,895,630,080	$ 419,865,600
12%	15,360	$ 5,340,687,360	$ 458,035,200

Potential Revenue and Royalty Dividends for Frack Water Market

The following table looks at the potential gross revenue and investor royalty dividend generated for the given percent of the frack water market sold into. The revenue and royalty for the 100kW WER unit are used to be conservative:

Frack Water Revenue and Royalty

%of Market	Potential Market 1,600,000	Gross Sales $ 347,701	Royalty Dividend $ 29,820
1%	16,000	$ 5,563,216,000	$ 477,120,000
2%	32,000	$11,126,432,000	$ 954,240,000
3%	48,000	$16,689,648,000	$ 1,431,360,000
4%	64,000	$22,252,864,000	$ 1,908,480,000
5%	80,000	$27,816,080,000	$ 2,385,600,000
6%	96,000	$33,379,296,000	$ 2,862,720,000
7%	112,000	$38,942,512,000	$ 3,339,840,000
8%	128,000	$44,505,728,000	$ 3,816,960,000
9%	144,000	$50,068,944,000	$ 4,294,080,000
10%	160,000	$55,632,160,000	$ 4,771,200,000
11%	176,000	$61,195,376,000	$ 5,248,320,000
12%	192,000	$66,758,592,000	$ 5,725,440,000

Final Comments

It is rare to see a technology with as much potential to meet core market needs with as positive an environmental impact as the WER system has. In addition, the potential sales numbers are impressive even at very low market penetrations. However, with the significant maintenance advantages we expect this product to take the market in major ways.