

LAND USE BOARD
TOWNSHIP OF BEDMINSTER
COUNTY OF SOMERSET

In the Matter of)
The Application of:)
CASE LUB# 12-015 (BOA))
KDC SOLAR SA55 LLC) Transcript of
Solar Project -) proceedings
Country Club Road)
Block 71.02, Lot 1)
Block 62, Lot 10)
Block 69, Lot 4)

Thursday, December 11, 2014
Bedminster, New Jersey
Commencing at 7 p.m.

LAND USE BOARD

LANCE BOXER, Chairman
GEORGE RODELIUS
NICK STRAKHOV
DORN STEWART
KENNETH OLSEN

ALSO PRESENT

TRINA LINDSEY, Recording Secretary
FRANK BANISCH, Township Planner
PAUL W. FERRIERO, Township Engineer

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1 THE CHAIRMAN: It's been a while since
2 we've had KDC before us. We will go straight to
3 KDC, Land Use Board 12-015, so it's been since I
4 guess October.

5 MR. HALL: Good evening. We were here
6 in October. I'd like to call George Rever. Bill --
7 I'm sorry -- Rever. You're going to get sworn.

8

9 W I L L I A M R E V E R, sworn.

10 DIRECT EXAMINATION BY MR. HALL:

11 MR. COLLINS: Please state your name and
12 please spell your last name.

13 THE WITNESS: Yes, my name is William
14 Rever, and I reside at 119 Kingbrook Road in
15 Linthicum, Maryland, 21090.

16 THE CHAIRMAN: Mr. Rever, could you do
17 me a favor and speak into the microphone.

18 THE WITNESS: Sorry, yes, sure.

19 MR. COLLINS: And spell your last name.

20 THE WITNESS: Yeah, R-e-v-e-r.

21 Q. And, Mr. Rever, can you tell the Board
22 your background and qualifications.

23 A. Yeah, sure. So my educational
24 background is a BA in physics from John's Hopkins
25 University, MSC and MBA degrees from University of

1 Pennsylvania in Philadelphia.

2 Q. Can you tell them what the MSC means?

3 A. Oh, master of science in energy
4 engineering.

5 Q. Okay?

6 A. And I began my career in photovoltaics
7 in 1982 with industry pioneer company called
8 Solarex. That company become part of BP in 1999,
9 and I worked for that company until the end of 2011,
10 and since then I've been an independent consultant
11 working in the field of photovoltaics.

12 Q. And have you testified before planning
13 and zoning boards such as this one on issues
14 involving photovoltaics?

15 A. Yes, I have, yes.

16 THE CHAIRMAN: And what states have you
17 been testifying?

18 THE WITNESS: In New Jersey.

19 THE CHAIRMAN: Okay.

20 Q. And have you been accepted as an expert
21 in that field?

22 A. Yes, sir.

23 Q. And could you -- you said photovoltaics.
24 Can you just describe for the Board what that
25 entails and what types of things you've testified

1 about and are experienced with.

2 A. Of course. So photovoltaics is the
3 direct conversion of electricity or -- sorry -- of
4 light into electricity, and I've testified a number
5 of different aspects around that technology,
6 including the impact of the --

7 THE CHAIRMAN: Just speak into the mic.

8 A. I've testified at a number of different
9 hearings regarding the technology, the systems, the
10 attributes that are encountered during use, how
11 systems perform, certification, system lifetimes,
12 basically all the key issues that are surrounding PV
13 technology.

14 Q. And that includes the composition and --
15 of solar panels?

16 A. Yes, correct.

17 Q. And the equipment used in connection
18 with solar energy projects?

19 A. Yes, correct.

20 Q. Inverters?

21 A. Yes.

22 Q. And the other components?

23 A. Yeah, combiner boxes, transformers,
24 switch gear, et cetera, all the different aspects of
25 a complete photovoltaic system.

1 MR. HALL: I would offer him as an
2 expert in photovoltaic equipment.

3 THE CHAIRMAN: Thank you. Mr. Collins.

4 MR. COLLINS: Mr. Chairman, I would
5 recommend you open it to the attorneys for questions
6 as to voir dire, meaning any questions just about
7 the qualifications of this expert.

8 THE CHAIRMAN: I appreciate that.
9 Mr. Sasso, Miss Donato, nice to have you again this
10 evening. Do you have any questions for this
11 witness?

12 MR. SASSO: Thank you. Just a few. And
13 I guess in terms of him providing testimony, it'll
14 be interesting to know at this point in the
15 proceedings whether or not he's going to be
16 testifying about the panels that are actually going
17 to be installed in Bedminster, or is he being
18 offered as an expert to talk about all different
19 panels, because as you know, on behalf of the
20 objectors, we've been seeking for over a year to
21 find out what panels are going in in Bedminster so
22 we can do our due diligence to determine the
23 toxicity of those panels. So is he going to base
24 it -- I know Mr. Hall's wiggling in his chair, but I
25 guess the question is will he be testifying tonight

1 as an expert as to the panels that are going to be
2 installed in this township in this project or just
3 overall in the industry.

4 MR. HALL: That question has nothing to
5 do with voir dire. I mean, we're testifying. If
6 they don't like what they hear, they can ask
7 questions.

8 MR. SASSO: Mr. Chairman, I beg to
9 differ.

10 MR. COLLINS: I think Mr. Hall is
11 correct, Mr. Chairman. You should focus, Mr. Sasso,
12 at this stage on not on speeches but just on any
13 questions you have about this witness's
14 qualifications to appear as an expert before this
15 Board.

16 MR. SASSO: Well, my question,
17 Mr. Collins, which goes to the direct meet of the
18 matter, the crux of the matter, is --

19 MR. COLLINS: I'm directing you now,
20 Mr. Sasso. You know how this works.

21 MR. SASSO: Well, I do, but I think --

22 MR. COLLINS: And you shall focus your
23 attention solely on the question for this witness,
24 not a statement to me, not a statement to the Board.
25 Ask your question of the witness.

1 MR. SASSO: Sure.

2 MR. COLLINS: Make it relevant to his
3 qualifications for this time. That does not mean
4 that later you will not be able to ask questions
5 about the substance of his opinion.

6 MR. SASSO: I understand that perfectly
7 well, Mr. Collins. My question is --

8 MR. COLLINS: Go ahead and ask your
9 question, Mr. Sasso.

10 MR. SASSO: I'm trying to. Mr. Rever.

11 THE WITNESS: Yes.

12 MR. SASSO: Are you going to -- do you
13 have knowledge as an expert with regard to the
14 panels, the solar panels that are going to be used
15 on this particular project?

16 THE WITNESS: The client has advised me
17 that there are -- is a general class of PV modules
18 that's being considered for use in this project,
19 which is crystal and silicon based PV modules, with
20 which I'm very, very familiar and can talk to the
21 issues around the manufacture and deployment of
22 those modules, but I believe that the client has not
23 selected a specific model of panel for use in this
24 project at this time.

25 MR. SASSO: Okay. So is it within your

1 realm of expertise to talk about panels in that
2 general area when you don't know the exact panel
3 that they're going to use? Do you understand what
4 I'm saying? In other words, within that general
5 area of, quote, panels could there be a panel that
6 they pick after you leave here tonight that you're
7 not familiar with?

8 THE WITNESS: I would say that it
9 certainly is possible, but it's very unlikely
10 because PV modules of the type that are being under
11 consideration for this project are very highly
12 standardized in terms of their design, and the
13 client has enumerated a number of models,
14 essentially what I would call a short list of -- and
15 they all fall under the same fundamental category.
16 They all meet the same basic certifications. They
17 pass the same sorts of tests. They're made in very,
18 very similar ways. So I think that, you know, you
19 could -- some people will call them a commodity. So
20 I think that's in some ways an accurate description
21 but they're very, very similar across this general
22 class.

23 MR. SASSO: Mr. Chairman, with that, I
24 have no objection to him being qualified as an
25 expert.

1 THE CHAIRMAN: Thank you, Mr. Sasso.
2 Miss Donato.

3 MS. DONATO: Yes, thank you. I just
4 have one question, and that is are you also familiar
5 with the aspects of toxicity that may exist with
6 respect to some solar panels or --

7 THE WITNESS: Yes, it's something I've
8 encountered in my career, and I'm able to --

9 THE CHAIRMAN: Speak up, sir.

10 THE WITNESS: Yes, I'm going to address
11 that issue and try to provide some further
12 explanation about the toxicity aspects of PV.

13 MS. DONATO: And are you also familiar
14 with -- assuming that you're familiar with the
15 potential toxicity in the panels, are you familiar
16 with the effects of such potential toxicity?

17 THE WITNESS: That's not really my field
18 of expertise so I would say no.

19 MS. DONATO: Thank you so much.

20 THE CHAIRMAN: Thanks, Miss Donato.
21 Appreciate that, Mr. Rever.

22 MR. COLLINS: Mr. Chairman, I recommend
23 the Board consider a motion to accept the
24 qualifications of Mr. Rever --

25 THE CHAIRMAN: We'll do that.

1 MR. COLLINS: -- as a PV expert.

2 THE CHAIRMAN: So a motion -- is there
3 are a motion to deem his qualifications acceptable
4 by the Board?

5 A BOARD MEMBER: So moved.

6 THE CHAIRMAN: Is there second?

7 A BOARD MEMBER: Second.

8 THE CHAIRMAN: And a roll call.

9 MS. LINDSEY: Mr. Strakhov.

10 MR. STRAKHOV: Aye.

11 MS. LINDSEY: Mr. Rodelius.

12 MR. RODELIUS: Aye.

13 MS. LINDSEY: Mr. Olsen.

14 MR. OLSEN: Aye.

15 MS. LINDSEY: Chairman Boxer.

16 THE CHAIRMAN: Aye. Okay, Mr. Rever.

17 MR. HALL: Thank you.

18 Q. Why don't you, Mr. Rever, if you would,
19 explain to the Board what's proposed here in
20 whatever sequence makes sense to you.

21 A. Sure. So I thought that it might make
22 sense given the type of questions that have arisen
23 around PV technology to talk a little bit about some
24 of the aspects of how it works, what are the basic
25 components, what do they do, how some of these

1 things are made, especially the PV modules,
2 themselves, which is a key element in one of these
3 systems, and I think that might help to just give
4 you some general background, and then we can open it
5 up to questions.

6 Does that make sense?

7 THE CHAIRMAN: Sure.

8 A. So I think let me start out by saying
9 that, you know, everyone I think is aware that
10 basically a PV system consists of PV modules, which
11 the active element is called a PV cell or a solar
12 cell. Actually, it was invented not too far away
13 from here around 60 years ago at Bell Labs with
14 silicon solar cells that we're talking about here,
15 and that's the type of technology that's under
16 consideration for use in this project.

17 A module consists of a number of
18 individual solar cells connected together usually in
19 series. That's the configuration that's again being
20 proposed for this plant. The individual PV module
21 is an assembly of those cells put together
22 mechanically and electrically, and then individual
23 modules are connected together, again, mechanically
24 and electrically, to make arrays of photovoltaic
25 modules. Typically, you'll connect together in

1 groups of series strings. Those are then aggregated
2 together in parallel and what are called combiner
3 boxes. You know, large field like this, those
4 combiner boxes then feed into other larger
5 recombiner boxes. Those are fed in electrically to
6 the inverters on the site, which convert the direct
7 current electricity, which is what photovoltaic
8 systems produce naturally, into alternating current,
9 which is what we are familiar with and use in our
10 houses. It's a standard current that's used in the
11 mains. And then in this particular case, this
12 generated AC current will then be stepped up by a
13 transformers to a somewhat higher voltage and
14 transmitted for use at Sanofi, which is a
15 neighboring facility.

16 Q. And when you refer to solar modules, is
17 that what we in lay terms call a panel?

18 A. Yeah. The terms are -- have become more
19 or less interchangeable. I won't get into the
20 technical details between what one is and what the
21 other one is, but basically, yes, it's an individual
22 unit, typically in this case something around
23 3-foot-by-5-foot in size, weighs around 40 pounds
24 each.

25 Talk a little bit now I think about

1 maybe what's in a panel. The construction we're
2 talking about here -- and this is what I'm saying --
3 is very, very standardized. It's actually been
4 something that was developed basic design almost
5 30 years ago. It's been embellished over the years,
6 and cells are far more efficient, but the
7 fundamentals of this design came out of work at the
8 jet propulsion laboratory in late 1970's, the early
9 1980's.

10 So in these designs, the front of the PV
11 module is a sheet of low iron, low iron because it's
12 high transmissivity for light. So it means a lot of
13 light gets through the glass into the cells.
14 There's a sheet of encapsulating polymer called
15 ethylene vinyl acetate, which is a synthetic
16 transparent rubber compound. So most commonly the
17 application might be most familiar with is maybe in
18 running shoes. So it's a basically a rubber,
19 synthetic rubber. There is the matrix of solar
20 cells, which is the interconnected range from the
21 solar cells, I spoke about earlier then another
22 layer of the EVA, and then finally a back sheet
23 material, which is usually a polymer -- there's a
24 number of different compositions, but typically
25 something containing Tedlar or polyethylene and/or

1 both. What that does is seals -- all that, all
2 those things are basically put together into a
3 sandwich. It's put into a vacuum lamination
4 process, and air is evacuated from that, and it's
5 heated, and the EVA flows in between all the
6 interstices with all the spaces in the module, and
7 it becomes one, essentially one mechanical sealed
8 unit.

9 After that, the final finishing of the
10 module is putting on the aluminum frame, which is
11 how it's mounted, how it's held up, provides
12 mechanical strength, as well, and the attachment of
13 the connectors on the back. So that's how a PV
14 module and how is assembled.

15 The individual cells, themselves, start
16 out as highly refined silicon wafers. The raw
17 material for that is quartz sand initially. That's
18 refined into what's called metallurgic grade
19 silicate is the first step. There's then a
20 subsequent set of chemical refining steps to take
21 that silicate to a very high level of purity, which
22 is needed to make good semiconductors and solar
23 cells, and then that highly purified silicon is
24 melted and solidified in a certain way basically in
25 a big block typically, and that creates a big

1 crystalline block of silicon that has the right
2 properties to make good solar cells. During that
3 process of melting and casting, a small amount of
4 impurity element called boron is added, which makes
5 the silicon what's called p-type, which basically
6 means it has a certain type of electronic
7 properties. That then, when that is cast into those
8 blocks, those are sawn into smaller bricks, of which
9 the cross-section will become the ultimate solar
10 cell. So in this case, each brick would be
11 156 millimeters on the side. That's the standard in
12 the industry, which all of the makes under
13 consideration use that. And then those bricks are
14 then subsequently sliced into very thin wafers using
15 what are called wire saws. Those wafers then get
16 cleaned, etched, and begins the process of making
17 individual solar cells.

18 So the wafer goes in the first part of
19 the solar cell manufacturing process is what's
20 called diffusion, where a small amount of another
21 impurity, which contains phosphorous, is put into
22 the front of the cell, and that creates what's
23 called an n-type region, and it's the juxtaposition
24 of the n-type and p-type which creates what's called
25 a junction. So there's actually an electric field

1 existing within that silicon wafer, and when a
2 photon of light goes into that silicon wafer, it's
3 able to excite electrons, and the absence of
4 electrons, which are called holes, form and move in
5 the other direction, and those electrons are what
6 are able to move out into an external circuit, give
7 up some of the energy that was in the initial photon
8 at the end of the silicon wafer, and that's what
9 creates the PV power and energy.

10 So the -- once the junction is created
11 in the silicon wafer, then the subsequent processes
12 in the solar cell are essential to make it a better
13 cell. So it's putting a metal grid on the front, a
14 metal surface on the back for conductivity and
15 attachments, and then subsequently interconnecting
16 individual cells together with copper ribbons, and
17 then that goes into making the PV modules that I
18 described earlier.

19 Generally, it might make sense to talk a
20 little bit about the composition. So a typical PV
21 module of this type is about 75 percent glass by
22 weight. It's about 10 percent aluminum by weight,
23 and about 6 percent or so are the polymers that are
24 used in it, and the rest are other materials,
25 including silicon, which is like around 1 percent,

1 and some of the other things like copper and very
2 small amounts of silver, for example, which is used
3 in metalization of the cells.

4 So as designed, the typical PV module
5 today, which I mentioned, you know, the design comes
6 out of a design that was invented a long time ago,
7 it's derivative of that, and today, all of the top
8 tier manufacturers are certified to international
9 standards. One of them is most -- the most
10 important is called IEC 61215, which all of the
11 models that are under consideration by the client
12 meet that standard, as well as one called IEC 61730,
13 which is also around safety.

14 So in a nutshell, what the standards do
15 is they test the module under accelerated life
16 conditions is one aspect, and that is to tease out
17 any potential failure mechanisms. So all of these
18 modern PV modules that meet these certifications
19 have been tested and to these kind of standards, and
20 what they are is things like cycling them to
21 different temperatures and putting them into
22 conditions of high humidity for long periods of
23 time, putting them through freezing and high
24 humidity cycles, putting them under different kinds
25 of mechanical loads that simulate the effect of very

1 high winds or snow loads, for example.

2 MR. OLSEN: Can we get copies of those
3 standards?

4 THE WITNESS: Sure.

5 MR. OLSEN: Can I just ask one question?
6 When you're describing the physical configuration of
7 the panels, you said that there were two polymeric
8 strata, one on top and one below the actual cells.

9 THE WITNESS: Right.

10 MR. OLSEN: I'm trying to visualize. So
11 wouldn't that make you have an opaque layer above
12 the cell, itself? Why does not -- that does not
13 inhibit the light from getting through?

14 THE WITNESS: It's actually transparent.
15 That's the EVA is a transparent material.

16 MR. OLSEN: It's not really black like
17 the bottom of a sneaker.

18 THE WITNESS: No, it's like a -- it's a
19 transparent material.

20 MR. OLSEN: Thank you.

21 Q. You were talking about the standards, I
22 think you said two different kinds?

23 A. One essentially is to qualify the
24 modules for their environmental robustness,
25 basically, so they're going to last in the field,

1 and then there's other standards around safety, so
2 it's things like electrical isolation. They'll be
3 able to withstand different kinds of fire
4 situations, et cetera. So again, nowadays, there's
5 many, many different modules that meet these
6 standards.

7 MR. OLSEN: Is the safety about
8 environmental safety or physical safety to people
9 around it? What are the standards addressing?

10 THE WITNESS: It's generally the safety
11 to people and property typically. So there are some
12 environmental standards. Some companies, you know,
13 follow them. Some don't. Let's say that each
14 company follows its own path to some degree. I know
15 that one of the key companies that is under
16 consideration for this project in terms of
17 environmental is qualified to ISO 14,001, which
18 basically is a quality standard that includes
19 environmental aspects, and they're also a part of a
20 group called PV Cycle, which is oriented towards
21 Europe because in Europe there are very rigorous
22 standards for electronic and electrical equipment
23 and responsibilities of manufacturers, but
24 basically, it means that the company would take back
25 the products at end of life and recycle essentially.

1 THE CHAIRMAN: Mr. Rever, I'm not sure
2 if this is your field of expertise, but as you think
3 about your comments, in the event of a major
4 failure, whether it's electrical or it's mechanical,
5 but if there was a chain of events that created
6 massive destruction on the site, whether it be
7 through hurricane or lightning, it was just a
8 cascading event, I guess the word I'd use is toxic
9 penetration, all these panels were to explode -- I
10 don't even know how that would happen. I'm really
11 thinking in a very worst case in a mega disaster,
12 which is what we try to think about, are there
13 studies or are there experiences that maybe you can
14 talk about or defer to another expert as to the
15 potential effects this may have on ground water in
16 the area? So again, my question really may not
17 be -- my question is broad and you may not be the
18 expert. It may not be your area of expertise, but
19 maybe you can comment on it.

20 THE WITNESS: Yeah. I think that what I
21 would say is, as you, yourself, pointed out, it
22 would be, you know, it would really be a
23 catastrophe. These things are pretty rugged.
24 Normally, I mean, it's -- if one breaks, it's an
25 unusual circumstance. You know, most manufacturers,

1 just to give a number, like the typical return rate
2 for module manufacturers is .1 percent.

3 THE CHAIRMAN: What does that mean,
4 return rate?

5 THE WITNESS: Well, in other words, if
6 they ship out a million modules in a year, they get
7 .1 percent back, a hundred modules I think or a
8 thousand modules, but .1 percent of a million.
9 But --

10 THE CHAIRMAN: So your point is that
11 based on their shipments, it appears that they get
12 back everything they ship minus some small rounding
13 error.

14 THE WITNESS: Essentially, nothing comes
15 back. I mean, in other words, they're very, very
16 rugged things. But, you know, I don't want to
17 dismiss your question on that basis.

18 THE CHAIRMAN: No, I understand.

19 THE WITNESS: But I think if you did,
20 like let me talk about what happens if a module does
21 break, I mean, you know, if it would happen, I mean,
22 for a variety of reasons, somebody can throw a
23 wrench through a module even though they're pretty
24 sturdy. Immediately there's not going to be any
25 toxic element released, I mean, because all of these

1 materials are designed to be fundamentally inert. I
2 mean, that's sort of how they achieve high levels of
3 reliability, but if you put moisture on it,
4 especially over time, you know, things can, you
5 know, you can get chemical reactions, especially you
6 have acid rain, for example, which can promote
7 chemical reactions, and some of these materials
8 would begin to have some leaching out. It's -- I'm
9 not an expert enough to say exactly what degree that
10 would be for the case you used, but in general,
11 there's very minute quantities of anything that's
12 very toxic in these modules.

13 THE CHAIRMAN: Okay. Thank you.

14 THE WITNESS: So I guess I'm moving to
15 questions.

16 Q. Is that pretty much it on the panels,
17 themselves?

18 A. Yes.

19 Q. Maybe makes sense to ask questions about
20 that before you go to the inverter and the other
21 components.

22 MR. HALL: I defer to you, Mr. Chairman.
23 Does that make sense?

24 THE CHAIRMAN: Mr. Hall, we can also ask
25 Mr. Sasso and Miss Donato how you would like to

1 handle this. We can wait until the end and they can
2 certainly cross-examine.

3 Q. Well, why don't you just go through
4 everything.

5 THE CHAIRMAN: Maybe that's better.
6 We'll try to deal -- otherwise, we can get
7 distracted.

8 Q. All right. So anything else you want to
9 tell us about the panels? So let me back up. On
10 what you're just talking about, are there different
11 panel designs that some are potentially more, quote,
12 toxic than others?

13 A. Within --

14 Q. Either historically or whenever?

15 A. The answer is yes looked very, very
16 broadly across all PV technologies. So, you know,
17 we're talking about one specific type of
18 photovoltaic, which is the silicon wafer based
19 technology. There are other technologies that have
20 become commercial in the last half dozen years,
21 specifically cadmium telluride based PV's, copper
22 indium diselenide. These are all alternative
23 semiconductors to silicate, and there's even more
24 for silicon, which is another class, and there's
25 starting to be more of these things coming out of

1 laboratories, but the wafer based crystal and
2 silicon is 90 percent of the market. So, you know,
3 some of these alternative technologies, each has its
4 own characteristics, and it's distinct from the
5 crystal and silicon technology I've been discussing.
6 So I would say, yes, there can be differences in
7 these areas, but they're not under consideration for
8 this project.

9 Q. And the terminology of what's considered
10 and what you've been speaking about is crystalline
11 --

12 A. Yes.

13 Q. -- silicon wafer?

14 A. Yes, the wafer based -- silicon wafer
15 based technologies.

16 Q. That's what's proposed and that's what
17 you've been talking about?

18 A. Correct, yes.

19 Q. Not any other technology?

20 A. That's correct.

21 Q. Okay.

22 A. Yes.

23 Q. Okay. Does that cover the panels for
24 now?

25 A. Yes.

1 Q. Okay.

2 MR. STRAKHOV: Can I just ask one very
3 direct question. Does the glass get dirty over
4 time? Does it need to be washed periodically, or
5 does the rain take care of it, or how does that
6 work?

7 THE WITNESS: It varies a lot by
8 climate. So in this area, generally speaking, you
9 don't need to clean panels. It can be locational.
10 If you have a specific soiling situation giving
11 place that might change that, but generally here
12 there's enough rain that you -- the dirt generally
13 washes off of them, and it's not generally
14 necessary. I would say that typically now these
15 systems are all monitored very carefully, and
16 typically there are strong financial reasons to want
17 the output of the systems to be maximized. So
18 typically, if there's enough of a soiling condition
19 that a drop in output is seen beyond a certain
20 level, then people do go out and clean them.

21 MR. STRAKHOV: What's that procedure?

22 THE WITNESS: It's also quite variable.
23 Typically, it can be --

24 MR. STRAKHOV: Well, what would it be in
25 this case?

1 THE WITNESS: To be honest with you,
2 I've not heard a cleaning process so I really
3 wouldn't want to comment, but it could be as simple
4 as simply washing them off.

5 THE CHAIRMAN: So we've talked at some
6 points in this hearing about end of life, whatever
7 end of life is -- I've forgotten -- 15, 20 years.
8 What components, what elements remain inside the
9 panels that might be relevant to decommissioning
10 concern? So for instance, as the panels produce
11 less electricity over time, what actually happens to
12 the panel, and if it was 20 years from now and we
13 were to take that same panel, is there less crystal?
14 Is there less aluminum? Which components ultimately
15 change to produce less electricity over the life of
16 the panels?

17 THE WITNESS: That's a great question.
18 Actually, you wouldn't -- unless there was generally
19 a catastrophic failure, which would be really,
20 really unusual, probably you would have a hard time
21 seeing what is going on to reduce the power.
22 Experts would be able to. You'd be able to with
23 test equipment and so on. But you might be able to
24 see some of the things. I mean, there's a couple of
25 things that happen. So one of them is that the

1 encapsulation can degrade, and so you can get
2 yellowing. So that obviously if it happens it's
3 visible or can be visible. Probably more
4 significant is the inner connection, the attachment
5 of the interconnects to the cells begin to get
6 higher resistance and, this is due to combination of
7 the thermal cycling and some amount of corrosion
8 that's starting to happen at the terminals inside
9 the cell matrix. You may or may not be able to see
10 anything. You could probably pick it up in certain
11 types of scans to see hot spots within a module
12 would be an example of that. But basically, it
13 would look exactly, pretty much exactly the same as
14 the day it was installed unless it's had some sort
15 of catastrophic failure.

16 THE CHAIRMAN: Thanks.

17 Q. To follow up on that decommissioning was
18 mentioned, if 20 -- you say 20 years and there's a
19 lease and it's over, and so the KDC has to remove
20 the panels, where do they go?

21 A. Well, that's an interesting question. I
22 mean, I think that the anticipation within the
23 industry is that there will probably be a recycling
24 capability at that time. This is something that's
25 incipient or embryonic today simply because we don't

1 have modules in any significant quantity reaching
2 end of life, but like I was mentioning earlier, in
3 Europe, where you've a had a little bit earlier
4 deployment cycle and a pretty fair -- of PV
5 deployed -- Germany alone is 37 gigawatts, for
6 example -- I think we're going to see this much
7 sooner, and so I think I've seen a number of papers
8 at conferences recently, for example, showing how PV
9 modules can be recycled so I think that would be the
10 most likely disposal.

11 THE CHAIRMAN: Let me just ask you one
12 question. Is there something inherent with solar
13 broadly specific to this installation that concerns
14 you that's either dangerous or odd or affects
15 quality of life that we haven't asked you? So is
16 there anything as an expert that you look at solar
17 and say I wish if one thing could be changed, what
18 would it be that would help the deployment, either
19 make it safer, make it longer lasting? I'm not
20 trying to get into a technical debate over the
21 issues. I'm just trying to understand from your
22 perspective is there something inherently wrong with
23 solar that would affect quality of life that we
24 haven't asked you and we should ask?

25 THE WITNESS: I would say no in the

1 quality of life at the deployment. I mean, I think
2 you can ask questions about at the point of
3 manufacture, although in all honesty, I think that's
4 getting a lot better, but I think there was a period
5 of time, I'll say roughly 5 years ago, when the
6 Chinese manufacturing industry had just gone through
7 an enormous burst, and I think there were shortcuts
8 being taken by some -- not all, but some --
9 manufacturers in China.

10 THE CHAIRMAN: Are most panels made now
11 in China?

12 THE WITNESS: Barely. It's the single
13 largest location globally, but it's just a nudge
14 over 50 percent I think of all the PV modules are
15 made in China, but so -- but I think again, this is
16 one of those things where sort of yesterday's story
17 was some of these things that you might have read
18 about back in that time frame, but now I think
19 certainly the major actors have, quote/unquote,
20 cleaned up their act, and I think they're much more
21 sensitive to these environmental issues.

22 THE CHAIRMAN: I appreciate the answer.
23 Thank you.

24 Q. Okay. So the panels, each panel
25 generates direct current, right?

1 A. Correct.

2 Q. And where does it go?

3 A. Okay. So once the current is generated
4 by the module, they're put together in series
5 strings. So in this case, the proposed design is 11
6 modules in series. Those then go into combiner
7 boxes. These are literally electrical boxes that
8 you're familiar, probably seen in other electrical
9 installations. That then goes into higher level
10 aggregation, so these are using typical electrical
11 industry wiring practices. There's wires
12 specifically developed for PV's with UV resistant
13 jackets and so on to allow relatively simple
14 stringing of these arrays. And then that's fed into
15 the next significant active component, which is the
16 inverter, and the inverter is a very large basically
17 solid state switching device that converts that
18 direct current flow into an alternating current
19 flow. It's got a few other functions, but that's
20 the principal function. It's basically a large
21 piece of solid state electric in a big metal box
22 basically.

23 From that point, the output of the
24 inverter goes to a transformer, again, a very
25 standard piece of electrical equipment, which takes

1 that output up in voltage so you can transmit it
2 longer distances, and that's a fairly very, very
3 standard kind of technology just basically using
4 electromagnetic principals. And then it's fed to
5 the distribution panel where it will be used in this
6 case because the system is a behind-the-meter
7 system. It's a utility term actually because it
8 means it's on the other side of the meter from the
9 utility. So all the energy generated from this
10 project is going to consumption on a facility that's
11 nearby.

12 Q. So the first the combiner box, a number
13 of those?

14 A. Yes.

15 Q. How many panels per combiner? Is that
16 the way you -- how does that work?

17 A. Yeah, so you have strings, a number of
18 series strings. I'm sorry, I don't happen to know
19 that number off the top of my head for this project,
20 but it's typically several dozen strings going into
21 a box, and there's a practical number of how many
22 you can put together, which is why you need series
23 of different combiners to build it up to get to the
24 inverter.

25 Q. Do you know how many inverters there

1 are?

2 A. Well, in this project there's three main
3 inverters proposed.

4 Q. And one transformer or more than one?

5 A. I'm sorry, I'm getting beyond my -- I
6 think there's two actually because in this case
7 there's a need to split the output to be on
8 different parts of the -- basically where it's tied
9 into the utility grid, so I believe there's actually
10 two.

11 Q. Okay. Now, the inverters and the
12 transformers, are they dangerous? Are there
13 protections that need to be considered there?

14 A. Well, basically, I mean, they're pieces
15 of high power electrical equipment so they're
16 something that have to be, you know, dealt with by
17 qualified electricians and so on, which they are.
18 So you wouldn't want to have a layperson going
19 inside any of that equipment. But it's not anything
20 that different from what you find in a HVAC room at
21 a, you know, a shopping mall or something like that.
22 It's in that same kind of power class and range.

23 Q. And they're within an area that's fenced
24 in to keep --

25 A. Yes.

1 Q. -- people out.

2 A. Yes, exactly.

3 Q. And there's signage required, do you
4 know?

5 A. Yes, yes. So, I mean, these things are
6 labeled danger, high voltage, et cetera. So it's --
7 it's obviously a piece of electrical -- high powered
8 electrical equipment that's to be avoided by the
9 layperson.

10 THE CHAIRMAN: Mr. Rever, what does that
11 really mean, though? So this is a facility that
12 will be not guarded by 12-foot fences. There's
13 fencing, but it's going to be limited. If somebody
14 were to jump a fence, when you say it shouldn't be
15 dealt with by lay people, where in this operation
16 are the most vulnerable points, the most dangerous
17 points? So for instance, if somebody was to go in
18 and sit by a panel, is that dangerous or not?

19 THE WITNESS: No, no. I think where it
20 gets dangerous is if someone were to interrupt the
21 flow of current, i.e., you know, grab a wire, you
22 know, then it gets dangerous.

23 THE CHAIRMAN: But the wires are
24 connected in the inverters are inside buildings --

25 THE WITNESS: Right.

1 THE CHAIRMAN: -- and the transformers
2 are also protected; is that correct?

3 THE WITNESS: Yes. There's locked
4 enclosures and so on.

5 THE CHAIRMAN: If somebody was to be
6 under a panel, if somebody was to walk over to a
7 panel and touch it, there would be a nonevent; is
8 that what you're saying?

9 THE WITNESS: Yes.

10 Q. And the electrical equipment, I think
11 you said that any commercial building facility has
12 something, maybe not the same thing, but --

13 A. Similar classes of equipment.

14 Q. Places where strangers shouldn't be
15 touching things.

16 A. Exactly.

17 Q. Okay.

18 A. Yeah. I mean, I think that it's maybe
19 worth pointing out that you could get into --
20 there's more risk of -- again, one of the
21 certifications for PV modules is, in fact, like a
22 wet resistant or insulation test, but the risk goes
23 up if it's wet.

24 THE CHAIRMAN: What does that mean?
25 Explain that.

1 THE WITNESS: Well, because,
2 essentially, if the back -- if the back of the
3 module -- you mention somebody coming up and
4 touching the back of the module. Well, the ability
5 to conduct current is much higher if there's
6 moisture, you know, present. It's like almost
7 anything electrical. It's the same principal. So
8 there's a higher degree of risk. It doesn't say
9 that something would happen, but there's a higher
10 degree of risk if it were to be wet.

11 THE CHAIRMAN: I don't mean to probe and
12 make this negative. I'm just trying to understand.
13 If somebody were to touch a panel during a rainy
14 day, would there be a chance of electrocution if
15 they touched the primary panel, or they have to
16 touch the other parts of the panel that are more
17 dangerous -- obviously, everything is exposed, but
18 are there specific parts that are more dangerous?

19 THE WITNESS: Probably, you know, this
20 is where you get into -- you probably have to have a
21 failure condition of some sort, but it wouldn't be a
22 fail -- it may not be a failure that you would see
23 otherwise. I guess that's where I'm kind of going,
24 that you could have, you know, for example, a tear
25 or something in the back sheet of the module that

1 you might not immediately detect otherwise or
2 something like that, but if a person were to
3 complete the circuit with that, that could
4 conceivably be dangerous. So you could say under
5 the normal operating conditions, no, but again,
6 there's more risk if you get into something like a
7 wet condition.

8 MR. OLSEN: How much power does an
9 individual panel produce? What -- what's the
10 capacity of that to generate a shock?

11 THE WITNESS: These are 300-watt panels,
12 but the way the system is set up is 11 modules and
13 series, and each one is around 35 volts, so it's
14 400 volts typically to ground. So it's enough to be
15 dangerous.

16 MR. STRAKHOV: Does the power shut off
17 at some dual level of cloudiness like as it gets
18 rainy or darker?

19 THE WITNESS: It's proportional.

20 MR. STRAKHOV: So doesn't something say,
21 oh, it's too long, going to zero.

22 THE WITNESS: You get low enough, it
23 does, but, I mean, that's a fairly low point.

24 MR. STRAKHOV: It would compensate for
25 the less energy.

1 THE WITNESS: It's pretty linear, pretty
2 far down the scale.

3 Q. Does it shut off, or does it just stop
4 generating, producing, I guess?

5 A. Yeah, I think it gets tricky because, I
6 mean, in a sense, a PV panel, as long as there's
7 light on it, always has some electrical potential
8 there, but the inverter would not be able to track
9 it at that very, very low level so there would be no
10 output coming out of the system after a certain
11 point is reached, but, you know, there's still some
12 small amount of electricity there at the panel.

13 Q. So in a rain storm where it's cloudy,
14 you probably wouldn't have any juice; is that fair
15 to say?

16 A. Yeah, it would be producing quite a bit
17 less power, if not zero, if it were very, very dark,
18 but you'd be surprised. You can still make
19 10 percent power on an overcast day.

20 Q. Have we missed anything that you want to
21 share with the Board?

22 A. I don't think so. I think we've
23 covered -- I mean, I'm open to your questions.

24 Q. Okay.

25 THE CHAIRMAN: Thank you, Mr. Rever.

1 Thank you, Mr. Hall. Why don't we start with
2 Mr. Sasso or Miss Donato, and then we can go to the
3 public.

4 MR. SASSO: Thank you, Mr. Chairman.

5

6 CROSS-EXAMINATION BY MR. SASSO:

7 Q. Mr. Rever, with regard to your opinions
8 today concerning what happens at the end of the
9 cycle or life cycle of the panels, you indicated
10 that the industry in general has this recycling of
11 panels. It's in the embryonic stages, correct?

12 A. Correct.

13 Q. In fact, if we talk about this issue,
14 Europe is way ahead of the United States in that
15 regard.

16 A. Yes, that's true.

17 Q. All right. This technology that we're
18 talking about, I know you told us about the 60's.
19 It was actually 1954 at Bell Labs that they
20 discovered the ability to convert the solar synergy
21 into electricity; correct?

22 A. That's absolutely right.

23 Q. And, in fact, by 1958, they had already
24 started using that technology in certain
25 applications, correct?

1 A. Yes.

2 Q. And this panel that is being proposed
3 for use here in Bedminster is a silicon?

4 A. Yes, it's a silicon based PV.

5 Q. Okay. And you indicated to us that's
6 basically the old technology, and 90 percent of the
7 existing panels in the market are those silicon
8 based units; is that right?

9 A. Absolutely, yes.

10 Q. Is that true also in Europe, by the way?

11 A. Yeah, I believe the market share is very
12 similar over there.

13 Q. Okay. So that when we're talking about
14 the recycling efforts in both Europe and the United
15 States, we'd have to conclude that they're dealing
16 with the vast majority of those panels needing to be
17 recycled as those silicon based units.

18 A. That's correct.

19 Q. Similar to the ones that are being
20 proposed here.

21 A. That's correct, yes.

22 Q. Now, you told us during your testimony
23 that with regard to the panels that KDC has not
24 chosen a particular panel yet.

25 A. Not a specific one, yes.

1 Q. And you were given a, quote, short list.

2 A. Yes.

3 Q. Do you have that with you here today?

4 A. Actually, it was part of the exhibits
5 that were presented here earlier I believe.

6 Q. You rendered a report, correct?

7 A. It was from the engineering firm.

8 Q. Okay.

9 MR. HALL: There are several plan sheets
10 that had some specs, and back in May, I believe we
11 filed a -- some illustrative cut sheets.

12 Q. Okay. But again, getting back I guess
13 to my voir dire questions, as you sit here today and
14 give your opinion before the Board, you don't know
15 the exact panel that's going to be used; is that
16 accurate?

17 A. That's correct.

18 Q. All right. Let's talk about these
19 panels at the end of their useful life because
20 that's when recycling is required, right?

21 A. Sure.

22 Q. Recycling at that time, again, not
23 governed by standards here in the United States.
24 You hope that the company is still in existence at
25 the end of the cycle of 15 or 20 years to do the

1 recycling, correct?

2 A. Well, that's correct. Different
3 companies have -- because of the turmoil in the
4 industry in the last few years, a lot of companies
5 have essentially backed up things like product
6 warranties with external insurance and so on. I
7 agree with your concern, but I think that there are
8 a number of companies that have figured out
9 essentially ways around or basically they've insured
10 against those kinds of issues.

11 Q. But not all the manufacturers.

12 A. Not everyone, of course.

13 Q. In fact, why don't you tell the Board,
14 you know, the percentage of manufacturers that
15 actually agree to do that is actually below
16 10 percent; isn't that right?

17 A. I'm sorry, I don't know the answer.

18 Q. Well, okay. So you're telling us that
19 some manufacturers insure the recycling of the
20 product. You mentioned even a particular name of a
21 manufacturer earlier for the Board. But would you
22 agree with me that the vast majority of
23 manufacturers as it exists today do not give that
24 representation or warranty based on your knowledge
25 in the industry?

1 A. I agree with that.

2 Q. So in other words, these panels that are
3 being suggested on this short list, many of those
4 companies, if not the majority of those companies,
5 don't have that specific warranty that you told us
6 about; isn't that right?

7 A. Yes.

8 Q. Okay. So in this particular case, do
9 you know who the Applicant is?

10 A. Sorry?

11 Q. Sure.

12 A. The Applicant?

13 Q. Yes, the Applicant in the -- in this
14 particular application in Bedminster that wants to
15 install this solar farm, do you know who the
16 Applicant is?

17 A. KDC Solar.

18 Q. And if I told you that it was KDC Solar
19 SA55, LLC, would that surprise you?

20 A. No.

21 Q. And if I told you that my research
22 indicates there's over 20 KDC --

23 MR. HALL: I object to that because I
24 don't care about his research. He's not testifying.

25 MR. SASSO: I'm not testifying.

1 MR. HALL: Well, you are, you are.

2 MR. COLLINS: I think the objection will
3 be sustained then, Mr. Sasso. Why don't you go
4 ahead and ask a question instead of --

5 MR. SASSO: Well, I'm trying to,
6 actually. So can I have this marked, please.

7 MR. COLLINS: It will be an O exhibit.
8 I do not have the list. So I don't actually so see
9 if you have a list of any in the A list. There may
10 not be any.

11 MS. DONATO: I'm thinking there is not,
12 Mr. Collins, but I'm checking my notes.

13 MR. COLLINS: I kind of remember
14 somebody trying to use a picture of something. We
15 couldn't accept it because we didn't have any basis
16 for it. So let's make it -- we can make it easy by
17 making it OS for Mr. Sasso -- make it OF for Forbes,
18 1, with today's date, 12-11-2014, and if there's
19 another O-1, we'll know that this is different by
20 being OF-1. I think you better show it to Mr. Hall
21 and see if there's anything necessary to just admit
22 it because I have my doubts about this witness
23 knowing anything about the --

24 MR. SASSO: Well, that's the point,
25 isn't it, Mr. Collins?

1 MR. COLLINS: It's all right to make a
2 point, sir.

3 MR. SASSO: I am trying to.

4 MR. COLLINS: You need to now just focus
5 in on let's see if it's admitted into evidence,
6 okay, so --

7 MR. SASSO: -- submit it into evidence
8 yet. I want to show it to the witness and ask him
9 if he's aware of the companies.

10 MR. COLLINS: Why don't you show it to
11 Mr. Hall.

12 MR. HALL: I'm looking at it. It's a
13 list of KDC Solar entities, and I don't know the
14 relevance of this. I don't know what it's -- says
15 it's from Hoovers apparently.

16 MR. SASSO: The relevancy I would submit
17 the proffer is that it's extremely relevant to this
18 application. We're being told that the Applicant is
19 KDC and then a different LLC than what exists as an
20 entity on here in Bedminster. So the question
21 becomes and the relevance becomes what company is
22 going to do this project, and will this particular
23 company be viable at the time that recycling is
24 called for in accordance with your ordinance, okay.
25 That's how it matters.

1 MR. HALL: But that has nothing to do
2 with this witness's testimony.

3 MR. SASSO: Well, he --

4 MR. HALL: That's argument, and, you
5 know --

6 MR. SASSO: It's not argument.

7 MR. HALL: Yes, it is.

8 MR. SASSO: According to you. I need to
9 find out if he knows who he's working for and who
10 the Applicant is.

11 MR. HALL: And he testified KDC Solar.

12 MR. SASSO: That's not the Applicant,
13 Mr. Hall, based on the application.

14 MR. HALL: I believe we filed an
15 ownership disclosure form way back when that -- I
16 don't have it with me -- that presumably listed KDC
17 Solar as a parent entity.

18 MR. SASSO: It may be.

19 MR. HALL: If there are any issues about
20 that, and if we ever get an approval, that can be
21 dealt with then as far as other entities. It has
22 nothing to do with this witness's testimony.

23 MR. COLLINS: Yeah, I think you could --
24 you know, you have a problem that this witness
25 doesn't know anything about that form that you put

1 in front of him. At least you want to get him to
2 admit that, go ahead and ask, but it doesn't sound
3 like he's going to know anything about it.

4 MR. SASSO: I agree, Mr. Collins,
5 completely.

6 MR. COLLINS: Why don't we do the
7 first --

8 MR. SASSO: The point is that we need to
9 make a record --

10 MR. COLLINS: I'll take care of this
11 right now. Mr. Rever, do you recognize that
12 exhibit?

13 THE WITNESS: No, I do not.

14 MR. COLLINS: So no further questions.
15 Let's go on.

16 MR. SASSO: Mr. Collins, I'm not asking
17 him --

18 MR. COLLINS: He doesn't know what it
19 is. He can't even identify it.

20 MR. SASSO: I'm not asking him if he can
21 identify the document. I'm asking him --

22 MR. COLLINS: You have to ask him --

23 MR. SASSO: -- if he can identify the
24 companies. It's totally --

25 MR. COLLINS: That's not the question.

1 The question -- this is whether it is a document
2 that will be admitted into evidence.

3 MR. SASSO: No, I'm not covering it in
4 evidence.

5 MR. COLLINS: Then fine, go ahead.

6 MR. SASSO: Yeah, I mean, and I can do
7 this rather quickly.

8 MR. COLLINS: But it's not going into
9 evidence yet.

10 MR. SASSO: I'm not asking to go in
11 evidence. We're asking if he knows who he's working
12 for, okay. Let me show you --

13 MR. COLLINS: That isn't what the
14 question is. You have to focus your question. If
15 you would like --

16 MR. SASSO: It's very focused.

17 Q. On this particular document, go through
18 the list and tell us whether or not you recognize
19 any of those different companies that are listed on
20 the three pages, if you would.

21 A. I do not recognize these specific
22 companies, but it's not my area of expertise.

23 Q. No, I under -- well, your expertise
24 deals with whether or not according to your
25 testimony this project would be safe for the

1 Township of Bedminster, correct?

2 A. Yes.

3 Q. That's one of the reasons why you're
4 here.

5 A. Yes.

6 Q. Let's go back to what I was asking you
7 about, recycling. I mean, in the industry, as you
8 know, and you started touching on it earlier, there
9 have been a series of company failures along the way
10 in the solar industry.

11 A. Absolutely.

12 Q. I mean, we can mention Solyndra, for
13 instance, in California.

14 MR. HALL: I object. He's testifying
15 again.

16 MR. SASSO: It's cross-examination. I'm
17 asking him if he knows about Solyndra.

18 MR. COLLINS: It's a fair question. Go
19 ahead, Mr. Sasso.

20 MR. SASSO: I don't appreciate this.

21 Q. So Solyndra, not only was it a
22 manufacturing facility, which is, I mean, admittedly
23 different than what we have here, they also had
24 panels on the site, correct?

25 A. Yes.

1 Q. And, okay, tell the Board in terms of
2 the industry -- and I apologize, maybe I should move
3 over.

4 A. It's okay. I'm good.

5 Q. Okay. In terms of what happened at
6 Solyndra, did they effectuate a cleanup after they
7 went bankrupt?

8 A. Unfortunately, I can't answer. I don't
9 know.

10 Q. All right, and Solyndra was the solar
11 company that was funded with \$535 million by the
12 U.S. government?

13 A. I believe that's correct.

14 Q. Yeah, and they were guaranteed loans
15 under President Obama. Now, this was located in
16 Fremont, California, correct?

17 A. That is correct.

18 Q. All right. Were you familiar -- are you
19 familiar with the issue of the solar panel waste
20 that was left on the property?

21 A. I'm sorry, I'm not familiar with that
22 issue.

23 Q. Okay. The issue of the recycling of the
24 panels again bears directly on the solvency of the
25 solar company in general 15 years down the road;

1 would you agree?

2 A. Yeah, I agree that it -- it's a -- yes.

3 Q. I mean, in other words, if the company
4 puts these panels out there, and useful life --
5 we've had earlier testimony, and maybe I'm
6 misspeaking, but I believe it was like 15 to
7 20 years; is that about right?

8 A. Yeah, the panels under consideration are
9 typically warranted for 25 years, but the commercial
10 terms of this project are 15 with potential
11 extensions 5 and 5 beyond that. So I would say that
12 the -- you know, there could be a shorter commercial
13 life. The technical life is 25 years.

14 Q. And in terms of the particular Applicant
15 or company that's doing the work, is it possible for
16 a bankrupt company to do the recycling that you're
17 talking about?

18 A. It seems like an impossibility, but I
19 think that this is an area kind of beyond my ken.

20 Q. Let's talk about your ken. Let's talk
21 about your ken. Your ken is you're telling us
22 tonight that this solar situation, the solar panel
23 project that is being proposed by one of KDC's
24 companies is safe here in Bedminster, correct?

25 A. Yes, I agree with that.

1 Q. All right. And in the industry, because
2 you've been in there so long, you understand that
3 there's a concern generally in the industry with
4 regard to hazardous waste resulting from solar
5 panels, correct?

6 A. I would rephrase that slightly. I would
7 say that there's an issue with hazardous materials
8 used in manufacturing of panels and potentially
9 certain types of PV panel technologies, their
10 disposal.

11 Q. Well, let's exclude manufacturing out of
12 fairness, okay. Would you agree with me that there
13 would be no necessity, either in Europe or the
14 United States, to have any concern about recycling
15 these panels if there wasn't some type of
16 environmental problem with leaving the panels on
17 site, no longer being utilized?

18 A. I would agree with that, yes.

19 Q. Okay. So let's talk about that concern
20 because we really haven't talked about that tonight.
21 Tell us with regard to this old technology that is
22 going to be employed on the panels here in
23 Bedminster, what happens and what toxins develop in
24 the panels at the end of their useful life?

25 A. Okay. Well, as I was just earlier

1 addressing, the Chairman had a very, very similar
2 question. Generally speaking, at the end -- you
3 know, again, this depends on whether the end of life
4 is generally a technical end or whether it's, in
5 fact, a commercial end. One thing I would want to
6 comment on is that these types of panels could, in
7 fact, last very long periods of time. They could
8 last upwards of 30 or more years. So I think that,
9 in fact, it's entirely possible there be a
10 commercial end of life before a technical end of
11 life, but that we don't know. I think if there's a
12 technical end of life and it's due to sort of this
13 sort of gradual degradation over time, there's
14 really no significant toxic material buildup or
15 whatever within these modules that wasn't, you know,
16 something that might not or that wasn't present in
17 the initial condition. So you're having things like
18 oxidation, for example, occurring at some of these
19 interconnections between cells. That's a resisted
20 element that's going to reduce the power of the PV
21 modules, but it's not necessarily a toxic element.
22 So I don't -- in my mind, I don't see that a PV
23 module is anymore toxic 20 years down the road than
24 it is essentially the day it's produced.

25 Q. All right. Then could you tell me

1 whether or not you're familiar with the association
2 that is related to solar panel manufacturers known
3 as Solar Energy Industries Association?

4 A. Yes, I am.

5 Q. Are they basically the hallmark
6 organization for photo cell or photo solar units in
7 the country?

8 A. Yeah. I would describe them as the
9 leading national trade association for solar in the
10 United States.

11 Q. Okay. And you're familiar also with the
12 general press that has come out over the years
13 concerning solar panels and solar energy, correct?

14 A. Yes.

15 Q. And you're familiar with the Associated
16 Press piece that talked about, you know, hazardous
17 waste, the dirty secret of the solar industry;
18 you're familiar with that?

19 A. I believe so, but I'd have to see the
20 specific article you're referencing to make sure
21 that it's one that I'm familiar with.

22 Q. Okay. Well, let's talk about the one
23 that you're familiar with. What was the toxicity
24 that they were referring to in connection with the
25 solar industry?

1 A. The article that I'm remembering --
2 again, this is related to some testimony I provided
3 a little bit earlier this evening -- was relating to
4 a Chinese manufacturer of poly silicon and their
5 dumping of one of the waste streams from that
6 particular refining process into the countryside in
7 China, but I'm not sure that's the same article
8 you're referring to.

9 Q. All right. You told us earlier about --
10 you testified to some standards. What were the
11 standards?

12 A. Yeah, the standards I was referring to
13 are basically around the initial integrity and
14 robustness of the PV module and ability to withstand
15 different kinds of environmental stresses. So that
16 was the IEC 61215 certification.

17 Q. And what's ISO -- for instance, ISO 1400
18 as an industry standard? Can you speak to that?

19 A. Sure. That's a little bit different.
20 That actually is a set of standards that ISO -- it's
21 actually 14,001. Basically, if a company has been
22 certified to that standard means that they follow
23 very well defined procedures for both quality and
24 environment and essentially have been externally
25 audited to confirm that they comply with those

1 standards.

2 Q. Okay. Now, on an SEIA site, it speaks
3 to not a 14,000 but a standard called ISO 1400,
4 1400. Is that the one you're referring to?

5 A. No. That's -- I'm not sure -- I don't
6 know 1400. I know 14,001 and 9,0001.

7 Q. I don't see that anywhere on their site,
8 but how about ISO 2600, again, not in the 10,000,
9 but 2600.

10 A. I'm not familiar with that.

11 Q. Okay. Do you know in terms of proposed
12 life cycle standards, what does SEIA say in that
13 regard in terms of what their members should do, if
14 you know?

15 A. I do not know.

16 THE CHAIRMAN: Mr. Sasso, would you -- I
17 think I thought it might be just a good time to take
18 an 5-minute break, let the stenographer rest her
19 hands, and get everybody back. Maybe 5, 10 minutes
20 the most. We need to get going. Thank you.

21 (Board recess)

22 THE CHAIRMAN: Ladies and gentlemen
23 we're going to start. Mr. Sasso is back. Ladies
24 and gentlemen, if we can get started. All right.
25 Thanks very much. Okay, Mr. Sasso, it's back to

1 you.

2 MR. SASSO: Thank you.

3 Q. Mr. Rever, we're talking about that
4 Associated Press article again, and do you remember
5 it listing that there's a movement in California to
6 compel this recycling that you referred -- you
7 described for us earlier?

8 A. I've heard of that, yes.

9 Q. And also that in California, which is
10 one of the leading states in terms of environmental
11 regulations, is compelling the solar companies to
12 report on the environmental waste that is being
13 produced; is that correct?

14 A. I have heard of that, yes.

15 Q. Okay. And do you know in the industry
16 what the scientists call life cycle analysis?

17 A. Yes.

18 Q. What is that?

19 A. It's looking over the entire life cycle
20 of a product and trying to understand different
21 aspects of that in terms of its environmental
22 impact.

23 Q. Okay. Do you remember in the AP article
24 the -- basically reporting in the article that a
25 small majority -- small number of the solar

1 manufacturers had actually reported the amount of
2 waste that they created in California?

3 A. I'm sorry, I don't remember that.

4 Q. Okay. And when you consider as a
5 scientist the life cycle analysis -- and that's what
6 your degree is in in terms of solar energy -- one of
7 the things that's not being considered would be the
8 carbon footprint score, which talks about or speaks
9 to the issue of the amount of fossil fuels that
10 would be required to transport the waste materials
11 that are produced from the solar industry; is that
12 correct?

13 A. I would say that a properly done life
14 cycle analysis would, in fact, include that.

15 Q. Okay, so you agree with that.

16 A. Yeah.

17 Q. All right. Let's talk about the
18 individual panels again. Now, could you tell us in
19 terms of the individual panels at the end of their
20 life whether or not there are any toxins within the
21 panel.

22 A. I would say that it depends on the
23 details of the -- exact details of the design.

24 Q. Okay. Could you -- are you unable to do
25 that and testify directly to this Board since you do

1 not know the exact design of the solar panel that
2 would be placed in Bedminster in accordance with
3 this application?

4 A. Yeah. I mean, I couldn't give an
5 absolute 100 percent assurance because, you know,
6 that could vary with the model. So there's a
7 small -- there's a small possibility that there
8 might be some material specific, you know, in a
9 module type, so yes.

10 Q. But we also discussed before the fact
11 that the reason why the recycling is important both
12 in Europe and the United States is because you don't
13 want something to happen to the -- basically the
14 panels that are no longer being utilized at the end
15 of the project, correct?

16 A. Yeah. I think maybe it makes sense for
17 me to -- I know a little bit about the motivations,
18 and, you know, there's different motivations
19 actually for this. I mean, one is -- as you
20 identified, is make sure that there's not toxic
21 materials going into the environment. I think
22 actually in Europe, there are probably larger
23 motivations around. One is simply the volume of
24 materials because these are anticipated to be fairly
25 large quantities when you get a few decades down the

1 road, and the other thing and as we talked about
2 earlier, most of this material is stuff like glass,
3 aluminum, plastics, et cetera, that we're all
4 familiar with, and so it's mainly an issue just like
5 in ordinary recycling about just reducing the volume
6 of that stuff.

7 And then the other thing is that there
8 are some high value materials contained in PV's,
9 like silver, copper, et cetera, that, you know,
10 people want to reduce the environmental impact by
11 not having to continue mining, if you will, so much
12 and having to extract so many new materials. So
13 those are the other issues also involved in wanting
14 to promote the recycling of PV's. It's not just
15 about the toxic aspect.

16 Q. And there are other elements actually
17 that could be within those panels that would also be
18 concern, for instance lead, correct?

19 A. Some types of PV modules do have small
20 amounts of lead, that's correct.

21 Q. All right, but you didn't tell us about
22 that before. In other words, I'm trying to find out
23 from you what would happen if the panels let's say
24 were taken to a landfill because there is no bona
25 fide recycling plan in effect for KDC or the other

1 basically installers. So if the -- if the landfill
2 contained solar panels that are then broken --

3 MR. HALL: I object to the question.
4 There's no testimony they could even take it to a
5 landfill. So many things are regulated now. I
6 don't know. It's far afield of what he's --

7 Q. So we illuminate Mr. Hall, in other
8 words, these solar panels that you and the industry
9 -- is one of the concerns in the industry at this
10 time that these solar panels are being taken to
11 landfills?

12 A. You're asking me?

13 Q. Yeah.

14 A. I think that, you know, it's a very,
15 very case-by-case situation I think. I think that
16 in some -- it's up to the people that are handling
17 those panels. I don't think there's a general
18 industrywide -- anyway, I'm not sure -- remember
19 exactly what you just said exactly, but I --

20 Q. Is there a concern in the industry, just
21 so we're clear --

22 A. Concern?

23 Q. -- about, yeah, recycling panels, in
24 lieu of recycling, putting them in a landfill?

25 A. I think that there's -- the answer to

1 that would be yes because there's certainly some
2 entities and so on in the industry that have concern
3 about that. So yes.

4 Q. And then the group that we talked about
5 before, which was the landmark or Hallmark Group
6 Solar Energy Industries Association, do you know if
7 KDC is even a member of that association?

8 A. I am not positive, but I believe they
9 are.

10 Q. And you base that on what?

11 A. I believe I've seen their name on a
12 list.

13 Q. Okay. And on the CEIA site, are you
14 aware of the issues and policies section that deal
15 with recycling, PV recycling, and what is being
16 proposed in the industry?

17 A. I'm not familiar with SEIA's position.
18 I'm familiar with some of the technical proposals
19 that have been made by different organizations for
20 accomplishing PV recycling and some of the
21 initiatives that have been taken towards doing that,
22 but I'm not familiar with the SEIA position.

23 Q. And you admitted before that with regard
24 to the recycling situation that that is important
25 because the materials that are in these panels

1 should not be left to either being exposed to the
2 environment, including water, or any other type of
3 situation where they're placed into the ground,
4 correct?

5 MR. HALL: I object to the
6 characterization of his testimony. I don't think he
7 said that.

8 MR. SASSO: Well, he can tell us what he
9 said.

10 A. Could you repeat that again, please.

11 Q. Yeah. In other words, the reason why
12 recycling becomes important is that you don't want a
13 situation where these panels are simply left on the
14 property and could be, for instance, the glass
15 broken, okay, and then the contents then go into the
16 ground and contaminate the soil; how's that?

17 A. I think, you know, my view would be that
18 the conscientious management of a project like this
19 includes the decommissioning, which I believe KDC
20 has already submitted a plan for. It's not unlike
21 -- in my view it's not unlike any other aspect of
22 something that we build in the environment. So
23 building a house, whatever, if you left it derelict
24 for a long period of time, you're potentially going
25 to have an impact on the environment that's

1 negative.

2 Q. Right. And is this the first
3 application you've worked on for KDC?

4 A. Yes, it is.

5 Q. Okay. Do you know anything about KDC's
6 finances?

7 A. I do not.

8 Q. Okay. In terms of the element cadmium
9 chloride, is that present in silicon wafer type
10 panels?

11 A. Not to my knowledge.

12 Q. What other than the lead we talked about
13 before -- and you mentioned one other thing -- what
14 other possible elements are there in the solar panel
15 at the end of its useful life?

16 A. Well, as I mentioned earlier, I mean,
17 most of the degradation processes don't really
18 change things all that much. They change things
19 enough to affect the electrical output of a panel,
20 but you still have -- the polymers are present I
21 mentioned earlier in my testimony. You still have
22 obviously the glass is unchanged pretty much. You
23 have the aluminum. And that's -- when you talk
24 about those three factors, you're talking about
25 something like 98 percent of the weight of the PV

1 panel. And then, you know, the silicon wafers,
2 themselves, are pretty much unchanged at that point
3 in time. You have the small amounts of the metallic
4 pastes that are on the surface of the cell, which
5 things like aluminum and silver, and then you have
6 copper ribbons and tin on the copper ribbons
7 typically. So those materials would all still be
8 present in the module.

9 Q. Okay.

10 MR. STRAKHOV: What about the boron and
11 the phosphorus?

12 THE WITNESS: Yeah, those are --

13 MR. STRAKHOV: Those are so small that
14 they don't count?

15 THE WITNESS: Very tiny. I mean, it's
16 one part of a hundred thousand in the silicon so
17 it's very, very small.

18 Q. Okay. How about gallium arsenide?

19 A. The modules we're describing will not
20 contain that compound.

21 Q. Okay. Now, in terms of the testing that
22 you described for us earlier in your testimony, you
23 talked about testing of the panels in terms of what
24 would happen in the event of, for instance, a
25 failure, an electrical failure; is that right,

1 putting them into a high humidity?

2 A. Yes.

3 Q. Freezing?

4 A. Well, there's different -- yeah, there's
5 different tests that are designed to -- essentially,
6 it's called a qualification test to qualify the
7 module for application, and so that includes these,
8 you know, what we talked about the accelerated life
9 testing, for example, where you cycle a module
10 repeatedly between minus 40 and plus 85 degrees
11 Celsius. That's one aspect of it. There's a cycle
12 where the module is subjected to 85 percent relative
13 humidity at 85 degrees Celsius for a long period of
14 time, a thousand hours, at which point its
15 electrical performance is measured, as well as the
16 electrical isolation of the cell circuit. There are
17 other tests where high potentials are applied to the
18 frame and cell matrix to verify the integrity of the
19 electrical insulation between those, you know,
20 essentially the cell circuit. There are mechanical
21 load tests where the module is subjected to various
22 levels of force to simulate things like wind load
23 and snow load. So those tests. And then there's
24 also a test for hail, for example, which subjects
25 the module to the equivalent of a 1-inch hail

1 strike. So all of the modules that are under
2 discussion would have to pass all of those tests.

3 Q. Okay. Well, how about the catastrophic
4 event that the Chairman was asking about. Are you
5 testifying here tonight that the glass panels on the
6 proposed solar panels, whatever solar panel happens
7 to be chosen by the Applicant later, is impregnable?

8 A. Not at all. I mean --

9 Q. In other words, let's talk about what
10 he -- the Chairman was talking about. We have
11 another -- we have a hurricane with 120-mile-an-hour
12 winds, and, you know, this is a -- Somerset County
13 is a wooded mountainous area. If there were tree
14 limbs, if there were things that get picked up in a
15 hurricane, that type of storm, and it hits the
16 panels, are you telling the members of the Board and
17 the public that they cannot be broken?

18 A. Not at all.

19 Q. Okay. And if these type of elements
20 went into prime farmland soil, just like any other
21 soil, they would have the ability to contaminate it;
22 would you agree?

23 A. Yes, I think if you put crushed PV
24 modules into soil, you would consider that
25 contaminated.

1 Q. Okay. All right. Now, being involved
2 in this area for as long as you have, do you also
3 take a look at and have an interest in any type of
4 papers or treatises that come out with regard to the
5 solar industry? And I'm going to ask you about a
6 specific study. Would you agree with me that you
7 find them interesting?

8 A. Of course, I follow the industry.

9 Q. All right. How about Silicon Valley
10 Toxics Coalition, out of California, obviously. Are
11 you familiar with the report they rendered in 2009?

12 A. I'm not sure. No, I don't believe I am.

13 Q. Okay. Are you familiar with that
14 association?

15 A. Yes, I'm familiar with the organization.

16 Q. Let me just talk about a few things that
17 are in there that I read.

18 MR. HALL: I'll object. He said he's
19 not familiar with it so how can he answer questions
20 about it.

21 MR. SASSO: He's familiar with the
22 association. I can ask him about subject matter.

23 MR. COLLINS: Not the way that you
24 phrased the question, so if you rephrase the
25 question --

1 MR. SASSO: Sure.

2 MR. COLLINS: -- you might be able to
3 proceed in general.

4 Q. Based on your knowledge in the industry
5 as you come before us this evening, can you tell us
6 whether or not this is correct or not, that current
7 solar PV products contain many toxic materials that
8 should not enter the waste stream when products are
9 decommissioned. Do you agree or disagree with that
10 statement?

11 A. I agree with that statement, but it's
12 very broad so --

13 Q. I understand it's broad, but do you
14 agree with the statement?

15 A. I do, yes.

16 Q. Okay. And when they talk about the
17 panels containing many toxic materials that should
18 not enter the waste system when they're
19 decommissioned, what are they -- what in generally,
20 based on your knowledge, what is that referring to?

21 A. Well, I think they're mainly, because of
22 just you have to think back to sort of the timing of
23 that and what was going on in Silicon Valley at the
24 time, there were a lot of companies that were
25 starting up in nonsilicon based technologies at the

1 time because silicon was actually -- let's say
2 refined silicon was undergoing a very severe
3 shortage because of the huge growth in global demand
4 for PV's and a limited supply of that material. So
5 what that created was tremendous interest in finding
6 alternative semiconductors and especially in the
7 Silicon Valley community where there was a lot of
8 development, and you mentioned one of the companies
9 that was involved in that, Solyndra -- there were
10 many, many others -- and I think that as that was
11 growing and that seemed to be a potential new area
12 of industrial activity for the companies in that
13 region based on their experience with things like
14 flat panel displays and so on, they were looking to
15 commercialize things like copper indium diselenide,
16 which was, in fact, the Solyndra technology. Many
17 companies were starting to try to commercialize
18 that. There were other companies that were trying
19 to commercialize high concentration photovoltaics
20 based on things like gallium arsenide cells because
21 these are opportunities or these companies believed
22 there were opportunities for these very high
23 technology materials to take their place in the
24 industry and compete with the sort of mass produced
25 silicon based technology.

1 Q. Including those from China?

2 A. Correct, yes.

3 Q. And you told us before that about
4 50 percent of the solar panels that are on the
5 market here in the U.S. are made in China?

6 A. It's 50 percent on a global basis. I
7 think it's probably slightly less here in the U.S.
8 it's close to that.

9 Q. Yeah. I mean, China is producing about
10 50 percent of the panels throughout the world.

11 A. That's correct.

12 Q. And in terms of our environmental
13 manufacturing requirements in the U.S., obviously,
14 they don't -- they are inapplicable to those panels
15 constituting 50 percent of the panels being
16 distributed in the world.

17 A. They are -- they are not applicable in
18 their manufacturing sites, that's correct.

19 Q. Right, that's what I'm talking about.
20 Okay. I just want to ask you about a few other
21 elements. They were talking about -- and you told
22 us lead because in that Silicon Valley Toxics
23 Coalition report they speak to -- and I want you to
24 tell me --

25 MR. HALL: I object again to referring

1 to something --

2 Q. -- based on your knowledge whether it's
3 true.

4 MR. COLLINS: Why don't you start over,
5 Mr. Sasso.

6 Q. Are there companies, a significant
7 number of companies that use lead in the
8 manufacturing of the panels?

9 A. Yes.

10 Q. Okay. And out of the short list that
11 you have from KDC or actually KDC Solar SI55, LLC,
12 that any of those panels contain lead?

13 A. I don't know specifically.

14 Q. All right. So before you came here to
15 tell us that this would be safe for Bedminster, you
16 don't know whether or not any of the proposed panels
17 contain lead, correct?

18 A. It's not clear. They may or they may
19 not.

20 Q. Right, but they may contain lead.

21 A. Yes.

22 Q. And what's cadmium?

23 A. Cadmium is a heavy metal that's used in
24 a number of different types of industrial things and
25 manufacturing and some types of solar cells, but not

1 the ones under consideration here.

2 Q. Okay. How about nitrogen trifluoride?

3 A. Nitrogen trifluoride is an industrial
4 gas. It's used in certain parts of PV
5 manufacturing.

6 Q. And if a panel is broken, does the gas
7 get released?

8 A. No, there's no nitrogen fluoride present
9 in a PV panel.

10 Q. Okay. In terms of what is being
11 proposed here, do you know which units on the short
12 list have the manufacturers' warranty that they will
13 take them back?

14 A. Well, as I was mentioning earlier, I
15 mean, one of the companies, LDK, is a member of a
16 group called PV Cycle, which is a European based
17 organization of manufacturers that have agreed to
18 take PV modules back, and so I would, you know,
19 anticipate that they would have that ability or
20 could have that ability in the future. I'm sure
21 frankly that some of the others on the list do, too.
22 I just don't know all the details on those
23 companies.

24 Q. But you said before that's a minority of
25 the companies.

1 A. Yeah. I think that you get different
2 situations because in Europe where you have laws
3 that are basically requiring the manufacturer of the
4 PV product to take stewardship, those manufacturers
5 are, in fact, doing that. I think here we don't
6 have that kind of overarching law, and therefore, it
7 becomes much more fragmented.

8 Q. Okay. As you sit here today, can you
9 enlighten the Board in terms of any pending U.S.
10 legislation that you're aware of that would compel
11 companies like KDC 55 whatever it is to post any
12 type of bond or anything else as to guaranteeing
13 recycling at the end of the life cycle of the solar
14 panel?

15 A. I'm not aware of it.

16 Q. All right. In terms of the
17 manufacturers taking back the solar panels at the
18 end of their cycle, would you agree with me that
19 that is not going to take place if 15 years from
20 now, 10 years from now, or even 5 years from now,
21 the -- that manufacturer is out of business?

22 A. It seems obvious, yes.

23 Q. Right. Okay. And you said before there
24 were many other companies, a couple answers ago,
25 besides Solyndra that went bankrupt in the solar

1 industry, correct?

2 A. Yes.

3 Q. All right. That's all I have, Mr.
4 Chairman.

5 THE CHAIRMAN: Thank you. Miss Donato.

6

7 CROSS-EXAMINATION BY MS. DONATO:

8 MS. DONATO: Should there be a
9 microphone here?

10 Q. Mr. Rever, I am the farthest thing from
11 a scientist so obviously you are quite a
12 knowledgeable scientist, but I'm going to ask you
13 some kind of fundamental questions because I don't
14 really even know what silicon is. What is it?

15 A. Well, silicon is what's called a
16 semi-metal. It's an element in the periodic chart
17 that falls under carbon and basically has properties
18 that in some ways are like metals and some ways are
19 like nonmetals, and that makes it one of the most
20 ideal semiconductors.

21 Q. Okay. Does silicon have any toxic
22 properties?

23 A. Well, it depends. You know, like a lot
24 of things, it depends on the physical form. So in
25 the form we're talking about in a PV module where

1 it's a solid crystalline form, I would say the
2 answer is no. On the other hand, you know, if you
3 made a fine dust of silicon or something like that,
4 you could create something that, you know, you
5 wouldn't want to be breathing that for the rest of
6 your life.

7 THE CHAIRMAN: Mr. Rever, just make sure
8 you speak into the mic.

9 MS. DONATO: It's so awkward. I feel
10 bad for the witness.

11 THE CHAIRMAN: Well, maybe Mr. Rever can
12 turn around.

13 Q. So then other than the dust, is there
14 anyway that this silicon can be degraded and enter
15 into the environment?

16 A. Not easily because when silicon
17 interacts with the environment, the first thing that
18 happens is it forms an oxide, and that oxide is
19 insoluble. Essentially, it's quartz. It's very
20 impermeable. It doesn't easily degrade.

21 Q. Okay. Now, when you originally
22 testified when you started this evening, you
23 indicated that you saw a short list of panels that
24 would be used.

25 A. Yes.

1 Q. And you said this is the same
2 fundamental product.

3 A. Yes.

4 Q. So what's not the same about -- you
5 know, they're fundamentally the same. What are the
6 differences?

7 A. Well, you know, there's some sort of
8 obvious ones, like there can be minor differences in
9 the exact size. They're not exactly the same size.
10 They're -- the cells may not produce exactly the
11 same amount of power from one model to the next.
12 The precise details of the way which individual cell
13 or some of the materials are slightly different.
14 They're slightly different uses of material in back
15 sheets, for example, is a good example. Within a
16 certain envelope, they're quite similar.

17 Q. Have you examined these specifications
18 of each of the product types that are on the short
19 list?

20 A. I've looked at them. Some of them -- I
21 haven't memorized them is I guess the way I would
22 put it, you know, so I know in general what's --
23 what they do, but I don't know all the details by
24 heart.

25 Q. I'm most interested in the question of

1 the component parts, the materials that are used.

2 A. Okay.

3 Q. So with respect to the materials, are
4 they fundamentally the same?

5 A. Yes.

6 Q. So what then are the differences in the
7 materials?

8 A. No significant differences across these
9 different makes.

10 Q. You said that the panels are then --
11 they have like a metal grid.

12 A. Yes.

13 Q. Okay. What type of metal?

14 A. Well, the cells, themselves, on the
15 surface of the cells, there's a grid that's made --
16 on the front of it that's made out of silver paste,
17 which has basically glass and silver put together
18 into a frit, and it's fired under the surface of the
19 cell. The back of the cells is typically an
20 aluminum paste that's similar in structure. It's
21 aluminum instead of silver.

22 Q. Okay. And are either of these products
23 susceptible to any corrosion?

24 A. Not in a sort of -- not in the, quote --
25 I would say not under normal circumstances, but when

1 you -- if you had a moisture, for example,
2 especially in the case where these things are
3 illuminated so that creates electrical potentials,
4 you have different to similar metals, and that can
5 cause electrochemical action, and so in that
6 circumstance, there is a degradation of some of
7 these things or oxidation essentially reaction.

8 Q. Right. And isn't -- can aluminum
9 degrade in a manner that it kind of gets a little
10 dusty?

11 A. Yeah, and that's what I was referring
12 to. That's an oxidation reaction from --

13 Q. So then if that were to occur, then that
14 aluminum would then kind of leach off of the panel
15 and go into the ground?

16 A. Well, we're talking about two different
17 things. I was thinking about the cell. The module
18 frame, itself, is also aluminum, but the aluminum on
19 the module frame is anodized so that means that it's
20 basically got a coating, which usually consists of
21 an aluminum oxide essentially is anodization
22 coating, and what that does is that is an
23 impermeable material. It's because it's essentially
24 it's already chemically reacted with oxygen. So in
25 that case, you're not going to have a continuous

1 stream of that material coming off of the module
2 because the aluminum is essentially inherently
3 protected by its own oxide.

4 Q. And that oxide never deteriorates?

5 A. Well, it's a protective layer. It's not
6 soluble. So it's one of the reasons why aluminum is
7 such a good material for these types of things
8 because once it has that oxide form, it doesn't
9 continue because the oxide, itself, is a barrier.

10 Q. So you're saying that that oxide, the
11 anodized --

12 A. Yes.

13 Q. -- aluminum aspect of it, that just
14 never deteriorates?

15 A. Well, I will say that under certain, you
16 know, you can have certain environmental conditions
17 like a marine atmosphere where you have salt. Now,
18 salt because it has chlorine in it can corrode
19 aluminum, for example. So that would be an example
20 where the aluminum would be -- you'd have to have
21 the right alloy for a situation like that. This
22 obviously is a not a marine situation so you don't
23 need anything special like that.

24 Q. Okay. Now, when you were describing the
25 components of a typical PV module, the first thing I

1 really -- again, this is something I just do not
2 really understand or know what it is. You said
3 there was a certain type of glass that it was.

4 A. Yes.

5 Q. What is the type of glass that you
6 indicated?

7 A. Well, it's low iron is the key attribute
8 of it so it means that it's high transmissivity, and
9 that's basically going to increase the performance
10 of the panels. It's also tempered glass so that
11 makes it much, much stronger than an equivalent
12 thickness of nontempered glass. It's roughly 6
13 times stronger than an equivalent thickness of
14 nontempered glass.

15 Q. Okay. So what is put into the glass to
16 make it tempered?

17 A. Tempering is a heat treatment process.

18 Q. That's all?

19 A. Yes.

20 Q. Okay. All right. So you said it was
21 75 percent glass, right?

22 A. By weight, yes.

23 Q. By weight.

24 A. Yes.

25 Q. Not by content.

1 A. No, that's -- I mean --

2 Q. Well, it's kind of like if you read the
3 ingredients on a label of food --

4 A. Yes.

5 Q. -- and it doesn't tell you how much
6 weight is in each of it. It just says the
7 percentage of it. So this is all by weight. I just
8 want to clarify?

9 A. If you looked at -- if you had a food
10 labeling agreement on a PV module, the first thing
11 would be glass.

12 Q. Okay. But you gave us these numbers.
13 These numbers are by weight.

14 A. Correct.

15 Q. Okay. Then you said it was 10 percent
16 aluminum?

17 A. That's correct.

18 Q. And you said it was 6 percent polymers?

19 A. Polymers.

20 Q. So that's a total of 91 percent, right?

21 A. Right.

22 Q. So you said the other 9 percent --

23 A. Wait a minute. Let me do the math here.

24 Q. Seventy-five plus 10 is 85 plus 6 is 91.

25 A. Right.

1 Q. So where is the other -- what's the
2 other 9 percent?

3 A. Well, you've got things like the module
4 junction box, for example, which is itself another
5 type of polymer, but it's a plastic. You've got the
6 silicon solar cells, which roughly -- I'd have to --
7 again, I'd have to do the math. So the silicon
8 would be the next element after the polymers in
9 terms of total weight. Then you'd get to probably
10 the copper bus bars would be next because copper is
11 quite a dense material so it's got a lot of weight,
12 you know, and then you get into sort of things like
13 the aluminum pastes and the things like I talked
14 about earlier, silver.

15 Q. Has what you have described that
16 constitutes the total of that remaining 9 percent in
17 weight?

18 A. We just talked about all those things.

19 Q. There's nothing else?

20 A. No.

21 Q. Nothing else. Well, because in response
22 to a question from Mr. Sasso, you said you didn't
23 know if there was any lead.

24 A. Well, there could be. I mean, some
25 modules use lead in their -- in the soldering on the

1 rivets.

2 Q. Isn't that common practice to use lead
3 to solder electric?

4 A. It's a mix. I mean, there are some that
5 don't use it and some that do. So it's not clear
6 whether it's used or not in these specific models.

7 Q. So in your examination of the
8 specifications of the short list --

9 A. Right.

10 Q. -- there was no disclosure as to the
11 presence of lead?

12 A. No.

13 Q. Is there any requirement for the
14 manufacturer to disclose the presence of lead?

15 A. I'm not aware of that, actually.

16 Q. All right. Now, let's assume that I
17 were to ask you based on food labeling approach,
18 there's some things like you know the old joke,
19 what's heavier, a pound of lead or a pound of --

20 A. Right.

21 Q. -- feathers, okay, is there anything
22 that doesn't weigh much or negligible weight that is
23 in the PV module that is not disclosed in the weight
24 list?

25 A. I think we've pretty much covered them

1 because when you get into like, for example, the
2 lead that's -- when you get to the lead that's on
3 the solder, I mean, you're talking about something
4 that's on the order of 12 -- for those that are
5 using lead, something like 12 grams. So it's like a
6 third of an ounce per module so it's not a very high
7 number, but I think we've kind of talked about all
8 those.

9 Q. Right, but you're aware of the health
10 concerns regarding leaded paint, right?

11 A. Of course.

12 Q. So do you know how much lead is in a
13 gallon of leaded paint?

14 A. I don't. I'm sorry.

15 Q. No, you don't. So you don't know that
16 they make people take lead off of windows --

17 A. Of course.

18 Q. -- painted windows, maybe far less than
19 what you're indicating.

20 A. Sure, sure. I guess I would argue that
21 it's kind of a -- it's a very different situation.

22 Q. Well, it isn't a different situation, is
23 it, if the panel were to somehow become broken.

24 A. Right.

25 Q. Would become damaged in some way,

1 whether it was catastrophic or not, that this lead
2 would then come into what is essentially a fairly
3 pristine environment here.

4 A. It takes action beyond that I guess
5 would be my response. In other words, you've got to
6 have something that's going to actually have a
7 chemical action with the lead so it begins to come
8 out of the PV module. I know in many cases -- I
9 don't know in New Jersey specifically, but I know in
10 many cases, you know, PV modules are not considered
11 hazardous waste, for example.

12 Q. If it has lead in it, it's still not
13 considered a hazardous waste?

14 A. No, it depends on the details.

15 Q. Right. The devil's in the details.

16 A. The devil's in the details. There's
17 actually a test because I know because we used to
18 make PV panels. There's actually a test called the
19 TCLP test, which basically tests for leaching, and
20 depending on the exact details of what you're doing
21 and whatnot, you may or may not pass that test, even
22 if you have lead in the product.

23 Q. So is there a TCLP test for what is
24 being proposed here so there could be some assurance
25 as to this -- does T stand for toxicity?

1 A. Yes, it's -- I'm sorry the acronym
2 eludes me, but it's a test that involves testing
3 things for leaching out of toxic materials, and, you
4 know, so typically, if you're going to put something
5 into a waste stream, it's one of the things that --
6 it's a test that you would do on something.

7 Q. All right. You referred to top tier
8 manufacturers that are -- of these PV modules that
9 are certified to certain standards.

10 A. Correct.

11 Q. That -- you did say that, right?

12 A. Yes.

13 Q. And did you say that all of the models
14 under consideration meet these standards?

15 A. That's correct.

16 Q. What is this top tier?

17 A. In round -- in the general description,
18 these are the largest manufacturers typically. So
19 they're the ones that, you know, frankly have
20 usually the best combination of performance at the
21 product level and value, as well.

22 Q. Okay. Now, you also said that all of
23 the models are under consideration. Okay. Is there
24 any other model that's under consideration?

25 A. I can't answer. I'm not privy to that.

1 Q. Okay. So it's your understanding that
2 there is no choice other than this short list.
3 That's your testimony is based on that?

4 A. Yes. I mean, what I've -- I've been
5 told that there's -- these are the ones that are
6 under consideration, and, you know, it makes sense
7 to me that they would be.

8 Q. But I think it's the ambiguity of the
9 term under consideration.

10 A. Yes.

11 Q. I think I'm looking for -- I'm trying to
12 find out from you if there's something more
13 definitive than under consideration.

14 A. Unfortunately, I don't think so because
15 I don't believe that the actual full design -- there
16 has not been that level of full design on the system
17 where a specific module would be selected and a
18 specific -- the process hasn't gone that far.

19 Q. And you did say that you would provide
20 certain spec sheets that I think one of the Board
21 members asked you said you would supply?

22 A. Standards.

23 Q. What is it specifically, the standards?

24 A. I think what was asked for was the
25 standards.

1 MR. HALL: You mentioned two of them is
2 my recollection.

3 A. Yeah, IEC 61215 and IEC 61730.

4 Q. Okay. All right. Now, there was
5 something I didn't understand. In response to the
6 question from the Chair regarding potential impacts
7 from some type of catastrophic event, you then said
8 there is less than a .1 percent return rate.

9 A. Correct.

10 Q. What does that have to do with a
11 catastrophe? Did I misunderstand something?

12 A. Well, I think what I was trying to
13 provide some information on is just how likely is it
14 that these things are going to fail or break, the,
15 quote, infant mortality of these things, and I think
16 that's, you know, that's -- so my experience both in
17 -- as being part of a manufacturer and also now
18 outside of that and seeing the numbers from other
19 manufacturers is that, you know, that's a fairly
20 representative kind of number that -- in other
21 words, there's a very, very few modules that get out
22 of the factory gate that don't perform correctly
23 when they're first installed.

24 Q. So but you're talking about being
25 returned for a warranted defect; is that correct?

1 Is that what you're referring to?

2 A. Yes, but it could be, you know,
3 something breaks or something like that. So I'm
4 kind of basically saying that, you know, you're
5 going to have to have a -- and I could go into more
6 details about these particular qual standards. I
7 mean, just to give you an example, the modules under
8 consideration here pass a load test that is -- that
9 is equivalent to 112 pounds per square foot of load.
10 That's pretty intense. I mean, that's equivalent to
11 something like 30 foot of snow or something. I
12 mean, these are intense levels of stress that are
13 applied in these tests, you know, and so I just
14 wanted to convey that we are really talking about,
15 you know, Armageddon if you have an entire PV array
16 like this destroyed by some kind of environmental
17 situation.

18 Q. But you're not suggesting that a solar
19 operator would return a solar panel to the
20 manufacturer if, you know, a 200-pound weight fell
21 on top of the panel --

22 A. No.

23 Q. -- and broke it so it -- there was a
24 disconnect between that topic. I just wanted to
25 make sure. Okay. Are you aware of the fact that

1 there's an airport in close proximity to this
2 property?

3 A. Yes, I am.

4 Q. Do you know how many flights a day?

5 A. I do not know.

6 Q. Would you be surprised to know that
7 there's about 80 flights a day?

8 A. I'm not -- sorry, I'm not familiar with
9 the area so I don't know.

10 Q. And I presume then that you're not aware
11 of the fact that there have been several crashes
12 involving that airport over the years, small
13 airport?

14 A. No, I'm not.

15 Q. And do you know that there's a big hot
16 air balloon festival that's like the biggest I think
17 in the whole east coast or something in close
18 proximity?

19 A. No, I did not know that, no.

20 Q. So if a plane fell on this solar array,
21 that might be one of the type of solar events that
22 the Chair was referring to?

23 A. Sure, but I think again, like we're
24 talking about literally acres and acres of PV
25 panels. It would take out a certain section, but

1 it's not going to take out the entire array.

2 Q. Okay. Well, if -- has there been any
3 incidents where there's been a fire or some type of
4 a catastrophic event where it then becomes a
5 conflagration for the entire solar array or a larger
6 portion of it than what was originally -- I mean,
7 fire does have a tendency to spread.

8 A. It does. I've not heard of that in
9 these types of systems. You do hear sometimes of
10 fires in buildings with the solar, but you've got to
11 be careful because sometimes it's not even the solar
12 that's, you know, that's causing the fire. It's --

13 Q. Right, and I know that firemen have had
14 trouble getting access because of the panels on the
15 roofs and the disconnect systems that they have now.

16 You know that there's been a proposal by
17 the Applicant to plant certain types of grass is
18 under and around these panels?

19 A. Yes.

20 Q. So you know what happens to the grasses
21 in the fall, how they dry out. So have you taken
22 that into consideration in looking at potential of
23 fire affecting these panels?

24 A. Well, yeah, I think, you know, that
25 certainly is an issue, but I think that the first

1 step, like any kind of fire prevention, the first
2 step is preventing it in the first place. So that's
3 things like modules that meet these standards. It's
4 the system design being done to the best industry
5 practice because the fires are, you know, fires and
6 PV are not normal by any means. They're caused by
7 the improper installation or, you know, sometimes
8 materials and workmanship at the module level, but
9 that's why it's important to choose things that
10 follow these certifications and so on.

11 Q. Well, do you think the manufacturers
12 considered in their testing that you would have this
13 meadow grass that dries out, becomes dry and very
14 flammable at the end of a summer or even potentially
15 in the summer where you have drought conditions,
16 have they considered the possibility of fires under
17 these panels then spreading through the grasses, the
18 dry grasses, and its effect on the panels; has that
19 even been anything they tested?

20 A. Well, PV modules do have to pass a fire
21 test. I mean, the second standard I cited was --
22 includes a fire rating. So, yeah, it's normally
23 something that is done, but I'm not sure about the
24 specific situation, you know, that you've talked
25 about, but there's a lot -- obviously, there's a lot

1 of PV panels installed on buildings so there's a
2 very high concern for, you know, reducing to
3 absolute minimum the chance of fire because of risk
4 to property and life.

5 Q. But if one were to examine all the New
6 Jersey codes that are applicable potentially or
7 actually to the installation of the solar panels, is
8 there anything that really addresses that situation?

9 A. I'm not aware of it, but I have to say
10 it's not my specific specialization.

11 Q. Okay. I'd like to just touch again on
12 this electronic, the waste. You acknowledged that
13 there is a kind of a global problem with the
14 disposal of electronic waste.

15 A. Absolutely.

16 Q. Okay. And so it is not required in the
17 United States that there be any recycling for these
18 panels; am I right?

19 A. That's correct.

20 Q. And you indicated that it's the
21 anticipation of the industry that recycling the
22 occur, right?

23 A. I think most people are sort of figuring
24 that it's a classic thing, that until there's a
25 market, you're not going to have providers coming in

1 to fulfill the need, you know, so there's no --
2 there's such a small market.

3 Q. So there may be a need, but if there's
4 no requirement, someone doesn't really have to
5 recycle the panels.

6 A. That's true, but I think without getting
7 into a long treatise, I think that what people are
8 anticipating is that as these processes get
9 developed and honed that, you know, it will be
10 something where the cost of sending a panel to a
11 recycler will be lower than the cost of landfilling
12 it, and I think -- I actually think that's likely
13 with some development. So I think it's not
14 necessarily going to be the same economic choice we
15 have today.

16 Q. So but either of those choices, sending
17 it to a landfill or recycling it, is going to be
18 dependent on a municipal requirement for
19 decommissioning that is backed up by some kind of
20 monetary bond or some other security. Otherwise,
21 it's the choice of the --

22 A. Probably. It's -- I mean, it could be
23 any of our different levels of government, but yeah.

24 Q. So if that were not done, it would kind
25 of be like the anticipation of the nuclear industry

1 since post World War II that we were going to have
2 someplace to dispose of the radioactive waste. We
3 don't to this day, do we?

4 A. I'm not sure I want to take the analogy
5 there.

6 Q. It's waste. It's just maybe far more
7 toxic or --

8 A. Hazardous.

9 Q. -- hazardous, but it still has -- the
10 industry certainly thought there was going to be a
11 method to dispose, didn't they?

12 A. Sure. I guess the way I would put it is
13 that to me a crystalline silicon PV module is more
14 like a car windshield or, you know, the glass that's
15 in the side of an office building or these things
16 that are really common in our lives. So I don't --
17 I think that, you know, again, to what degree is the
18 siding on your house recycled when you do a remodel
19 or whatever. I think it all falls into sort of the
20 same deck. These are items that from a societal
21 viewpoint, it would certainly be good if we recycle
22 these things, but it depends on the right policies
23 being in place to make that happen.

24 Q. And 75 percent is the glass. The rest
25 of it is something else --

1 A. Right.

2 Q. -- potentially some lead, as well.

3 A. Right.

4 Q. Okay. Now, you indicated that the
5 interconnection to the cells that, you know, that
6 that's where they scan them?

7 A. Uh-huh.

8 Q. To detect hot spots?

9 A. Correct.

10 Q. What's a hot spot?

11 A. Well, basically, when these things are
12 under operation, you have electrical current
13 flowing, and so a place where you have more
14 resistance in that circuit is going to get hotter;
15 therefore, it's a hot spot.

16 Q. So when do they find out if there -- and
17 if it's a hot spot, then it's something that's more
18 likely to cause electrical fire; is that correct?

19 A. Well, it could. You know, it depends on
20 how hot it is.

21 Q. So when do they perform this scan to see
22 if there are any hot spots?

23 A. They can be performed at almost any
24 time.

25 Q. And when you have a product that's out

1 in the open subjected to the weather for, you know,
2 I guess for 25 years let us say, so is it more
3 likely they might develop hot spots as age
4 approaches and corrosion occurs?

5 A. Yes, yes, absolutely.

6 Q. So there -- would there be some
7 recommended regular testing for hot spots?

8 A. I would say that the norm is that it's
9 only under an off normal condition so like if you
10 start to see a power loss, because the same
11 resistance increases that occur in the circuit,
12 they're going to diminish the power. Literally, the
13 power is being dissipated in these places. So
14 typically with monitoring, you're going to start to
15 see a loss of power and, you know, so the normal
16 practice would be that when you have a loss of
17 power, you go in and you diagnose it, and that would
18 be one of the methods that would be used.

19 Q. So in order to effectuate that safety
20 concern, it would be dependent on the integrity of
21 the operator to say there is a loss of power and I
22 better take a look at what this is.

23 A. Yes.

24 Q. I'm making sure I don't ask anything
25 that Mr. Sasso asked. At least I'm trying. You

1 said that the solar industry has had turmoil.

2 A. Yes.

3 Q. What did you mean by that?

4 A. Well, there's been a period of very
5 rapid change in -- across all different parts of the
6 value chain. I mean, overall it's enormous amount
7 of growth, but there's been a lot of, to quote
8 Professor Schumpeter, created destruction, so there
9 have been entities that disappear and there have
10 been entities that appear, and the industry as a
11 whole has grown, and it's maturing and so on, but
12 basically there have been entities that disappear.

13 Q. And it's really grown because of the
14 impetus to try to provide an alternative energy
15 source, right?

16 A. Yes.

17 Q. Policy basis government has encouraged
18 the installing of solar. As you know in New Jersey,
19 they made it inherently beneficial. They said these
20 panels aren't impervious. So they did all these
21 things to encourage it. So they give grants, they
22 give money.

23 A. Yes.

24 Q. How much do they regulate the industry?

25 A. Well, I think it's under the same degree

1 of regulation as many other industries.

2 Q. Well, do they do a cradle-to-grave
3 analysis of the impact, the environmental impact of
4 the manufacturer, installation, and disposal of
5 solar panels?

6 A. No, I'm not aware of that.

7 Q. Did they require recycling of solar
8 panels?

9 A. No.

10 Q. Did they prohibit the importation of
11 solar panels that had this celluride or -- whatever
12 that is -- cadmium telluride I think?

13 MR. HALL: Excuse me. Can I have a
14 clarification of who they refers to.

15 MS. DONATO: The government.

16 MR. HALL: Are you talking about New
17 Jersey, the federal, the world?

18 Q. Is there any regulation, either federal,
19 state, local government, that said you can't import
20 these panels with cadmium?

21 A. In the United States, I don't believe
22 so, no.

23 Q. Now, you kept referring to commercial
24 life. Do you mean the life of the lease?

25 A. Well, I mean the core commercial aspect

1 of this is the sale of the power. So my
2 understanding is -- and again, this is only I know
3 just from background -- is that it's 15 years in
4 this case. So there's a 15-year agreement to sell
5 that power to Sanofi.

6 Q. So there's like at least a 25-year
7 warranted life.

8 A. That's correct.

9 Q. That will produce electricity for
10 25 years.

11 A. That's the expectation.

12 Q. So what happens to the next 10 years?
13 Let's say Sanofi decides to close up shop there and
14 doesn't want to stay there any more in what's that,
15 Bridgewater I guess it is?

16 A. Then they would have to follow a
17 decommissioning.

18 Q. Have you examined this township's
19 ordinances regarding decommissioning?

20 A. I have not.

21 Q. What are you familiar with in terms of
22 -- when you say decommissioning, what do you think
23 would -- what is required in your knowledge?

24 A. Well, I believe KDC's filed a plan on
25 this, and they have a standard that they follow in

1 other sites, which is what they plan to follow here.
2 It basically means removal of all the equipment from
3 the site and restoring it to its previous condition.

4 Q. Other than being a promise, is there any
5 enforceable mechanism to assure that that promise is
6 fulfilled?

7 MR. HALL: If you know.

8 Q. If you know, of course.

9 A. This is beyond my knowledge.

10 MR. HALL: That's what I was trying to
11 get to.

12 A. It's a commercial aspect.

13 Q. That's fair.

14 MS. DONATO: I don't have any questions.
15 Thank you.

16 THE CHAIRMAN: Mr. Rever, could I just
17 ask you one follow-up question.

18 THE WITNESS: Sure.

19 THE CHAIRMAN: Mr. Sasso asked you a
20 question earlier about -- and I want to make sure I
21 have it right -- if modules would be crushed into
22 the soil, you responded to him that there would be
23 some level of contamination.

24 THE WITNESS: Yes.

25 THE CHAIRMAN: I'd like to follow up on

1 that and try to understand what you meant by that.

2 THE WITNESS: Sure. I guess, you know,
3 kind of going back to my earlier statement, I think
4 if you, you know, crush up a bunch of automobile
5 windshields and put them in the ground, you'd have a
6 contaminated place. I don't think that -- again, in
7 my mind, there's materials that you're not going to
8 normally find in soil in there. There's nothing
9 specifically that's going to be an enormous, you
10 know, toxic kind of issue on any kind of short-term,
11 you know, even significant basis, you know, but I
12 think -- I'm just being logical -- you've got, you
13 know, plastics, you've got glass. You know, it's
14 going to be a bit of a mess, you know. You're not
15 going to want to leave it there. It might over some
16 really, you know, geological time period degrade
17 into something, but it might take that kind of time
18 frame.

19 THE CHAIRMAN: Thank you. I appreciate
20 that. Okay. Let me ask the audience if there's any
21 citizens that would like to come up and question Mr.
22 Rever. The process is -- sure. Come on up, ma'am.
23 The process is you'll come up, you'll get sworn in,
24 you'll state your name and address, and we would ask
25 that you try and focus on questions that haven't

1 been asked of the witness by our attorneys and the
2 Board. We think that would be the most efficient.

3 MS. FORT: I'll try not to.

4 THE CHAIRMAN: Thank you, ma'am.

5 MS. FORT: Susan Fort.

6

7 S U S A N F O R T, sworn.

8 MR. COLLINS: Please spell your last
9 name.

10 MS. FORT: Fort, F-o-r-t, 210 Country
11 Club Road.

12 Michele, thanks for asking about the
13 airplane because that is such a huge consideration
14 to us, and also the helicopter that comes several
15 times back and forth. What I'm confused about, if
16 you have this large array of solar, I'm not
17 satisfied at all as to what happens if there's a
18 fire or a plane or something lands in the middle of
19 the field. I have friends that happen to, you know,
20 work in fire departments in very near townships, and
21 they tell me when they get to a home and it has
22 solar, you can't turn off that solar so they can
23 fight the fire, that it is stored in these panels.
24 So now if they see a house with solar panels, the
25 terminology is let it burn. And what happens when

1 we have woodlands? We have, you know, our homes
2 very close to all of these panels. I don't at all
3 feel satisfied with how you can tell us they're
4 going to be put out as a solar expert. It's been
5 dodged all night long.

6 THE WITNESS: To be perfectly honest, I
7 don't think anybody has asked that, so thank you for
8 asking a different question, but in all
9 seriousness --

10 MS. FORT: I think Michele was
11 definitely asking that. I think she was very much
12 referring to if a plane crashes, what happens.

13 THE WITNESS: So I think in terms of
14 fire suppression, you know, there's a big
15 distinction between a PV array on a building and a
16 PV array on a field, and the main distinction, in a
17 PV array on a field, you can extinguish the fire
18 without coming up through the array. You can pump
19 water onto the --

20 MS. FORT: And how does the fire
21 department do that if it's this big a field and
22 there's panels all there? How does the truck get in
23 there? I don't understand that. If a plane is in
24 the middle of this solar field, how do you get
25 there? You just try to shoot the hose real hard?

1 THE CHAIRMAN: I'm not sure he's the
2 fire expert.

3 MS. FORT: I know, but he's a solar
4 expert.

5 THE CHAIRMAN: But I'm not sure he's the
6 fire expert.

7 THE WITNESS: I think this is, you know,
8 probably beyond my knowledge at this specific site
9 and plan, but, yeah, it would be that basically you
10 would project out a stream of water and get it onto
11 the combustibles, and you would certainly, you know,
12 surround whatever the fire area was.

13 MS. FORT: So you're telling me that a
14 fire department can put water on these panels
15 without any kind of issue, because local townships
16 around here, they won't do that. They're afraid of
17 being electrocuted, themselves.

18 THE WITNESS: I'm sorry. I'm not an
19 expert.

20 MS. FORT: Okay. Well, it is out there,
21 and I just want to bring that up.

22 It's very hard for us to ask direct
23 questions to you because I feel like we've been so
24 generalized on the information that we've been
25 given. For instance, this evening, there's a list

1 of solar companies, so it's hard for us to do our
2 research, but I want to go back to when this all
3 started -- you rung a bell so hard in my head --
4 that I read there's a dust particle that comes off
5 of these panels, and they're not only extremely
6 dangerous to people that have any kind of breathing
7 or lung issue, that they can also cause lung
8 infections and lung cancers. What can you testify
9 about that as the expert?

10 THE WITNESS: That does not strike me as
11 correct in terms of the finished module, itself.
12 There are certainly certain parts of the PV
13 manufacturing process where, for example, silica
14 powder is used to make crucibles where the silicon
15 is melted, but that material is not present at all
16 in the finished PV module.

17 MS. FORT: Okay. Again, it's very hard
18 because we don't know the exact solar panel, but in
19 my research, I definitely read that, and --

20 MR. HALL: I'll object to the testimony
21 as part of the question.

22 MS. FORT: I'm not being testimony.

23 MR. HALL: You are, you are.

24 MS. FORT: I'm questioning him.

25 Secondly, I've also read that insects multiply and

1 their reproductive cycles are interrupted so that if
2 they normally hatch a million eggs a month, they are
3 now multiplying to like 3 times as much or 3 million
4 a month, and that is from these panels being put on
5 fields like this. Could you tell me anything about
6 that?

7 THE WITNESS: I've not heard that
8 phenomenon.

9 MS. FORT: Okay. Again, it's research
10 we have done. And I find it very unsettling that
11 you said it's not going to be an enormous toxic
12 mess. What is it going to be, just a little toxic
13 mess?

14 THE WITNESS: Well, I guess where I'm
15 going with this is it's all relevant.

16 MS. FORT: I guess it is relevant unless
17 you live there. Then it becomes very relevant. So
18 that --

19 THE WITNESS: I would argue that you've
20 got -- I'm going to argue that a standard home
21 you've got more toxic materials than you have in an
22 equivalent plan area.

23 MS. FORT: I don't think any of that's
24 been proven, but that's all opinions.

25 Last but not least, I want to ask the

1 Board -- and it is a little off the subject -- but
2 we have gone to the township numerous times, at
3 least once a month. For the last year and a half
4 that KDC has been leasing this piece of property, we
5 have watched it completely disintegrate. We have
6 begged them to mow the lawn every single month
7 through last spring. We can't get them to mow the
8 lawn. We -- I know they have put cameras up
9 recently, but we've had all summer long people
10 knowing that the property is an abandoned piece of
11 property and going behind the buildings and parties
12 or doing whatever. I know they put cameras up, but
13 we've had a lot more police action in our
14 neighborhood because it looks like an abandoned
15 building and it's not maintained. That affects me
16 and my safety in that neighborhood and anybody else
17 that lives in Bedminster, and I beg this Board to
18 fine them or do something where they are forced to
19 maintain it. If I grew my grass as long as they
20 have and maintained my home like they did, I think I
21 would have a problem, and since the day they, you
22 know, they paid no respect whatsoever to the piece
23 of property, and I can't imagine what they would do
24 once they have the project down and the money in
25 their pockets. Why would they have to care then.

1 That's all I have to say.

2 THE CHAIRMAN: Thank you. I'm sure if I
3 was a neighbor, I would be --

4 MS. FORT: I'm very disturbed. And the
5 township's doing nothing.

6 THE CHAIRMAN: I'm not sure that --
7 Mr. Ferriero can certainly --

8 MR. FERRIERO: Just to be clear, the
9 township --

10 MS. FORT: I don't mean to say you're
11 doing nothing, but I don't feel like --

12 MR. FERRIERO: The township does not
13 have a property maintenance code. If you grew your
14 grass long, we couldn't come out and give you a
15 summons. We can't give them a summons for that.
16 The zoning officer has made contact and has
17 requested that certain things be done, and some
18 things have been done, but the ordinance in the town
19 is very limited.

20 MS. FORT: As you can see, we have
21 police, you know, action and things that we have
22 never had in that neighborhood before, and at least
23 in my opinion, it's because of the way the piece of
24 property looks, and it looks abandoned. There's not
25 a light on ever in the house. There is nothing on

1 that piece of property that makes it look like
2 anybody is paying attention to it.

3 MR. HALL: And that might change if
4 we're allowed to build our project.

5 MS. FORT: Well, then it might not. You
6 might just walk away, as well, and say I've got the
7 money and who needs to do anymore.

8 THE CHAIRMAN: Well, it's unfortunate
9 that the Kirby property has been disintegrating over
10 the years. It's a shame for the town, and I feel
11 for you, and I know if I was sitting there --

12 MS. FORT: Every day I open my window, I
13 have to look at that building, and it's boarded up
14 windows, and I know that was part of the
15 regulations, but consider that when you consider --

16 THE CHAIRMAN: I wish --

17 MS. FORT: -- the plan or the
18 application because it's been an eyesore for all of
19 us.

20 THE CHAIRMAN: Understand. We
21 appreciate your comments. I know that I -- and
22 Mr. Ferriero has commented. Unfortunately, we just
23 don't have the capacity as a board to go to any
24 applicant and tell him to take care of property, or
25 any citizen. It's really hopefully a

1 self-responsibility that they have.

2 MS. FORT: And I agree, and I feel a
3 sense of pride --

4 THE CHAIRMAN: You should.

5 MS. FORT: -- by living in this township
6 and maintaining my property, and like I've spoke
7 before, having my children help maintain it, and it
8 is a family effort to do that, and it is a slap in
9 the face to have somebody across the street that is
10 applying for something and is an application that --
11 they wouldn't want to set an example of how they're
12 going to maintain it. You could see the way they
13 will maintain it. That just speaks for itself is
14 all I want to say.

15 THE CHAIRMAN: Understand, ma'am.
16 Appreciate you coming up. Okay. Mr. Hall, let me
17 ask you, what would you like to do next. Do you
18 have another witness?

19 MR. HALL: Yes, we have --

20 MR. COLLINS: Are we done? Is there
21 anyone else?

22 THE CHAIRMAN: I'm sorry. We have more.
23 I didn't realize. You just need to then raise your
24 hands and come up. We'll take -- Joe, why don't you
25 come up and introduce yourself. I'm sorry, I

1 thought we had nobody else.

2 MR. CIRONA: Joe Cirona, Country Club
3 Road, Bedminster.

4 MR. COLLINS: Joe, were you previously
5 sworn in this case? You're still under oath.

6

7 J O S E P H C I R O N A, having been previously
8 sworn, resumed.

9 MR. CIRONA: I'm sorry, I got here a
10 little late. I didn't get your name.

11 THE WITNESS: Bill Rever.

12 MR. CIRONA: Okay. First of all, not
13 required to cleaning the panels that in this area is
14 not that much effect on them. You wouldn't want to
15 tell my wife that.

16 THE WITNESS: Do you have one on your
17 house?

18 MR. CIRONA: No, just the windows.

19 THE WITNESS: Oh, okay. Yeah.

20 MR. CIRONA: Something else that the
21 Chairman had referred, you know, about something
22 catastrophic happening to the panels. I don't think
23 it was fully addressed, you know, to some extent,
24 and what would happen with the toxic whatever
25 anything into the soil, but --

1 THE WITNESS: I guess my -- let me be
2 more clear about that. What I was saying is the
3 panels are -- even panels that have -- that might
4 contain lead on the solder, for that to begin to go
5 out into the environment requires a process and
6 requires some of the acid rain hitting the broken --
7 so that can get into that and start that process.

8 MR. CIRONA: Which we have.

9 THE WITNESS: It takes time so this is
10 not something where it's not like a canister of gas
11 that you puncture, and boom, it's all over the
12 place. You know, if you had a situation where like
13 an entire array was destroyed or even a small
14 portion of an array, you could clean it up, and, you
15 know, there's really going to be no immediate impact
16 because it takes time for these processes to happen,
17 these chemical degradation processes to begin to act
18 on these materials and leach them out. So it's
19 really a matter of, you know, acting on that
20 catastrophe and cleaning it up, basically, but
21 it's -- there's not going to be any immediate impact
22 from that.

23 MR. CIRONA: And I understand what
24 you're saying. What puzzles me, if I buy one of the
25 new bulbs and they tell me don't throw it in the

1 garbage, you got to bring it back to where you
2 bought it, a bulb, a bulb compared to a panel or
3 panels, and to bring a bulb back. What about these
4 panels?

5 THE WITNESS: Well, you'd be surprised.
6 You're talking about different strokes, as the
7 saying goes. I think the bulb you're talking about,
8 talking about CFL's you're talking about that
9 contain mercury, that's a different thing. It's a
10 gaseous form. It's a really different animal, you
11 know. We're talking about something that's really --

12 MR. CIRONA: Imagine how many people
13 bring them bulbs back to the store?

14 THE WITNESS: Yeah, yeah.

15 MR. CIRONA: That was my only. The
16 other thought I had also was on these -- the
17 electricity flows from the panels to the --

18 THE WITNESS: Combiner boxes.

19 MR. CIRONA: The boxes, okay. I know
20 there are places where these panels and these boxes,
21 same set up, the noise level, the humming is
22 24 hours a day, day and night. That's a lot of
23 noise.

24 THE CHAIRMAN: Mr. Cirona, do you have a
25 question for the witness?

1 MR. CIRONA: Well, I don't think we
2 addressed that at all.

3 THE CHAIRMAN: That's not his area of
4 expertise.

5 MR. HALL: That's our next witness.

6 MR. CIRONA: Sorry about that. That was
7 it.

8 THE CHAIRMAN: We appreciate it, sir.
9 Thank you. Is there anybody else that has any
10 questions? If you do, come on up.

11 MR. YINGLING: Jeff Yingling, Country
12 Club Road.

13 MR. COLLINS: You're still under oath.

14

15 J E F F Y I N G L I N G, having been previously
16 sworn, resumed.

17 MR. COLLINS: Just spell your last name
18 again.

19 MR. YINGLING: Sure. Y-i-n-g-l-i-n-g.

20 Mr. Rever, question. You mentioned that
21 the panels collect the energy from the sun, feed the
22 energy then to an inverter, converts from DC to AC
23 power, converts through a transformer, increases the
24 voltage, three inverters on site, two transformers
25 to split the power. Why would the power need to be

1 split?

2 THE WITNESS: My understanding is that
3 because of the feed into the utility grid, basically
4 they want to have it split up in different feeders.
5 So it's -- I think I'd probably defer that to the
6 engineering firm. I think that's my understanding.

7 MR. YINGLING: Because previous
8 testimony indicated that the power was going to go
9 directly to KDC and that was the extent of it. It
10 wasn't going back to the grid.

11 THE WITNESS: I think that --

12 MR. HALL: You mean Sanofi.

13 THE WITNESS: Sanofi. It is going to
14 the Sanofi main power, but the issue is it's a grid
15 interactive system. So if you had a situation like
16 Sunday afternoon on a bright spring day or something
17 like that, there is going to be some energy
18 potentially flowing back out onto the grid. So in
19 that circumstance, they want to have it balanced.
20 But I'm sorry. I'm not an expert on all that
21 detail. I'll defer -- maybe be better if you asked
22 the engineering firm.

23 MR. YINGLING: So that similar question,
24 so say 5 years down the road when Sanofi is gone,
25 all that excess power will go back to the grid

1 forever?

2 MR. HALL: If you know.

3 MR. YINGLING: If you know. In theory.

4 THE WITNESS: In theory -- no, it's
5 not -- well, they would have to have a different
6 commercial arrangement from what they have today.

7 MR. YINGLING: But essentially, the
8 system wouldn't just be -- if Sanofi moved out, the
9 system -- somebody wouldn't come out flip a switch,
10 and turn the solar farm off?

11 THE WITNESS: Yeah, they would have to.
12 Sorry, I'm getting out of my expertise. I'm going
13 to say I don't know.

14 MR. YINGLING: Thank you.

15 MR. COLLINS: Whoa, whoa, whoa. Now
16 that can't be totally outside your expertise so
17 you're going to have to explain your answer better
18 than you just did.

19 MR. HALL: Well, I think he was -- they
20 always ask about the business arrangement.

21 MR. COLLINS: Stay on the question. The
22 question was I think if Sanofi wasn't operating
23 there, the power would automatically go to the grid.
24 That's basically what he was asking you, and you
25 said that's not within your expertise, but that is

1 within your expertise, isn't it?

2 THE WITNESS: Well, you know, the
3 commercial --

4 MR. COLLINS: You know about --

5 MR. HALL: But that assumes another
6 occupant wouldn't take the power instead. How does
7 he know that?

8 MR. COLLINS: Well, but he knows --

9 MR. HALL: Has nothing to do with --

10 MR. COLLINS: He knows enough about the
11 system of New Jersey's power supply to know that
12 this is net zero.

13 THE WITNESS: I guess what I was
14 alluding to is that --

15 MR. COLLINS: Net zero meter.

16 THE WITNESS: Yeah, I just -- I don't
17 know -- you know, it's a kind of hypothetical
18 situation. I don't know enough about, you know,
19 what they would do commercially, you know, under
20 that circumstance.

21 MR. COLLINS: But your understanding
22 about this project is that this electricity is being
23 generated to solely serve the Sanofi property --

24 THE WITNESS: Yes.

25 MR. COLLINS: -- in Bridgewater. That's

1 your understanding, isn't it?

2 THE WITNESS: Yes.

3 THE CHAIRMAN: But then you said the
4 infrastructure is in place to go directly to the
5 grid, right, should you flip a switch. That's what
6 you said.

7 THE WITNESS: What I meant was,
8 obviously, Sanofi is connected to the grid. So
9 under, you know, under conditions where there's a
10 flow of energy back and forth that, you know, the
11 grid -- you would want to control where that goes.

12 THE CHAIRMAN: I think a bigger question
13 is under oath at some point we're going to need to
14 have your witnesses be very clear, Mr. Hall, about
15 the application here because the intent early on was
16 to be very specific to Sanofi, and we're starting to
17 hear comments, even though it may not be your intent
18 to comment, but the comments that you're making are
19 a little troubling because it talks about power
20 being fed back to the grid, maybe bought by the grid
21 in days when Sanofi may not need it, or it might be
22 split to the grid if there was a sunny day and there
23 was excess power. It's not important right now,
24 but, Mr. Hall --

25 MR. HALL: From the beginning we said

1 that. By definition a net meter project is you --
2 this was the testimony way back when. It's been a
3 long time. The total production of the solar
4 facility can't exceed the total annual use --

5 THE CHAIRMAN: I understand that.

6 MR. HALL: -- of the receiver, which
7 means on a hot summer day, which somebody mentioned,
8 the solar field's producing more power than is being
9 used, and by definition under net meter, the excess
10 goes to the grid.

11 THE CHAIRMAN: I understand. I just
12 think at some point through this hearing process
13 we're going to need to have --

14 MR. HALL: That's fine.

15 THE CHAIRMAN: -- the commercial
16 experts, the planners really talk about this a
17 little bit.

18 MR. RODELIUS: And he also said at the
19 end of 15 years it certainly could go into --

20 MR. HALL: Excuse me?

21 MR. RODELIUS: He also said that if the
22 lease was up, it could go there, too.

23 MR. HALL: I don't think he said that.

24 MR. RODELIUS: I have one other
25 question.

1 MR. COLLINS: I think there was a
2 statement in the course of testimony about that. At
3 the end of 15 years it could go to the grid. Maybe
4 you could help us understand.

5 MR. HALL: We'll clarify that. I think
6 that's a business issue.

7 THE WITNESS: If I said that, I didn't
8 mean to say that.

9 MR. RODELIUS: Mr. Rever, thank you so
10 much for your expert testimony. I just got a
11 question kind of in a general sense. You wrote a
12 paper called Economic Optimization of Building
13 Integrated Photovoltaic Systems.

14 THE WITNESS: I did.

15 MR. RODELIUS: I just had a question
16 about one of the things you mentioned in the paper.
17 You said that rarely would a ground mounted array be
18 considered against a roof mounted one, and I just --
19 what is the rarely there?

20 THE WITNESS: I'm sorry, you're
21 stretching my memory. That's from 1996, I believe.

22 MR. RODELIUS: That's why we hate to
23 write things. So in essence, you're saying that
24 rarely would a ground mounted array be considered
25 against a roof mounted one.

1 THE WITNESS: I guess I --

2 MR. RODELIUS: I'm just -- what type of
3 situation would that be?

4 THE WITNESS: Gosh, I'm trying to
5 remember. I think what I was really referring to
6 there is that it's not very common to have a
7 situation where a ground mounted array and a roof
8 mounted array are options under consideration on the
9 same project. You know, usually, there's a
10 constraint where you've only got the roof and that's
11 the only place you've got to work with, or you've
12 got land, and if you've got land, you know, then
13 you're going to go for a ground mounted array
14 typically or potentially even both. I've seen
15 facilities where you've got ground and roof in the
16 same mount.

17 MR. RODELIUS: The ground could be a
18 parking lot, too.

19 THE WITNESS: The ground could be a
20 parking lot. So, sorry, it's been a long time since
21 I looked at that, but I think that's what I was
22 referring to is it's not common to have a choice of
23 those for an equivalent project.

24 MR. RODELIUS: But when you do have a
25 choice, rarely would a ground mounted array be

1 considered; that's what you said, right?

2 THE WITNESS: I hate to say it, but I
3 don't really remember. I think the context of that
4 article was really -- or the paper -- was really
5 talking about building integrated photovoltaics, and
6 I think in that context -- but it's a long, long
7 time ago, and, you know, so there's different
8 economic conditions for PV's today than there were
9 in those days, really very different, and I think I
10 was looking at with the economics of that time and
11 PV modules were, you know, 5 to 6 times more
12 expensive than they are today.

13 MR. RODELIUS: What are the differences
14 in the economics today?

15 THE WITNESS: Very, very different
16 situation.

17 MR. RODELIUS: Legislation, how does
18 that affect the economics?

19 THE WITNESS: Significantly. I mean,
20 basically, you've got a couple of major things that
21 have happened that almost 20-year period. You know,
22 obviously, one of the things is that the cost of
23 systems are dramatically lower, you know. So as I
24 was just mentioning, in real dollar terms, you know,
25 PV modules are 15 percent of the cost they were even

1 half a dozen years ago. So that's a huge factor.

2 The other thing, of course, as you just
3 mentioned is the policy environment. So in this
4 country, we've had the solar investment tax credit,
5 a 30 percent rate, an accelerated depreciation
6 basically for the last half dozen years, and that
7 has created, you know -- a combination of those
8 factors has created a real economic case for PV's,
9 which, you know, in back in the 90's what we were
10 having to do is we were having to find special
11 circumstances where we could make PV work
12 economically, and one of the things we were looking
13 at heavily in those days was trying to displace
14 building materials because that was -- that created
15 value for the PV material. If you can displace a
16 high value building material on a building, then
17 you've basically, you know, penny saved is a penny
18 earned, so you basically earned that value. So I
19 think that, you know, today that's one of the
20 reasons why we've seen the proliferation of PV
21 across a whole range of applications, but, you know,
22 especially the larger systems where they -- they're
23 economic today, and they certainly weren't 10 or
24 15 years ago.

25 MR. RODELIUS: Thank you.

1 THE WITNESS: Sure.

2 THE CHAIRMAN: Sir, come on up.

3 MR. GRAVEN: Bob Graven, Country Meadow
4 Farm.

5 MR. COLLINS: Mr. Graven, you're still
6 under oath.

7

8 B O B G R A V E N, having been previously sworn,
9 resumed.

10 MR. GRAVEN: One of the numbers I
11 haven't heard in this long testimony is the
12 efficiency of silicon panels. This speaks to the
13 size of the array. If we have -- what range of
14 efficiency are the present silicon panels?

15 THE WITNESS: The ones under
16 consideration for this project are between 15 and
17 16 percent.

18 MR. GRAVEN: Okay, 15 to 16 percent --

19 THE WITNESS: That's correct.

20 MR. GRAVEN: -- is the current
21 commercial grade?

22 THE WITNESS: Correct.

23 MR. GRAVEN: But it can go up to what
24 number for higher efficiency, higher purity silicon?

25 THE WITNESS: I would say for commercial

1 products, it's around 20 percent. It's kind of
2 upper.

3 MR. GRAVEN: So the difference between
4 15 and 20 percent on a relative basis, this is a lot
5 of panels to get the same amount of power.

6 THE WITNESS: That's correct.

7 MR. GRAVEN: So the whole field could
8 shrink --

9 THE WITNESS: Right.

10 MR. GRAVEN: -- with the higher
11 efficiency. Now, can we go to a yet higher
12 efficiency with 20 percent with other materials?

13 THE WITNESS: It's debatable. I could
14 get you into the theory here, but, you know, you
15 can -- the issue is really the module efficiency
16 under the circumstances here in New Jersey. I
17 happen to have just come from the world conference
18 on photovoltaic energy conversion in Japan 2 weeks
19 ago, and at that conference, one of the -- there
20 were a lot of milestones announced in efficiencies,
21 but one of them was 35 percent module efficiency for
22 concentrator photovoltaics, which is pretty
23 impressive, right, but the thing is you need a
24 certain kind of climate and solar resource in order
25 to use that, and that's what's called a high direct

1 normal insolation environment, which is typically in
2 the United States it's in the southwest and so on.
3 You wouldn't find that here. Here you have a lot of
4 diffuse light, and those types of modules would not
5 actually work properly here because you don't have
6 sufficient direct normal insolation.

7 MR. GRAVEN: Do you have a set of
8 numbers for direct normal versus diffuse, how
9 many -- in the southwest, yes, we get 320, 330 days
10 of direct normal. And here we get how many days?

11 THE WITNESS: I know the numbers for
12 flat installations. I don't know the numbers for
13 concentrators specifically, but I can tell you from
14 my experience in system design that you have -- when
15 you have a climate like here where you have roughly
16 1,400 equivalent sun hours per day of, you know,
17 kilowatt hours per square meter per year of
18 insolation, you have a high diffuse component, and
19 you know that from your own weather, and so it's
20 probably something like half of that is DNI, so, I
21 mean, you'd have to look it up. I don't have the
22 number off the top of my head, but the general rule
23 of thumb is you need to have climates like the
24 southwestern U.S. to have concentrators make sense.

25 MR. GRAVEN: And utility scale,

1 certainly concentrators -- if the value of the area
2 is high --

3 THE WITNESS: Sure.

4 MR. GRAVEN: -- then you want to go to
5 concentrators to get more power from less area.

6 THE WITNESS: But the trick you get into
7 -- it's really tricky because, you know, as soon as
8 you get into concentrators, you've got to do very
9 accurate tracking because it's effectively like
10 telescopes following the sun. So, you know, you
11 have to have two access tracking, which means that
12 all of a sudden you can't have dense arrays of
13 modules. You have to have them pretty spaced out so
14 you don't have the shadow of one getting on another
15 one. So when you really start looking at amount of
16 kilowatt hours per land area, which I think is the
17 critical factor, it's debatable unless you get into
18 a high DNI climate whether that's successful
19 technology to use.

20 MR. GRAVEN: I think that would be an
21 interesting debate. Thank you very much.

22 THE CHAIRMAN: Thank you. Mr. Cirona, I
23 think we're going to be --

24 MR. CIRONA: It's one quick question.

25 THE CHAIRMAN: If it's quick.

1 MR. CIRONA: If I may, will KDC provide
2 a specific list of all components in the panels that
3 are proposed?

4 THE WITNESS: Say again, please.

5 MR. CIRONA: Will KDC provide a list of
6 all the components that are in the panels that are
7 proposed to be used, all the components that are --

8 MR. HALL: I think he already testified
9 to that more than once.

10 MR. CIRONA: Well, we don't have
11 anything --

12 THE WITNESS: I guess I would say --

13 THE CHAIRMAN: I'm sure in your design
14 everything will be provided.

15 MR. HALL: We can provide a list, but he
16 testified to that.

17 MR. CIRONA: Will there be -- will we be
18 able to get a list.

19 THE WITNESS: Once the project is
20 designed, there will be much more detail.

21 MR. CIRONA: A detailed list of what the
22 components are in the panel that's being proposed.

23 THE WITNESS: Yeah.

24 THE CHAIRMAN: We don't have the panels
25 yet. We don't really know yet.

1 THE WITNESS: I think I need to defer
2 that to KDC.

3 MR. HALL: I think he testified they're
4 the same components, and just so we're all clear as
5 to why one hasn't been selected, we submitted a
6 letter back in May that explained that KDC bids out
7 when it buys the panel so if it identified one they
8 are definitely going to use now, it would be not
9 commercially reasonable to do that because then they
10 couldn't bid it out. So anyway, just so we're
11 clear. But we can provide what he testified to. It
12 will be in the transcript, as well.

13 THE CHAIRMAN: Thank you. Miss Donato.

14 MS. DONATO: Mr. Boxer, if I may, I
15 think that the witness candidly admitted he didn't
16 know if there was lead or anything. It would be
17 really helpful if you take the short list that he's
18 referring to and just tell us what are the materials
19 that are in each of these different manufacturers'
20 products because we don't really know that
21 completely. We have -- so I think that it could be
22 very helpful to understand that because we spent a
23 long time, but we still have not really certain.

24 THE CHAIRMAN: Understand. Thank you.
25 Sir, come up and introduce yourself.

1 MR. METZ: Tom Metz is the name, 104
2 Preston Terrace.

3

4 T H O M A S M E T Z, sworn.

5 MR. METZ: Question, do solar panels
6 reflect sunlight like a mirror?

7 THE WITNESS: Well, I guess the way I
8 would answer that is the panel in general is going
9 to absorb around 92 percent of the light so it's a
10 very dark item, but at very high incident angles, so
11 glancing angles, then you have a higher degree of
12 reflection. So it's like reflecting off the surface
13 of a pond or something like that.

14 MR. METZ: The reason I ask that
15 question is because we have an airport right next to
16 the site. We got approximately 85 flights in and
17 out every day. I would think we have a disaster in
18 the making with blinding pilots coming in for a
19 landing. Is that a possibility?

20 THE WITNESS: Well, I think -- I
21 wouldn't want to say there's no possibility of
22 something like that, but I think in general the low
23 angle of the PV panels means that you're not going
24 to have that kind of specular reflection under -- I
25 mean, there could be in certain angles to the array

1 I guess, but --

2 MR. METZ: What you're saying -- excuse
3 me for interrupting -- but it is a possibility.

4 THE WITNESS: Yeah, I mean, I guess I
5 would really sort of defer. I think that there's
6 FAA guidelines that have been issued around this. I
7 think it would be up to KDC to follow those
8 guidelines.

9 MR. METZ: Okay. Thank you.

10 THE CHAIRMAN: Yes, sir, come on up.

11 MR. FRANTZ: Steve Frantz, Preston
12 Terrace.

13 MR. COLLINS: Were you previously sworn?
14 You understand you're still under oath.

15
16 S T E V E F R A N T Z, having been previously
17 sworn, resumed.

18 MR. FRANTZ: Frantz, F-r-a-n-t-z. In
19 the event that the power has nowhere to go, the --
20 Sanofi leaves, the new tenants don't want the power,
21 and if it's not going to the grid, can you actually
22 shut down the facility? Do the panels still produce
23 energy if they're just stagnant sitting there?

24 THE WITNESS: No, it's one of the
25 interesting things about PV's is that if you just

1 open circuit them, i.e., turn them off, they don't
2 produce any power. It has to do with their current
3 voltage characteristic. So essentially, if you open
4 up the circuit, there's no power.

5 MR. METZ: So they're standing in a
6 sunny day --

7 THE WITNESS: They're standing there,
8 exactly.

9 MR. METZ: Okay. Thank you.

10 THE CHAIRMAN: Come on up, ma'am.

11 MS. CIZMAR: My name is Anna Cizmar.

12 MR. COLLINS: Do you understand you're
13 still under oath?

14 MS. CIZMAR: Yes.

15 MR. COLLINS: And just spell your last
16 name.

17 MS. CIZMAR: C-i-z-m-a-r, Cizmar. You
18 talked about a solar panel being made of glass
19 aluminum. You also aware that also have cadmium?

20 THE WITNESS: Well, these types of
21 modules do not have cadmium. There are some types
22 that do, but --

23 MS. CIZMAR: Majority of solar panel on
24 the market has cadmium.

25 THE WITNESS: I would not say it's a

1 majority. It's a type that's made in the U.S. It
2 is popular, but it's not under consideration for
3 this project.

4 MS. CIZMAR: So you're definitely sure
5 that the panels that you're going to install here
6 does not have cadmium.

7 THE WITNESS: That's correct.

8 MS. CIZMAR: Because cadmium is very
9 toxic to the --

10 THE WITNESS: Yes.

11 MS. CIZMAR: And so what kind of
12 chemicals in it?

13 THE CHAIRMAN: Ma'am, I think we went
14 through this before. I think he gave a fairly long
15 list of what was in them.

16 MS. CIZMAR: Can we have a copy of that?

17 THE CHAIRMAN: Well, you can get the
18 transcripts.

19 MS. CIZMAR: I would like to know what's
20 in --

21 THE CHAIRMAN: You can get the
22 transcripts from the town. It's not a problem.
23 That would be not a problem at all.

24 MR. COLLINS: Mr. Chairman, I did have
25 some questions that came up because of the questions

1 on cross, and the first question was there was a
2 question about the efficiency, and you said that
3 there are some panels that are commercially
4 available that probably would be commercially
5 efficient for this project or for the projects like
6 this that might have efficiencies up to about
7 20 percent; is that --

8 THE WITNESS: Well, let me just be
9 correct. I say there are commercially available
10 modules with efficiencies up to 20 percent. You
11 know, the choice of their viability for this
12 particular project, you know, is really up to KDC
13 and the engineering firm, but generally speaking,
14 there's a trade-off with cost and performance, and
15 so it really becomes an economic decision as to
16 exactly what class of module is used. Those types
17 of modules are typically today mostly commercially
18 reserved for applications where there's very limited
19 area, such as home roofs is the principal
20 application or other kinds of rooftop applications.
21 Not exclusively, but it's the most common, and it
22 just has to do with the project economics.

23 MR. COLLINS: Are any of those products
24 among the list of the modules that is on the short
25 list provided in this application?

1 THE WITNESS: No, they're not.

2 MR. COLLINS: Are any of those the same
3 technology of silica wafer, silicon wafer?

4 THE WITNESS: Yes, they're related. I
5 would call them specialized variations of the
6 crystalline wafer technology using different types
7 of silicon wafers, using different cell processes,
8 et cetera.

9 MR. COLLINS: And they would have
10 similar constituents of the other ones that you
11 talked about.

12 THE WITNESS: Yes.

13 MR. COLLINS: And that increase in
14 efficiency from 15 to 16 percent to about
15 20 percent, that -- is that about a 33 percent
16 increase in efficiency of the panels?

17 THE WITNESS: Well, I would say it's
18 more like a 25 percent increase.

19 MR. COLLINS: Okay, and does a
20 25 percent increase in the efficiency of panels
21 result in a 25 percent reduction in the area that
22 the panels need?

23 THE WITNESS: It would if you wanted to
24 generate the same power. I think that in a
25 condition -- in a situation like this, what the

1 designer would actually look at is actually putting
2 more power on the site if it made sense in terms of
3 the user demand because that would probably make
4 more sense economically.

5 MR. COLLINS: But if the Board were
6 interested in trying to reduce the disturbance of
7 land, the efficiency of the panel could have some
8 relationship to that goal of reduction of the
9 disturbance of land; is that correct?

10 THE WITNESS: Yes.

11 MR. COLLINS: Thank you.

12 THE CHAIRMAN: Thanks, Mr. Collins.

13 Okay. Thank you, sir. Mr. Hall, I think given the
14 late hour, we'll probably not get into new
15 witnesses. We do have some housekeeping items for
16 next month, and we want to try to get some dates
17 scheduled so we can be a little bit more certain of
18 when you guys are going to come forward. We do have
19 the reorganization meeting. Trina, we're thinking
20 of putting a special meeting on, right, in January?

21 MS. LINDSEY: For the 15th you discussed
22 it.

23 MR. HALL: She had told me about it.

24 MS. LINDSEY: We don't have anything
25 scheduled for that.

1 THE CHAIRMAN: Right.

2 MR. HALL: She had told me that, and I
3 think probably on the 8th I know we have some
4 other -- I have a conflict either time, but the 15th
5 is fine with me.

6 THE CHAIRMAN: Okay.

7 MR. COLLINS: Check with the other
8 attorneys, and let's see if we can get -- make sure
9 our witness is available, and let's decide the date
10 certain we'd be carried to.

11 MR. HALL: Fifteenth?

12 MR. COLLINS: Michele and Mr. Sasso, are
13 you both available on January 15, the third
14 Thursday, because we can't meet on the first
15 Thursday.

16 MS. DONATO: I'm not available on that
17 night.

18 MR. COLLINS: Thought it would be
19 perfect for you. Are you available on the --

20 MS. DONATO: I am available on the 8th,
21 yes. I'm available on the 8th. I'm available on
22 the 22nd. I'm available on the 29th.

23 THE CHAIRMAN: I'm not here on the 8th
24 so I'm not sure that that matters.

25 MR. COLLINS: No. We have George,

1 assistant vice chair.

2 THE CHAIRMAN: Yeah, I mean, I would say
3 we should try and get dates scheduled for all of you
4 that work so we can try to get a little bit more
5 planning done. So maybe we can think about January
6 and even talk about February. So if you're not good
7 for the 15th and you're not good for the 8th --

8 MR. HALL: I think the one thing
9 probably to factor in -- I mean, we do have -- we
10 filed a report. I don't think that would take the
11 whole night. In which case then we would intend to
12 do clean-up with the storm water. I think the 15th
13 would be a better date. It would give another week
14 for -- with the holidays for all the engineers to
15 meet. I know -- I'll defer to Mr. Ferriero. I know
16 he got some more information today. The goal is
17 that they all meet before the next meeting so we
18 can --

19 THE CHAIRMAN: Right, and I know Miss
20 Donato would probably have specific interest in
21 storm water. Would it be possible to look at the
22 22nd?

23 MR. HALL: Is that -- what day of the
24 week is that?

25 MS. DONATO: It's a Thursday.

1 MR. HALL: That's fine.

2 THE CHAIRMAN: Mr. Collins.

3 MR. COLLINS: Let me just check.

4 THE CHAIRMAN: Mr. Ferriero.

5 MR. COLLINS: I usually have a meeting.

6 January, what date are you trying for?

7 THE CHAIRMAN: The 22nd would be an
8 alternative to that.

9 MR. FERRIERO: I know I have a meeting
10 that night. I'll have to see if I can --

11 MR. COLLINS: I know I have a regular
12 reorganization meeting. I would doubt that -- I'd
13 prefer the 8th.

14 MS. DONATO: January has five Thursdays.

15 THE CHAIRMAN: We could try. We can
16 keep probing a little bit. We can do it -- what
17 about the 29th?

18 MS. LINDSEY: We have nothing scheduled
19 for February yet. If you're going to go to the
20 29th, why not just go to the first meeting in
21 February?

22 MR. HALL: I think we'd like to do two
23 meetings. One possibility I guess would be if we
24 could just do Mr. Dotti on the 8th and then planning
25 and storm water on the 29th.

1 THE CHAIRMAN: We're willing to work
2 with you.

3 MR. HALL: I'm just trying to throw out
4 because I know we --

5 MR. FERRIERO: I know we have -- for the
6 8th, we have reorganization. We have Elite
7 Equestrian coming back, too. So it's not like it's
8 all your night.

9 MR. HALL: Twenty-ninth?

10 MR. COLLINS: I can do the 29th, Mr.
11 Chairman. I think Frank can, too.

12 THE CHAIRMAN: You'd be okay for the
13 29th? Why don't we do the 29th.

14 MR. HALL: Then hopefully we can do one
15 of the February meetings. We need to talk about
16 that tonight.

17 THE CHAIRMAN: Why don't we talk about
18 that now.

19 MR. HALL: If you want to talk about it
20 now.

21 THE CHAIRMAN: So we have the 29th, and
22 then what would be the February.

23 MS. LINDSEY: We meet February 5 and
24 February 12.

25 THE CHAIRMAN: So do you have a

1 preference?

2 MR. HALL: The 5th because I have the
3 second Thursday conflict, but we can --

4 THE CHAIRMAN: What about --

5 MR. HALL: If I'm freed up in January, I
6 can do that.

7 MR. SASSO: Whatever date.

8 THE CHAIRMAN: What about you, Miss
9 Donato?

10 MR. HALL: Do you still have a second
11 Thursday problem.

12 MS. DONATO: I have a problem with the
13 first and the third. That's what it's been all the
14 way along.

15 THE CHAIRMAN: So you can do the 12th.

16 MR. HALL: Let's do the second in
17 February because we're clearing up January. Nobody
18 is having a conflict.

19 THE CHAIRMAN: So you'd be okay on the
20 12th?

21 MR. HALL: In February, yes.

22 MR. SASSO: Is that for storm water and
23 noise?

24 MR. FERRIERO: Noise is going to be --

25 MR. HALL: -- 29th of January.

1 THE CHAIRMAN: Twenty-ninth of January
2 we'll do storm water. We'll have one witness.
3 We're not going to do the 8th.

4 MR. SASSO: This is my question, Mr.
5 Chairman. I want to schedule the next meetings,
6 too, and it's not clean-up, though, which we always
7 hear. In other words, has the high water table been
8 established with the new information. I know
9 Najarian keeps telling me that the high water table
10 still hasn't been established in your system. Your
11 storm water management system gets designed around
12 that. So it's not clean-up. The question is was
13 the fundamental information that the Board
14 requested --

15 THE CHAIRMAN: We don't know, and I'm
16 not sure I would use clean-up. Let's get to the
17 meeting dates.

18 MR. HALL: That gives us more time to
19 hopefully get to that point.

20 THE CHAIRMAN: So let's just lock some
21 dates in. Really, the Applicant can proceed in
22 whatever way they want.

23 MR. FERRIERO: So you want to do noise
24 on the 29th and storm water on the 12th?

25 MR. HALL: Let me ask if we can do noise

1 on the 8th. You have some things. Hopefully that's
2 only not a long thing.

3 THE CHAIRMAN: I don't know. How much
4 do we have on the 8th?

5 MR. FERRIERO: We have reorganization,
6 and we have Elite Equestrian.

7 MS. LINDSEY: Depends on what they come
8 back with, I guess.

9 THE CHAIRMAN: We can put it on, but it
10 will have to be after Elite Equestrian. We just
11 don't know how long it's going to be. You can try
12 it.

13 MR. HALL: I prefer. I mean, I don't
14 want to belabor the storm water. I know it's going
15 to take some time. So if we can get the noise out
16 of the way before that.

17 MR. FERRIERO: So you want to do noise
18 on the 8th, storm water on the 29th.

19 MR. HALL: Yes, if we can do that.

20 MS. DONATO: Mr. Chairman, may I please
21 address that? The last time we -- this Board was
22 very, very clear in June. You wanted comprehensive
23 data on storm water. So we've been still trying to
24 get to that. We haven't seen it. You haven't seen
25 it. Your engineer hasn't seen it. We were supposed

1 to come here and address it and, you know, late in
2 the afternoon we found out --

3 THE CHAIRMAN: We understand all that.

4 MR. HALL: We got a letter. Let's not
5 waste our time on this. We're beyond that.

6 MS. DONATO: We're not beyond that.

7 MR. HALL: We're scheduling storm water
8 for the 29th, which gives you plenty of time to
9 complain more.

10 MS. DONATO: Mr. Hall, I think that's
11 really rude and unnecessary.

12 MR. HALL: I think your letter to me was
13 rude.

14 MS. DONATO: You have an application
15 that you haven't established the seasonal high water
16 table on. It's fundamental. So don't start getting
17 nasty.

18 THE CHAIRMAN: Well, let's not argue
19 this tonight. I think all I want to focus on is
20 dates. If we're not prepared on the 29th, we'll
21 deal with it on the 29th. Right now I want to make
22 sure we lock some dates in. We want the citizens to
23 be aware of it. And we'll try to work through this
24 the best we can. I understand all the issues that
25 revolve around storm water.

1 So we're gonna do the 8th for noise, the
2 29th for storm water. We're going to do the 12th
3 for KDC. And we'll figure out what you guys will do
4 then.

5 MR. HALL: That's great.

6 MS. DONATO: We have the 8th, the 29th,
7 and February 12.

8 THE CHAIRMAN: Yes, ma'am.

9 MS. DONATO: The 8th is noise, Mr.
10 Chairman?

11 THE CHAIRMAN: It was always noise.

12 MS. DONATO: Always noise.

13 THE CHAIRMAN: But we'll specifically
14 focus on noise on the 8th.

15 MR. HALL: And we did file a report way
16 back when.

17 THE CHAIRMAN: That will give us I think
18 a good launch point for the year and get a lot of
19 meetings in.

20 MR. HALL: Appreciate that.

21 THE CHAIRMAN: Yeah, no problem. Thank
22 you.

23 MS. DONATO: Thank you very much.

24 THE CHAIRMAN: We're done with comments
25 tonight.

1 FROM THE FLOOR: Just a quick question.

2 THE CHAIRMAN: We have no more time for
3 questions.

4 FROM THE FLOOR: A quick question for
5 the Board about the date. If they're not going to
6 be ready again like they were --

7 THE CHAIRMAN: I'm sorry, sir, we're not
8 taking anymore questions. Not responding to anymore
9 questions. We're done for the evening. Motion to
10 adjourn. So moved. Thank you.

11 (Proceedings concluded at 10:10 p.m.)

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LAND USE BOARD
TOWNSHIP OF BEDMINSTER
COUNTY OF SOMERSET
STATE OF NEW JERSEY

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In the Matter of)
The Application of:) CERTIFICATE
CASE LUB# 12-015 (BOA))
KDC SOLAR SA55 LLC)
Solar Project -)
Country Club Road)
Block 71.02, Lot 1)
Block 62, Lot 10)
Block 69, Lot 4)

I, DEBORAH A. MASTERTON, a Certified Court Reporter and Notary Public of the State of New Jersey, certify that the foregoing is a true and accurate transcript of the proceedings in the above entitled matter at the time and place aforesaid.

DATE: December 23, 2014

License No. XI001655

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