

## EXTIEL PLASMA REACTOR

### Description of Technology

**Plasma Power Generation.** Extiel designed & tested a plasma reactor named AKM-1 for generating electricity, superheated steam & pure hydrogen and now AKM-1 is fully operational with 1.5 kW at the inlet and 3 kW at the outlet. Our first commercial prototype will be a self-sustained AKM-2-Power-Generator with a capacity of 30 kW at the outlet while getting 3 kW at the inlet. The fuel for the plasma reactor is steam and nanoclusters of the cathode alloy, which are released into plasma at the temperature of about 5000<sup>0</sup> C. Extiel is also prepared after launching AKM-2 for power generation in commercial production to assemble and test a hydrogen generator for fuel cell vehicles with the capacity of about 2 kg of hydrogen per hour using water and nano-clusters of nickel cathode as fuel. This amount of hydrogen per hour is enough to power any fuel cell vehicle. The weight of a hydrogen generator for fuel cell vehicles is about 60 lb and it can be mounted under the hood.

### Technology Status

We believe that considerable additional emission of the heat energy in the plasma reactor takes place due to specific internal high-energy plasmo-chemical reactions with ionized hydrogen, which is the product of steam dissociation in the discharge zone, on the one hand, and the electrons of nanoclusters of eroding cathode material, on the other hand. The new science field could be logically called “internal electron chemistry”. The recorded heat value of the nanocluster fuel reaches the level of 1 KeV/atom. It’s worth noting that this value considerably exceeds the heat value of any known chemical fuels.

We are ready to demonstrate now the proof of the concept that our plasma reactor can generate more energy at the outlet in comparison with the inlet energy. We have a functioning AKM-1 reactor, which is supplied with 1.5 kW at the inlet and produces 3 kW at the outlet. We have been also testing a prototype of AKM-2 reactor with 1 kW at the inlet and 10 kW at the outlet. Our next task is to assemble the AKM-2 reactor with 3 kW at the inlet to start it up and then when the outlet power reaches 30 kW to disconnect it from the grid at the inlet and keep the plasma in a stable condition feeding back from the outlet the 3 kW and applying the remaining 27 kW to feed other power consumers.

## Applications of Technology

If we take an AKM-2-Power-Generator unit of 30 kW and compare it to a solar panel plant of the same capacity we will see that the cost of the solar plant will be about \$90,000 (\$3 per installed watt capacity) and its efficiency currently is about 25%, while AKM-2PG will be fabricated commercially at least for half that price (\$1.5 per watt) and it will be operational 24/7 at its 100% efficiency. We introduce a technology, which beats all the renewable solar and wind power plants in terms of cost and efficiency.

Besides, AKM units can generate pure “green” hydrogen, which can be used for further power generation and for fuel cell vehicles.

## Current State-of-the-art in this Area of Technology

There is a long and rapidly growing list of credible people and organizations worldwide affirming that LENR is real including NASA, US Navy, US Department of Defense, European Directorate General, as well as leading scientists and a number of promising start-ups such as Brillouin, Lenuco, Nichenergy, Brilliant Light Power, Leonardo Corp., Clean Planet, Jet Energy, Lattice Energy and others. However, not having a clearly accepted theory and understanding of the LENR process has likely delayed the ability to better control and scale the reaction. It has limited more widespread scientific acceptance ([lenrproof.com](http://lenrproof.com)).

The government research of LENR is classified, but the private companies, which work in the field of LENR have one thing in common: they all register additional power produced by the plasma reactor at different levels, in most cases in dozens of watts, which is really exciting by itself and serves as a proof of concept: LENR is real and it's the future of global energy production. But at the same time in most cases those companies are not capable of producing stable operation of their plasma reactors, as it is a serious challenge to contain the plasma within a reactor at the temperature of around 5,000<sup>0</sup> C and avoid the reactor meltdown.

## Main Advantages of this Technology over Current Practice

Extiel can run its plasma reactor AKM-1 generating additional 1,500 W demonstrating COP = 2 nonstop 24/7. We are also ready with its enhanced version of AKM-2 showing COP=10, which means 10 times more energy at the outlet than at the inlet. We do not see

any restrictions of scaling it up to megawatts, but currently we are focused on the design we have already tested and which is repeatable. It needs improvements and enhancements to be able to operate non-stop from service time to service time, which is about six months for replacing the spent cathode. We are fully aware that it is a disruptive technology, which will phase out fossil fuel by generating unlimited clean power that will dominate in the future. There is no doubt that a fully operational prototype of AKM-2 generating power at a commercial level of 30 kW while disconnected from the grid using only water and eroding metal of the cathode will attract global attention and unlimited cash for development.

The current renewable sources of solar panels and wind turbines are not profitable without being subsidized. Their efficiency on average is about 25% due to a simple fact that the sun doesn't always shine and the wind doesn't always blow.

Extiel's Plasma Reactor uses water, seawater including, which is ubiquitous and will always exist on Earth until the end of time. Besides we need such materials as nickel, aluminum or graphite, which are not in short supply at all. What is really in short supply is powerful, creative, insatiable human intellect and we are happy to possess this precious resource, although it's shelf life is very short. Time is of essence for our breakthrough technology.

## **EXTIEL PLASMA REACTOR**

### **Using Water and Nickel Nanoclusters as Fuel for Heat and Power Generation for Family Household**

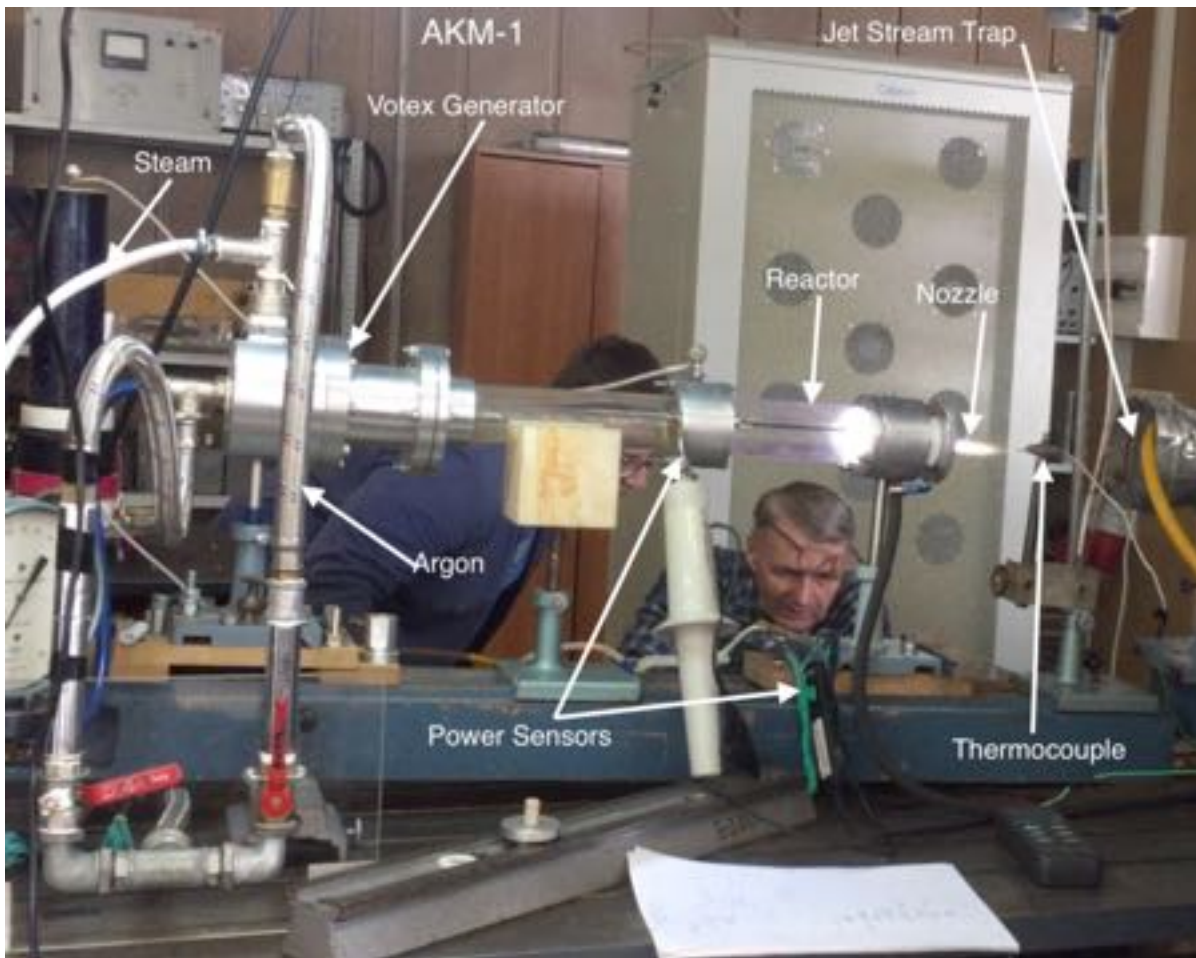
#### **AKM-1 Plasma Reactor**

Extiel designed and tested a plasma reactor named AKM-1 for generating electricity, superheated steam and pure hydrogen. The fuel components for AKM-1 are water plus nanoclusters of the nickel cathode in the plasma reactor. The power consumed by AKM-1 for keeping the plasma stable in the reactor is 1.5 kW but at the output AKM-1 yields 3 kW, i.e. the coefficient of performance (COP) is 2. According to modern classical physics nothing in nature can function with the efficiency above 100%. It is impossible, because the law of conservation of energy applies always and everywhere. Based on this law it's impossible to produce more energy than the amount of energy applied to the input of any device, which performs work. The output work is always less than the input work because some of the input work is used to overcome friction. Therefore, efficiency is always less than 100%.

However, the COP (efficiency) of the AKM-1 unit exceeds 200%, which is recorded with quite traditional and properly calibrated instruments.

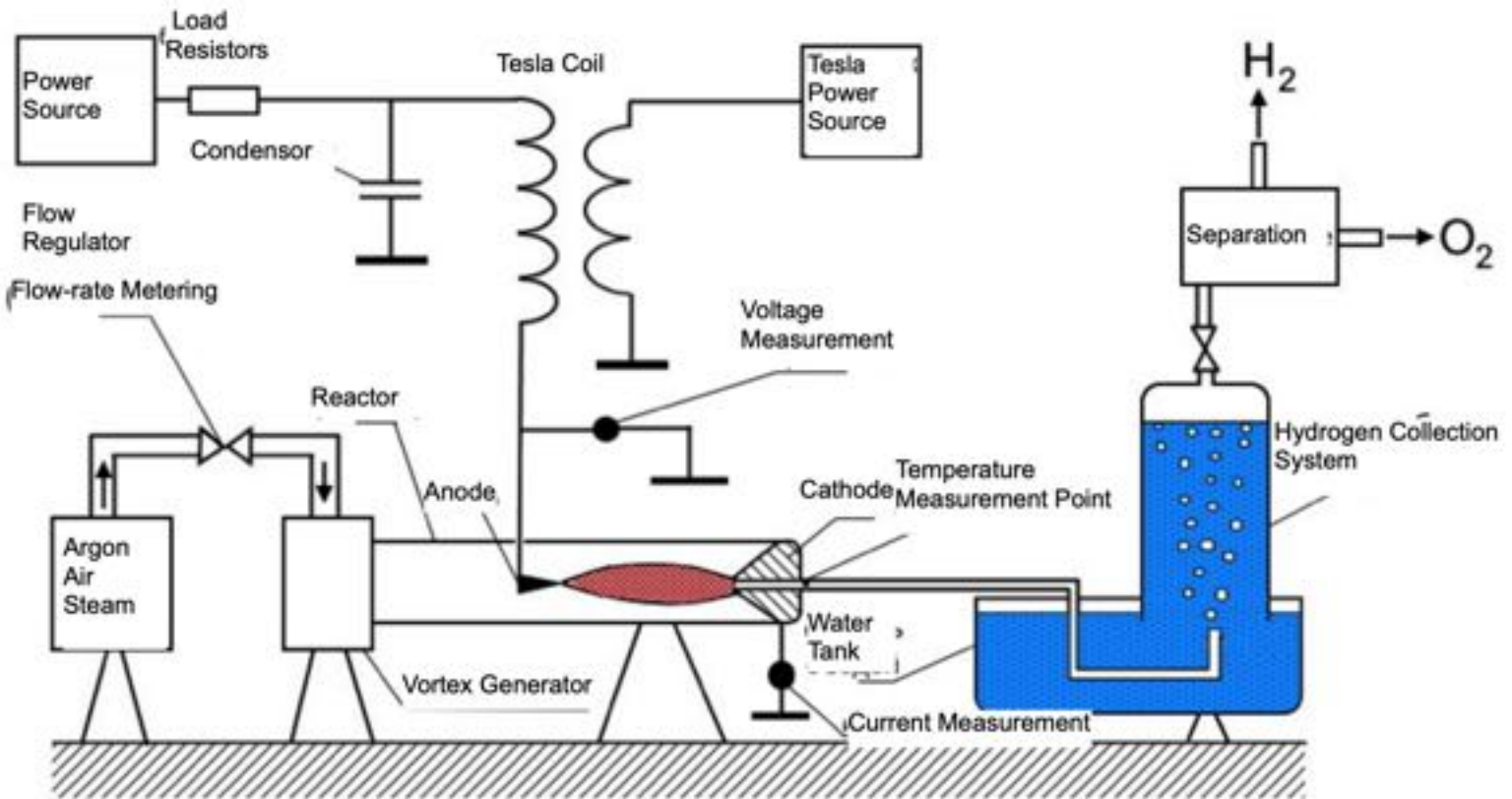
The unit generates a steam flow at a velocity of up to 100 m/sec at the temperature of about 1200 ° C and it also generates pure hydrogen (see the attached process flow diagram and actual parameters).

The plasma temperature in the reactor rises to about 5000 ° C, however no supporting part of the reactor melts down as the AKM system itself is absolutely safe and when the electric circuit breaks, the plasma immediately goes out.



**Fig. 1. AKM-1 in Extiel's laboratory setting.**

**AKM-1  
Process Flow Diagram and Parameters**

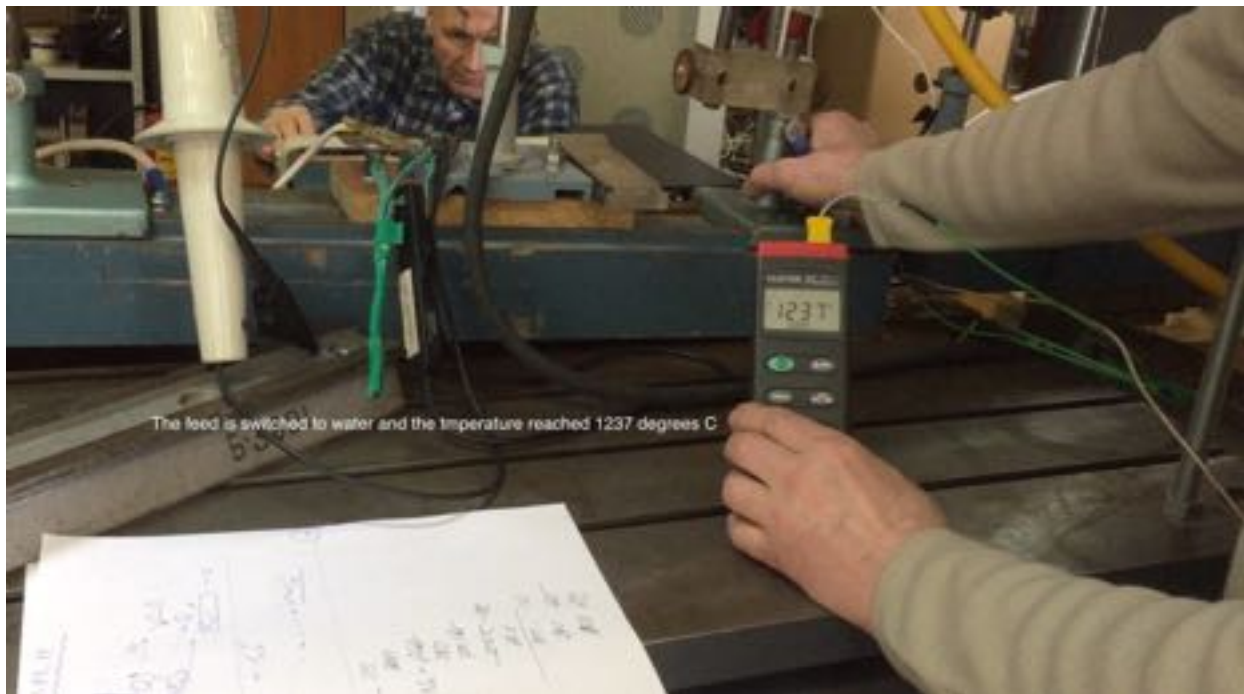


**Fig. 2. AKM-1 Process Flow Diagram**

We believe that considerable additional emission of the heat energy takes place due to specific internal high-energy plasm-chemical reactions with ionized hydrogen, which is the product of steam dissociation in the discharge zone, on the one hand, and the electrons of nanoclusters of eroding cathode material, on the other hand. The new science field could be logically called "internal electron chemistry". The recorded heat value of the nanocluster fuel reaches the level of 1 KeV/atom. It's worth noting that this value considerably exceeds the heat value of any known chemical fuels.



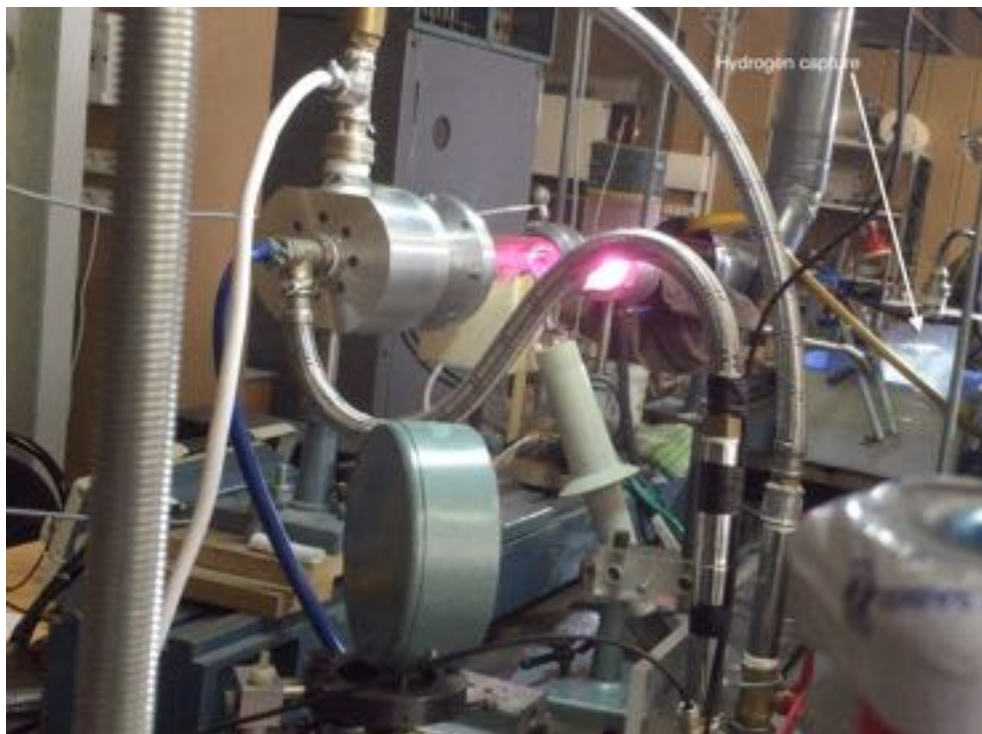
**Fig. 3.** The temperature at the reactor nozzle is rising to 506<sup>0</sup>C.



**Fig. 4.** The temperature at the nozzle rose to 1237<sup>0</sup> C when the feed was switched from argon to water steam.



**Fig. 5.** The plasma in the reactor increased the light emission when the feed was switched to steam. You see the steam fog in the glass tube before the reactor.



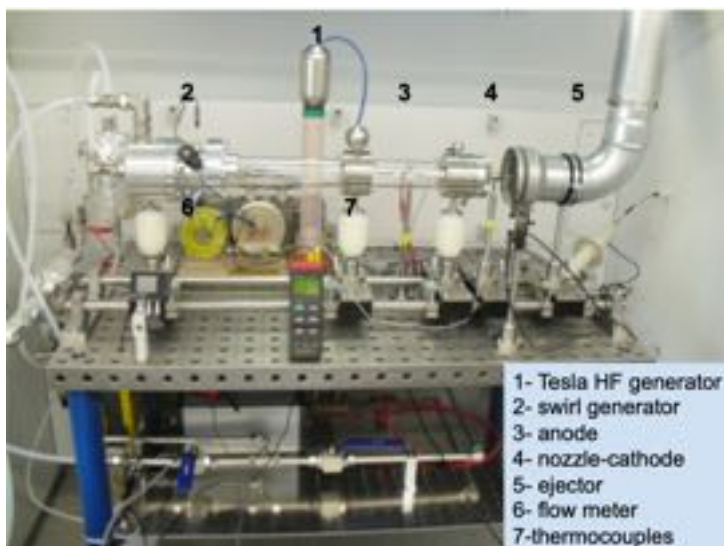
**Fig. 6.** Hydrogen is collected for measurement in a water lock.

### AKM-2 Plasma Reactor

The AKM-1 reactor is just an illustration of what is called “low energy nuclear reaction” (LENR), which challenges the established perceptions of the possibilities of modern power industry to produce clean energy without burning fossil fuel and without using solar panels and wind mills.

Moreover, Extiel’s developers of AKM reactors are ready in the shortest possible time to assemble the AKM-2 reactor with 3 kW at the input and 30 kW at the output. Thus, the efficiency of the AKM-2 reactor will reach the level of COP = 10. AKM-2 will continue to generate power using water and cathode nanoclusters as fuel after it is disconnected from the power grid for a period of time until most of the cathode mass is used. Based on our preliminary tests a cathode would last for about 6 months of continuous operation of AKM-2. The water in the AKM-2 system is used in a closed loop. When it passes through the plasma reactor it dissociates into ionized hydrogen and oxygen but in the mode of power generation these gases are not separated as they are used in the superheated jet stream for a turbo generator or for a magneto hydrodynamic generator (MHD generator). When the jet stream cools down hydrogen and oxygen recombine back to water and the cycle repeats. Turbo generators are readily available at the market; for example, the Dresser-Rand steam turbines cover a range from <10 kW up to 25 MW. MHD generators are also available and could be used for power production coupled with the AKM-2 reactor.

AKM-2 is designed to solve specific applied tasks, such as power generation and hydrogen production. A flow of superheated steam is directed to a turbo generator, which produces ~ 30 kW.



**Fig. 7. Prototype AKM-2 in Extiel's laboratory setting.**



Thus, our first commercial prototype will be a self-sustained AKM-2PG (power generator) with a capacity of ~ 30 kWh. If we assume that each American uses 4,500 kWh per year at his/her household it means that it takes about 12 kWh per day or 0.5 kWh per hour per person every hour for the whole year. Then an average family of four would require about 2 kWh capacity to heat/cool and light their household and power all the appliances. AKM-2 has the capacity of 30 kWh, which is enough for several households.

For practical purposes we may decide to combine several AKM-2PG into one small power plant, let's say ten of them of the total of 300 kWh to supply power to several households. In this case such a power plant will support the peak loads and at the same time there will be no carbon emission at all.

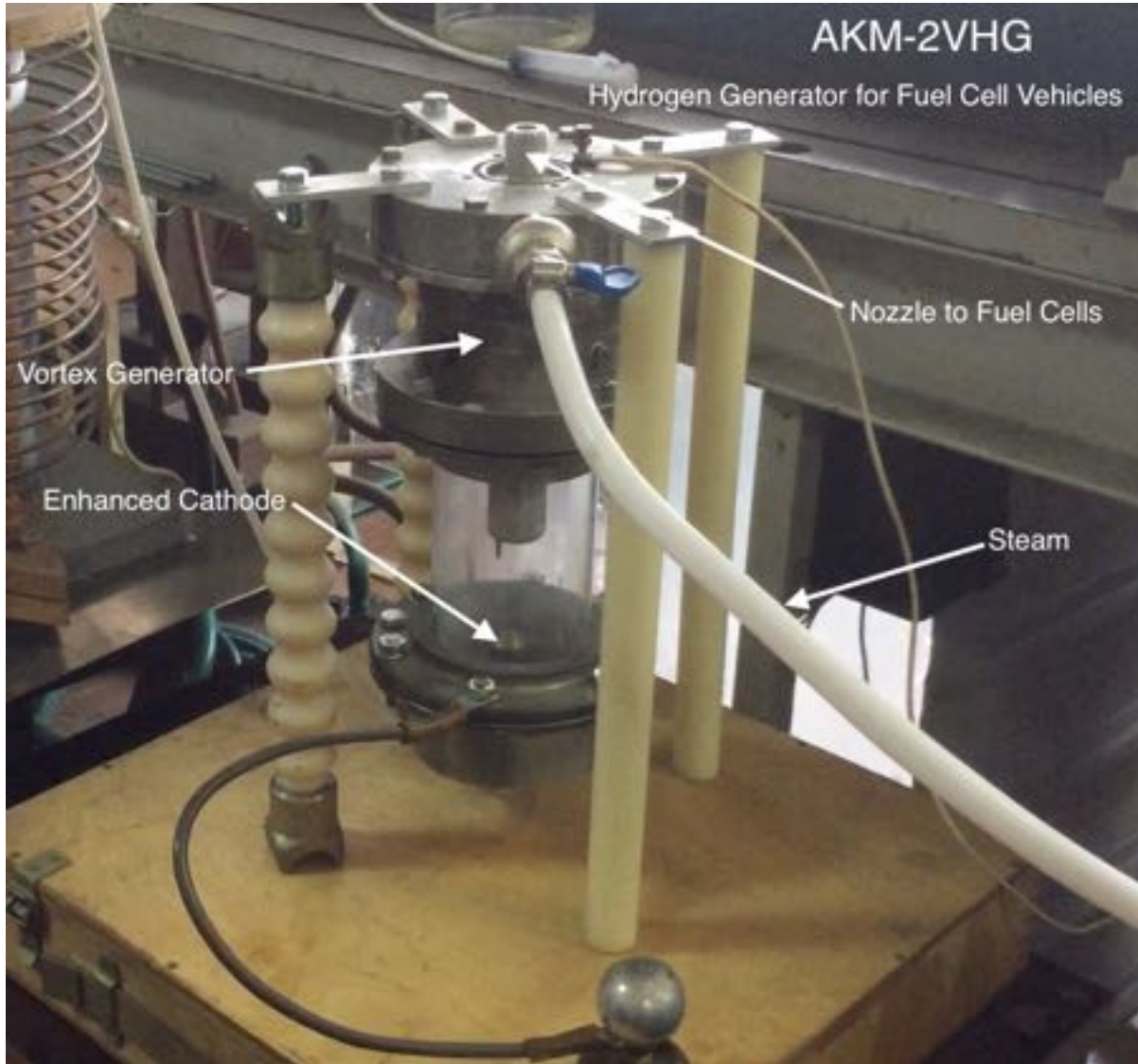
If we take one AKM-2PG unit of 30 kWh and compare it to a solar panel plant of the same capacity we will see that the cost of the solar plant will be about \$90,000 and its efficiency at best will be about 25%, while AKM-2PG will be fabricated commercially at least for half that price while it will be operational 24/7 at its 100% efficiency. We introduce a technology, which beats all the renewable solar and wind power plants in terms of cost and efficiency.

AKM-2 also produces cheap hydrogen in the amount of 2 kg/hour and it can be used as a component for a hydrogen fuelling station with several of them assembled in parallel depending on the required capacity.

### **AKM-2 Vehicle Hydrogen Generator (VHG) for Fuel Cell Engines**

The AKM reactor generates about 2 kg of hydrogen per hour. Most of the fuel-cell vehicles coming to market in the next few years will be able to deliver close to 70 miles per kilogram of hydrogen fuel. With the capacity of 2 kg per hour the AKM-2VHG can supply any fuel cell vehicle with enough hydrogen using water and nano-clusters of the nickel cathode as fuel.

However, for further tests on a vehicle, an additional budget is required in the range of \$4-5 million and one additional year for engineering and design work.



**Fig. 8. Prototype of AKM-2VHG, which generates hydrogen for fuel cell vehicles.**

**Business Proposal**

The budget for assembling AKM-2 prototype within 12 months with state of the art laboratory instruments and equipment will require by our estimates about \$3 million at a test site we select in North America. \$1 million of that amount will cover the costs of the parts, assembly and tests of AKM-2 and the salaries of the working group for 12 months. The other \$2 million will be used on a contingency basis for purchasing the required laboratory equipment, selecting and testing a turbo generator and preparing the project for commercial production making the whole unit modular and compact. Thus, within this budget of \$3 million we are ready to assemble AKM-2 with the expectations that in about

12 months we will be demonstrating the working prototype and publicly declare the preparation for commercial production of a 30 kW plasma electric generator and a plasma hydrogen generator. We expect to raise billions of dollars for the AKM project if we decide to go for an IPO.

We hope that Extiel's technologies briefly described in this presentation will be of interest for the investor as the world is ready for maximizing the green power generation and eliminating fossil fuel vehicles in near future.

## **FREQUENTLY ASKED QUESTIONS ON AKM-2 UNIT**

### **1. Is there a limit of power capacity for the AKM unit design?**

The capacity of AKM-2 of 30 kW is not the limit for a single unit design. It is quite feasible to enhance it 10 fold to 300 kW and higher, but it'll be the next step of testing and designing. Currently we have designed a unit of 30 kW and need financing to make it reliable and ready for commercialization.

### **2. Is it feasible to combine AKM-2 units into a battery or a farm for generating power for several consumers while supporting peak loads?**

It's clear that the average household power consumption of ~2 kW per day does not reflect peak loads. Just use a welding machine in your garage and simultaneously all other appliances to make it clear. But if 10 AKM-2 units are put together in a battery to supply power for 10 households, the 300 kWh can mitigate all the peak loads.

### **3. How does AKM-2 unit compare with solar panel power plants?**

Let's first compare costs. There is a good example of the solar panels where the installed cost on average is about \$3 per watt. Thus, 30 kW solar power stations would be about \$90K. But even if the price of our AKM-2 is \$90K (which if fact will be much cheaper, no more than \$1.5 per watt) it will be operational 24/7, while a solar panel unit can function only for a part of the daytime. Thus, we have a clear competitive edge over any solar system. Here is the quote for us to consider:

“Scientists have developed a solar cell that is capable of converting direct sunlight into electricity with 44.5 percent efficiency — making it, potentially, the most efficient solar cell in the world. Current solar technology only converts electricity with a maximum efficiency of about 25 percent.” In this case we have 25%-44.5% over 100%. Investors already pumped billions of dollars into solar panels. They created a new industry of solar panel fabrication, installation and maintenance. Every dollar invested into our AKM project now at this early stage will bring back huge returns.

#### **4. What are the key parts of AKM-2 unit?**

Practically there are three parts of AKM-2 to focus on: a) the high-voltage power source for plasma-arc; b) the vortex flow generator for supplying steam to plasma and for removing heat from the walls of the plasma reactor; c) the reactor with a nickel alloy cathode for release of nickel nano-clusters into the plasma reactor. Plus a standard turbine generator of 30 kW capacity or an experimental MHD generator.

- a) High-voltage power source is the core of the know-how. Extiel designed a unit, which creates power impulses for the plasma reactor within one-nanosecond intervals. The structure of the impulse itself and intervals between them are of crucial importance. Extiel knows exactly what pieces of equipment are necessary to purchase. In the US it would cost about \$13K for a prototype unit. There are no expensive parts in this unit: just coils and electronics.
- b) Vortex generator has a smart design but it's just an impeller. We will assemble it for \$2,300.
- c) Reactor with nickel alloy cathode would be another \$2,200.

The above quotes are for a hand-made prototype. If put on a conveyor belt the costs will be reduced substantially.

#### **5. How to convert the super hot jet flow of gas from the reactor into electric power?**

We'd need a microturbine with a generator. Here is a quote of its cost from Siemens: “Microturbine capital costs range from \$700–\$1,100/kW.” These costs include all hardware, associated manuals, software, and initial training. Thus, for AKM a turbine would cost around \$21K from Siemens but we have our own design for half this cost.

**6. What are the tangible results, which could be demonstrated now?**

We can show our first prototype of AKM-1 with 200% efficiency, which is repeatable and reliable. We have tested a preliminary design of AKM-2 with 1000% efficiency. But in any event AKM-1 serves as a proof of the concept to start with.

**7. How much money do you need to raise for launching commercial production of AKM-2 units?**

At this stage we need to raise ~\$3M. \$1 million of that amount will cover the costs of the parts for AKM-2, assembly work, multiple tests and the salaries of the working group for 12 months. The other \$2 million will be used on a contingency basis for purchasing the required laboratory equipment, the turbo generator and preparing the project for commercial production. Thus, within this budget of \$3 million we are ready to assemble AKM-2 with the expectations that in about 12 months we will be demonstrating the working prototype and publicly declare the preparation for commercial production of a 30 kW plasma power generator and a plasma hydrogen generator.

**8. Can AKM plasma reactor help with COVID-19 pandemic?**

Yes. Extiel developed an efficient ozone generator AKM-2OG, which produces 3 kg of pure ozone per hour while consuming only 7 kW. The nearest competitor can produce 2.6 kg consuming 35 kW. Ozone destroys this type of virus by breaking through the outer shell into the core, resulting in damage to the viral RNA. Ozone can also damage the outer shell of the virus in a process called oxidation. Ozone will be required for sterilizing hospitals, stores and restaurants on a regular basis.

**9. Can AKM plasma reactor be used for purifying water?**

Yes. Ozone water treatment is the only universal method of purifying potable water as it totally destroys all microbes and viruses, eliminates organic impurities, phenols, manganese, nitrates, hydrogen sulfide and petrochemicals. As water disinfectant ozone is much better than chlorine and it destroys organic chlorine compounds, which have cancerogenic effect on humans. AKM-2OWT (Ozone Water Treatment) can generate for water treatment up to 20-30 kg of pure ozone per hour.



VP Business Development  
Eastern Hemisphere  
**EXTIEL Holdings, LLC**  
2311 Cedar Springs Rd. #350\* Dallas, TX 75201  
Russia: +7-903-584-0941  
USA: +1-206-877-2201  
[sergei.nazarov@extiel.com](mailto:sergei.nazarov@extiel.com)  
Skype: sinazarov  
[www.extiel.com](http://www.extiel.com)