UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF FLORIDA

ANDREA ROSSI and LEONARDO CORPORATION,

Plaintiffs,

v.

THOMAS DARDEN; JOHN T. VAUGHN, INDUSTRIAL HEAT, LLC; IPH INTERNATIONAL B.V.; and CHEROKEE INVESTMENT PARTNERS, LLC,

Defendants.

CASE NO. 1:16-cv-21199-CMA

EXPERT REPORT OF RICK A. SMITH, P.E.

INDUSTRIAL HEAT, LLC and IPH INTERNATIONAL B.V.,

Counter-Plaintiffs,

v.

ANDREA ROSSI and LEONARDO CORPORATION,

Counter-Defendants,

and

J.M. PRODUCTS, INC.; HENRY JOHNSON; FABIO PENON; UNITED STATES QUANTUM LEAP, LLC; FULVIO FABIANI; and JAMES BASS,

Third-Party Defendants.

EXPERT REPORT OF RICK A. SMITH, P.E.

Defendants THOMAS DARDEN, JOHN T. VAUGHN, INDUSTRIAL HEAT, LLC ("IH"), IPH INTERNATIONAL B.V. ("IPH"), and CHEROKEE INVESTMENT PARTNERS, LLC (collectively, "Defendants"), pursuant to Fed. R. Civ. P. 26 (a)(2)(B), hereby submit the expert report of Rick A. Smith, P.E.:

I. INTRODUCTION

I, Rick A. Smith, P.E. principal of Applied Thermal Engineering, Inc., located at 7400 Brown Road, Ostrander, OH 43061, have been retained by counsel for Defendants in the above-captioned litigation to provide my opinions concerning the reported validation of certain low energy nuclear reactor ("LENR") technology referred to as the "E-Cat." Specifically, I have been asked to render my opinions on the following issues:

1. Whether the device tested by Mr. Penon in Doral, Florida, from February 2015 through February 2016 operated at a coefficient of performance of at least 10.85 for a period of 350 days (even if not consecutive) within any 400 day period prior to March 29, 2016.
2. Whether the device so tested in Doral consistently produced energy more than 2.6 times greater than the energy consumed by the device and whether the temperature of the steam produced by the device was consistently 100 degrees Celsius or greater.

II. STATEMENT OF OPINIONS

Equipment Description

This author has not yet been able to inspect the E-Cat site in Florida. The address of this site is 7861 NW 46th Street, Doral, FL 33166-5470. However, based upon information currently available to him, the author believes that the equipment in question at the Florida site is: the E-Cat, a device invented by plaintiff, Andrea Rossi, a purported chemical processing/production facility run by J. M. Chemical Products, Inc. or J.M. Products, Inc. (hereinafter JM), and related

piping, electrical equipment, utilities, etc. to support the two ventures. The author believes that the purpose of the E-Cat was to sell steam, via Mr. Rossi's company Leonardo Corp., to JM.

Background, Observations, and Narrative

One claim, perhaps the primary claim, of Mr. Rossi's invention, the E-Cat, is that it will produce many times more energy than it consumes. The author's understanding is that defendants Industrial Heat and IPH International, B.V. entered into a contractual arrangement with Mr. Rossi, based upon a hope that the E-Cat might, in fact, produce more energy than it consumed.

The author's understanding is that the plaintiffs contend that the Report dated 03/28/2016 by Dr. Ing. Fabio Penon is validation of the E-Cat's performance. The purpose of the author's investigation is to determine if the E-Cat did, in fact, produce more energy than it consumed, as Mr. Penon reported. The author has not been asked to form an opinion, nor has he formed an opinion on the physics of the reaction claimed by Dr. Rossi.

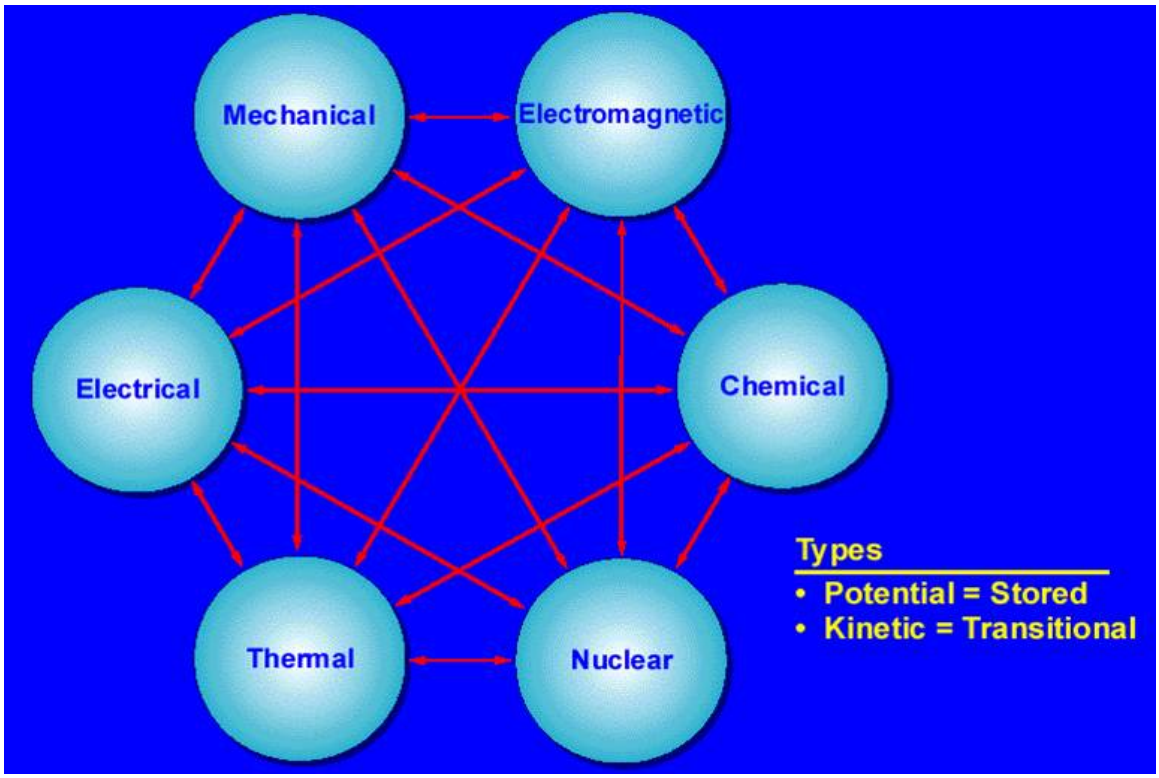
Basic Thermodynamics

The author will discuss the basics of thermodynamics before he analyzes the claimed performance of the E-Cat.

There are two foundational laws of thermodynamics, the First, and the Second.

The engineering definition of the first law of thermodynamics, in Thermodynamics, by Kenneth Wark, states: "When a closed system is altered adiabatically [i.e. without heat transfer], the work is the same for all possible paths which connect the two given equilibrium states." To put this into normal English, the first law of thermodynamics states that neither matter, nor energy, can be created or destroyed, they can only change form.

There are many forms of energy. A few of them are chemical, electrical, mechanical, nuclear, thermal, electromagnetic, and so on. Please see the picture below.

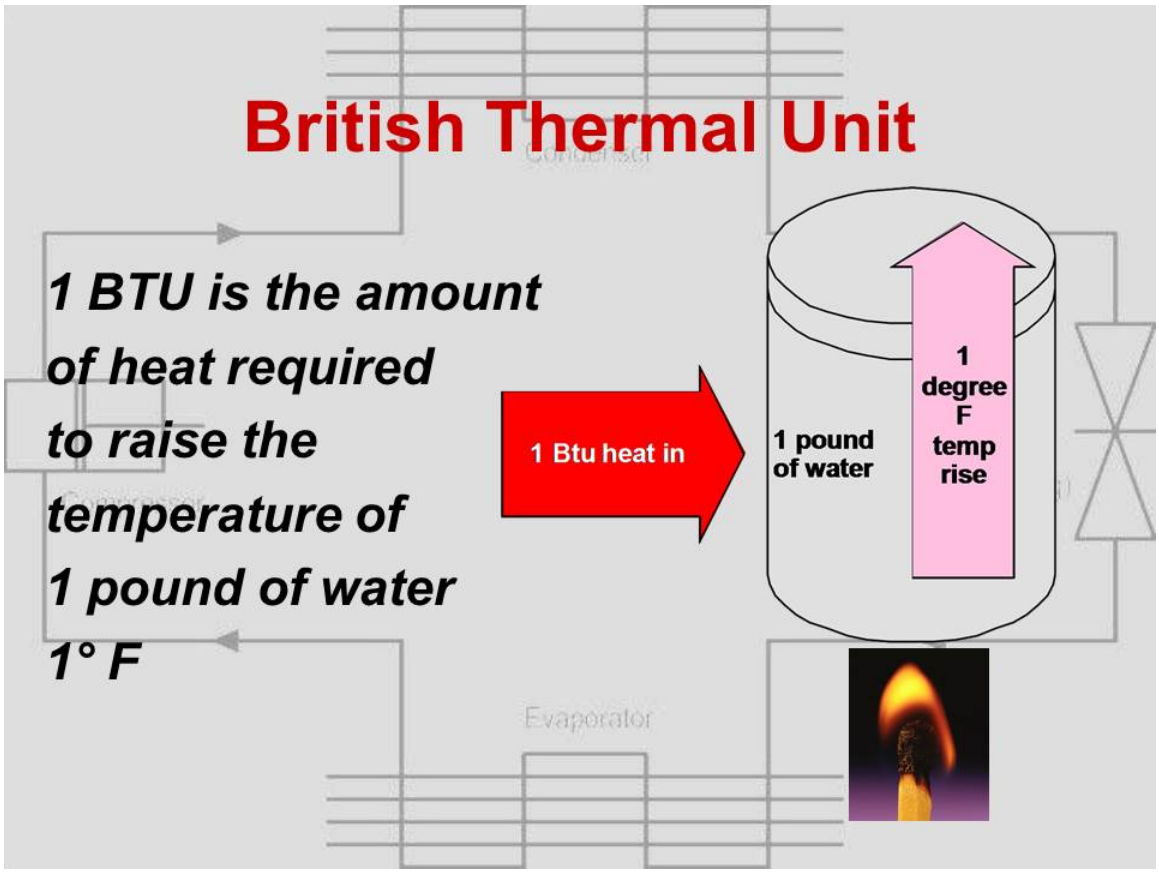


In theory, they are all interchangeable. A ubiquitous example is a cell phone battery. When the phone is in use, the battery is using chemical energy to generate electrical energy. When the phone is charging, electrical energy is being converted into chemical energy. These two conversions are very interchangeable.

In other instances, the interchangeability is somewhat limited. Nuclear energy is generally a one-way street. In a nuclear weapon, for example, the nuclear energy released by the explosion produces enormous amounts of thermal, mechanical, and electromagnetic energy. In a nuclear power plant, the controlled decay of the isotopes produces enormous amounts of thermal energy to produce electrical power or propel a ship.

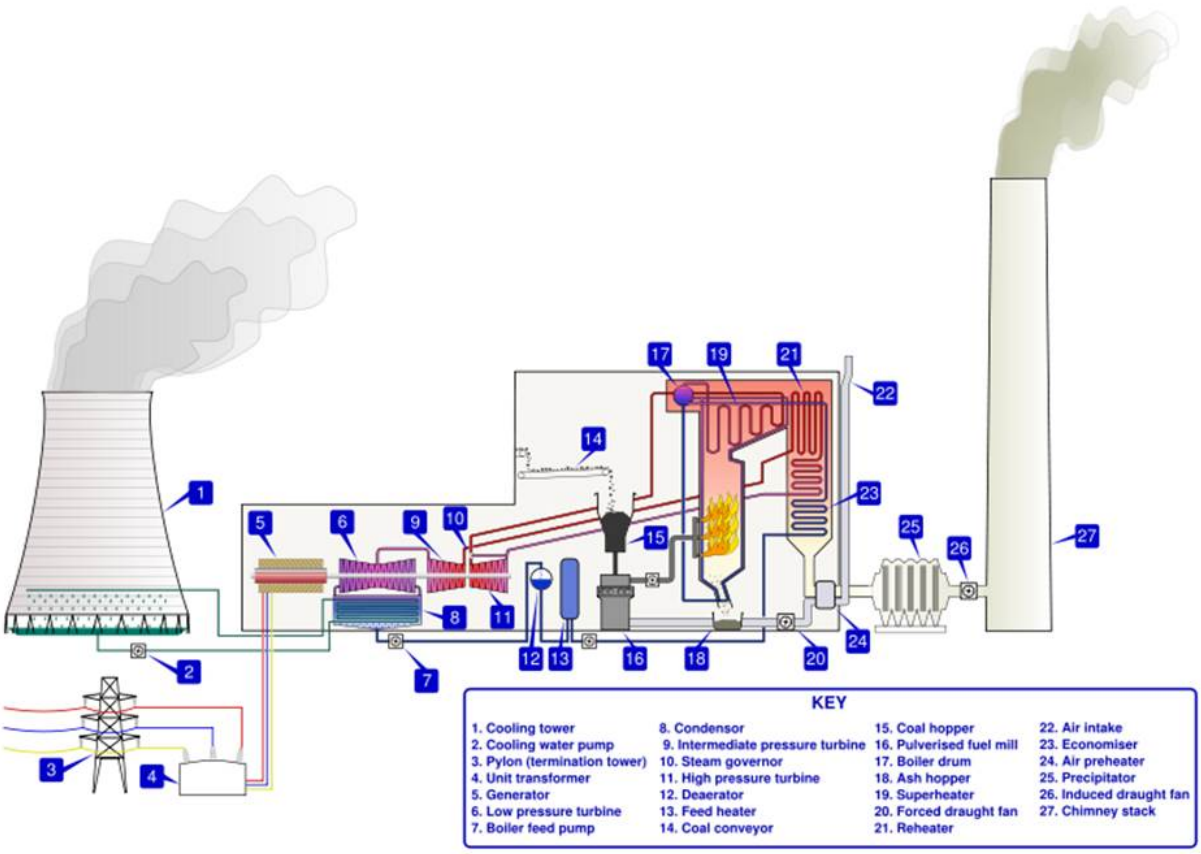
Dr. Wark defines the second law of thermodynamics thusly: "The entropy of an isolated system always either increases or remains the same when the system changes from one equilibrium state to another." In other words, energy systems always "roll downhill" when left to themselves. Thermal systems will always proceed from hot (higher energy) to cold (lower energy), left to themselves; they will never go from cold to hot unaided. The human body does not generally become stronger, healthier, or more agile as one ages. The author has personal experience with this.

Another fundamental definition is that of a BTU, or British Thermal Unit. A BTU is the amount of heat required to raise (or lower) one pound of water one degree Fahrenheit.



A wooden kitchen match contains about one BTU, to put things into perspective.

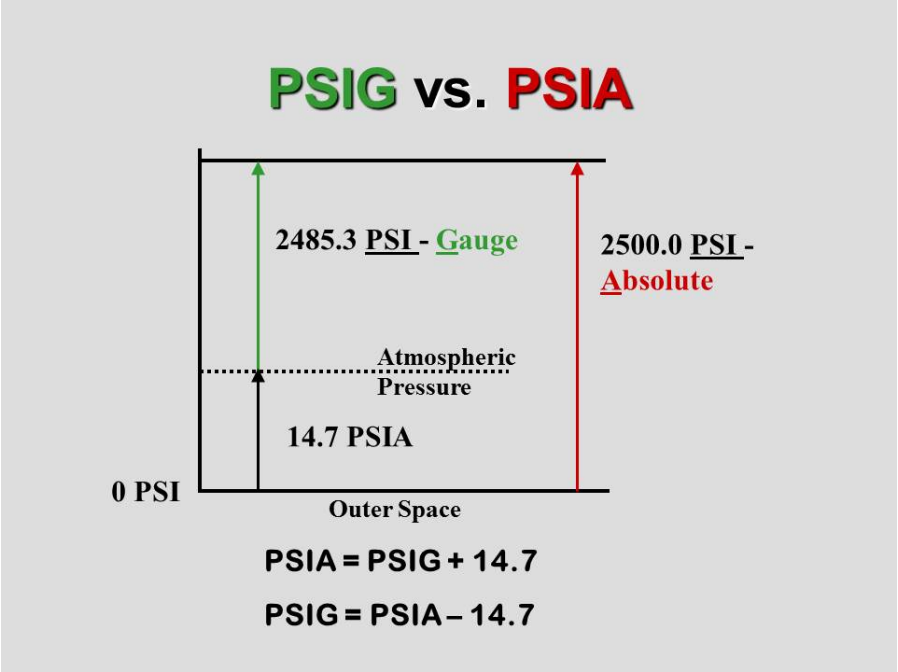
Let's do a quick entropy example in a hypothetical, but realistic situation. The picture below shows a conventional, coal fired steam power plant.



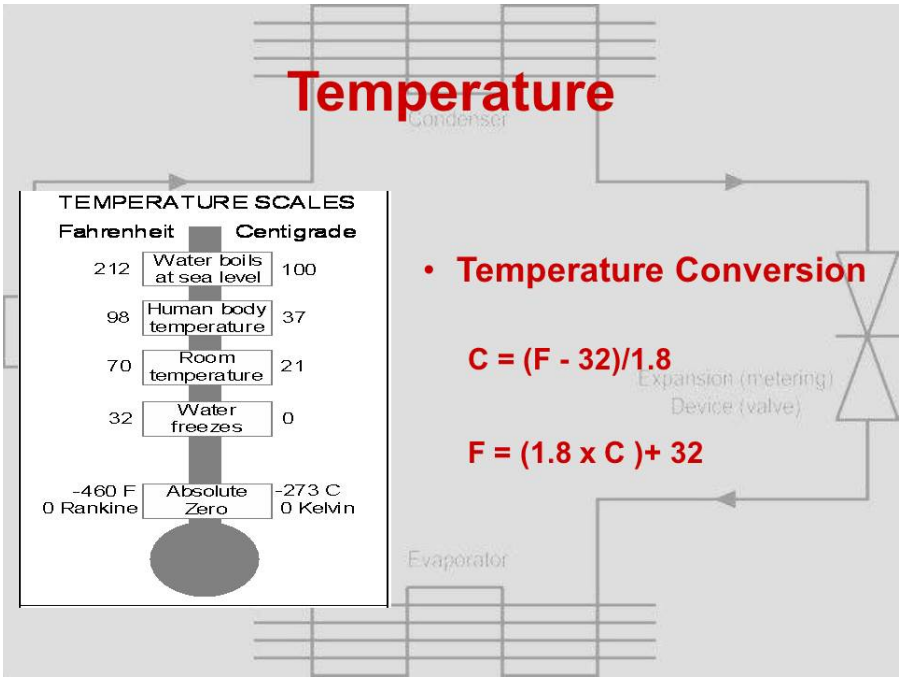
A conventional steam power plant might have steam leaving the boiler at a pressure of 2485.3 PSIG (Pounds per Square Inch, Gauge). This is equivalent to 2500 PSIA (Pounds per Square Inch, Absolute).

Gauge pressure has the local atmospheric pressure as its base, normally 14.696 PSIA, at sea level. Think Miami. Absolute pressure has zero as its base. Absolute pressure equals gauge pressure plus the local atmospheric pressure, and is used in most thermodynamic calculations. So in this example: 2485.3 + 14.7 = 2500.0

Please see the following picture for pressure and temperature comparisons.



The leaving steam temperature of our hypothetical power plant might be 990° F. This is equivalent to 1450° R (degrees Rankine), or absolute temperature. Our Fahrenheit temperature scale is based upon water freezing at 32° F and boiling at 212°F (at sea level pressure). In our English measuring system, absolute zero is 0° Rankine. To obtain degrees Rankine from Fahrenheit, one must add 460. So, water freezes at 492° R.



Now, in our hypothetical steam plant with superheated steam leaving the boiler at 2500 PSIA, and 1450° R, the steam would have an entropy of 1.6966 BTU per pound per degree Rankine. The enthalpy (heat content) of the steam is 1741.7 BTU per pound of steam.

The condenser of our power plant will operate in a deep vacuum, in order to maximize the work output and the thermal efficiency of the plant. If the condenser operates at 0.6 PSIA, its condensing temperature will be 85° F (545° R), and the steam entering the condenser will have an entropy of 2.0218 BTU per pound per degree Rankine. As the power plant converts the thermal energy of the fuel into thermal energy in the steam, into mechanical energy in the turbines, and then into electrical energy in the generator, the entropy of the system increases from 1.6966 to 2.0218. This plant obeys the second law of thermodynamics, as do all legitimate power producing systems.

Remember that there are many losses in the system: the boiler shell as well as the steam lines give off heat to the environment, there are fluid friction losses in the steam and water piping systems and air and gas handling systems, there are combustion losses due to the inefficiencies in combustion and the exit gas temperature, there are mechanical and windage losses in the turbine and generator, there are electrical losses in the generator, wiring, and transformer. All of these losses are irrecoverable and unavoidable. Further, it takes a huge amount of internal power (pumps, fans, conveyors, etc.) to run a power plant, as well as the cost of running the pollution control systems. Utilities spend enormous resources to reduce these losses and maximize the efficiencies of their plants, as well as minimizing the plant pollution.

The steam entering the condenser has a total enthalpy of 1098.6 BTU per pound, and an evaporation heat content of 1045.5 BTU per pound. For each pound of steam that passes through the system, 696.2 BTU's (1747.1 – 1098.6) are available to do work and thereby generate electricity.

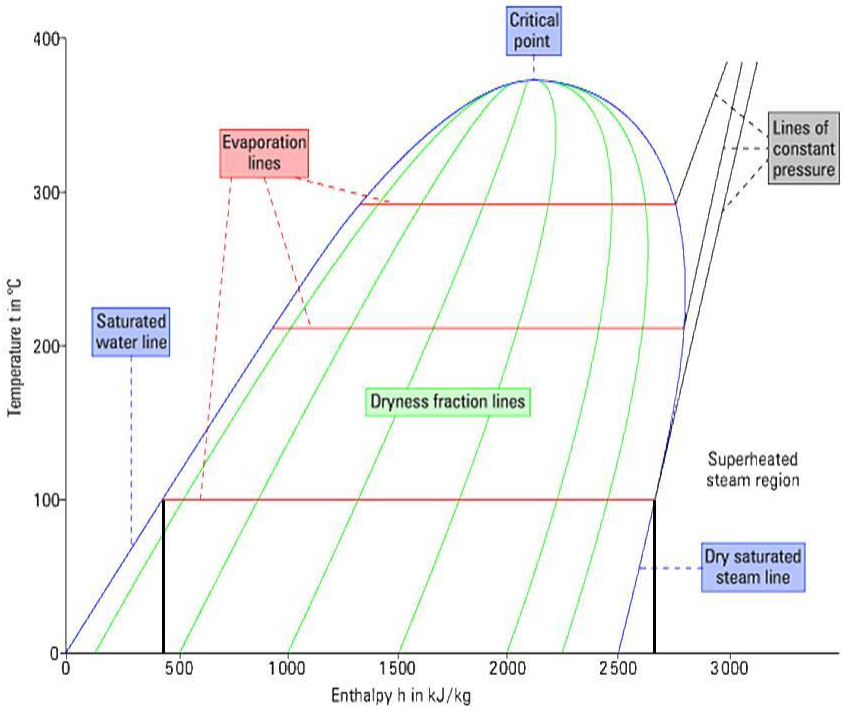
The astute reader has observed that the steam still has a lot of energy left as it enters the condenser, 1045.5 BTU per pound to be exact. Why can't more power be extracted from that steam? Because it is at almost no pressure, only 0.6 PSI above a perfect vacuum or zero pressure. There is no pressure left to spin a turbine and do more work. This heat MUST be rejected to the atmosphere. That is the purpose of the condenser and the cooling tower.

The condenser is a heat exchanger which uses water from the cooling tower to remove the heat from the low pressure steam and convert it back to water (condensate), so it (the condensate) can be recycled through the plant over and over. The cooling tower water loop pumps the water outside the plant to a cooling tower, where the water is cooled by ambient air passing over it. This is where the waste heat from the plant is rejected. The cooler water from the cooling tower then returns to the condenser to remove more heat from the low pressure steam in the condenser.

A crucial point that the reader must fully understand is that the rejected heat MUST GO SOMEWHERE. It does not just simply vanish, rejected heat generated by indoor equipment must be rejected to the atmosphere by mechanical equipment. This is true of any and every thermal plant. The "air conditioner" which normally sits outside one's house, is in reality only

the compressor and condenser section – the other parts, which are connected by a line set between the two, are inside the house. The box outside the house is that part of the system which rejects the heat collected from inside the house to the ambient atmosphere.

Another thermodynamic concept that must be understood is that the boiling point of water (or any liquid) depends upon the pressure of the liquid. At sea level conditions, water boils at 212° F. At Leadville, CO, which is at an elevation of just over 10,000 feet (the local atmospheric pressure is about 10 PSIA, not 14.7 PSIA), water boils at about 192° F. In a typical industrial boiler which operates at 150 PSIG (164.7 PSIA) the water boils at 366° F. When a liquid is at its boiling point, it can exist as 100 % liquid, or 100 % vapor, or any fraction in between depending upon how much heat has been put into it at a given time. The picture below shows this.



The units in the picture are metric, but the concept remains. Also, saturation is a term of art used in the thermodynamic world. It means that a fluid is saturated with heat. In a closed pressure vessel, where liquid and vapor are in physical contact with each other, the fluid in the vessel (water in a boiler or refrigerant in an air conditioning system) can exist as 100 % water (the left portion of the blue line), 100% vapor (the right portion of the blue line), or any fraction in between (the green internal lines) depending upon how much heat has been put into the fluid at a particular time.

Another crucial issue regarding the red evaporation lines is that each point on the line represents the value of the energy (enthalpy) in the fluid at that point. The bottom red line is at 100° C which also happens to be the nominal fluid output temperature of the E-Cat. Furthermore, the saturation pressure for 100° C water is atmospheric pressure or 1 bar absolute.

A pressure level of one bar is equal to one atmosphere at standard sea level conditions (14.696 PSIA English).

At the left, where the red line and the blue (saturated water) line intersect, the enthalpy is about 418 kJ/kg (kilo Joules per kilogram of water). On the right side, where red and blue intersect, the enthalpy is about 2676 kJ/kg (I looked them up. I cannot actually interpolate that well). The difference is 2258 kJ/kg. This difference is the amount of heat it takes to convert a kg of water at 100° C to a kg of steam at 100° C, both at one bar pressure.

In English units, the enthalpy of saturated water is 180 BTU per pound at 212° F and atmospheric pressure, 14.696 PSIA. The enthalpy of saturated steam at the same conditions is 1150 BTU per pound. Therefore, it takes 970 BTU's per pound of fluid to convert water into steam.

It should be immediately obvious to the reader that it takes a great deal of energy to convert a kilogram or a pound of water into the equivalent amount of steam. In fact, it takes over five times the energy to convert a pound of water to a pound of steam than it does to raise the temperature of water from the freezing to the boiling points.

Also, for any given fluid, the boiling temperature is dependent on the pressure the fluid is experiencing. Again, where liquid and vapor are in physical contact with each other, the temperature - pressure relationship for a given fluid is fixed and immutable. At a given pressure, the temperature of the fluid WILL be fixed by that relationship. And at that fixed temperature and pressure, there can be 100 % liquid, 100 % vapor, or any fraction in between. The horizontal red evaporation lines illustrate this concept.

Superheated steam (or any superheated vapor) is at a temperature above the saturation temperature for a given pressure. Obviously, the fluid is 100 % vapor, and there is no liquid present. Superheated steam is generated in a separate set of tubes which remove the steam from the liquid and then heat the steam to a temperature higher than the saturation temperature.

The author now begs the reader's forgiveness for subjecting the reader to the previous six pages of thermodynamics. However, a basic understanding of this subject is crucial if the reader is to understand the concepts which will be discussed below as they relate to the subject litigation.

E-CAT MW1 Energy Plant Final Report

This report, dated 03/28/2016 by Dr. Ing. Fabio Penon is claimed to be the validation report of the E-Cat's performance. Penon is referred to as the Expert Responsible for Validation (ERV) in various documents, and will be referred to as such in this document, although the author expresses no opinion on whether Engineer Penon was the ERV as specified in the parties' contractual documents.

This author's search of the internet reveals a prior relationship between Dr. Penon and Mr. Rossi. If true, this author wonders how Dr. Penon could have been an objective, dispassionate third party verifier.

Defendants' Third Amended Answer, Additional Defenses, Counterclaims and Third-Party Claims identifies many issues regarding the test protocol, adherence to the original test plan, number of cells in service, and related issues. Due to time constraints, this author will not address these issues in this report, but reserves the right to address them in the future.

In general, this author is not in this report discussing the E-Cat, per se. First, he has not had a chance to inspect it, although he has viewed many photos of it. Secondly, he has seen no documentation of the machine itself. Again, the author reserves the right to address this in the future.

Mr. Penon's Data

The author has inspected Engineer Penon's reports, and also summaries of Penon's data in Excel spreadsheets titled, ROSSI_00001075 and ROSSI_00008579.

Final Report Annexe 13: Daily valuation of the energy multiple - FEBRUARY 2016

		days of functioning	average power supply (wh/h)	supplied energy (wh/d)	tank water T max (°C)	effective flowed water(Kg/d)	reduced flowed water (kg/d)	steam T min (°C)	steam pressure (bar)	produced energy (wh/d)	COP
01/31 22:30	02/01 22:30	339	10291,7	247000	68,1	36000	32400	104,6	0.0	2,03E+07	82,3
02/01 22:30	02/02 22:30	340	10375,0	249000	68,5	36000	32400	104,7	0.0	2,03E+07	81,7
02/02 22:30	02/03 22:30	341	10375,0	249000	69,2	36000	32400	104,7	0.0	2,03E+07	81,7
02/03 22:30	02/04 22:30	342	10375,0	249000	69,6	36000	32400	104,7	0.0	2,03E+07	81,7
02/04 22:30	02/05 22:30	343	10500,0	252000	70	36000	32400	104,7	0.0	2,03E+07	80,7
02/05 22:30	02/06 22:30	344	10333,3	248000	68,5	36000	32400	104,6	0.0	2,03E+07	82,0
02/06 22:30	02/07 22:30	345	10291,7	247000	70,3	36000	32400	104,7	0.0	2,03E+07	82,3
02/07 22:30	02/08 22:30	346	10375,0	249000	68,5	36000	32400	104,7	0.0	2,03E+07	81,7
02/08 22:30	02/09 22:30	347	10291,7	247000	68,5	36000	32400	104,7	0.0	2,03E+07	82,3
02/09 22:30	02/10 22:30	348	10291,7	247000	68,5	36000	32400	104,7	0.0	2,03E+07	82,3
02/10 22:30	02/11 22:30	349	10458,3	251000	68,9	36000	32400	104,6	0.0	2,03E+07	81,0
02/11 22:30	02/12 22:30	350	10458,3	251000	68,5	36000	32400	104,6	0.0	2,03E+07	81,0
02/12 22:30	02/13 22:30	351	10458,3	251000	68,9	36000	32400	103,6	0.0	2,03E+07	81,0
02/13 22:30	02/14 22:30	352	10375,0	249000	68,5	36000	32400	103,6	0.0	2,03E+07	81,7
02/14 22:30	02/15 22:30	-	10375,0	249000	68,9	36000	32400	103,9	0.0	2,03E+07	81,7

The picture just above is one of the pdf annexes of Penon's report.

The Penon reports generally (with some variation) contain certain data. The author understands that these data were provided to Industrial Heat as pdf files and not as Excel

spreadsheets. The columns are not labeled as in an Excel spreadsheet, so each column will be referred to by its title. The verbatim column descriptors shown below the title block will be reproduced for clarity.

The first four columns are the date and time columns. These are unremarkable.

The entitled "days of functioning", is the cumulative days counter. This is also unremarkable.

The column entitled "average power supply (wh/h)". This would appear to be the average power supplied to the E-Cat. (wh/h) is watt hours per hour, which equals watts. Some months are in wh/h and others are in Kwh/h. This difference in units is of no concern. An interesting thing occurs starting in June, 2015. If one takes the number in the column entitled "supplied energy wh/d" and divides it by 24, one gets the exact number in the "average power supply (wh/h)" column to five digit precision.

The column entitled "supplied energy wh/d". This is apparently the daily energy supplied to the E-Cat. If one takes the values in "average power supply" column and multiplies by 24, one obtains the almost exact value in the "supplied energy wh/d". Here is the problem. Instead of a value of 247,000 this column on Feb. 06, the author would expect to see a calculation here that would not result, in each entry, in a rounded number. The report does not explain the calculation or estimation that Penon made to arrive at the reported number. Additionally, this is inconsistent with the Florida Power and Light records which casts further doubt on the data in Penon's report.

The column entitled "tank water T max (Celsius)". This is the tank which feeds the E-Cat cells. It presumably is the large rectangular block in the center of Figure 2, on page 2/5 of Dr. Penon's final report. Fig. 2 has an annotation pointing to this block titled "probe for water temperature measure". This is also unremarkable.

The column entitled "effective flowed water (kg/d)", is the total mass of water transited during the test period. The pictures of the flow meter shows that it reads in m3, or cubic meters. This author wonders if the data logger converted cubic meters to kilograms or is it done in the spreadsheet. This author has the same concern with this column as with the column entitled "supplied energy wh/d" regarding the cell contents, i.e., seeing a rounded number in each cell as opposed to seeing a formula in each cell, or an explanation in the report as to how this number was calculated. In the vast majority of the cases, this cell content was 36000, not 35837, or 36714, but 36000 exactly. 27000 and 29000 were well represented also. This is undoubtedly the most uniform data collection which this author has seen in his forty plus years of engineering. There is no reason or need to round data to the nearest 1000 in a report like this. In fact, one needs to use the "Round" function in a spreadsheet to get numbers to display like this. This author has more comments on the water meter later in the report.

The column entitled "reduced flowed water (kg/d)" is described at the bottom of page 3 of the ERV report. "Measurement uncertainties have been present during the test. To take this into account the total mass of water transited during the test period has been reduced by 10%."

This column is simply 90% of the "effective flowed water (kg/d)" column. This author has the same concern with this column as with the "supplied energy wh/d" column regarding the cell contents, i.e., seeing a number in each cell as opposed to seeing a formula.

The column entitled "steam T min (Celsius)" is the measured temperature of the fluid leaving the E-Cat (This author has used fluid instead of steam intentionally. This will be discussed later in the report). The numbers themselves are unremarkable. What they actually represent is a different matter.

The column entitled "steam pressure" is the measured pressure of the fluid leaving the E-Cat (This author has used fluid instead of steam intentionally. This will be discussed later in the report). The numbers themselves are unremarkable. What they actually represent is a different matter. Every cell under steam pressure is "0" in the entire spread sheet.

The steam pressure in the "steam pressure" column is uniformly reported as "0.0" (bar). 0.0 bar is 0.0 atmospheres absolute. The way the data are presented the E-Cat is reported as operating in a perfect vacuum. If the ERV meant 1 atmosphere, the column should have been labeled "1 bar" or 0.0 (barg), (barg being bar – gauge). Another very serious data anomaly is that the steam temperatures are almost all reported as being over 100° C. The saturation temperature of water/ steam at atmospheric pressure is 100.0° C.

The column entitled "produced energy (wh)" is represented as being the energy produced by the E-Cat. The same comments about numbers in the cells versus formulas generally hold true for this column.

The "produced energy" numbers should have been generated and provided by a calibrated energy measuring device (to include steam flow, steam quality, temperature, and pressure) in the outlet of the E-Cat. However, there never was an energy measuring device in the outlet of the E-Cat, as shall be discussed in depth later in this report. Instead, the report raises suspicion that COP numbers (more on these later also) were not properly calculated, and the produced energy numbers may have been "back calculated".

With respect to the column entitled "COP", based on the above discussion, these numbers do not appear to have been properly calculated. If an appropriate energy measuring device had been installed in the outlet of the E-Cat, the "produced energy" column would be a tabulation of those actual readings. This value would then be divided by the "supplied energy wh/d" column, the actual supplied energy, to get the "COP". Which gets us to COP.

COP stands for Coefficient of Performance. It is a term which is used in the air conditioning and heat pump industry, not the steam producing and power generation industries. The most general definition of air conditioning and refrigeration is removing heat from a place where it is not wanted and rejecting it to a place where it will dissipate to the environment. The COP is a measure of how much work it takes to move a given amount of heat from point A to point B. The more efficient an air conditioner is, the higher its COP will be because it takes less work to move the heat from inside to outside. To use "COP" as a measure of the efficiency of a

heat producing device (the E-Cat), as opposed to a work absorbing device (an air conditioner), is a misapplication of the term.

In summary, it is this author's professional opinion that the entire ERV spreadsheet is not a valid means to tabulate and compute the performance of the E-Cat. Its data are suspect and the methodology is not explained in enough detail to render the results valid, standing alone.

Test Instrumentation

The E-Cat test setup is briefly described by the ERV on pages 1, 2, and the top of 3. Figure 2 on page 2 purports to be a schematic of the test setup. With this setup, in the author's opinion it is not possible to accurately measure the output of the E-Cat.

The American Society of Mechanical Engineers (ASME), of which this author is a member, produces many Performance Test Codes for boilers and many other types of equipment. In the course of running one of these tests, numerous parameters which are delineated in the codes are carefully measured, one of which is the steam flow from the boiler. The steam flow, as well as its temperature, pressure, and quality in a saturated steam system are critical parameters to accurately measure and determine the actual BTU's per hour (BTUH) which the boiler is producing. Without knowing this, it is impossible to measure the performance and efficiency of the boiler.

The E-Cat is a boiler, albeit of unconventional design. Since it is a boiler, its efficiency can only be accurately measured by accurately determining its actual flow out of the unit, as well as its temperature, pressure, and steam quality, among other things. Steam quality is the percentage of steam in a given flow. A steam quality of 100% means that there is 100% steam in the boiler output and no moisture. A steam quality of 75% means that there is 75% steam and 25% moisture in the boiler output. Please remember that at a given temperature and pressure, there can be 100% liquid, 100% vapor, or any fraction in between, as was explained above.

By only measuring the temperature and pressure of the fluid leaving the boiler, there is absolutely no way of knowing how much fluid is flowing, and what the steam quality is. The E-Cat could have been producing 100% hot water, or 100 % steam, and no one would know the difference based upon the installed instruments.

It is this author's understanding that the E-Cat output line goes to an enclosed space which is or was occupied by JM Chemicals, or JM Products, or a similarly named entity. The return line from the enclosure to the E-Cat has a flowmeter installed in it. By any normal engineering standard, the flowmeter in the return line is measuring an input to the E-Cat. There is no way that this can be considered an output.[1] It is unknown what happens to the fluid inside the JM Products enclosure. Is it heated? Is it cooled? Is part of it drained off? Are city water or other substances added to the flow stream?

[1] Even if the flowmeter had been installed in the proper location, this author has serious concerns about the flowmeter's suitability for its stated purpose.

On page 3 of the ERV report, he states, "The measurement equipment has been placed and operates in a manner that is not necessary to study the client's use of the energy produced or even inquire about such use." This is not correct.

Back to thermodynamics, briefly. The reader should recall that a pound of 100% quality steam at 212° at atmospheric pressure contains more than five times the heat that the same pound of water (which is also 0% quality steam) contains at that temperature and pressure.

The point is that the E-Cat "system" could just as easily have been flowing water as steam. With the installed instrumentation, there is absolutely no way of knowing. Determining and establishing the whether the system was flowing steam would have been easy to do, if the person establishing the test plan was interested in knowing that data. If the E-Cat was in fact flowing water, and the output was not measured, but rather was only calculated, based on the assumption that the flow was steam, the calculated (not the actual) E-Cat thermal output would be exaggerated by at least a factor of five.

On page 4 of the ERV's report, is the equation:

$Ep = 0.9x \lambda x Mw$
Ep is the total energy produced in the steam as shown on page 3, section 2.1
λ is the heat of vaporization (the heat it takes to boil water at a constant temperature)
Mw is the mass of water vaporized during the whole test, coming from the tank

The huge and unverified assumption built into this equation is that the flow out of the E-Cat is 100% quality steam. This equation, while technically correct, is not valid if the system is flowing water not steam. Again, there is absolutely no way of knowing exactly what is exiting the E-Cat.

Mr. Joe Murray addressed some of his concerns to the ERV concerning the flow meter. This author shares Mr. Murray's concerns and would like to see the ERV's responses. This author also shares the other concerns Mr. Murray has about the other issues in his letter, to wit: 2. The consistency of the reported flow rate statistics, 3. The number of reactor units in operation varied substantially over time, 4. System alteration on the night of February 16 or the morning of February 17, and 5. The flow of steam through the pipe to J. M. Products. This author reserves the right to address these issues at a later date.

It is this author's professional opinion that the E-Cat test setup was not properly instrumented and did not measure the E-Cat's actual output.

E-Cat Heat Rejection

For the sake of discussion (but not agreement, just to be clear), let us assume that the E-Cat produced all the heat that the ERV says it did, and that it was 100% quality steam. During the test period, the average assumed output from the E-Cat was about 790 KW.

E-Cat Output = (790 KW) x (3413 BTUH / KW)

2,696,270 BTUH

E-Cat Output = (2,696,270 BTUH) ÷ (33,465 Boiler HP / BTUH)
80.57 BoHP

Crosschecking:

E-Cat Output = (790 KW) x (1 BoHP / 9.803 KW)
80.59 BoHP

An 80 boiler horsepower (BoHP) boiler is a small commercial boiler. For illustration, below is a generic picture of a very common Cleaver Brooks steam boiler of this type.

This conventional boiler does not appear to be greatly different in size than the E-Cat.

The E-Cat is putting approximately 2,700,000 BTU's into the JP enclosure every hour. What happens to this heat? Please remember that the first law of thermodynamics states that neither matter, nor energy, can be created or destroyed, they can only change form.

If JMP was actually performing any processing, they would have taken the steam, used it to heat some materials to create or enhance a chemical reaction, or to heat materials to kill biologicals, or whatever other productive use would require 212° F (100° C) heat. The product stream would then have to be cooled for further processing, packaging, shipping, etc. In other words, all of the heat that entered the product stream would leave the product stream, either by air cooling, or by some sort of heat exchanger.

To illustrate, if one boils water (212° F) to make sweet tea and leaves the hot tea sitting on the counter, what happens to it? Does it naturally get hotter or does it eventually cool down to room temperature? We all know that it cools to room temperature eventually, even though it may take a while.

In an industrial process, the product cooling is accelerated by the use of heat exchangers or fans, or some other mechanical means of cooling. This is done to maximize the production rate and minimize the space required to do so.

In the issue at hand, let us first assume that air is used to cool the product stream. Please keep in mind that 2,700,000 BTU's enters the product stream every hour of every day of the test period (24/7). This same 2,700,000 BTU's per hour then leaves the product stream and has to be rejected to the environment.

Mr. Murray has produced some simulation videos purporting to show what happens to the temperature of the entire facility if one assumes (or contends) that the rejected heat was left to naturally dissipate in due course. This author has not verified Murray's numerical analysis, but only viewed the videos, and therefore reserves the right to verify Mr. Murray's calculations and analysis regarding this. The Murray videos show a very marked temperature rise in the space, with temperatures approaching 373° K (absolute temperature), which is 100° C, which is 212° F. This is warm, even for Miami.

If the unit were generating the amount of heat that Penon claims, and that heat had been left to naturally dissipate, no human could have worked, or even survived, for long in the space. Obviously, this temperature rise in the space never happened.

Alternatively, JMP could have used a roof-mounted fan to remove all rejected heat. Fan sizing is:

CFM = Cubic Feet of air per Minute
c = Specific heat of air in BTU per pound of air per °F (BTU / Lb. °F) = 0.24
ΔT = Temperature difference of the air, in this case 130° F - 80° F
ρ = Average density of the air in pounds per cubic foot = 14.3

$$CFM = (2{,}700{,}000) \times (1 / c) \times (1 / 60) \times (1 / 130 - 80) \times \rho$$
$$= (2{,}700{,}000) \times (1 / 0.24) \times (1 / 60) \times (1 / 50) \times 14.3$$
$$= 53{,}625 \text{ CFM}$$

A roof mounted fan to move this much air would have a blade diameter of about 54", a 10 HP motor, would have dimensions of about 60" square and about 48" high, and would look something like the next picture.

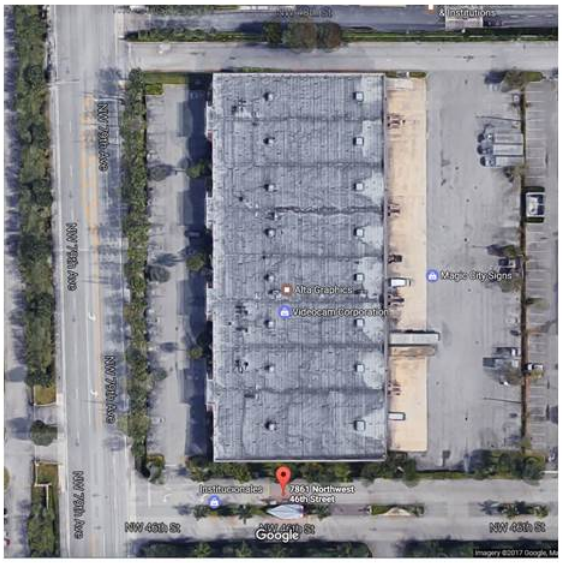
If most of the 2,700,000 BTUH were rejected to cooling water through a heat exchanger of some sort, the best way to remove the heat would be a cooling tower. Cooling towers are sized in tons of refrigeration or cooling. This refers to a ton of ice melting in a 24 hour period, not the weight of the equipment. A ton of cooling equals 12,000 BTUH.

Tons of cooling = (2,700,000 BTUH) ÷ (12,000 BTUH / Ton)
Tons of cooling = 225 T

A cooling tower of this size would be about 12' x 12' x 12' and would look something like this.

The author has examined photographs of the site at 7861 NW 46th Street, Doral, FL, as well as aerial photos (below), and has spoken to Mr. Joe Murray, who inspected portions of the facility in February 2016. The author has seen no evidence that the plant contained any equipment resembling large rooftop ventilators or cooling towers. Aerial photos of the property are below:

Bing Maps



Google Maps

The author has seen no evidence of cooling towers. There are some squares on the roof which may be roof-top ventilators. Let's look inside the building.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Only the first interior picture shows anything in the ceiling. Since the rectangular opening is light, it could be a skylight or a natural (no fan) ventilation opening. A powered roof fan with a cap (a necessity in Miami) would not let any light through. The other photos show no openings in the ceiling.

The last interior photo, showing the dark grey partition with the white door is very interesting. As mentioned, no openings can be seen in the ceiling. Other than the small items along the left wall, there are also no visible pipes, pipe racks, pipe drops, conduits, cable trays, transformers, switchgear, motor control centers, storage racks, or any other items which one normally associates with a manufacturing facility, even a small one.

Is there any place else in the facility where 2,700,000 BTUH can be rejected? Another possibility might be to use city water to absorb the rejected heat. This author has analyzed the Miami-Dade water bills for the subject property and has determined that during the validation period, the facility used about 40,000 gallons of water. This is about 4.6 gallons per hour. For this discussion, assume that all the water was used for heat rejection, none was used for domestic purposes.

Assume: a 50° inlet water temperature, 130° water outlet temperature (sewer temperature restriction)
Flow is 5 gallons per hour.
Water density is 8.34 pounds per gallon.
Specific heat of water is 1 BTU per pound per degree.
Q is engineering shorthand for heat absorbed by the city water.

The formula is : Q = (gallons per hour) x density x temperature difference x specific heat
(5) x (8.34) x (130° F – 50° F) x 1.0

Heat absorbed by water = 3336 BTU per hour.

How much water under the same conditions would it take to absorb 2,700,000 BTU? Working the above equation backwards, it would take 4047 gallons of water per hour, or 67.5 gallons per minute to absorb this amount of rejected heat.

City water was not used for heat rejection.

Where did the rejected heat go?

Air cooling – no.

Cooling tower – no.

City water – no.

There are now but two alternatives left.

The heat just vanished. – no. The first law of thermodynamics prohibits this.

or

It never existed.

It is this author's professional opinion that the E-Cat never produced the energy which was claimed for it. This energy had to be rejected somewhere, and this analysis has shown, by the process of elimination, that the claimed energy never existed.

Conclusions

Based on the preceding and my more than forty years' experience as a professional engineer engaged in facility and utility engineering and operations, it is within a reasonable degree of engineering certainty that I conclude the following:

1. The Penon reports, standing alone, are not valid to tabulate and compute the performance of the E-Cat. The data are suspect and the methodology is not explained.

2. The E-Cat test setup was not properly instrumented and there was no measurement of the E-Cat's actual output.

3. The E-Cat never produced the energy which was claimed for it. This energy had to be rejected somewhere, and this analysis has shown, by the process of elimination, that the claimed energy never existed.

III. FACTS AND DATA CONSIDERED

In forming the opinions expressed in this report, I have relied on my education and experience as described in my curriculum vitae attached hereto as Exhibit A. In addition, I received and considered the documents and information identified in Exhibit B hereto.

IV. EXHIBITS THAT SUMMARIZE OR SUPPORT OPINIONS

I have not prepared any exhibits to summarize or support my opinion, other than as incorporated in the text of Section II above. I reserve the right to prepare exhibits in connection with my anticipated testimony at trial, after the completion of discovery.

V. QUALIFICATIONS

A summary of my qualifications is provided in the CV attached as Exhibit A, which includes a list of all publications I have authored in the previous 10 years.

VI. EXPERT WITNESS EXPERIENCE

Since January 2012, I have testified as an expert at trial or deposition in the following matters:

1. I provided my expert opinion in *Jerew v. Rhodes Heating*, Case No. 11-CV-0876, in the County Court for Marion County, Ohio, and testified at trial in December 2012.
2. I provided my expert opinion in *Akron Fairlawn Properties v. Edgell Plumbing*, Case No. 2012-09-5199, in the Court of Common Pleas for Summit County, Ohio, and testified at deposition and trial in October 2013.
3. I provided my expert opinion in *Richmond v. Sears Roebuck, et al.*, Case No. 12-CV-010718, in the Court of Common Pleas for Franklin County, Ohio, and testified at deposition in December 2013.

4. I provided my expert opinion in *Young v. First Energy*, Case No. 2013-CI-0408, in the Court of Common Pleas for Coshocton County, Ohio, and testified at deposition in April 2015.

VII. COMPENSATION

I am being compensated for my work in these proceedings at a rate of $275.00 per hour, except that y rate for deposition and trial testimony is $375.00 per hour. My compensation is not dependent on the opinions rendered or the outcome of this proceeding.

By: _____ 30 JAN 2017

Rick A. Smith Date

Respectfully submitted,

/s/ Christopher R.J. Pace

Christopher R.J. Pace
cpace@jonesday.com
Florida Bar No. 721166
Christopher M. Lomax
clomax@jonesday.com
Florida Bar No. 56220
Christina T. Mastrucci
cmastrucci@jonesday.com
Florida Bar No. 113013
Erika S. Handelson
ehandelson@jonesday.com
Florida Bar No. 91133
Michael A. Maugans
mmaugans@jonesday.com
Florida Bar No. 107531
JONES DAY
600 Brickell Avenue
Brickell World Plaza
Suite 3300
Miami, FL 33131
Tel: 305-714-9700
Fax: 305-714-9799
Counsel for Defendants/Counter-Plaintiffs Third Party-Plaintiffs

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing was served by e-mail on counsel of record this 30th day of January, 2017.

/s/ Erika S. Handelson
Erika S. Handelson

SERVICE LIST

John W. Annesser, Esq.
Brian Chaiken
Paul D. Turner
D. Porpoise Evans
PERLMAN, BAJANDAS, YEVOLI &
ALBRIGHT, P.L.
283 Catalonia Avenue, Suite 200
Coral Gables, FL 33134
Tel.: (305) 377-0086
Fax: (305) 377-0781
jannesser@pbyalaw.com
bchaiken@pbyalaw.com
pturner@pbyalaw.com
pevans@pbyalaw.com
Counsel for Plaintiffs

Fernando S. Aran
ARAN, CORREA & GUARCH, P.A.
255 University Drive
Coral Gables, FL 33134-6732
Tel.: (305) 665-3400
Fax: (305) 665-2250
faran@acg-law.com
Counsel for JM Products, Inc., Henry Johnson and James Bass

Rodolfo Nuñez
RODOLFO NUNEZ, P.A.
255 University Drive
Coral Gables, Florida 33134
Tel: (305) 665-3400
Fax: (305) 665-2250
rnunez@acg-law.com
Counsel for United States Quantum Leap, LLC and Fulvio Fabiani

EXHIBIT A

RICK A. SMITH, P.E.

7400 Brown Road
Ostrander, OH 43061
(740) 666-4872

PROFESSIONAL EXPERIENCE

JUN 1988 - PRESENT **APPLIED THERMAL ENGINEERING, INC.**

Principal of this specialty engineering firm whose forté is identifying and solving complex, intractable problems; industrial power plant engineering; utility generation and distribution; cogeneration; energy conservation and recovery; industrial process improvement; project design and management; forensic engineering and expert witness in the above specialties. Boiler, air conditioning, and pump instructor. Worked as a relief utility operator at a local R&D facility whose equipment includes two 750 HP, 250 PSIG boilers, an ammonia and a carbon dioxide refrigeration system.

Clients (direct or immediate sub) include:

- ALCON
- Anheuser - Busch
- ARCCA, Inc.
- ATT
- Cargill, Inc.
- Climax Molybdenum
- Ford Motor Company
- General Motors
- Georgia Pacific
- Graphic Packaging Int'l.
- Honda America Mfg.
- Johnson Controls
- Level 3 Communications
- Mead Paper
- Nestlé
- NIBCO
- Owens - Corning Fiberglass
- PPG Industries
- RIB USCost
- Ross Laboratories
- Spirax Sarco
- State of Arkansas
- State of Ohio
- Strategic Value Solutions
- The Ohio State University
- Thomson Consumer Elec. (RCA)
- US Dept. of Justice, BOP
- Volcanic Heater
- Numerous law firms internationally
- Numerous smaller companies

Please see last page for representative projects.

OCT 1983 - JUN 1988 **THE OHIO STATE UNIVERSITY**

Senior Mechanical Engineer:

- Successfully managed a $7,000,000 steam line expansion project which encompassed 30,000 feet of superheated steam and condensate lines, several major road crossings, a river bridge crossing, and 15 building tie-ins / system upgrades, all on a crowded urban campus. Project management entailed:
  - Oversight of consulting engineers.
  - Review and approval of all plans, specifications, and change orders.
  - Coordination and liaison with all affected University departments.
  - Installation coordination and oversight.
  - Resolving conflicts between this and other ongoing projects.
  - Minimization of disruption to all University operations.
- Spearheaded a $2,300,000 cogeneration project in McCracken Power Plant. Authored the feasibility study which withstood a peer review by outside consultants; overcame significant technical and political hurdles; supervised design, specification, procurement, and installation of the 3125 KW non-condensing turbine generator, and all associated piping and auxiliary equipment.
- Assisted in the completion and startup of a 125,000 pound per hour coal fired boiler and its associated flue gas scrubber system.
- Assisted in the preliminary needs assessment and scope of work development for a medical waste incinerator.
- Earned the Mechanical Engineering Advanced Professional Degree.

NOV 1981 - JUN 1983 **CUMMINS ENGINE COMPANY**

Facilities project manager for maintenance and engineering at five large buildings. Provided engineering services for an additional twenty-five buildings, totaling over 1,000,000 square feet.
Major accomplishments:

- Converted three boilers to dual fuel capability to minimize fuel costs.
- Analyzed major electric accounts. Through a transformer purchase, brought a major facility into a lower rate structure, saving thousands of dollars annually.

JUN 1979 - OCT 1981 **ALUMINUM CO. OF AMERICA**

Mechanical engineer in charge of energy conservation for a large aluminum extrusion plant. Provided engineering services for the boiler house and billet annealing furnaces.
Major Accomplishments:

- Initiated closing the doors of the homogenizing furnaces between loads to conserve energy and reduce furnace turnaround time. Zero cost, very large annual savings.
- Discovered and engineered a heat recovery project for an aluminum chip dryer.
- Designed and built a new boiler ash handling facility. Performed major equipment enhancements.
- Analyzed the condensate return system in search of a solution to a vexing problem only to find that the difficulty was caused by a faulty control valve diaphragm.

JUL 1977 - MAY 1979 **PURDUE UNIVERSITY**

Project engineering including design and installation of retrofit HVAC systems on campus.

JUL 1976 - JUL 1977 **ARMOUR - DIAL, INC.**

Project engineer, then maintenance supervisor at a large soap manufacturing plant.

LICENSES

PROFESSIONAL ENGINEER: Ohio STATIONARY ENGINEER, 3rd CLASS: Ohio
UNIVERSAL REFRIGERATION TECHNICIAN: USEPA
STEAM SYSTEM SPECIALIST: USDOE

QUALIFIED AS AN EXPERT IN U.S. AND CANADIAN COURTS

MILITARY SERVICE

OCT 1968 - AUG 1972 UNITED STATES MARINE CORPS
Parris Island - 1968. Completed Officer's Candidate School at Quantico in 1969. Volunteered for and actively participated in Viet Nam as an artillery forward observer.

EDUCATION

OHIO STATE UNIVERSITY: Mech. Engineering Professional Degree, 1988.
PURDUE UNIVERSITY: BSME, 1976. Member - Pi Tau Sigma.

PROFESSIONAL AFFILIATIONS

MEMBER - American Society of Mechanical Engineers

PUBLIC SERVICE WORK

MEMBER - Columbus District Heating Task Force, 1984 - 1986
MEMBER & PAST COMMANDER - American Legion Post #115, Delaware, OH

COMPUTER EXPERTISE

Proficient in all Microsoft Office applications as well as AutoCAD. Have received extensive training in the use and integration of all these products. Can learn any other package as required.

REPRESENTATIVE ENGINEERING PROJECTS

- Corrected excessive gas consumption in an asphalt drying plant.
- Performed a gas line capacity and cathodic protection study for a glass blowing plant.
- Performed boiler house, steam, and condensate studies at various plants.
- Performed engineering design reviews and assisted with depreciation studies.
- Performed project engineering for an energy center upgrade.
- Performed cogeneration studies for a major university and a major auto manufacturer.
- Wrote standard air compressor specifications for a major food products company.
- Designed a steam reducing station for a large paper drying machine.
- Resolved HVAC problems in a paper mill machine room air conditioning system.
- Performed a cooling tower study for a large brewery.
- Re-engineered the heating system for a bottle washing tank at a large brewery.
- Confirmed the sizing of refrigerant and steam piping.
- Walked down and re-drew the chilled water piping at a large auto assembly facility.
- Walked down and re-drew the ammonia PID's for a large food R&D facility.
- Performed a compressed air study at a large steel mill.
- Performed a cooling study for a large natural gas pipeline compressor.
- Performed a boiler safety audit at a large food R&D facility.
- Perform Coast Guard / ASME design review and certification for thermal fluid heater manufacturers. Developed a complex, interactive Excel based program to perform the calculations.
- Have assisted in value engineering studies for the VA and the City of New York.

TRAINING EXPERIENCE

- Have taught hundreds of boiler, HVAC, and pump classes for American Trainco, Applied Thermal Engineering, Lewellyn, NTT, and Versa-Tech in the US, Canada, and the Caribbean.
- University of Wisconsin - Engineering Extension, Industrial Boiler Controls Course Presenter.
- Taught ME 625, a dual level course in Power Plant Engineering, while at Ohio State University.

REPRESENTATIVE FORENSIC / EXPERT WITNESS PROJECTS

- Steam line failures and explosions.
- Pressure vessel explosions.
- Boiler explosions, both fire side and water side.
- Boiler failures – non explosion.
- Pump and valve failure analysis.
- Coal supply issues.
- Cogeneration system failure.
- Atmosphere oven explosions.
- Carbon monoxide accidents and fatalities.
- Water meter failure.
- HVAC compressor failures.
- Hydro testing explosion.
- Large diesel engine cooling system failure.
- Boiler refractory failures.
- Investigate cooling tower freeze failure.
- Hot water burns / scalds.

PUBLISHED ARTICLES

- “Winter Storm Warning, NBBI *Bulletin*, Winter 2012, Volume 67, Number 1.
- “75-Ton Bottle Rocket Case Study”, NBBI *Bulletin*, Fall 2012, Volume 67, Number 3.

EXHIBIT B

EXHIBIT B

1. The Complaint and all exhibits thereto [D.E. 1]

2. The Third Amended Answer, Additional Defenses, Counterclaims and Third-Party claims, and all exhibits thereto [D.E. 78]

3. The E-Cat MW1 Energy Plant in Miami Tests Plan, IH-00011128

4. Initial Queries for M. Eng. Fabio Penon as to Measurements of 1MW Plant, IH-00011086

5. Documents produced in response to subpoena served on Florida Power & Light Company, INDUSTRIALHEAT_FPL000004-000067

6. Documents produced in response to subpoena served on Miami-Dade Water and Sewer, INDUSTRIALHEAT_MDWS-0001-0049

7. The E-Cat MW1 Energy Plant in Miami Energy Multiple Evaluation Final Report by Fabio Penon, IH-00079630-79658

8. Fulvio Fabiani's Electric Data, produced in discovery by Fulvio Fabiani on or about January 13, 2017 on an unlabeled flash drive.

9. Fulvio Fabiani's Thermal Data, produced in discovery by Fulvio Fabiani on or about January 13, 2017 on an unlabeled flash drive.

10. Fulvio Fabiani's MW1-USA System Absorption Data (translated to English)

11. A video and photo of the flow meter time lapse conducted by Joseph Murray

12. Videos of the heat simulation conducted by Joe Murray

13. Photos taken by Joseph Murray at the Doral Location

14. Joseph Murray's October 31, 2016 Power Analysis

15. Photos taken in December 2014 at the Triangle Drive Facility, produced by Defendants in discovery as part of the three terabyte hard drive (Folder: 3 Triangle Drive>2014-12>Images)

16. Photos of the E-Cat and related equipment taken by Andrea Rossi, produced in discovery by Andrea Rossi on a thumb drive labeled 00000002.

17. Rossi's Testing Data, produced in discovery by Andrea Rossi in native format as ROSSI_00001075, ROSSI_00008579.

18. Industrial Heat spreadsheets summarizing data collected from Florida Power and Light

19. Industrial Heat spreadsheet summarizing the data from Penon's final report

20. Telephone interviews with Joseph Murray