IN THE UNITED STATES DISTRICT COURT FOR THE
DISTRICT OF UTAH CENTRAL DIVISION

UNITED STATES OF AMERICA,

Plaintiff,

vs. Civil No: 2:15-cv-00828-DN-EJF

RAPOWER-3, LLC, INTERNATIONAL AUTOMATED SYSTEMS, INC., LTB1, LLC, R. GREGORY SHEPARD, NELDON JOHNSON, and ROGER FREEBORN,

Defendants.

DEPOSITION OF THOMAS R. MANCINI
October 23, 2017
9:01 a.m.
201 3rd Street, Northwest, Suite 900
Albuquerque, New Mexico

PURSUANT TO THE FEDERAL RULES OF CIVIL PROCEDURE, this deposition was:

TAKEN BY: MR. DENVER C. SNUFFER, JR.
Attorney For Defendants

REPORTED BY: Peggy Jo Gonzales, RMR, CCR #145

(9013L-PJ)

A P P E A R A N C E S

For the Plaintiff:

CHRISTOPHER R. MORAN
ERIN HEALY-GALLAGHER (Telephonically)
ERIN R. HINES (Telephonically)
Post Office Box 7238
Ben Franklin Station
Washington, DC 20044
christopher.r.moran@usdoj.gov 202.307.0834

For the Defendants:

DENVER C. SNUFFER, JR.
NELSON, SNUFFER, DAHLE & POULSEN
10885 South State Street
Sandy, Utah 84070
denversnuffer@gmail.com 801.576.1400

Also Present:

Mr. Neldon Johnson
Ms. Glenda Johnson

I N D E X

EXHIBITS MARKED OR FORMALLY IDENTIFIED

THOMAS R. MANCINI,

after having been first duly sworn under oath, was questioned and testified as follows:

EXAMINATION

BY MR. SNUFFER:

Q. Mr. Mancini, have you ever had your deposition taken before?

A. I had a video deposition taken maybe 15 years ago.

Q. Okay. You understand that the oath you were just given is the same oath that you would be given if you were testifying in a courtroom?

A. I do.

Q. Okay. The answers that you give today should be the same as any answer you would give if you were testifying in open court in this proceeding. If there's a difference between your testimony today and your testimony at trial, should you testify at trial, we're entitled to point out those differences and it will reflect upon the credibility of the testimony, so I'd like your answers to be complete and honest and forthright as you respond to the questions today. Do you understand that?

A. I do.

Q. Is there anything that impairs your ability

to testify today, for example, you're ill, under the influence of medication, you're suffering from some injury? Is there anything that impairs your ability to recall and to testify?

A. No.

Q. The court reporter is taking down all that is said by anyone who speaks today, and so it's useful, to get an accurate transcript, for only one person to speak at a time. There may be times when I think you're through with an answer and all you're doing is thinking. If you're not through with an answer, let me know and I'll wait until you've had an opportunity to fully respond. There may be times when you want to answer and someone wants to interpose an objection. If both of you are talking, that's not going to make for a good record. So if someone's going to object, let them do that and then proceed with -- with your contribution.

Let me caution you, also, that sarcasm and humor will oftentimes come through on the record exactly the opposite of what you intend, particularly sarcasm, so while we talk informally all the time using intonation, sarcasm and humor, in a deposition it's best if you state forthrightly exactly what you intend your answer to be and not rely upon

interpretative things like understanding that that was a joke. Do you understand that?

A. I do, thank you.

Q. If you don't understand a question I ask, that may be because I asked a bad question, and if you want me to rephrase it, I'm happy to do so. The objective here is to get you to testify in response to a question that's clear. If the question's not clear, let me know and I'll be happy to clean it up.

Responses like uh-huh and huh-uh or shaking your head or nodding your head which are used in everyday conversation are perfectly understandable in conversation, but they don't come through in the record, so if you'll respond audibly and intelligibly, that's correct, that's not correct, yes, no, I agree, I disagree rather than nonverbal communication or uh-huh or huh-uh, that will help your testimony be clearer on the record. Do you understand that?

A. I do understand that, thank you.

Q. I'm not here to try and trick you, I'm here to try and get information from you. Nevertheless, you should think about and try and answer and as clearly as you can the question put to you, and if you think a question includes something that

misstates, misrepresents or mischaracterizes, feel free to correct that before you respond. I want to know what -- what your testimony is going to be and I want to understand clearly what your position is. Do you understand that?

A. I do.

Q. Okay. I've brought copies of the notice of deposition for today. I assume you received a copy of that notice?

MR. MORAN: Mr. Snuffer, can we mark this -- do you intend to mark this as an exhibit?

MR. SNUFFER: We can. Let's go ahead. And my inclination is to mark it as the next successive deposition -- or exhibit number, but I don't know what that number is.

MR. MORAN: How about we just have you start at 1001.

MR. SNUFFER: Okay.

MR. MORAN: We're in the 600s, but...

MR. SNUFFER: Okay, so let's have this marked as Deposition Exhibit 1001.

MR. MORAN: Mr. Snuffer, before we get into the substance of your questioning, do you mind if we get appearances from everyone else in the room and on the phone?

MR. SNUFFER: Oh, the court reporter took them down, but that -- that probably is good to do on the record, as well. I'm Denver Snuffer, I'm counsel for the plaintiff. Today in the room is -- or, excuse me, counsel for the defendants. Today in the room with me is Neldon Johnson and his wife, Glenda Johnson, and Neldon is both a representative of several of the parties and he's also a party individually. Glenda is affiliated with some of the other parties.

MR. MORAN: And I'm Christopher Moran here on behalf of the Plaintiff United States. With me on the phone is Erin Healy-Gallagher and Erin Hines, who are also counsel for the United States. Thank you.

(Exhibit 1001 marked.)

Q (By Mr. Snuffer) Okay, did you receive a copy of Exhibit 1001?

A. I did.

Q. Okay.

(Exhibit 1002 marked.)

Q (By Mr. Snuffer) I'll hand you a document that we'll mark as Exhibit 1002. Exhibit 1002 is a copy of a subpoena to testify at a deposition in a civil action. Did you receive a copy of this document?

A. I did.

Q. Okay.

(Exhibit 1003 marked.)

Q (By Mr. Snuffer) And I'll hand you a document we're going to mark as Exhibit 1003. Did you receive a copy of Exhibit 1003, a subpoena to produce documents?

A. I did.

Q. If you turn to Exhibit A, the third page of the document, there's a list of items 1 through 7. Did you produce those items?

A. I produced items 1 through 6 and a letter explaining my response to item 7.

Q. Okay, all right. Thank you. I want to clarify that you are not a certified public accountant, are you?

A. That's correct.

Q. And you are not an enrolled tax preparer, are you?

A. I am not.

Q. You do not prepare tax returns for others, do you?

A. That's correct.

Q. And as I have reviewed your expert report, you express no opinion regarding 26 USC 7402, do you?

A. I don't even know what that is.

Q. If I were to ask you the same about Section 7408, would your answer be the same?

A. It would.

Q. And Section 6700?

A. Correct.

Q. And you express no opinion regarding Section 48 of 26 USC either, do you?

A. These are all tax-related codes, so, no, I have no knowledge of those.

Q. And you do not intend at the time of trial to offer any testimony regarding those matters, do you?

A. That's correct.

Q. Okay. Do you intend to express any kind of an opinion regarding a tax credit at the time of trial?

A. No.

Q. Do you intend to express any kind of an opinion regarding depreciation deduction under the Internal Revenue Code at the time of trial?

A. No.

Q. Okay. Is it your understanding that only RaPower sold anything to the public?

A. I -- you know, I don't know the answer to

that. There -- I simply don't know the answer to that.

Q. Fair enough. And is it your understanding that the only item that got sold to the public that's at controversy in this case are Fresnel lenses?

A. That is my understanding, yes.

Q. Okay. Do you have any opinion regarding the position of the Department of Justice that the defendants were involved in a tax scheme?

A. I don't have an opinion on that, no.

Q. Okay. Can you give a brief description of what the U.S. attorneys who hired you told you about the IAS system before they hired you?

A. I don't -- that was over two years ago, and I don't remember what we discussed. I think they -- as I recall, and to the best of my recollection, they told me that they were interested in a particular case and they referred me to look at the website for RaPower-3, and I believe that's what I did and then we discussed it further after that.

Q. Okay. When you looked at the website for RaPower-3, what did -- what did you see? What did you observe?

A. Well, I went into the website and, of course, the first thing I did was go to look at the

technology, and I reviewed the few documents there that were involved with the technology. There were also a number of other documents related to tax items, and I didn't feel that that was of interest to me, so I didn't bother to look at those.

Q. Okay. Did you reach any conclusions or form any opinions as a result of looking at the RaPower-3 website?

A. No, I didn't reach any conclusions at the time. I guess what I -- what I saw was what I would call a dish engine system based on some of the technologies -- similar to some of the technologies that I'd worked on before, so I felt relatively comfortable with the technology, which was the issue at hand. Would I be interested in providing a technical opinion on these types of technologies, and feel comfortable doing so, and I did.

Q. Okay. Your report indicates that there are four generic concentrating solar power systems. Does the RaPower system fit within one of those four categories?

A. It -- it nominally falls into the dish engine system with a slight overlap because of using multiple dishes to collect heat and drive a central engine that looks in some ways more like a trough

system in a sense. So it -- it is similar to some systems that were evaluated many years ago and not pursued.

Q. So the IAS system doesn't fit precisely with any of the four categories, if I understand your testimony?

A. It's most like a dish engine system.

Q. Okay. Is it your opinion that the IAS system will never be commercially viable?

A. Yes.

Q. Okay. Is that related to the failure to be an authentic dish engine system since it's most like it, but it is not precisely like it?

A. No.

Q. Why do you think -- well, never mind, you've covered that in your report, I think. Are you currently a civil engineer?

A. No, I'm a mechanical engineer.

Q. Are you currently an optical engineer?

A. I've done a lot of optics work as part of my training as a mechanical engineer.

Q. Okay. Are you a design engineer?

A. I've done some design over the years, yes.

Q. As I understand your background, you have done consulting work for other solar energy

companies, correct?

A. That is correct, yes.

Q. Can you tell me the names of all the solar energy companies for which you have provided consulting work?

A. There are over 30 of them, and I don't have that list with me.

Q. If you could name the most significant or the highest cost companies.

A. I've done some work for Abengoa, I've done a little bit of work -- you know, this is difficult for me to do because I have the list and I'd be happy to provide it, but I can't recall. There are 30 companies over the last multiple years.

Q. Okay. Is one of the companies that you provided consulting work for the Ivanpah project?

A. What company would that be?

Q. Well, the Ivanpah project was on the border of California and Nevada, and it involved a conglomerate of companies. Did you do any work for --

A. I haven't done any consulting work -- I'm sorry, I interrupted you.

Q. Have you done work for any of them for the Ivanpah project?

A. I don't believe so, no.

Q. Have you ever brought a product to market?

A. No, I have not.

Q. Have you ever designed a new product and brought it from what your report describes as stage 1 to stage 4?

A. No, I have not.

Q. Have you ever brought a new project to a commercial application?

A. No, I have not.

Q. As I understand your -- your resume, you worked for the Sandia Laboratories in Albuquerque from 1985 to 2011. Is that correct?

A. That is correct.

Q. Sandia has never had a commercial application for production of electricity through solar energy, have they?

MR. MORAN: Objection, assumes facts not in evidence.

A. I don't know the answer to that question. It's possible that they have developed systems for power production, but I -- in other areas than I was involved with. I don't know the answer to that question.

Q. Okay. All right. While you worked for

Sandia, did you work on Studevent engines?

A. I'm not familiar with that term.

Q. Okay. Are you familiar with Stirling engines?

A. I am.

Q. Did you work on the Stirling engines?

A. Yes.

Q. Did you ultimately conclude that Stirling engines were not a feasible project for solar energy?

A. No.

Q. Do you know if Stirling engines are currently being used in any solar energy project?

A. Could you repeat the question or provide more information?

Q. I'm more -- I'm more interested in whether a Stirling engine is being used in a commercially viable solar energy project. Are you aware of any --

A. I'm not aware of any Stirling dish systems being used in a commercial solar project.

Q. Okay. Do you know if Sandia received any tax credits for the work done on the development of the Stirling dish engine system?

A. Sandia is a government laboratory, a government contractor.

Q. Right.

A. It operates under a different set of rules that I don't understand or pretend to understand, so I'm not prepared to answer that question.

Q. Do you know if any commercial or private company took tax credits for work done?

A. I don't know for a fact that they did. I assume that commercial projects -- it's my understanding that commercial projects are -- of alternative energies have different tax situations in different states and so forth, so it's entirely possible, yes.

Q. Have you ever recommended using a Stirling engine in connection with a solar project to anyone that's hired you as a consultant?

A. No.

Q. Have you ever recommended to a client the use of the Stirling engine even as a demonstration project?

A. Perhaps you don't understand what my work was, but that wouldn't -- I haven't done that, no.

Q. Okay, fair enough. Were you involved with the Stirling engine project that was on display in Las Vegas, Nevada?

A. Which one was that?

Q. Any demonstration project in Las Vegas,

Nevada.

A. I -- without more information about whose system you're talking about, I really can't answer that question.

Q. Did you work on a system that did get demonstrated and displayed in Las Vegas, Nevada?

A. I did not.

Q. Okay.

A. I don't -- now, can I -- can we clarify that, please?

Q. Sure.

A. I'd like to clarify the question, because a system might have been installed in Las Vegas that I had worked on, but not knowing whose it was, I wouldn't know if I worked on it.

Q. Okay.

A. Is that -- that's confusing, isn't it?

Q. No, that's fair enough. Okay.

A. Let me -- let me correct that even further. One of the projects I worked on involved a McDonnell Douglas dish which later became Stirling Energy Systems, and I had some participation, mainly in an oversight role, with the University of Nevada at Las Vegas who installed one of their dishes -- not the whole system, just a dish, one component -- and

operated it there, and I was aware of that. And they were working with, at the time, a company named SAIC. But there was no engine on that dish, they were simply using the dish.

Q. Was that experimental or commercial?

A. That was experimental.

Q. Okay.

A. University research project.

Q. Do you know if it ever went into commercial production?

A. Not that particular version of it.

Q. Have you ever recommended using mirrors in a solar energy project?

A. No, but there again, I'm going to ask -- I don't think you understand what my job and role as a solar engineer was or is.

Q. Did anyone ask you to consult on the use of solar -- or, excuse me, of mirrors in a solar energy project?

A. Yes. Usually when people come to me, they have a system. They're not asking me to recommend what they design, they have a design, and they ask my opinion on that design. And when we worked with the government, our work was as partners with industry who would come to us, and our -- our mission as part

of the DOE program was to support industry to develop commercial systems, regardless of technology. In other words, we were technology agnostics.

Q. Oh, sure.

A. And --

Q. So they would bring to you an existing prototype, for example?

A. Prototype or system or -- or design and ask our opinion.

Q. And you would evaluate what they had designed?

A. We'd evaluate what they had designed, correct.

Q. To make recommended improvements or to recommend the project be tabled altogether?

A. We typically didn't recommend tabling something. We would only recommend what improvements they could make or how they might be able to do it, or ask questions about have you tested this and what kind of test results would you have, or that sort of thing. Now -- and those were our initial projects.

In some cases where they got further down the line, we might -- we would be authorized by DOE to go ahead and work with them to help them develop things further.

Q. Okay.

MR. JOHNSON: Ask him if companies paid for that information.

Q. When you -- when you evaluated the systems that were brought to you to consult on, were you compensated for that work?

A. Compensated by -- the government funds the national laboratories to support industry.

Q. So the private party that came to have their system evaluated would not be charged?

A. It depends. There were different -- different working relationships.

Q. And was this true throughout the time period you worked at Sandia?

A. It evolved over time.

Q. Did you see an increase in the number of companies attempting to develop solar energy during the years you worked at Sandia?

A. Yes, I think that would be a fair statement. We did see an increase in the numbers of companies involved and we saw an increase, also, in the level of sophistication and knowledge base, and we found that some of the companies getting involved involved larger companies.

Q. Sandia was supported by the government

grants; is that correct?

A. We're a government laboratory, we're funded through the Department of Energy, and there is an operating manager for the laboratory.

Q. Any of the projects that came to you for your evaluation, were they supported by government grants?

A. In some cases, they might be, yes.

Q. Were they supported by government tax incentives, for --

A. I don't know the answer to that.

Q. Okay. Did you see an increase in the level of government support, financial support, for the development of solar energy during the years you were at Sandia Laboratories?

A. I saw the -- the trend on funding decline substantially from the mid 1980s through about 2004, to the point where our particular solar program through the Department of Energy was very close to -- several of the budget requests had been zero and funds had been put back by Congress.

Following that and following the expansion of some of the work in Europe that was putting substantially more resources into building commercial plants, the DOE funding did increase.

Q. So did the trend change in 2005?

A. The trend of people coming to us asking for help increased in probably the early 1990s. There was a large groundswell of people wanting to do work in concentrating solar power areas. I assume it was the same for photovoltaics, but I didn't work in photovoltaics. But the -- but the government funding typically doesn't respond to that, it responds to other drivers.

Q. Did funding increase from 2005 to 2011, when you left Sandia Laboratories, for solar energy development?

A. For concentrating solar power, it did.

Q. Okay. And the systems that you evaluated involving solar energy projects while you were at Sandia, did any of them involve using a mirror to concentrate solar energy?

A. The bulk of concentrating solar power concentrators utilized mirrors. Power towers use a heliostat, which is a slightly curved mirror, dishes use the most radically curved mirrors, they're curved in two dimensions and troughs use linear focus parabolic shapes, also mirrors.

There was -- we also evaluated some concentrators that use a silvered polymer film to

replace that. There were some thoughts that that would be -- long-term, that that could be less expensive and still high performance. We did test those on and off over the years that I was there. They haven't since really made it into the commercial marketplace for lifetime issue reasons.

Q. Right. I read an article, something you wrote, that suggested that that film system was not commercially viable because it had too short a life in the real world application. Was that a conclusion you reached?

A. At that -- at that time. That doesn't mean that new films can't be developed or aren't developed already that, in fact, could address some of those concerns.

Q. If there is such a thing, though, you're unaware of it as you sit here today?

A. Yeah, you know, I haven't looked at polymer films for quite -- for probably ten years, so that's -- they could be a lot further along. I just haven't seen them appear on a commercial basis yet.

Q. Fair enough. In connection with your work, have you evaluated the use of mirrors in solar energy projects to determine how viable using mirrors to concentrate solar energy is?

A. Could you explain what you mean by how viable, what viability means?

Q. Commercially able to bring electrical energy onto the grid at a reasonable cost, at a competitive --

A. At a reasonable cost, okay.

Q. Yeah.

A. Virtually all of the projects we worked on, there was a cost component to it. Oftentimes engineers tend to get wrapped up in the technical aspects and the ultimate cost of the product that they're going to produce isn't -- isn't considered in detail until late in the project, what we would call maybe stage 3 or stage 4. The -- we tried to bring that to bear in all the projects we worked on. Typically that was done in conjunction with the industry partner, and typically they were way ahead of us on that. They understood where their costs were and where their issues were and what they needed to address, and we would try to help them in addressing those issues. So I think that answers your question.

Q. It does. What -- what maintenance or degradation issues attach to using mirrors for solar energy concentration?

A. You know, that's a pretty broad question. Would you -- could you narrow it a bit?

Q. Well, I -- first of all, I want to approach it as a general subject. If you decide that you are going to use mirrors in a solar energy project to concentrate the solar energy, what concerns as a consultant would you be aware that they -- the use of the mirror would require you to encounter and overcome?

A. The main issues using a glass mirror -- when you say mirror, I'm assuming you're saying -- mean glass.

Q. Yes.

A. A glass mirror is the issue of keeping it clean. And it has one surface that you have to clean, and that's very dependent on where you -- where you are locating the plant. Now, that's assuming you've got a design that's been vetted and the design is valid and all of that.

Q. Um-hum.

A. And usually when people come to us, the concentrator in the form of typically a trough, sometimes a dish, and sometimes a heliostat, the issues of actually tracking the mirror are well-understood and well-documented and people have

paid attention to that. You're concerned about how it's actually physically supported so that it will sustain operating and -- and survival wind loads. That's -- that's a key consideration. You don't want to break the glass, right?

And the -- but from an operational perspective, once you've got a design that -- that meets the criteria and have established a specification for it, the only real O&M issue on any of these is how often you need to clean them and keep them clean, and that's very much dependent on the location of the plant.

Q. Okay. Do you know of any way to automate cleaning of glass mirrors for a solar energy project?

A. There have been a number, over the years, of approaches to doing that.

Q. Any of them commercially viable that you're aware of?

A. I don't know, because there were a couple that were very close to being done in Europe, in Spain specifically, for troughs that would run along the trough and clean it. The -- the only issue relative to cleaning is what the cost of cleaning is, and if you can absorb that cost, which operating plants have done, to do it with semi-automated

approaches, the one I'm aware of that I know is in use involves tipping the troughs towards both -- toward the center of the space in between them and driving a tractor that then sprays and cleans the glass on both sides as it goes, and that's used very commonly in Spain and other places, here in the U.S., as well.

Q. Hum.

A. It involves rotating sprayers and they -- and they minimize the amount of water they're using which is always a concern because you're using deionized water. And they may find -- and the methodologies that I'm aware of are that typically in the down times during the winter when there's less solar energy available or there might be clouds, they'll go back and maybe take part of the crew and do a contact cleaning of the glass to have it ready to go during the main production time of the year which is in the spring and summer, so that they bring it back pretty -- pretty darn close to the clean -- the as-installed condition. So there are methodologies for doing this, and there's a whole level of issues around how you'd -- how you would do this. There are also issues around -- that have been used around applying surfactins and other things to

keep the mineralization or any contamination from bonding strongly to the glass. So there's a lot of work that's been done on this over the years.

Q. Yeah. Have you done any work or evaluation about the degradation that environmental dirt particles have on mirrors and the rate of reflection?

A. You know, I haven't done any of that work specifically myself, no.

Q. What about the effect of sand on solar mirrors, particularly in an environment where sand can be driven by wind into the mirror system?

A. I haven't, myself, looked at that, but a lot of people have.

Q. Okay. Are you aware that sand can damage mirrors used in solar concentrators?

A. It's possible that they could, but most of the glass that's been used shows very minimal effect from sand damage.

Q. Okay. Do you know what steps are taken to reduce dirt particles from interfering with the mirrors in a commercial project involving mirror solar concentrators?

A. Just washing it.

Q. Just washing. Have you seen any system that uses rocks below the structure as a way of

reducing sand interference with mirrors?

A. I'm not aware of that, no.

Q. Okay. You mentioned wind loads. Is there a point where wind loads require mirrors to be stowed in order to prevent damage caused by the wind?

A. We worked with industry a number of years ago to develop a generic set of specifications around that type of a requirement, and typically, although this is up to the individual company what they want to do, they typically will go to stow somewhere around 30 or 35 miles an hour, or they design -- maybe put more correctly, the systems are designed to operate with minimal degradation up to about 30 or 35. It's up to the company whether they want to go to stow or not. Typically most companies, most designs, are done to go to stow at around 100 miles an hour for sure for -- for survival.

So it's a grey area, but the general -- general set of specifications, if you want to call it that, for heliostats, generally apply to troughs and dishes, as well, is that you want to be able to operate under some wind conditions, and typically it's been up to around 30 to 35 miles an hour with minimal degradation in performance, and then if the wind ever exceeded or approached 100 miles an hour,

you would want to go to a safe stow position.

Q. Okay. In your consulting work, do you have a view as to the percentage of cost of overall operation of a solar energy project using mirrors would be devoted to keeping the mirrors clean?

A. I've actually looked at numbers for commercial projects on that, but I -- unfortunately, I can't share. That's related to the documents that I was unable to provide, and I can't share that number with you.

Q. Okay. Do you have an understanding of what the overall costs of operation for a solar energy project is devoted to the costs of having the mirrors track the sun?

A. That would be different for different technologies and, also, for different suppliers. And it's -- there -- I don't have a single number that I could give you that would represent that.

Q. Okay. Now, it's my understanding from your testimony that you've provided no consulting services for the Ivanpah project, correct?

A. I did not, that's correct.

Q. Okay. Have you visited the --

A. Can I -- can I correct that?

Q. Yeah.

A. I -- I -- I didn't provide any formal consulting. About, it would have been, February or March of 2011, the Ivanpah project was in the planning stages and the team from BrightSource contacted Sandia and NREL and we had a joint meeting here in Albuquerque where they presented their detailed design to the labs and asked for our -- our combined input, and suggested that we might find an opportunity to work together in some areas on some of the issues that they wanted additional support on.

Q. Okay. Were you involved in the meeting?

A. I was, I attended the meeting. And the reason -- it was held at the hotel just down the street here. And the reason I remember so vividly the date is it was shortly after I had a bilateral knee replacement and I was actually back at work for the first -- that was my first week back at work, so it was easy to know that. And it was an all-day meeting, and very good discussion, they presented a lot of information, and the labs asked a lot of questions, and a lot of cross-fertilization, which is the role the labs play.

Q. Right, understandably. Did you do anything following that meeting for the Ivanpah project?

A. No.

Q. Did you reach a conclusion as a result of your contact with the BrightSource folks that the Ivanpah project would be commercially viable?

A. It seemed very, very viable at the time, yes.

Q. Okay. I believe there's video of you somewhere predicting the commercial viability of the Ivanpah project. Do you recall being recorded making a statement, in advance of the Ivanpah project coming into development, that it looked to you to be a viable commercial project?

MR. MORAN: Objection, foundation.

A. I don't recall that, no.

Q. Okay. Have you changed your mind about the viability of the Ivanpah project?

A. I have not.

Q. So as you sit here today, you think it is still --

A. I do.

Q. -- commercially viable? Okay. Have you looked into the cost of maintenance required to operate Ivanpah?

A. I have not.

Q. Are you aware that natural gas is used to heat the water in the Ivanpah system?

A. I am.

Q. Why is natural gas used to heat the water used in the Ivanpah system?

A. The Ivanpah system is a central receiver system. It has a receiver located on the top of a tower with heliostats to track the sun in two axes and reflect images to that receiver. It does not have thermal energy storage. Because it doesn't have thermal energy storage, it needs to control the temperature of the water to the -- the turbine block and also, in some cases, to the receiver to -- in order to produce the power they want to produce at that point. That requires a supplemental energy source, which the natural gas is. It was always part of the design.

Q. Without the supplemental energy source provided by natural gas, would the Ivanpah system be viable at all?

A. It would require a different design, but, yes, I think it could be.

Q. What would have to change with the design?

A. Well, it would require some change in the way they handle the heating of the -- producing the steam is all. They'd -- they'd have to supplement it maybe with a large water -- they'd have to

effectively put some sort of storage into it, or more storage than they currently have to do that.

Q. And I asked that question as if it were limited to natural gas. Any heat source, coal, any heat source other than solar energy, I want to limit it to that, could the Ivanpah project be commercially viable relying solely and exclusively upon solar energy as its sole source of heat?

A. Well, you know, the Ivanpah project is a specific design. It's designed to operate with natural gas. So if I interpret your question correctly, you're asking can a central receiver system that uses water in the receiver be designed to operate without a supplemental energy source.

Q. Yes.

A. If it had thermal energy storage designed into it in some way, like a molten salt system, and used molten salt in the receiver, the -- and that's the whole point to the molten salt design. Each different design has its own positives and drawbacks. So Crescent Dunes would be a plant using molten salt. Gemasolar in Spain would be a plant using molten salt. These are commercial plants competing, Crescent Dunes directly with Ivanpah.

Q. But all of those use supplemental heat

sources, do --

A. Not --

Q. -- they not?

A. Not necessarily. A molten salt central receiver plant wouldn't have to use a supplemental heat source. They might have natural gas available in the event they need to do something special or in an off-normal operation, and they probably would, it would be imprudent not to, but a molten salt plant is not intended to operate with natural gas. So it's a different -- different in design philosophy and in the design of the plant.

MR. MORAN: Counsel, at this point, I'm going to object to further line of questioning on Ivanpah. Dr. Mancini's report has not referenced Ivanpah, it's not -- the Ivanpah design is not an issue in this case.

MR. SNUFFER: Okay.

Q (By Mr. Snuffer) What specific qualifications do you have that are relevant to operating a power plant using a boiler and a fin type turbine?

A. Well, the -- I taught thermodynamics and thermodynamic power cycles for -- over a course of ten years, so I understand the Rankine cycle very

well. Most of the -- virtually all the power -- the trough power plants that we work with use a conventional Rankine cycle power block. Plants like Ivanpah, like Crescent Dunes use a conventional Rankine cycle power block. So we -- myself and -- that's the power cycle that -- of choice for those systems. And I have something like 30 years experience working with them.

Q. Have you ever operated a power plant using the Rankine system and a traditional steam fin turbine?

A. No.

Q. Have you ever been involved in the design of a power plant using the fin type turbine system?

A. I've been involved with working with companies who are designing systems like that, and evaluating their analytical tools that they're using to size the different components and helping them do that.

Q. Were these for coal systems?

A. No.

Q. Natural gas systems?

A. No.

Q. Solar systems only?

A. Solar systems only. I may have done a

geothermal system once many years ago.

Q. Do you know what the expected lifetime is of a traditional fin type turbine?

A. Yes.

Q. What is that?

A. On average, 40 years, and some have operated as long as 60 to 65 years.

Q. Do you know what the lifetime of a traditional heat exchanger is?

A. No, I don't know a specific answer to that, but I can respond with the following: Typical heat exchangers are fin tube designs and in conventional power plants they typically don't need to replace the shells. What happens is there are issues with the tubes. So during the course of operation a tube may go bad in multiple ways, and all they do is block the tube at either end and continue to operate until they have a shutdown mode where they do replacement of the tubes. It's planned into their O&M activities for the plant. That would be a conventional coal fire plant or it could apply to a solar plant, as well.

Q. Okay. Do you have a view on the life expectancy of a secondary heat exchanger?

A. I do not.

Q. Okay. What would happen if you used tap

water in a boiler system in a typical Rankine design?

A. Well, a Rankine cycle is a cycle, and it assumes that the water is recycled because it does have to be treated. If you use tap water, you would foul the heat exchangers, you would foul -- with deposits, much like you see from your own tap probably unless you live in a really good place. If you live in Albuquerque, we get a lot of hard water deposits. So it's -- it's -- I'm not aware of any turbine cycle that's designed to operate using tap water.

Q. And I assume, therefore, using salt water would only make that problem worse?

A. I can't imagine using salt water as the working fluid in a Rankine cycle.

Q. Okay. Have you ever invented a new device for use in connection with solar energy?

A. I've participated in inventing different things, but never been the sole inventor, no.

Q. Okay. What things for use with solar energy have you participated in inventing?

A. I've done some work with -- and, again, this is in combination with other staff members --

Q. Right.

A. -- and with industry partners relative to

designing all kinds of things that are new -- new inventions. Things like -- we talked about the polymer film reflectors; I was involved with that. I've offered suggestions and been involved with receiver tube materials and helping evaluate different codings that were selective in nature. Things like that.

Q. Have you ever received a patent for any invention that you've made?

A. I have not.

Q. Have you ever brought a new device into production for use in solar energy?

A. No.

Q. Did you work with others in developing -- well, first, let me be clear. It's my understanding that you did work in developing the Stirling engine system. Is that correct?

A. I was responsible at DOE for -- at Sandia for our DOE program for dishes and dish Stirling systems for a period of about 15 years. And what that meant was that I was the project manager on a number of funded DOE projects to develop these components. They were typically cost shared with the industry. It involved managing the people and the funds and the distribution of those funds to the

different companies developing these systems. It involved everything from the contracting to evaluating the technical -- the technical progress being made.

Q. How many engineers worked with you in total on that development effort over the 15 years?

A. Engineers from where?

Q. At the Sandia Laboratory.

A. It -- it depended on what the issues were. Typically there was a project manager, myself, and it could be two or three other people, depending on what was needed, and as the needs changed we shuffled that around. For example, if a particular company was having a problem with a certain component, we might bring a designer in to help with that. And perhaps it was a material selection issue, maybe there was a problem with the material that we were testing and had been tested for a long time, we had a lot of data on it and there were -- we would generate some sort of issue with a material that didn't manifest itself until 10,000 hours of actual testing, and we'd look at that material, we'd bring a metallurgist in to help. So we had access to a lot of different specialized areas and people who could make very -- who were very expert in their particular areas, and

we called upon them frequently.

Another example, working with molten salts, we had a group at Livermore who worked on molten salts and did substantial evaluations of different formulations of sodium potassium nitrate salts and the percentage of mixture, the degradation, the components that would cause problems, and we'd bring them in when they were needed. So it -- it depended on the project.

Q. As a consultant on solar energy thermal projects, what has been your area of expertise or areas of expertise that you've offered as a consultant?

A. Okay, so when you ask me about being a consultant, I recognize that there could be some confusion here because the role that Sandia played when I was working there was largely as a consultant in many ways, too. Can I assume that you're suggesting the last five or six years?

Q. That's exactly what -- August 2011 to the present --

A. Okay.

Q. -- with your TRMancini Solar Consulting.

A. I've done a number of different types of things. You've seen the reference to the three

reports on lifetime, system lifetime assessment. I -- I did that. I've done -- most of the work I've done has been systems related, although I did review some concentrator designs in detail. Just generically, I did some work for an industry consortium where I helped them try to decide how they wanted to go forward to put more CSP out into the industry realm, so I found myself serving as a spokesman in some cases for them.

You know, if I had the list in front of me, I could be a lot more specific, and I apologize for that. I just haven't looked at that in many -- in a long time.

Q. Has your consulting working in any way been limited by you because you didn't feel yourself qualified?

A. If I didn't feel qualified to do a job, I wouldn't take it.

Q. Have you turned down projects?

A. Yes.

Q. Tell me what kind of projects you've turned down because you didn't feel you were qualified.

A. Oh, I think somebody came to me with a photovoltaic tracker that they want wanted me to evaluate, and I wasn't interested and I honestly

didn't feel qualified to do it and I didn't want to do it, so I said no.

Q. Any others apart from the photovoltaic tracker?

A. I've been approached to do some -- some projects that I probably was qualified for, but I turned down because I didn't want to work that hard.

Q. Do you think you're qualified to consult on a type of turbine engine to be used in solar thermal energy projects?

A. Yes, I think I'm -- I'm comfortable doing that.

Q. Have you consulted on any type of turbine used in solar thermal energy?

A. No. Apart from the current project, no.

Q. The current project being the IAS system?

A. That's correct.

Q. Okay. Have you consulted on a type of boiler to be used in power plants?

A. I've reviewed a number of system designs that would include boilers and so yes, the answer to that is yes.

Q. Have you referred anyone out to another consultant for boiler-related design issues, as a consultant?

A. I'm not sure. I may have on one -- on one occasion. There's another consultant who -- I have referred -- particularly people working with molten salt systems, I've referred to a couple of other consultants who were specifically -- who have done a lot of work in molten salts.

Q. Okay. Do you not feel qualified to consult on molten salt related issues?

A. No, I feel qualified to consult on molten salt issues as long we're not getting into the details, materials, capability, and some of the chemistry associated with it. In those regards, I've actually called in a consultant who helped me on a project for some of that and referred other things to him when it was -- when that was the major focus of the work.

Q. Okay. Do you have an errors and omissions policy in effect for your consulting work?

A. No.

Q. Have you ever had an errors and omissions policy for your consulting work?

A. No.

Q. Okay. Did you ever apply for and get turned down?

A. No, because that -- that's not the way I

work. I don't -- I -- prospective clients come to me.

Q. Okay. Are you currently licensed to put a civil engineering stamp on a design for a structure?

A. No.

Q. Have you ever been licensed to put a civil engineering stamp on design for a structure?

A. No.

Q. Have you been involved in any way, at any time, with designing a turning mechanism used in solar energy projects?

A. What -- what do you mean by a turning mechanism?

Q. Something to keep the --

A. A tracking structure?

Q. Yeah.

A. Yes, I have.

Q. What -- tell me about your background on tracking structures, beginning with Sandia and -- and coming up to the present.

A. Well, I mean, whenever we evaluated a system -- for one thing, I worked for 15 years with dishes. The issues there are tracking in two axes with high accuracy.

Q. Right.

A. So working with companies, a lot of the work we did was testing their equipment and measuring how accurate the tracking was, and when it wasn't up to snuff, recommending changes to it that they could make to improve the tracking reliability -- the tracking accuracy.

Q. Were those -- were those design changes that you were suggesting to --

A. They typically would have to be, yes.

Q. Okay.

A. Sorry.

Q. Okay.

A. I spoke over you, I apologize.

Q. Have you ever designed a tracking system on your own?

A. Not from scratch, no.

Q. Okay.

A. Well, I take that back. One of the innovative concepts that I developed during the dish program was an innovative tracking mechanism that ultimately wasn't -- that we didn't pursue, but it was a two-axis tracking mechanism.

Q. Why didn't you pursue it?

A. Well, we had no application for it, for one, and it turned out that one of the people we were

competing with had one that was very similar and it wasn't worth trying to pursue it.

Q. You described it as innovative. What was new or different from the system?

A. It used a -- it used a different -- different set of components for moving the dish in two axes.

Q. Okay. Have you designed a hydraulic system used in a solar energy tracking?

A. Actually, the one the I'm referring to involved hydraulics --

Q. Oh.

A. -- and that's -- that was a little bit innovative. That was back in the 1970s.

Q. Okay.

A. Or -- no, 1980s, I apologize.

Q. Have you ever operated a hydraulic system to track?

A. One of the -- one of the initial dish projects that we had was with a company named Accurex out of California, Mountain View, California, and they had a two-axis -- typically the elevation axis is hydraulic on a dish, and the azimuth axis in their case was also hydraulic. And the "innovation" that I worked on at one point was related to that.

Q. And have you ever operated a system like that?

A. We tested that dish, yes.

Q. Okay, you personally did?

A. I was involved -- I was the chief engineer responsible for testing that dish, yeah.

MR. JOHNSON: Can I ask you a question? Was it a hydraulic motor system?

Q. Oh, yeah, was the motor system itself involved with --

A. It was just -- it was pressurized.

Q. -- or hydraulic?

A. I don't know what you mean by a hydraulic motor. It requires a pump.

Q. Right.

A. A pump is all that's required, a pump and the oil and cylinders.

Q. And what was your involvement with operating the tracking hydraulic system?

A. Well -- what was my involvement with operating and --

Q. Yeah.

A. We tracked the dish and measured the power produced by that dish over the course of a day for -- for weeks, and so we ran the system.

Q. Because the sun moves on the horizon, the tracking system is going to have to adapt to that movement of the sun, correct?

A. That's correct.

Q. How does the -- how does the aim of the receiver get adjusted in the hydraulic system you're talking about?

A. Well, what happens is the dish is tracking in two axes. It's typically tracking in azimuth and in elevation. Okay, so there are -- there are typically -- and not all systems operate this way, but some do. All systems have to have signal sent telling it what time of day, what time of year it is, and where they're located, and the tracking system will know where the sun is. Now, many systems only rely on that to drive the dish. And that is what's called an open loop tracking system, okay, there's no feedback to drive the dish. Other systems will have sensors on the dish or on the receiver telling the tracking system to update periodically relative to the signal it gets from the program tracking. It depends on the system. On a dish. Now, other systems operate differently. Heliostats operate differently, they're all open loop.

Q. Right. Which was it that Accurex in

California had, the open loop or the receiver?

A. I think they had the combination of both.

Q. Okay. Is there computer programming involved in --

A. Oh, absolutely.

Q. Did you write any of the computer programs?

A. There are stock computer codes available to do that. Most people take those stock codes, they've been published for years, since the 1950s and '60s, and they take those codes and they put their own little wrinkles in them that they want to do or maybe adjust them to accommodate their particular dish that may have a certain amount of lag or whatever they need to do to do it, so...

Q. Have you personally been involved with any of that programming?

A. No.

Q. Okay.

A. I mean, I'm aware of it and I've looked at the codes, but in terms of developing the initial codes, I'm not a specialist in coding, that kind of coding.

Q. Have you ever designed a parabolic mirror solar energy thermal system?

A. Everything we're talking about is a

parabolic mirror of some sort. Could you be a little bit more specific?

Q. My understanding is that some of the parabolic mirror systems require the design of flexible metal holes to be used in the mirror itself. Is that your understanding?

A. I'm not aware of anything like that at all.

Q. Okay. You're acquainted, I think you've already talked about glass tubes around the pipe used to collect the energy from mirrors. Do the glass tubes themselves have any effect on the ability to collect the energy from the mirrors?

A. So we're talking about the receiver tubes for a parabolic trough system; is that --

Q. Yes.

A. -- correct?

Q. Yeah.

A. Yeah, and so the question was? Could you repeat the question?

Q. Do the tubes themselves have any effect on the ability or the efficiency of collecting the energy?

A. The tubes themselves have -- have several -- you mean the glass tubes on --

Q. Yes.

A. Okay. It's important -- they're oriented relative to the parabolic trough in such a way that the light is incident normal to the surface so you get the most transmission through the tube you can get, so the transmissivity of the glass is important because you don't want it coming in at large angles that won't -- will be reflected, the booster angle, if it's too deep.

Q. Okay.

A. Okay, so you avoid that in the design. So, yes, they do have some because some is reflected away, but it's relatively small. They have some loss due to the optical loss.

The other part that's important is that they have to sustain a vacuum in the space between them and the black receiver tube in the middle.

Q. Why is that vacuum important?

A. It's an insulator.

Q. Okay.

A. It reduces thermal losses.

Q. And the curvature of the glass tube has to be taken into account in order not to lose solar energy due to the angle?

A. It's circular, and so if it's circular, it's -- it's close enough. You lose a little bit,

but, you know, we're talking about a couple percent at most. I don't remember the exact number on -- on these things. But it's -- it's a water white glass, it's a special glass, a borosilicate glass and it -- in fact, Schott, one of the big manufacturers of these receiver tubes, used to have a manufacturing plant here by the airport in Albuquerque, and they -- they operated here for about five or six years when they thought there was going to be a huge market in the southwest U.S., and when that didn't materialize they shut down their plant, but they had some specific measurements and I -- I -- we spent quite a bit of time with those people looking at different things and helping develop some of their instrumentation, and so -- but I don't recall the actual numbers.

Q. Is there any maintenance required to maintain the integrity of the vacuum tube receiver or is it all or nothing?

A. They can fail through some leakage. The getters, there's a special material put inside -- what happens is hydrogen is an extremely small molecule, like the smallest one, since it's a monomolecule, and it can -- it can penetrate a lot of things, so over time there can be hydrogen leakage

out of the -- out of the oil that's flowing through the inner receiver tube, and so you put special materials in these space that are called hydrogen getters that absorb that hydrogen, because hydrogen also turns out to be, per some nuclear reactors that are designed to use hydrogen as the working fluid, an excellent heat transfer fluid. So you don't want it in there because it will make your losses greater. So those getters can fail and that can happen, but apart from that, the major issue is the glass to metal seals, and if those are broken or if somebody hits a receiver tube with a truck, which happens more often than you might expect, and breaks the tube, that's usually the reason for -- for having to replace them.

Q. Right. The solution for a vacuum tube with -- with an issue is replacement, correct?

A. If -- if it's really bad. Most -- most plants will, if they have just one or two in a string, it doesn't represent enough of a loss to be an issue and they'll operate it for a while with that, and then when they shut down for annual maintenance, they'll replace it. But most of the time -- and I've seen plants operate with broken tubes simply because it wasn't convenient to stop and

the losses weren't significant enough to matter.

Q. But in order to replace --

A. Yeah.

Q. -- a failed tube, you do have to shut the entire line down, correct?

A. The line has to be shut down, yes, and that's typically done, you know, in a plant shutdown or if something happened and you had to shut down a line, that's only one of many lines so it -- you can still operate the parabolic trough plant.

Q. Okay. Is there a single type of receiver that is most often used in thermal, solar or parabolic mirror systems?

A. There are two manufacturers, mainly two. There are -- have been a couple of flash in the pans come up once in a while, but most people building commercial plants will buy from either Schott or from -- I'm losing for some reason. There's a company that used to be run by Tabor in Israel, it used to be called Soleil, and it's -- the manufacturing -- the technology was purchased from them by Siemens and now I think Rioglass owns it. So I think they're currently being made by Rioglass. But I -- I apologize, but I'm not positive on that, who owns it now.

Q. Okay.

A. So those two receivers are, by far, the ones that -- you know, 99.9 percent of the people with commercial plants will be using those.

Q. Is there a predominant heat exchanger or heat exchangers used in the solar energy being produced by parabolic mirror systems?

A. I'm not sure what you mean by that.

Q. Is there a predominant heat exchanger manufacturer --

A. What kind of heat exchanger? See, when we talk about a solar plant --

Q. Um-hum.

A. -- there are heat exchangers for doing all kinds of different things, including the receiver tube itself is a heat exchanger. Okay, so can you be more specific?

Q. The heat exchanger converting what runs through the solar concentration side into the turbine side.

A. Okay, those are typically shell and tube heat exchangers and there are a lot of people supplying those. A lot of different -- you know, I --

Q. So there's no one that has market --

A. There's -- there's -- there's -- that's not a specific piece of equipment. There are a lot of people who can provide those.

Q. Is there a maximum theoretical limit to the temperature of oil that can be used in a parabolic mirror solar energy thermal system?

A. The maximum practical level is about 400 C. Above that temperature, the -- the oil degrades and it -- most systems, because they try to operate as close to that limit as possible, will have a ullage system built into them to take the degradation products out and provide some make-up oil. But they won't operate much above that or -- or -- or close to that if they can avoid it.

Q. Is there a theoretical limit on the temperature for molten salt use?

A. Again, I don't know if it's theoretical. I think we're talking about practical limits in terms of operation. Molten salt typically has been operated up around 565 C. There are some indications that you could operate up as high as maybe 600 C with a molten salt. The issues there, you're starting to approach material compatibility issues with piping or heat exchangers that are in contact with that high temperature salt.

Q. Okay. How do you deal with the loss of solar energy heat in the transport of the energy collected by the mirror to the turbine?

A. In which system?

Q. In -- in both sides. How do you --

A. What solar system are we talking about?

Q. Parabolic solar collector.

A. Parabolic trough systems?

Q. Let's start with that.

A. The piping is insulated. There are limited runs. Some of the runs might be heat traced, so you deal with that. The biggest issue, single issue that -- you have some losses even in insulated piping, but if the runs are -- if the piping gets to a header that's fairly large diameter, you reduce your losses substantially because you can insulate that and you're carrying a lot -- a lot of fluid.

The big issue is not so much the thermal loss, it can be the accommodating a rotating joint in the -- of the system, and those joints are hard to get them to operate for long periods of time and become an O&M issue.

Q. As a consultant, how have you -- what recommendations have you made regarding limited runs to deal with the heat loss issue?

A. I don't know that I've made any recommendations other than in the systems I've looked at to identify that as a potential issue that needs careful evaluation before the person proceeds with the design.

Q. Okay. Is natural gas typically used to supplement the solar energy systems that you're acquainted with?

A. If a backup system or a support system is needed, natural gas is one of the most available and convenient, and right now one of the cheapest, so most systems will be using natural gas.

Q. In plants that you have looked at or consulted on, is natural gas always used in each of the systems that you've evaluated to help produce electricity?

A. Not necessarily. I mean, it's usually -- it depends. There are different modes of operation for all these plants. Depending upon -- in fact, one of the things you look for when evaluating a design is what are the modes of operation. You know, how do you start a plant up in the morning when it's cool? You might use natural gas to help preheat some of the components so that they'll -- they'll -- the expansion and contraction will occur and you can

bring them up slowly to temperature where they need to be and be ready when the sun comes up to then fire up and go full bore. You might -- you might use natural gas to supplement the solar heat if the sun goes behind a cloud for an extended period of time in order to keep the turbine operating at a steady condition. So there are different operating modes.

Q. Okay, and I understand -- I understand that those are possibilities that might happen. Can you name a solar energy project that you have consulted on that did not rely on natural gas or coal or some other heat source in addition to solar energy?

A. In my opinion, if I were aware of one that did not have a backup system of some sort, I would recommend that they get it. So I'm not aware of one like that.

Q. Okay.

A. I'm not aware of one using coal, by the way. I'm only aware of natural gas being used as a backup system.

Q. Okay. In projects that you've consulted on, do you know how much energy is produced by natural gas or other heat source in comparison to the heat being produced by the solar thermal?

A. Yes.

Q. What's the percentage?

A. I can't share that with you.

Q. Why not?

A. It's protected information.

Q. Protected by whom?

A. I have contracts with the -- the three contracts that you referenced, I looked at that issue specifically for those projects, and I can't share that because --

Q. The -- the people that are consulting -- that you are consulting for consider that proprietary?

A. They consider my reports and the details associated with that as their exclusive license, I signed a contract to that effect, and without prior approval from them, which I haven't yet gotten, I can't -- I can't go to that level of detail.

Q. Can you tell me who the three contracts are with?

A. They're listed in -- in there. The contracts are with Allen & Overy, but the three clients are Eiser Infrastructures, Limited, Antin and RREEF. They're the owners of multiple power plants in Spain.

Q. Oh, okay. Do you know if they're publicly

traded?

A. I do not.

MR. SNUFFER: Okay. Maybe we should get the spelling of those for the court reporter so we know we've got the correct name. And do you want to take a short break?

MR. MORAN: I was going to suggest that. We've been going about an hour and a half.

MR. SNUFFER: Yeah.

THE WITNESS: The spelling is A-N-T-I-N R-R-E-E-F, and E-I-S-E-R, and -- they were listed in my letter to you.

MR. SNUFFER: Yeah.

(Recess was taken from 10:28 to 10:38 a.m.)

A. Before we -- before we start, could I ask a couple of questions?

Q (By Mr. Snuffer) You can always ask.

A. Yeah, but I -- I have to answer when you ask me, right?

Q. Exactly.

A. Yeah, okay. You -- you asked me about two things that I don't know. What is a Studevent motor, I've never heard that term? I may know it by a different name.

Q. Okay, and -- and that's fine. I'm

satisfied with your answer.

A. Okay. And what do you mean by an errors and omissions policy for my company?

Q. An insurance policy to cover mistakes or errors that get made, in effect a malpractice sort of policy.

A. Okay, that's what I assumed, but thank you.

Q. Yeah. That doesn't change your answer, does it?

A. No.

Q. Yeah, okay. When the meeting was held here in Albuquerque and the Ivanpah developers were pitching the project for the folks at Sandia, did they tell you how much energy was predicted to be produced by that plant?

A. They may have done so, I don't recall the number, though.

Q. Are you aware generally that there is a disparity between the predicted output of the Ivanpah project and the actual output of the Ivanpah project?

A. I am not.

Q. Okay. Is it your opinion today that the Ivanpah project today is viable technology?

MR. MORAN: Counsel, I'm going to renew my earlier objection to this line of questioning about

Ivanpah. Dr. Mancini hasn't been presented as an expert on Ivanpah, and his limited knowledge of it isn't relevant. You can answer.

A. The answer -- yes.

Q. What stage of operation would you classify Ivanpah to be at from stage 1 to stage 4?

A. It's in the lateral phases of stage 4.

Q. Okay. Would you recommend that that project be reproduced on a mass scale for production of electricity?

A. Yes.

Q. Do you know if Ivanpah is more expensive to produce electricity than a coal-fired plant would be?

A. I don't know the economics behind the Ivanpah plant so I'm really not in a position to comment on that.

Q. Okay. What stage of development are photovoltaic systems now in residential use?

A. I'm not sure I understand that question. They're being sold commercially so they're in the marketplace, they're past stage 4. They're in the lateral stages of phase 4.

Q. Okay. Do you consider a lens to be the equivalent of a mirror in concentrating solar energy?

A. It serves the same function. It's not the

same. I mean, there are different principles, physical principles involved.

Q. But it has the equivalent effect of concentrating solar energy, correct?

A. Yes, but there are a lot of differences between the two, I mean.

Q. Sure. The IAS project uses Fresnel lenses, correct?

A. Yes.

Q. You visited the IAS project in Delta, Utah, correct?

A. Yes.

Q. Did you observe the Fresnel lenses concentrating solar power while you were there?

A. I saw a couple of instances where the solar energy was concentrated, yes.

Q. Were the grooves in the IAS Fresnel lenses facing the sun or opposite the sun?

A. They're opposite the sun.

Q. Did you conclude that the IAS Fresnel lenses were not qualified to be identified as Fresnel lenses?

A. No.

Q. You would agree that they are correctly --

A. They are Fresnel designed lenses. I mean,

they're -- that's the principle of operation. I'm not sure I understood that question, sir.

Q. Okay.

A. Could you repeat it?

Q. I wanted to clarify whether you thought the IAS Fresnel lenses were or were not qualified to be identified as Fresnel lenses, and I think you said they are.

A. Yes. They're the same, yes.

Q. Did you perform any analysis on the estimated cost of maintenance and cleaning for the IAS Fresnel lenses?

A. I did not, no.

Q. Did you do any comparison between lenses that had not been cleaned for years and lenses that were completely clean and out of the box?

A. Comparison, I don't know what you mean by that.

Q. Did you make any measurement or do any comparison of the difference between a lens that had been out in the environment for years and a new lens right out of the box at the Delta IAS facility?

A. My contract doesn't involve doing any testing or measurement.

Q. Okay. Did you form any opinion about how

long the Fresnel lenses used by IAS would operate without material degradation? And by material degradation, I mean a 10 percent loss of efficiency, or more.

A. Could you restate the question? I -- again, I'm not sure I understood.

Q. Did you form any opinion about how long the IAS Fresnel lenses would use -- would operate without any material degradation?

A. I -- if -- how long they would operate without any material degradation?

Q. Yes.

A. I didn't form an opinion on how long they would operate without material degradation, no.

Q. Okay, fair enough. Did you perform any measurements or tests while you were there at the Delta plant?

A. No.

Q. And that's true of every component of the IAS system?

A. That's correct.

Q. Did you determine any wind load that would create disruption in the focal point of the IAS system?

A. I did not determine a specific wind

condition, but I did observe that the receiver supports were swaying at a very light breeze and since I never observed a concentrator tracking in elevation and azimuth with a receiver in place or in operation, I -- I reached the opinion that the receiver supports would cause the receiver to move relative to the facet and potentially reduce the intercept.

Q. Okay. But you didn't take any measurements or do any tests --

A. I did not, no. My contract didn't include that.

Q. You would agree, would you not, that the steel frame used by IAS could be adapted or strengthened in order to cope with the greater wind load?

A. I don't know whether that's necessary or not. I never saw any design analysis or detail or any testing or performance results that would suggest that it was inadequate or adequate, either way.

Q. Okay. Are you aware that IAS system uses a vacuum tube?

A. For what? I don't understand.

Q. As a receiver.

A. The receiver that I was told isn't a

vacuum -- wasn't in a vacuum.

Q. Okay.

A. I was -- the receiver design that I was told was the operating receiver is different than that.

Q. Okay. So if IAS uses a commercially produced vacuum tube system produced by another company other than IAS, you have no knowledge about that?

A. Oh, that's correct.

Q. Okay. Did you determine there was any distance, any specific distance between the towers and the turbine for the IAS system?

A. No, I didn't -- I didn't.

Q. Did you do any analysis on the light scattering of the IAS Fresnel lenses while you were there at the -- at the plant?

A. I didn't do any measurements or testing when I was at the plant.

Q. Or take any readings?

A. Well, I would consider that taking measurements or testing. Isn't that correct?

Q. Okay, well, then let's mark this as Exhibit 1004.

(Exhibit 1004 marked.)

Q. (By Mr. Snuffer) This is one of the documents that was produced in response to the subpoena we talked about earlier. It's a Statement of Work, and there's -- there's numbered items beginning at 5, and then going on to 17. Is that your signature on the last page of Exhibit 1004?

A. Yes, it is.

Q. Did you prepare this document or did someone else prepare this document?

A. This was a Statement of Work provided to me by the Department of Justice.

Q. Okay. So, for example, on the first page, 5, Purpose, it says "Briefly describe your understanding of what the government requires and how you intend to satisfy these requirements?"

The response says, "Dr. Tom Mancini of TRMancini Solar Consulting, LLC, is an expert on solar energy technology. The government requires an expert evaluation...," and so on. Did you compose any part of that?

A. You know, that was over two years ago. I don't recall whether we iterated on the response or not or what the content of -- of the response was. I'm sorry.

Q. The response to item number 5 indicates that there is a budget of $96,000 for your involvement. Do you know what the total to date is that you have been paid?

A. I do not.

Q. Do you know if it has exceeded $96,000?

A. Oh, it hasn't exceeded $96,000, no.

Q. And do you know if there have been any supplemental agreements to increase the budget above 96,000?

A. I'm not aware of any supplemental agreements.

Q. Okay. Under the Statement of Work, number 6, there's a sentence that begins at the very bottom of the page, "Dr. Mancini will prepare an expert report that conforms with the Federal Rules of Civil Procedure..." Do you know what the Federal Rules of Civil Procedure are?

A. I was asked to look at some stuff related to the Federal Rules of Civil Procedure, but I didn't see anything that was out of the normal of what I would do anyway, so I didn't really pay attention --

Q. Okay.

A. -- to what they actually are. In other words, it seemed consistent with the kind of thing I

would do.

Q. Does that help you recollect whether you wrote the response or whether this was response was written by someone else?

A. Again, I -- it very possibly could have been written by someone else, my input might have been solicited, and if something didn't -- didn't seem to effect it, I didn't offer any input or did offer input. I don't -- I don't recall.

Q. Number 13, the points of contact, the contact information for the expert is you at apparently your work address; is that correct?

A. Yes.

Q. And then for the United States, there's a list that includes one, two, three attorneys. Have you had contact with any representative or party for the United States other than these attorneys that are listed here?

A. The only other contact I had was with their information technology guy helping -- they sent me a computer with the documentation on it and I was having some trouble with it, and he helped me with it.

Q. Okay. All right.

(Exhibit 1005 marked.)

Q. (By Mr. Snuffer) I'm going to hand you what is marked as Exhibit 1005. Do you recognize this document?

A. Oh, yeah.

Q. Is that your handwriting on the document?

A. Yes, sir.

Q. Did you type the typewritten portion of this document, as well?

A. Yes, I did.

Q. As I understand this document, and correct me if I'm wrong, this is a list you prepared before visiting the Delta plant in January of 2016 with notes that you handwrote while you were at the Delta site on January 24th; is that correct?

A. That's correct, I laid out an outline for myself of the things I wanted to talk about or at least ask about so that I would know -- if and when I was able to get answers to those questions and ask them and -- and so forth, yes.

Q. Okay.

A. Short answer, yes.

Q. You typewrote onto this, "Traveling companions," and then "Skyler Bradbury, IRS attorney," but that's typewritten?

A. Yeah.

Q. Did, in fact, Skyler Bradbury accompany you on a trip to Delta in January of 2016?

A. He did, he was the only one I knew in advance was going to be there, and there were a number of other people who I added in -- in the -- in the notes.

Q. And what role did Skyler Bradbury have?

A. He is my point of contact with the IRS project.

Q. Okay. Why have you been in contact with the IRS?

A. I have a contract with the IRS, also, that I provided you copies of.

Q. And what is the purpose of the IRS contract?

A. It's very similar to this one, to assess the IAS technology, whether -- its current status and whether it has commercial potential.

Q. Have you provided to the IRS a report separate from the report that we have in this case?

A. I have not provided a final report to the IRS at this point. What I have done was as the projects evolved, it became clear that at least my initial -- the guidance on writing the contract --

writing the report and what it was supposed to contain was a little weak on both sides for me, so I wasn't quite sure what would be contained, so I contacted both Skyler and Chris and we discussed my preparing an initial report for -- on the project that I would provide to both of them, and then based on their specific needs of focus and whatever, I would refine from there. So I wrote one report, charging them each half for that first draft report, and I haven't pursued the IRS project past that point at this point, and the DOJ result of my eventual report is the one you received.

Q. Okay. Is there a separate budget for your consulting work with the IRS?

A. There's a separate budget and a separate contract.

Q. Do you know what the total contract amount is on that contract?

A. It's been adjusted a couple of times based on, mainly, the term of the contract. The amount hasn't been changed. It's -- it's in the contract, I don't recall.

Q. Is it the same, $96,000?

A. No, it's a different number. I believe -- I honestly, I don't remember. It's...

Q. The report that you prepared in this case is being used in the Federal District Court in the District of Utah. Do you know if the reports that you -- the report you are preparing for the IRS will be used in a different court?

MR. MORAN: Objection, this is getting into the drafting of the report, which is a privileged matter and not discoverable, so to the extent that this question calls for you to divulge information that concerns the drafting of your report either with the United States or with the IRS, I'm going to instruct you not to answer. If you can answer the question without divulging that information, you can answer.

A. Could we repeat the question, please?

Q. Well, maybe a better question is, do you expect to be called by the IRS to testify in the tax court in any proceeding?

A. It's -- yes.

Q. Okay. The next name is David, I think it's Sorensen, but that's your handwriting. Can you --

A. Yeah.

Q. -- tell me that name.

A. Yeah, well, I'm not going to do much better than you do. I didn't like the way this copied very

well. Yeah, I think -- I think it's David Sorensen.

Q. Do you know who he is?

A. I think he -- he was one of the IRS field guys.

Q. Okay, he's somehow affiliated with the IRS?

A. That's my understanding, yes.

Q. And then there's a name Kate I can read, and I don't know --

A. It's Kate Maracas.

Q. Do you know who she is?

A. She's another expert witness.

Q. Do you know who she's employed by?

A. I assume by the IRS, but I don't know.

Q. Where did you meet up with Skyler Bradbury for this trip? Did he fly from Albuquerque with you?

A. No.

Q. Where did you meet up with him?

A. I met him -- he picked me up at the airport in Salt Lake.

Q. Where did you meet David Sorensen?

A. We went to the IRS offices and all of us got in a car and drove down.

Q. Kate was also at the IRS office?

A. Kate -- Kate met us there, as well, yes.

Q. Okay. The next name is Kevin, and I can't

read the last name.

A. I think it's Madison, and then Martin Townsend.

Q. Uh-huh.

A. And they were other people affiliated with the IRS, and they met us at -- they were also, I think, field officers of some sort, affiliated, and they met us at -- in Delta, as I recall.

Q. They were already down there?

A. You know -- yes, I think that's correct. I -- I'm not going to say for sure it's correct, but I believe the two of them met us in Delta.

Q. You were picked up at the airport by Skyler Bradbury. Do you recall what time of day it was?

A. I was picked up at the airport hotel, at a hotel near the airport.

Q. Okay.

A. And it was early in the morning, yeah, about 7:00 a.m. or so.

Q. Okay. Do you know what time you -- approximately what time you arrived in Delta on January 24th?

A. It was 9:30 or 10:00.

Q. You have listed Neldon Johnson, Dave Nelson and Paul Jones. Do you recall who they were?

A. Yes, Neldon Johnson is the defendant in this case. Dave Nelson, I don't remember who that was. I assume it was his son, but I don't know. And Paul Jones was the attorney, his attorney, I believe.

Q. Okay. There's two different colors of handwriting. One is in blue ink and the other is in black ink. Next to what we've been looking at, there appears to be the word "overview" written?

A. Um-hum.

Q. Is that also your handwriting?

A. Yes.

Q. Did you write "overview" at a different time than you wrote the blue ink?

A. Boy, I don't remember. I do remember -- see, I carry multiple pens because I'm an engineer, and engineers are always afraid one pen is going to quit working. So I could have written it at a later date or I could have written it -- if I were really -- if I were -- I think I wrote it on the day I was there, I honestly do, but it could have been at a later date for -- for some other reason. I don't know.

Q. Okay. Underneath "overview" there's typewritten "The Site" and then a list of things. Were these things that you looked for or wanted to

look at in this inspection?

A. They were things I wanted to look at and ask questions about and get as much information, written information if possible, that I could.

Q. Okay. Did you inquire at Delta about all of the items listed on the site?

A. I asked multiple times about all these issues.

Q. I don't see any responses written down. For example, "total acreage at the site," there's nothing written there. Did you inquire about that?

A. Yes, I did.

Q. Did you get an answer?

A. I -- I got an answer, and the best of my recollection the answer was, well, we can use as much area out here as we want.

Q. Okay. There's an item, "sketch of the site layout." Did you inquire about that?

A. I -- I did, and I intended to make a sketch and when I got to the site it turned out it wasn't necessary.

Q. Why was it not necessary?

A. There -- the collectors I saw that were installed were installed in a straight line and there wasn't any reason to -- I thought there was going to

be piping layouts, which there were not. I expected there to be heat exchangers, which there were, but there were no pipes to them. And I expected there to be a turbine assembled and in operation and there wasn't -- wasn't one there.

Q. You've written "pipe sizes ?." Why did you write that?

A. I was concerned about how the fluid was going to be carried around the field, and when I saw there were no pipes, it became a moot point. And what I was really referring to here was PIDs, which is an engineering term for piping and instrumentation diagrams, and I asked about that and was told that they didn't need them.

Q. Okay. Handwritten next to that in blue ink is "a lot of options," and then a series of dots. What are you -- what were you discussing when you wrote "a lot of options"?

A. I think what -- I'm not positive, but I think this was during -- we were given a briefing by Mr. Johnson, and the -- there were a lot of different things discussed. All the different things that he thought they could do with different components and different systems. And I'm -- my focus was on the power generation system, and I realized that there

were a lot of other things that he was considering.

Q. Okay. You wrote down "concentrated PV." What -- why did you write that down?

A. Because it's one of the things he mentioned.

Q. Then you have a series of four more dots. Did he tell you about four other things that you did not write down?

A. I don't know. You know, I might have been anticipating other things or maybe I just didn't write them down. He did discuss other things like sodium batteries and desalination and some other -- other things.

Q. And you're recalling that from memory, it's not --

A. I am. It's not in the notes.

Q. Then there's "General Comments/Plans," typewritten with "current acreage, expansion," and so on. Did you inquire about that?

A. When we were out at the site, I did, and I was told that we have a lot of room out here, we can do whatever we want to do here.

Q. Did you get total number of acreage that was available?

A. Never -- never did. I was never provided a

number.

Q. Were you told that there were thousands of acres available?

A. I was told as far as you can see in any direction.

Q. Okay. Did you ask about technology changes and upgrades?

A. I did, because prior to going I had read the white paper from the site -- from the -- from the website, and I was interested in trying to understand where the prototypes of all these different things that were discussed, where the system was, and see component tests and component test data and I asked about all these things and was told, oh, we don't keep data and that they couldn't show me any component test set-ups.

Q. There's an entry for -- it's cut off, but I think it's "impression of the site."

A. Yes.

Q. Did you get an impression of the site?

A. I did.

Q. You didn't write anything down?

A. No, I didn't.

Q. What -- what was your impression of the site?

A. Well, I had different impressions of each of the three sites. I found that the manufacturing facility looked very much like a farm shop to me, I grew up on a farm, and that the activities there were not of the scale that I would have expected to have seen for a project at the level that had been described to me.

The test site, itself, was quite disheveled. There were broken parts laying all over the place. The solar concentrators were not tracking. The -- nothing appeared to be in working order. They did -- they were able to track one concentrator in azimuth only, and they burned a piece of wood to show something happening.

I was not impressed with the site. Instrumentation was lacking. There was no -- very little instrumentation. There were no pyranometers. I can't imagine a solar site without having pyranometers to measure the solar input, that's the first thing you want. There were no -- no instrumentation set-ups to do any testing or to show me any test results, and they -- and when I asked about test results, I was told they don't exist, we don't keep them. So I was not impressed there.

On the construction site, there were a

number of pipes installed that would support concentrator towers, and that's about all. So I guess I found the whole operation not to be what I expected to see when I arrived.

Q. You've written below that, "prototype, component tests ?," and "data." Why did you write that down?

A. Because that's what engineering is all about. You know, you -- you want to see the data, the prototype data, you want to see test data on components, you want to see systems in operation, and you want to see the data and the operation of it. I wanted to see the design drawings. Where were the design drawings? And I saw none of this in any of the 25,000 pages, plus, of the RaPower-3 file on this account, on this case, or during my visits there.

Q. Next to "component tests," you have a question mark. What -- what happened regarding component tests during your site visit in January of 2016?

A. Nothing happened, that's why the question mark. You know, where are they? Why -- why didn't they provide it?

Q. And you did no tests of any of the components?

A. I did no tests.

Q. Okay. On page 2 of 6, the next section has typewritten "Solar Concentrator," and then a list of things. Did you inquire about these things at the -- at the site in Delta?

A. Yes.

Q. What did you learn about the design while you were there?

A. Not very much, and that's the problem. I had expected to go over design drawings with a design engineer and at least look at the assembly drawings and have the opportunity to ask some of the questions listed below, and that opportunity was never provided.

Q. Did you look at the dimensions of the four plastic lenses?

A. I did. Actually, we looked at the lenses themselves and were told what the dimensions were.

Q. Okay.

A. And the transmissivity, I asked about that, and you see the note below, it's -- it's 83 percent.

And the material of lenses, there was some confusion over what the material of the lenses was, but -- and I don't think we resolved that when we were -- when I was at Delta, but subsequently in

reviewing the Lucite file, it is PMMA, it's Poly(methyl methacrylate), provided by the Lucite company.

I wanted to ask questions about tracking and see the accuracy of the tracking, and I was not provided any detail on that.

Again, the materials and the condition was -- was not in very good shape at the test site.

And I wanted to confirm the solar power from one dish, how much power did they expect to get, and the only -- that was really not answered when we were at the site. I later answered that question for myself based on the design of the turbine, that it appears to be approximately on the order of 10 kilowatts, roughly.

Q. And then you have "losses/efficiency." What did you investigate or observe at the site in January of 2016?

A. Where -- where are we looking at that?

Q. The last item under "Solar Concentrator" --

A. Oh, "losses" --

Q. -- "/efficiency."

A. I don't see that. Where is -- where is "losses/" -- oh, right there, yeah. I was interested in what the -- what the optical performance -- the

waterfall chart for the optical component, the concentrator. What is the efficiency of the dish? What's the measured efficiency of the dish?

Q. And what did you learn?

A. They weren't able to give me any answers to those questions.

Q. Okay. Now, to the right of that list in blue ink, there's -- there's some kind of doodle and then a slash, an 11. What is -- can you interpret that for me?

A. Yeah, I think it looks like plus or minus 1 inch tolerance on the acrylic lenses, and I think that I asked that question when we were looking at the lenses and I asked what sort of tolerance they had in this assembly, and they said they had plus or minus 1 inch tolerance.

Q. Okay. Then in black ink, there's written down below "83 percent" and then a dash and "Fresnel." What -- what are you -- what did you learn that resulted in that handwriting?

A. The 83 percent was the Fresnel lens theoretical efficiency according -- what I was told at the site.

Q. Okay. And then below that, can you read me what those words are.

A. That says "to the receiver diameter." And what that means is what I was thinking about is what's the intercept of the receiver, so that the efficiency in transmitting the solar energy was 83 percent. If 100 percent lands on the dish -- on the face of one of the circular facets, 83 percent of it is transmitted through that facet. But then I'm -- I'm interested in trying to determine what the intercept of that amount of energy is by the receiver. And so to the receiver diameter, what I mean is in the plane of the receiver, that's how much, 83 percent, was actually transmitted.

Now, the question is, how -- how big an image is that, and had they measured that, and the answer was no. And I was interested in knowing whether that included a secondary concentrator, because one of their receiver designs had a secondary concentrator. If you recall, one of them has a cone on top, and that could be impacted in why they did that. And I was given an explanation that, well, that's so that the receiver could -- could twist around a little bit and we could try to intercept the image more effectively. That essentially told me that that image was bigger than the receiver itself, and it told me that very possibly that receiver image

was moving, which is what I suspected based on the receiver supports.

Q. Then you've got the secondary concentrator list of items typewritten. Did you inquire --

A. We looked --

Q. -- about that?

A. We looked at the secondary receiver and I did inquire about that. Pretty quickly I was made aware that we're not using that anymore, it's not important. So I gave that less -- less -- I didn't pursue the discussion further.

Q. Were you told why there was no secondary receiver now being contemplated?

A. We have a better receiver. I was told, we have a better receiver. And then -- and during -- that was back at the manufacturing facility, and I was later shown what the current receiver is.

Q. Okay. And can you describe what the current receiver was that you saw in January of 2016?

A. Yes, and it -- and it did change a little bit later on and so I have to be careful here because I'm not sure exactly what I was told during the January 24th visit. I was shown the receiver with six or seven tubes, glass tubes contained in a rectangular array and told that molten salt would

flow into these tubes through copper tubes, and that the molten salt would be heated and operated on each receiver.

Q. Okay.

A. So, at that point, it was my understanding that molten salt was the working fluid.

Q. Okay. If you turn to the next page, there's a list under "Receivers." The receivers were what you were just describing; is that correct?

A. At this point, I wasn't sure which of the receivers they were using. I only knew of two, the one -- the magic ball with the secondary on top of it and then the spiral tube receiver that was shown diagramatically in the report. So I was trying to understand how the system operated and then this third receiver was -- I don't know where in this discussion the third receiver came up.

Q. Okay. In any event, there was a third type of receiver that you looked at at the plant?

A. Yes, he showed -- he showed me that one, and this is the one they're using now.

Q. Okay.

A. And, again, my understanding was molten salt, but then he was a little bit confused because he also talked about circulating oil through the

molten salt, so I'm not sure -- through a tube embedded in the molten salt, and I'm not sure whether that discussion came up here or whether that discussion came up later on the -- on the visit on April 4th.

Q. The blue ink, first of all, can you read me the blue ink?

A. Yeah, it says "black nickel," which I was trying to -- I was told that there was a selective absorber surface, it was black nickel. I questioned that.

"Annular flow" -- "annular flow, 7.5 kilowatts," that actually was the size of the motor generator that was in the shop.

And, let's see, "molten salt heat exchanger," and that was -- I was asking about the molten salt heat exchanger.

Q. Okay. You have in black ink "90 percent, how hot is receiver during normal operation?". What -- what was discussed about that?

A. Well, I asked about the efficiency of the receiver and was told it's 90 percent. So 90 percent means that the receiver is absorbing 90 percent of the solar energy that is incident on it. And then I asked about its temperature of operation, and I don't

recall that I got an answer to that. It was just hot molten salt.

Q. Hum. You've written down "flow rate." Did you ask about a flow rate?

A. I did, and I wasn't provided any information.

Q. Then "temperatures, actual," and I can't --

A. "Actual tests."

Q. Okay.

A. I wanted to know what actual tests were run and where the data from them was.

Q. Okay. And what were you told?

A. I was told that we've tested it completely, it gives us 90 percent efficiency, and we don't keep data.

Q. Okay. Then I think it says "same loss for dish." Is that what that says?

A. The question -- the question there has to do with if they tested the receiver, how did they test it? Did they test it on the dish or on a test rig of some sort, and is that -- are those numbers representative of what it would be on the dish?

And then I noted that the dish has no piping -- has no piping loss. I think what I was doing there, I was asking about the piping loss on

the dish, but wasn't provided any number.

Q. Okay. Then below that you have "Heat Transfer System" and you've handwritten "storage."

A. Yes.

Q. Did you inquire about these things?

A. I was told -- yes, I did, and I was told about storage in the heat exchanger in the trailer.

Q. What were you told about that?

A. I was told that's where the molten salt was.

Q. Okay.

A. I was unable to confirm that. No way to get into it or...

Q. Did you ask?

A. I asked if the molten salt was there; I was told yes it was.

Q. Okay. And then what -- you've written below that "T's" --

A. Temperatures and flow rates. What are the temperatures and flow rates through the heat exchanger? What I was interested in is what temperatures on the four -- the inlets and outlets of the heat exchanger, what temperatures during operation do you get. And, again, I asked about the length of piping and a piping diagram and was told,

well, we can do whatever we want, and he didn't have temperatures and flow rates for me.

Q. Okay. If you'll turn to the next page on "Heat Exchanger." Did you inquire about the items that are typewritten there?

A. I did. It turns out that as we got further along down the list, I came to realize that there was no documentation of any actual design analysis for any of the components in the system, that there was no engineering design package, at least that they were willing to share with me, and that there were no test results that they kept that -- again, available or that they were willing to share with me, and so I would ask the questions and get similar answers to the ones I got before. And I will add that in the over 25,000 pages of documentation I saw no detailed engineering analysis, I saw no engineering design packages for any of the components of the system or for the assembly of the system. I saw no PIDs, no piping and instrumentation layout documents. I saw no component test or system test results of any kind.

Q. You've written the number 2500. What is that referring to?

A. Okay, where is that 2500? Um, I think at one point I was told that the steam would enter the

turbine at 2500 PSI, which is a little low, but possible.

Q. Okay. Then under "Turbine," there's a list. Did you inquire about that?

A. I certainly did.

Q. And what did you learn?

A. I learned that the turbine had been around for quite a while. It had been designed at least 10 or 12 years earlier. I asked about testing on the turbine. I was told that, oh, they'd done a lot of testing and it had been operated for an extended period of time, and I asked to see the data and the -- or any data they had or performance evaluation of the turbine, and I was told that they don't keep that information, and none of that information was contained in the more than 25,000 pages of documents that I reviewed.

The notes underneath, I wanted to know what the full load condition was. I later found out from the white paper document that presumably the design was done for a turbine load of about a megawatt, so that 25 dishes would provide about a megawatt worth of turbine output.

(The court reporter requested clarification.)

A. And I asked how they determined the power

rating, and I was told the efficiency of the turbine is 43 percent, that they had -- I asked about having -- did they do a dynamometer test. I was told that they had connected it to a dynamometer at one time, at some university. I wasn't told which university, or if I was, I don't recall which one. And -- but that the tests hadn't been complete, that the turbine had blown up and destroyed some of the test equipment, so they had thrown them out of the lab. I asked if it had worked with a generator and he said yes, and he showed me the generator which was a 7.5 kilowatt generator and is not properly sized to actually power 25 dishes at 1 megawatt.

Q (By Mr. Snuffer) Did you see the turbine operating?

A. I did not.

Q. Did you ask to see it operating?

A. It was totally disassembled on both occasions I was there. I did not ask to see it operate.

Q. Okay. If you'll turn to --

A. I did -- now, in that regard, I did view the video on the website --

Q. Oh.

A. -- of the turbine operating without load.

Q. Okay.

A. That -- it's -- I mean, all you're doing is spinning a turbine. There's -- it's not producing power or doing anything.

Q. Right, it's not hooked up to something that would generate --

A. No, and that, by the way, is not a safe thing to do for either the turbine or anybody near it, because it was clearly operating at a speed higher than it was intended to operate.

Q. Okay. If you'll turn to the next page, there's "Generator" and "nameplate rating, how sized," and so on, and you've written next to that, apparently, the results of that inquiry. Can you explain that to me?

A. Yes, I can, and I can confirm now that I did use two pens at the site because this page doesn't have the light-colored pen. So all these notes were taken on that day with those two pens.

Q. Okay.

A. The nameplate rating on the motor generator that he had, both one in the shop and then later I saw another one out in the field, was 7.5 kilowatts. I asked how he had sized that and he essentially alluded to the fact that, oh, it was just something

he was using, he hadn't really done much with it.

I asked what the output conditions he was designing for were, and I don't recall getting any real answer to it. I think the -- we can assemble them however we want and we can do whatever we want was an answer that seemed -- seemed to be fairly frequent.

Q. Then there's the "Substation, who is offtaker" and "contract," you've written down "no one at this point negotiating." What is that referring to?

A. I'm referring to if you build a power plant, which RaPower-3 is doing at the site, they have -- they have some of the support structure for 200 towers, 200 different dish systems, and so if they're building a plant, where are they going to put the power? Who are they selling it to? Who is the offtaker on the tower and where is the substation located? And we were told and taken to a telephone pole and shown a transformer would be put up there and it would be put right back onto the line.

Well -- and I asked, well, who is going to be the offtaker? Is the utility buying your power? Do you have a contract? And, no, we're not negotiating with them now, we're not doing that. So

there was no substation identified and no offtaker to purchase the power, and if you're -- if you're delivering 8 megawatts of power, you need a substation. You can't put that on a transformer back on the lines. More power than that's set to accommodate, plus you've got to -- you've got to control that power and it has to be managed, and that's done at the substation, so...

Q. Then on the last page of this document, you have "Manufacturing Facility" and a list of things. Did you inquire about those things?

A. I did. We went -- we had a tour of the manufacturing facility. I observed that -- minimal amount of tooling and production equipment and certainly not sufficient equipment for any sort of mass production activity or production line set-up. They were assembling a few lens facets into lens assemblies and maybe manufacturing a couple of parts for the towers, and that was about it.

Q. You've written down "1 tower/hour W" or 10?

A. One -- their -- one tower per hour was their proposed production rate. They --

Q. Okay.

A. They were going to produce one tower an hour. I certainly didn't see enough people to do

that. And I think they indicated they could do that with 10 to 20 people. There weren't 10 -- there were maybe 10 people there, but there certainly weren't 20.

And they -- there's a note there, 32 kilowatts per dish, that's roughly the amount of solar energy falling on one circular lens. And that they felt that there would be 45 acres per megawatt. In other words, 25 dishes ranged and providing power to the turbine would take about 45 acres. With an overall system performance on the order of 15 to 18 percent.

Q. Okay.

A. I asked them about the EPC and O&M contractors and the response was that -- from Mr. Johnson that he was both. He was -- he was the O&M contractor and he was the EPC that would build the plant.

Q. Okay. As a result of this visit on January the 24th, did you form any opinions or reach any conclusions?

A. I think I started to form opinions. I certainly had the opinion that I didn't see an operation that was on the scale or had the resources either in -- in personnel or in engineering that

would be sufficient to accommodate what IAS is purported to be doing. However, I also had not read all of the documentation and was reserving judgment to -- to do that.

Q. Okay.

(Exhibit 1006 marked.)

Q (By Mr. Snuffer) I'm going to hand you a document that's marked as Exhibit 1006. Do you recognize this document?

A. I do.

Q. This appears to be handwritten notes of a second visit on April the 4th to Delta, Utah?

A. Correct.

Q. Okay, and is this a document in your handwriting?

A. It is.

Q. Okay. Why did you visit Delta a second time in April?

A. The Department of Justice people hadn't been there yet and had arranged a tour for us to go again to Delta, Utah, to visit the manufacturing facility and to visit the test site and the RaPower-3 power plant site.

Q. There's a list of names there. We -- we all know who Erin Hines and Erin Healy-Gallagher and

Chris Moran are. Who is Chad Potts?

A. He is the videographer.

Q. What was his role?

A. The Department of Justice had brought him in to do video -- videos of the site during the visit.

Q. One of the things that was in the subpoena was the -- any photographs or video. You provided those on a disk as I understand it.

A. Yes, that's correct.

Q. There are no video or photograph materials that you gathered on the site visit that you didn't produce, are there?

A. There are not.

Q. Okay. And then --

A. Actually, those photographs I took during the first visit. I didn't take any photographs during the second visit.

Q. So all of the photographs of the January visit --

A. Those are -- those are my photographs from the January visit, yes.

Q. And all of the videos are from the April visit?

A. That's correct.

Q. Okay.

MR. MORAN: And, Counsel, there is no video on the disk that we provided you. We've already provided that video.

MR. SNUFFER: Yeah, okay.

Q (By Mr. Snuffer) Then you write list Justin Heidemann, Attorney, oh, NJ, Neldon Johnson, Greg Shepard. He was not there before. Did Greg Shepard provide you with any input during this April 4th visit?

A. Greg Shepard was responsible for having us tour the manufacturing site, and he attended the rest of the tour. We met Neldon Johnson out at the test site and went through the -- we had a lecture from Neldon Johnson, and we went through the RaPower-3 power site over to the test site.

Q. Okay. You mentioned a lecture. What did he talk about? Or if it's -- if that's in your notes, we'll get to that.

A. My notes on the second page have some notes from that.

Q. Okay, we'll get to that. Who is Christian Austin?

A. He's another one of Mr. Johnson's lawyers.

Q. Oh, okay. And Matt Shepard, who's he?

A. He was another -- another member of the team. I think he -- I think he's Mr. Shepard's son. I don't know that that was -- I was told that at the -- on that day. And then I --

Q. Yeah, you've got the name Don there.

A. Don, I --

Q. -- there.

A. Don attended the first one. His last name -- no, I don't know who Don was.

Q. Was he with the government or was he with the --

A. I'm sorry --

Q. -- with the IAS?

A. -- I think he was -- I think he might have been one of -- another attorney, because it seemed to me there were three attorneys there that day for -- supporting Mr. Johnson, but I honestly don't recall.

Q. Okay, under "Manufacturing Facility," you've written some information. Can you tell me what happened at the manufacturing facility from these notes.

A. It was a very similar tour from what we had the previous time, except Mr. Shepard led it this time, and he told us that all the R&D was done and they were manufacturing for the -- the finished

plant. Again, the manufacturing facility showed about the same level of operation that I saw during the first visit, with a few activities going on at a few stations, as opposed to multiple stations producing multiple components and stockpiling them for shipment to the site, I saw none of that.

The -- I was told that this is brand new disruptive technology, everything has been done from scratch and that all the R&D is done. All the components will be manufactured here and we'll do one tower per hour. And so that's just some of the things that we were told during the course of the visit.

Q. Do you know whether there has been any towers erected since April the 4th of your visit?

A. I do not know that.

Q. Was this April the 4th of 2016 or 2017?

A. 2017.

Q. Okay, so this was the following year?

A. But the first visit was in January of 2017.

Q. I thought the date on exhibit --

A. No.

Q. 1004 --

A. I mis -- misdated that, that's a mistake.

Q. So the visit was not 2016 --

A. No, I apologize for that.

Q. Yeah.

A. I have that problem with first month of the year.

Q. Oh.

A. You probably don't have that, lawyers are more precise, right.

Q. Well, I carry a calendar around.

A. But that's my mistake. I'm sorry, I should have corrected that.

Q. Okay. So all of the testimony using the date 2016 for the January visit should read, instead, 2017?

A. 2017, and I apologize for that.

Q. No, that's fine, that's fine. So this was four months after the first visit?

A. Yes.

Q. Okay.

A. I might add, during the first visit, we were told that the power plant would be operating when we came back in April. By the end of April it would be operating.

Q. And was it?

A. No, it wasn't. The towers hadn't been erected at the time and there were no turbines

on-site, no receivers, no piping, none of that. Apart from the structural piping, there were no fluid piping, no pumps, no equipment for...

Q. Well, what differences were there that you observed from January to April in the two visits at this site?

A. There were probably two things. There were more -- there were more piping in the ground for the supports, for the towers at the RaPower-3 site, and there were more -- some more concentrator parts manufactured and in storage at the manufacturing facility, but that's the only difference I saw.

Q. Had any towers been erected?

A. No.

Q. Other than the visits to the site in January and April of 2017, have you gone back, driven by the facility?

A. No.

Q. Okay. So the current state of what's going on in Delta, Utah, you have not seen?

A. That's correct.

Q. Okay. Had any towers been erected between January and April?

A. No.

Q. Okay. The second page starts with "Neldon

Johnson, lecture." You've mentioned this before. Can you describe from your notes what took place with the Neldon Johnson lecture?

A. Mr. Johnson said -- proceeded to tell all of us there about his systems, in plural, here. He went through an extensive discussion. He gave more information on what the receiver design was, and that's the sketch you see here. No -- again, I think I asked him about the lifetimes of the lenses and he said he had no information on that. The receiver tube that I've sketched here was what he described as the tube through which the oil flows through the molten salt inside the glass tube where the oil is heated. So, at this point, he was -- he was telling me that the -- that the receiver design had changed, was not going to use molten salt as the working fluid in the collector field, but was now going to use the oil, but he was going to put molten salt inside these glass tubes that were painted black, and that that's how the -- what the receiver heat exchanger looked like.

And then there's a note below that to myself that the losses are proportional to the surface area and temperature to the fourth power. That's what that T to the fourth means, because the

hot surface is right there on the inside of the glass and there's nothing between it and the -- except for the thickness of the glass. It was a reminder to me to take a look at that. And then --

Q. You've written next to black with, I don't know, wood or something inside of --

A. Glass vacuum. Yeah, I couldn't understand how it was a vacuum inside if he was putting molten salt in there, and I asked him that. Because, he said, it's got molten salt inside the glass tube, but then the tube's painted black, and I wasn't clear why that tube would be painted black, it didn't make any sense to me, and then he said, but there's a vacuum around it, but the molten salt's in there, and I'm trying to think -- I couldn't -- I couldn't understand what it was.

Q. And you've written "vacuum doesn't help."

A. Yeah, if it's full of molten salt, there is no vacuum.

Q. Okay, if there were a vacuum, a vacuum would help insulate, would it not?

A. Except that he put the glass -- the paint on the outside of the -- on the inside of the glass surface, which is separated from this tube. And if you put a vacuum in there, it wouldn't help anyway.

Q. Okay.

A. So then --

(A discussion was held off the record.)

A. And then the last -- I have a note there with dashes around it underneath the T to the fourth, "comes off the body." I -- I don't -- I don't know what that first word -- it looks like --

Q. Igniter?

A. "Comes off the body," I don't -- that doesn't make any sense. I don't know what that means. I apologize for that, but I don't know.

I just made a note that he doesn't understand natural convection radiation and conduction heat transfer, and a note to myself that I need to think about how to address that issue.

Below I put a little bit of an outline for myself --

Q. Okay, but "critique his" --

A. "Heat transfer lecture." He gave us a lecture on -- I taught heat transfer for -- my areas of expertise are heat transfer, fluid mechanics, thermodynamics experimental methods. And I taught heat transfer and thermodynamics for a number of years. Mr. Johnson's explanation of heat transfer and how it works was incorrect, and I was struggling

with how -- how do I address that as I go forward in drafting a report.

Q. Okay.

A. Fundamentally, Mr. Johnson has no technical capability in the area -- in the areas he purports to have.

Q. What mistakes did he make in his lecture about the heat transfer?

A. Well, he was discussing how he would -- how he analyzed it and he would use the wrong words describing different processes. He didn't understand that conduction is only in solids. He didn't understand where convection took place, and he didn't understand how radiation heat transfer occurs at all three phases, as well. So he just fundamentally didn't understand the mechanisms of heat transfer.

Q. Okay, and the tube that he showed, it was a commercially produced tube that you were shown on April the 4th, was it not?

MR. MORAN: Objection, foundation.

A. You mean the one -- I'm sorry?

Q. The system you've drawn here, that was --

A. No, no, no.

Q. This was manufactured by --

A. By them.

Q. IAS?

A. Yes.

Q. Okay. All right, very good. So then you've written "outline" and "criticize" -- or "critique."

A. Critique. Yeah, I think I was starting to think about what I would -- how I would address some of this stuff. And -- I guess my notes are fair game. The Carnot cycle is not an engine, it's a cycle. Mr. Johnson has repeatedly used the design point of the turbine as the efficiency of the Carnot cycle, and it is not. That's wrong. That's a fundamental mistake, if you want to call it a mistake. It just reflects that he hasn't got the background to do the work.

He continues to maintain that there's no boiler or condenser in his system. There is a boiler, there is a condenser.

He doesn't seem to want to admit that when he changed from the molten salt -- there's the note "lower T brings more energy." I don't understand how he thinks that can happen. But his moving to the hot oil away from the molten salt changed -- fundamental -- is a fundamental change for the operation of the system, because now the high

temperature in the collector system is no longer 565 degrees, but 400-degrees. And as a point of fact, this -- his turbine design, and I would note that the turbine design was -- it was not possible in the documentation to understand what part of it was done by, quote, the engineering firm that he references and what part was done by him because there was no separate report on that. And he -- the design was done for 1,000 degrees F, which is close to the 565, and 3200 PSI steam. If you drop down to 400 degrees C or 750 F, which is where the hot oil operates, they quote -- it seems that the designers or perhaps even Mr. Johnson said this, that the turbine will not operate at a lower temperature of 750 degrees because it's designed for the design point of 1,000 degrees and 3200 PSI. So --

Q. You've written "42 percent/82 percent" and then something and no -- what are you referring to there?

A. 42 percent was roughly -- it was the number I was given as the Rankine cycle efficiency. It's the -- the design point of the turbine at 1,000 F. And the 3200 PSI is about 43 percent per the designers. And the 80 percent efficiency is what the dish efficiency is -- was represented to me at.

Q. And why have you written "no" in parentheses?

A. Because those -- those numbers are not right.

Q. Okay.

A. And he did say that he'd be using a new heat exchanger and a pump, but he never -- while he referenced this new heat exchanger a number of times, I was never provided with any information on it, even though I asked how does it work. I was shown something in the manufacturing facility --

Q. Um-hum.

A. -- during the first tour and told that this is our new heat exchanger design we're going to use, and I asked that he explain how it worked and he couldn't really explain to me or he wouldn't explain to me how it worked. I don't know which. And there was no documentation in any of the 25,000 documents that I reviewed on anything to do with a new heat exchanger design.

Q. Okay. Turn to the next page.

MR. JOHNSON: That's got a patent on it.

MR. SNUFFER: Yeah.

Q (By Mr. Snuffer) This is "two-cycle engine/pump." What is this referring to?

A. I don't know. There was some discussion during the -- during the lecture about a two-cycle engine and something about a jet, a jet that would fly on solar energy. I don't -- I don't even want -- and a 3,000 degree pump that would handle liquid steel. They were just notes I made from the lecture. I have no idea what they apply to.

Q. What is the list of items that appear below that? And are we still in the Neldon Johnson lecture?

A. Yeah, I was taking notes on different things during the lecture. The -- I think -- I think the -- after that list -- I think that list is just my summary of my thoughts about things that I needed to make sure I looked for in the -- in the RaPower-3 documents. Who has background in thermodynamics? Who has background in heat transfer? Who has fluid mechanics material science? There's a basic misunderstanding of fundamental -- fundamentals. What's the -- what are the temperatures? Some of the things I was going to look for in the -- in the documentation, which by the way, none of which is contained in the 25,000 pages of documents that I reviewed.

And I think after that list, I think we

went out in the field and started walking around and looked at a number of things. We walked first through the -- through the power plant there, RaPower-3 power plant under construction, and I think Mr. Johnson was talking about a 1500 megawatt power plant that was nearby and he started telling us about how it wasn't cost-effective and it wasn't operating properly, and they replaced an engine in December, a turbine in December, and that -- you know, I just didn't understand that. And then the half a cent a kilowatt hour, I don't know -- I don't recall what that was in reference to.

Q. Okay. And then you've got "make energy with his" concentrator?

A. Converter.

Q. Converter.

A. Yeah, they took us out onto the deck and they tilted a lens and put a PV cell out so that they could generate some electricity using a lens with a -- and they referred to that as a PV system.

Q. Was that an original design of his or was this a commercially produced one?

A. It was his lens, and I don't know where the cell came from.

Q. Okay. Did it, in fact, produce measurable

electricity?

A. There was -- there was a voltage across the -- the junctions. There was no application, there was no tracking mechanism, no system there. It's what I would call phase 1 of the design process demonstration.

Q. Then you have a list of items, "lens, variety of" heat exchangers?

A. You know, I think I wrote this list down in the car as -- as we were going home, just to remind myself of things I needed to look into. Look into the details on the lens, look into the heat exchangers. What -- what are the variety of heat exchangers? Anymore detail on the tracking system and the turbine? What about the PV? Salt and oil as working fluids.

Q. Since April the 4th, what about have you done to look into those items for the IAS system?

A. I reviewed all of the documents provided me by the Department of Justice, which comprise over $25,000 -- $25,000 -- over 25,000 documents, and I found that the only documents that really provided me with any information were the white paper document, and so I used those to try to gather as much information as I could and do some analysis on

whether I thought this concept could really work or not and what the current status of the technology was, and I moved on with my report, drafting my report.

Q. Isn't it true that your analysis of the Fresnel lens used by IAS was based on your visual inspection only, correct?

A. No.

Q. What was it based on?

A. I used the Lucite transmissivity to characterize the transmissivity of the lens, which is pretty close to what Mr. Johnson's been using, around 80 -- 80-some percent. And so I penalized it slightly for probably being dirty, having some dirt, and I penalized it -- I made engineering assumptions on the tracking accuracy and analyzing it. Again, not an unreasonable number, typical of any disk concentrator. So, no, what you said is not true.

Q. So you supplemented your visual inspection with Lucite transfer numbers provided by the manufacturer?

A. That's correct.

Q. Anything else?

A. So what was -- anything else for what?

Q. Used for your analysis of the Fresnel lens

used by IAS.

A. The -- in tracing the solar energy as it goes through the system, the first step is how much goes through the circular lens, how much power? There's roughly 35 kilowatts incident on the outside of the power. The calculation tells you about 27 plus percent, almost 28 is actually transmitted through the lens.

Now the question -- the next question that comes up is how much of that -- how is that image that's produced by that lens, how much of that is incident on the receiver? So that's the next step. But the lens has been characterized. I provided a small degradation in its performance for -- and actually I ought to refer to my notes here so that I -- to my report --

Q. Oh, sure.

A. -- so that I can look at the table to make sure I don't provide you -- Exhibit 644. Thank you.

Q. I think you're looking for page 36.

A. Oh, hey, thanks. No, that's the ultimate one, but the dish and the lens were looked at earlier on page 23 in Table 4. Mr. Johnson's number for the transmissivity was 90 percent, and using the Lucite data I used 89 percent. Lens cleanliness, he assumed

a reasonable lens cleanliness; I used that. He assumed that the lenses were perfect lenses. I assumed that they had a small degradation in the manufacturing process, which is an engineering estimate and common in things to have some -- some losses due to that. He assumed that the receiver input would be one -- all of that power goes into the receiver. I analyzed -- I took a video of IAS with a lens element showing a receiver in the plane of the lens -- in the plane of the optical image, and based on that I estimated the diameter of the concentrated image at 1 meter. And in -- within the context of that, the receiver, itself, would only cover 38 percent of that image area.

Now, the fact is that that image is not a uniform flux distribution, it's a Gaussian distribution, so that's not fair, that's not correct. So I adjusted the area ratio on the receiver, itself, to .6 intercept. And giving it a .6 intercept, then as you bring it down that's -- and I also allowed for a 90 percent tracking accuracy, which is very high. And 90 percent times .6 is .54 for the actual intercept, so... And then that gives me an optical efficiency, when you take that downstream, of 42 percent versus -- it's roughly half of what

Mr. Johnson has estimated. So that's my analysis of the optics of the system right there.

Q. And the receiver intercept was based upon viewing a video that was shot at the site?

A. That's true, I had to make an engineering estimate -- I would have dearly loved to have actual data. I could have -- that would have been a wonderful thing to have.

Q. Okay.

A. You know, any engineer will tell you that there are two pieces to designing a system or even a component. The first piece is you build a computer model of your system and components and you do a lot of work with that to make it as accurate as possible. The physics are all in it and it's -- it's validated then by some test you do.

But you have to spend a lot of money to do testing. Testing and test data are gold to an engineer. They're -- they're the main part of what you're doing, because what that allows you to do is to take that test data and validate your model and take that model then further down the line to how to predict the actual performance of your systems. The -- the need to keep accurate records and details of data that you've tested is, to an engineer, one of

the most important, most sacred things they can do. I hate to say sacred because it's not a religious thing, but...

Q. Do you consider yourself an expert in optics?

MR. MORAN: Objection, asked and answered.

MR. SNUFFER: No, I asked him what his background was before. I didn't ask him if he considered himself an expert.

A. I'm an expert, I think, in applied optics. I'm not an expert in theoretical optics.

Q (By Mr. Snuffer) Okay.

A. There's -- there's a distinction there that I think is significant.

Q. Other than watching the video and visiting the site, you didn't perform any optical tests on the IAS system, did you?

A. No, I did not.

Q. Had you reached any conclusions about the IAS system before you began your analysis of the equipment?

A. No.

Q. Did you reach any conclusions about the IAS system before you visited the IAS site?

A. No.

Q. And as I understand it, you have not made any attempt to determine the heat losses in the receivers of the IAS system, have you?

A. I have. It's in my analysis.

Q. Those are based upon no tests, however?

A. That's correct.

Q. Did you perform any experiments on the IAS system separate from site visits?

A. No.

Q. Other than the mathematical equations that appear in your report, did you use any mathematical models to evaluate the IAS system?

A. Other than the analysis in the report, no.

Q. What hours of wind during daylight hours for the Delta, Utah, location did you factor into your analysis?

A. None. I gave it the benefit of the doubt that it was a clear day performance. The analysis I did was a for a clear day with no wind. I assumed 1 kilowatt per square meter of solar energy available, which is an excellent day, and I tried to cut -- where things were -- for example, with the intercept factor, I increased that by 30 percent in order to accommodate what potentially could be the actual performance.

Q. Okay. You concluded that there would only be 28 percent of the time when the receiver would be receiving solar energy from the lens. What was the --

A. I did not conclude that. That's incorrect.

Q. Okay, then give me your correct --

A. I'm sorry. I'm sorry --

Q. -- conclusion.

A. -- I interrupted you when you were asking a question.

Q. Yeah, I want to know what percent of the time you concluded the receiver would be receiving solar energy from the lens.

A. I assumed that this would be a static test -- my model of this process is a one-hour period when you have 1 kilowatt per square meter and the receiver is receiving energy the whole hour. It's a one-hour snapshot, if you will.

Q. Under optimum conditions?

A. Yeah, I'm assuming --

Q. Yeah.

A. I'm not -- I'm not assuming that there was any wind effect or any of that. With one -- with one caveat here. I think I did allow a little bit for -- where did I do that? Oh, the tracking accuracy,

where I said it was 90 percent, that -- that sort of collects everything about the receiver moving versus -- and the concentrator maybe not tracking accurately. But it's still a very good representation. In other words, I'm giving the concentrator the benefit of the doubt on this point.

MR. SNUFFER: Okay, it's after noon. Should we take an hour break?

MR. MORAN: An hour sounds good.

MR. SNUFFER: Okay.

MR. MORAN: You want to meet back here at 1:10?

MR. SNUFFER: Yeah, 1:10, and then we'll finish up.

(A recess was taken at 12:09 p.m., and reconvened at 1:15 p.m., as follows:)

Q. Okay, let's go back on the record. Do you have any background, education or experience in rocket science?

A. Some of the courses I took did have rocketry involved in them, propulsion systems.

Q. Have you ever analyzed a rocket engine as a consultant?

A. No.

Q. Have you ever designed a rocket engine?

A. No.

Q. Have you designed any component that would be used on a rocket engine?

A. No.

Q. I believe it was your conclusion that the rocket nozzle on the rocket engine used by the Johnson turbine would require dry steam. Is that correct?

A. Yes, that is correct.

Q. What's the basis for that conclusion?

A. Well, the temperature of the design point was 1000 degrees F, 3200 PSI. At that condition, you've got vapor only. There's no water. Above 705 degrees, you're above the triple point of water and it can only exist as vapor steam.

Q. But the Johnson turbine can operate at lower temperatures than that, can it not?

A. That wasn't the design point.

Q. Okay. Nevertheless, it could operate at lower temperatures?

A. If it were designed for that. The one that we're talking about was designed for 1000 degrees F, 3200 PSI.

Q. And where did you find the design criteria that specified that temperature and that PSI?

A. That's in the white paper document, Plex 16 and 17. I don't know which of those it is.

Q. Okay. What experience do you have with the Johnson turbine engine in operation?

A. None.

Q. Okay. Is it your belief that it's impossible to run a steam turbine without using the Rankine cycle and a boiler system?

A. I don't know why you would do -- what it would be for. If you would give me some options, I could tell you whether it could be done or not, but...

Q. Well, do you believe the rank and cycle on a boiler system is necessary for the Johnson turbine?

A. I don't know what -- what other cycle you would run a steam turbine in if you didn't run it in the Rankine cycle. It's not an Ericsson cycle or an Otto cycle, which are internal combustion cycles. It's not a Brayton cycle which also has a combustion cycle. There are only a finite number of different power cycles where you could actually do work, and they're defined by a certain number of processes described by thermodynamics in the form of two state points, pressure and temperature or temperature and pressure and entropy or enthalpy and pressure, or any

two of those combinations, and there's only a certain number of actual mechanical devices that you can design that will do work and -- using a turbine or some other engine option.

Q. Have you read any studies analyzing the Johnson turbine?

A. Well, I don't know if it was a study or not, but there was a -- there were comments in the white paper attributed to third parties who were unidentified and it wasn't obvious what were their words and what were other people's words. So I saw no independent reports, I did see that, so I don't know -- I honestly don't know the answer to that.

Q. Are you aware of or reviewed any experiments or tests operating the Johnson turbine at temperatures lower than 750 degrees?

A. I haven't read or are aware of any situation operating -- I've seen no data, no analysis, and no performance data on the operation of that turbine at any temperature or pressure. I would just note that if it's operated at 700 degrees, it's not going to be operating at the conditions it was designed at and, in fact, someone stated in the document that it would not operate there at all.

Q. Do you know if the Saturn rocket system

used steam propulsion?

A. I don't know anything about it.

MR. MORAN: Objection, foundation.

Q. Do you believe that the Rankine cycle boiler system was used on the Saturn rocket system?

MR. MORAN: Objection, foundation.

A. I don't know the answer to that question.

Q. Do you believe that all rockets using steam propulsion would have to employ the Rankine cycle?

A. I don't know anything about rocket systems using steam.

Q. Okay. Are you aware that Johnson's -- Neldon Johnson has been granted a patent by the U.S. Patent Office on a new heat exchanger?

A. Yes.

Q. Have you looked at the patent?

A. I've looked at it briefly, yes.

Q. Have you done any analysis on it?

A. I have not. To be honest with you, I couldn't understand how it operates.

Q. Okay. And you haven't seen a prototype of that --

A. I saw a prototype that I was told was that heat exchanger in the manufacturing facility during the tours, but it was -- when I asked how it worked,

I was told that they couldn't tell me.

Q. Did the patent tell you?

A. No.

Q. Okay. What products have you brought from -- brought into a stage 1 development?

A. Oh, I've been involved in a lot of stage 1 development. There's a lot of -- a lot of different projects where you just look at different things and how they might operate and you -- you may model it. You may even go so far as to try to put together something that sort of represents like a stage 1, like taking a lens and just focusing a little sunlight on a cell and saying, gee, does that produce electricity. I mean, you do that all the time. I don't know how many of those I've done over the years. Many.

Q. What products have you brought from stage 1 to stage 2?

A. I haven't been -- I've been involved with other people's products, mainly in the late stage 3 through stage 4 range. Most of the things that are brought to me are relatively mature. At that point, they have a pretty good idea of what they want to do and it's an issue of trying to understand how to -- how we might improve the performance and help reduce

the cost.

Q. Okay. But in terms of taking a product from stage 1 to stage 2, none of that has --

A. No. I -- you know, it's -- you know, that's just -- it's sort of a model of product development. In fact, most companies have their own models that might have -- I think GE has a model that has, you know, 12 or 14 steps in it and every one of those steps has to have a review between -- in a board, an engineering board that reviews, you know, specific details for all kinds of things. So it's -- it's just an idea.

It was a model we used in teaching introductory engineers, actually it was used in a Capstone engineering course to help students understand roughly what they might see when they get out into industry.

Q. Do any of the IAS components that you have reviewed have commercial viability?

A. Well, some of the components in the system are commercial items, like the shell and tube heat exchangers that would be used for the boiler and the condenser. Those are off-the-shelf items that are already commercial. So anything they would purchase like that, certainly pumps, piping, those sorts of

things.

Q. What about components developed by IAS, do any of those components have commercial viability?

A. For the application as defined, no.

Q. Would you agree that piping can be successfully connected to a heat exchanger by any competent workman?

A. Well, in a power plant situation, you need to have pipefitters do the work. I mean, that's what an EPC contractor would require.

Q. Do you deny that IAS can successfully connect piping to a heat exchanger?

A. No.

Q. Likewise, you would not argue that IAS cannot successfully connect piping to the Johnson turbine, would you?

A. No.

Q. Would you agree that the solar industry is looking to the R&D community to provide next generation components such as solar concentrators and thermal receivers?

MR. MORAN: Objection, foundation.

A. The solar industry as it exists is always looking for new ideas and new concepts and you see -- you see them all the time. So would they be looking

to the -- could you repeat the question? I'm not sure I understood.

Q. Yeah, the R&D community to furnish the next generation of components for solar concentrators and thermal receivers, would you agree with that proposition?

A. Not --

MR. MORAN: Objection, vague. R&D community is undefined.

A. It's not just the R&D community. They'll look anywhere for the next potential breakthrough, as will any industry who -- who's really out there trying to work on the cutting edge.

Q. Okay. I believe you've already mentioned that you witnessed a wooden board catch fire during one of your visits to the IAS site.

A. That's correct.

Q. Was that in January or April?

A. I think it was both.

Q. Okay. Would you agree that the Fresnel lenses, therefore, do generate concentrated solar heat?

MR. MORAN: Objection, vague. Concentrated solar heat is undefined.

A. They don't generate concentrated solar

heat. They take the sun's energy and focus it.

Q. Okay. So the IAS system includes lenses that concentrate solar heat?

A. That's correct.

Q. Would you agree that lenses that concentrate solar heat are no longer in the R&D stage because they succeed in concentrating solar heat?

A. No.

Q. Would you agree that the lenses could heat a coil?

A. For what application?

Q. For any application.

A. Well, it would depend on the application. They might not be able to -- I mean, you've got to design it so that you heat the right amount of material.

MR. MORAN: Objection, Counsel, what do you mean by coil? The question is vague.

Q. Would you agree that the lenses could heat water?

A. How would you do that? I don't -- potentially, yes, but what are you using -- you mean, just focus them on water?

Q. Yes.

A. Yeah, they'd probably heat it a little bit.

I'm not sure what you would use it for.

Q. Would you agree that the lenses could heat synthetic oil?

A. Just by focusing on a pool of oil, is that what you're asking?

Q. Well, if you put synthetic oil inside a coil and use the IAS lenses to concentrate solar energy on the coil, would the synthetic oil be heated?

MR. MORAN: Objection to the term coil, it's vague and assumes facts not in evidence. There's no foundation for this coil.

A. I think so, yes.

Q. In your report, on page 13 --

MR. MORAN: Counsel, and the report you're referring to is Plaintiff's Exhibit 644?

MR. SNUFFER: Yes.

MR. MORAN: Okay.

Q. (By Mr. Snuffer) There's a paragraph 48 where you explain what you expected the designer or operator to have and item A is 400 to 600 detailed engineering analysis and design drawings for the solar dish, receiver, heat exchangers and turbine generator. Were you furnished copies of all of the patents for all of the components that IAS has

patented that are used in the IAS system?

A. I believe I reviewed all those patents. It's certainly in the -- Mr. Johnson's critique of my report, I think he attached copies of all of his patents.

Q. Right.

A. But the patents are not engineering design drawings and analysis. They're very limited drawings with no dimensions, no technical background, no analysis. It's not an engineering design package, sir. If that's -- I'm probably guessing at what you're asking and I'll back off on that and let you ask.

Q. Well, what technical design items would you want to see beyond the information contained in the IAS patent drawings?

A. Well, first of all -- that's an excellent question. You'd expect to see analysis supporting every piece of -- piece on the solar concentrator, for example. I would estimate there are, what, probably between 35 and 45 individual pieces, maybe more, on there. Each piece would have its own engineering design drawing with multiple perspectives, dimensions, material call-outs, and engineering analysis to support it.

Then what you would find for that would be subassembly drawings showing the subassemblies of all of the individual components into subassemblies. For example, a circular facet or maybe even -- you'd probably have one for one of the gore-shaped -- pie-shaped, gore-shaped facets. Then you'd have that for all the subassemblies on the dish, and then you'd have a master drawing that would show how the subassemblies fit together, along with descriptions of how -- how they go together, and what order they're to be assembled in.

But for all of these drawings, you've got stress analysis, you've got material call-outs in terms of not just what the material is, but if it's a piece of angle, where that came from and what the call-out and specification on it is. You've got lists of materials to support that. So that's the minimum I would expect to see for every component, including the P&IDs, the piping and instrumentation diagrams for the system, for each of -- for the turbine, the receiver.

The purchased parts, like a heat exchanger, would require the design analysis and design data. You would -- since you're not fabricating it yourself, you would not necessarily have to have the

detailed design drawings on it, but you may want them for O&M purposes in case you have to replace tubes, as we discussed earlier, or do another form of O&M.

So that's what I'm looking for is a very complete set of drawings; some of them take up filing cabinets worth of space for a solar power plant.

Q. Yeah. The absence of subassembly drawings does not mean that the IAS system cannot work, does it?

MR. MORAN: Objection to IAS system, it's undefined.

A. I don't -- I don't know how -- the absence of a subassembly drawing could very well mean something isn't going to work because there's mistakes in it or there's mistakes because you didn't do a subassembly drawing. So I don't think you can say just flatly that missing one would make a system work or not work --

Q. Right.

A. -- to be honest.

Q. Same would be true for a master drawing, the absence of one does not mean that a system is doomed, does it?

A. No, but it means that you've -- you've given as much thought as you can to how things go

together so that you don't have problems when it comes to doing it. And, in fact, most drawing packages have multiple iterations on the drawings and the subassemblies representing actual corrections to them as people go through and find problems that weren't caught up front. So it's not an end all and be all, it's a process, and it's called engineering.

Q. Does molten salt expand or contract when it freezes?

A. Molten salt, when it freezes, actually contracts.

Q. Um-hum. I think the next one is 1008 -- or 7, 1007.

(Exhibit 1007 marked.)

Q. (By Mr. Snuffer) I'll hand you a document that's 1007. This is a copy of a document that was produced in response to the subpoena to appear here today. Do you recognize the document?

A. I do.

Q. And that's your signature on it?

A. It is.

Q. This one, and a number of others, have the same entry of "review DOJ documents." I want to make sure that the documents that are referred to in this and other billings are documents that you've produced

in response to the subpoena. Is that correct?

A. No, they're documents -- in this reference, these DOJ documents are documents that are contained in the document files that DOJ provided me for review, the 25,000 documents of RaPower-3, Lucite and so forth.

Q. Included in that would be depositions, for example?

A. If I -- if I reviewed a deposition, it would be included in that, yes.

Q. Are all of the documents that you reviewed listed in the back of your report?

A. All of the documents that I reviewed listed in the back of my report?

Q. Beginning on page 49, Appendix II, List of Facts and Data Considered.

A. Okay. I can mention two more documents that I think are not included here.

Q. Okay.

A. One is the deposition of Mr. Neldon Johnson as an expert witness, and the other one is a video of a test of some sort of a receiver that appeared that I got from DOJ.

Q. The video of the test of the receiver, did a component overheat and steam get emitted?

A. I don't know what that was. I did see something coming off of it; I didn't know if that was paint burning or if it was steam or what.

Q. Okay, all right.

A. That's correct.

(Exhibit 1008 marked.)

Q. (By Mr. Snuffer) I'm going to hand you a document that's actually an excerpt, Exhibit 1008. You produced a larger document and I excerpted only this one page from that larger report. Are you familiar -- does this document look familiar to you?

A. I've looked at a lot of documents over the years like this. I mean, I have a feeling for what I'm looking at, but I don't remember this specific document, no.

Q. Well, this is a pie and a bar chart that attempt to show the U.S. energy production for 2013 --

A. Um-hum.

Q. -- in which the bar chart breaks down the renewable 11.2 percent to show that .04 percent is the solar energy production in 2013.

A. Yeah.

Q. Does that number -- is that number familiar to you?

A. No, it's not familiar, but it sounds about right.

Q. Okay. And then the energy consumption for that same year shows that .03 percent of the energy consumed was produced by solar. Do you see that?

A. Yeah, I don't recall what the definitions for energy consumption and energy production really are, though, so I'm not sure what that means.

Q. Do you have an estimate of what the current 2017 percentage of energy production for the U.S. is solar?

A. My understanding is that -- I don't have a number for the production, no. But what I do have is a number for the capacity, and the capacity is about .5 percent, which is not way out of line with this.

Q. Okay.

A. It's small no matter how you want to cut it.

Q. Right. At this point, solar energy is not a significant contributor to solving energy needs in the United States, correct?

A. Or globally.

Q. Yeah. Would you agree that there's enough thermal inertia in most CSP systems to coast through the small-scale interruptions you might have in solar

energy due to clouds or small clouds, that sort of thing?

MR. MORAN: Objection, vague. CSP systems isn't defined.

A. That varies depending upon the system. Certainly a system with thermal storage has that capacity, it's built into it. There has been evidence shown for parabolic trough plants, for example, that there's enough heat in the oil to carry you through five, maybe even ten minutes, perhaps a bit more. Dish engine systems have very little thermal capacity or thermal inertia because they don't carry with them a convenient or cost-effective way to provide thermal energy storage.

Q. What was the Solar II program?

A. Solar II was a DOE-funded experiment that was supported by the industry and by the utilities to take an existing experiment, Solar 1, and convert it -- which was a central receiver system in Barstow, California -- located actually in Daggett, outside of Barstow -- and it converted that plant to a molten salt plant to demonstrate molten salt storage for -- to try to address some of the issues that we perceive there to be relative to molten salt storage.

Molten salt storage had been a concept that

had been around for a long time. It had originally been proposed for nuclear reactors in the form of sodium and other -- other salts, and some of our Sandia people who were working on these projects back in the '70s had done significant amounts of modeling and initial testing of molten salt materials to see if they thought a system could be built from it. And this -- Solar II was actually the first shot at building molten salt power tower plant.

Q. Why did the Solar II project die?

MR. MORAN: Counsel, I object to this line of questioning to the extent that Solar II is not the a topic of Mr. Mancini's report.

A. Solar II didn't die. The funding for it was terminated based on having met virtually all of the objectives of the test. It wasn't intended ever to operate for an extended period of time.

Q. And Solar II is not in current operation; is that correct?

A. Solar II doesn't exist anymore. The land was owned by Edison, and DOE had a responsibility to recover the site and restore it, and that was finally done, gee, about five or six years ago.

Q. Okay.

MR. SNUFFER: Why don't we take a short

recess, let me talk with my client for a minute, and I think we're done.

(A recess was taken from 1:46 to 1:49 p.m.)

MR. SNUFFER: I don't have any other questions of this witness.

MR. MORAN: I have a few.

EXAMINATION

BY MR. MORAN:

Q. Dr. Mancini, Mr. Snuffer elicited some testimony from you about an engineering license. Do you recall that testimony?

A. Yes.

Q. And you testified that you don't have an engineering license currently?

A. That's correct.

Q. Why don't you have an engineering license?

A. You know, I've never needed a professional engineer's license. I considered getting one at different times, but I don't do any work on equipment or anything where public safety is involved or where design codes as specified by the state, for example, for bridges, buildings, other things of that type where personnel safety is involved, so I -- and I've never had a job that required me to do that sort of thing, so I've just never done it. I've actually

taught classes to get -- for both students and for graduate engineers who were getting ready to take the PE exam and I've graded PE exams, but I've never taken it.

Q. And Mr. Snuffer asked you a similar question on whether or not you were licensed to sign engineering drawings.

A. I don't remember that question.

Q. You don't?

A. No.

Q. Okay. Are you licensed to sign off on engineering drawings?

A. It's the same thing, I don't have a PE stamp; I wouldn't sign off on an engineering drawing.

Q. Okay. And is that because -- and why is that?

A. Because I don't have the PE license.

Q. Okay. You mentioned a couple of times that RaPower-3 -- you mentioned a power plant that's associated with RaPower-3. I think you called it a RaPower-3 power plant. Do you recall that testimony?

A. Yes.

Q. Do you believe that RaPower-3 or any defendant in this case actually has a power plant?

A. Well, the power plant's under construction,

that's what I'm referring to. It isn't -- it hasn't produced any power yet.

Q. In your opinion, will it ever?

A. No.

Q. So is it fair to say that there is actually no power plant?

A. Yes, at this time.

Q. Mr. Snuffer asked you a question about a lecture that Neldon Johnson gave at his home during one of your visits. Do you recall that?

A. Yes. I don't know that it was his home. I think --

Q. Right. It was at a house.

A. -- it was just at a house on the site, yes.

Q. Okay, and that was during the April site visit?

A. That was during the April 4th visit, yes.

Q. Okay. You identified a few ways that Mr. Johnson misstated principles of heat transfer, do you recall that testimony?

A. Yes, I do.

Q. Okay. Are there any other -- do you recall any other ways or any other instances where Mr. Johnson was incorrect in his statements about thermodynamics or heat transfer?

A. Well, one of the major issues has been his continued insistence that the efficiency of the turbine is the same as the efficiency of the Carnot cycle and it isn't, or of the Rankine cycle and it isn't, and it's just simply he doesn't understand that there's a cycle. So that's a fundamental misunderstanding.

Q. He doesn't understand that what's a cycle?

A. Well, that even his own system is a cycle has a condenser. Even if you don't put the equipment in there to do it, it will just condense in the pipes or on the housing of the turbine and limit the performance of the system, and you'll quickly install a condenser because you're not supporting the back pressure you need and providing the condensate -- condensate you need for the -- for the cycle.

Q. Is that because in any heat -- in any thermodynamic cycle, there will be a condenser and that's not a fact you can change?

MR. SNUFFER: Objection, leading. You can answer, though.

A. In any thermodynamic Rankine cycle, there will be a condenser. Other types of cycles have different pieces of equipment, but in a Rankine cycle, it operates between two temperatures and the

key is keeping those temperatures as far apart as possible, and if you don't have the condenser in there, what that does is that skews the performance curve so, in fact, you get less and less work out of there and don't provide the proper output for the system that you're trying to get.

Q. Mr. Snuffer asked you some questions about rocketry and rocket nozzles, do you recall those questions?

A. I do.

Q. Are you -- are you familiar with a component in the turbine that is purportedly a rocket?

A. There is a nozzle -- the answer is yes.

Q. Okay, you just called it a nozzle. Do you view that component as a rocket or a nozzle?

A. Well, I call it a nozzle. It's -- it's not clear to me on the design whether it actually accelerates the flow after the throat or not. If it does so, it could be referred to as a rocket, but it's really just a contracting expanding nozzle in that case to me, which accelerates the flow. So, I mean, the use of the word rocket is not 100 percent precise, but I can kind of understand how that might -- might be used.

Q. Okay. Mr. Snuffer asked you some questions about what documents you reviewed in addition to the documents that you list at the back of your report, do you recall that --

A. Yes.

Q. -- question? Did you also read and review Neldon Johnson's response to your expert report?

A. Oh, I did, yes. That's another document.

Q. Okay. Last question, Dr. Mancini, are you familiar with the term process heat?

A. I am.

Q. What does the term process heat mean to you?

A. Well, it typically means using heat from the sun, solar process heat -- and I assume we're talking about solar. Is that correct?

Q. However you understand the term process heat.

A. Well, process heat just generically means any heat you provide to a process in any application, whether it's water heating or part of a chemical plant where you have to heat -- heat some of the inlet streams in order to cause a particular chemical reaction to occur, or anything like that. The more general term that's been used or discussed relative

to this case has been solar process heat, and that to me means that you're using the heat in some way to accomplish some function or application.

I've actually worked on a couple of process heat projects, for example, in the potash industry where we were exploring the opportunity to heat some of the potash that was being mined in order to accelerate some of the processes in creating the fertilizer. So that would be an example of process heat.

Another example of process heat would be there was a demonstration of a -- of a central receiver plant where steam was injected underground to help release -- essentially raise the temperature of an oil shell reservoir and increase its production. So that would be another example of what I would call process heat.

Another example that I actually referenced in my report was the Bleyle Plant at Shenandoah, Georgia, where heat was used in an application in a laundry. So that's my understanding of what process heat projects are.

Q. And is it fair to say -- and I'm just judging from the examples that you just gave -- that the term process heat means that the heat you're

obtaining -- the heat -- the process heat is used for some other ancillary purpose?

A. Yeah, they're -- there's an application for it. You wouldn't -- you wouldn't collect the heat if you didn't have a use for it. The -- it's a difficult area because it's -- you're dealing with a couple of things. You're dealing, number one, with usually existing plants and processes, so you run into a lot of things like can you actually put solar collectors anywhere nearby to actually do it. It's a very low temperature process in most cases because you're not -- you're not trying to produce power or anything in most cases. You're just trying to provide heat for a process, and so you're competing with extremely low cost natural gas or in some cases you're competing with processes in chemical plants where they burn excess product or excess waste materials to achieve process heat. So it's never really become something that anybody has ever -- there's no system for it because it's got to be designed for the specific application and it's got to fit the particular location, so it's not like you can have one -- one design fits all or that sort of thing. So it's never really found a home, and, in fact, I haven't heard much about it for the last 20

years. It's something that came up back during the '70s -- '60s, '70s and maybe into the '80s a little bit, but just too low a temperature. Using solar concentrators, you pay money to get that concentrated source of heat, and so you need to find applications that give you a high value product and energy as close as you can get there.

Q. So based on your understanding of what process heat is, does it involve more than simply generating heat, that you have to do something with the heat in order to have solar process heat?

A. Well, I mean that's the whole point.

Q. Okay.

A. I mean, that's the only reason you do it --

Q. Okay.

A. -- you have to have an application.

MR. MORAN: I have nothing...

EXAMINATION

BY MR. SNUFFER:

Q. I just want to follow up on that last point. Is it your view that you cannot generate solar process heat during an R&D phase?

MR. MORAN: Objection, R&D phase is undefined.

A. I don't understand the question.

Q. Yeah, when you're doing research and development, is it your position that it is impossible to produce process heat from solar energy if the research and development is focusing on just producing concentrated solar heat?

A. I'm sorry, but I still don't -- if you were doing an R&D project and you -- as part of that process you had some excess heat that you could heat water with maybe and use for -- for -- maybe it's your lavatory on-site or something, I'd consider that a process heat application and perfectly acceptable during an R&D project. I have no problem with that.

Q. Okay.

A. No, I don't think that has anything to do with it.

Q. Okay. Thank you.

MR. SNUFFER: That's it.

MR. MORAN: Yes, you have the opportunity to read and sign the transcript. You do want to read and sign, right?

THE WITNESS: I have to read and sign the whole transcript right now?

MR. MORAN: Not right now. Madame court reporter will send you a copy, or send it to us and we'll get it to the doctor.

MR. SNUFFER: I want an electronic copy. PDF copies of the exhibits, and color would be helpful.

(The deposition concluded at 2:03 p.m.)

IN THE UNITED STATES DISTRICT COURT FOR THE
DISTRICT OF UTAH CENTRAL DIVISION

UNITED STATES OF AMERICA,

Plaintiff,

vs. Civil No: 2:15-cv-00828-DN-EJF

RAPOWER-3, LLC, INTERNATIONAL AUTOMATED SYSTEMS, INC., LTB1, LLC, R. GREGORY SHEPARD, NELDON JOHNSON, and ROGER FREEBORN,

Defendants.

CERTIFICATE OF COMPLETION OF DEPOSITION

I, PEGGY JO GONZALES, New Mexico CCR #145, DO HEREBY CERTIFY that on October 23, 2017, the deposition of THOMAS R. MANCINI was taken before me.

I FURTHER CERTIFY that copies of this

certificate have been mailed or delivered to all Counsel, and parties to the proceedings not represented by counsel, appearing at the taking of the deposition:

I FURTHER CERTIFY that examination of this transcript and signature of the witness was requested by the witness and all parties present.

I FURTHER CERTIFY that I did administer the oath to the witness herein prior to the taking of this deposition; that I did thereafter report in stenographic shorthand the questions and answers set forth herein, and the foregoing is a true and correct transcript of the proceeding had upon the taking of this deposition to the best of my ability.

I FURTHER CERTIFY that I am neither employed by nor related to nor contracted with (unless excepted by the rules) any of the parties or attorneys in this case, and that I have no interest whatsoever in the final disposition of this case in any court.

_____

Peggy Jo Gonzales CM

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Date Taken: October 23, 2017

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ACKNOWLEDGMENT OF DEPONENT

I, _____, do hereby acknowledge that I have read and examined the foregoing testimony, and the same is a true, correct and complete transcription of the testimony given by me, and any corrections appear on the attached Errata Sheet signed by me.

_____ _____

(DATE) (SIGNATURE)