

**Oral History Interview of
Andy Swift**

**Interviewed by: Andy Wilkinson
November 14, 2014
Lubbock, Texas**

**Part of the:
*Wind Interviews***

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Interview Series Background:

In addition to interviews pertaining to the National Wind Institute, oral histories have been conducted with various individuals whose lives have been impacted by wind engineering in the Southwest. For example, interviewers have spoken with farmers and ranchers who witnessed the rise of wind turbines on their properties and adjacent lands, employees of electrical co-ops, and engineers who helped logistically create the large wind farms.

Transcript Overview:

This interview features Andy Swift, professor of civil and environmental engineering and director of the Texas Wind Energy Institute, discussing the history, current state, and possible future of the wind power industry.

Length of Interview: 00:58:22

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Nolan Clark and the original USDA research station	5	00:00:39
Recent developments in the wind industry	11	00:11:13
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Keywords

Wind energy, Texas Tech University, West Texas, energy issues, power grid, water issues

Andy Swift (AS):

Okay.

Andy Wilkinson (AW):

And this is—again, we’ve really got a nice interview. In fact, I listened to it the other in preparation for this. It was really interesting; it was informative, some great stuff. But here I am babbling, and I have not told the tape machine that this is Andy Wilkinson and it’s the fourteenth day of November, and I am here with Andy Swift, brothers of the same first name—in that club—and we’re just going to catch up a little bit on what’s new in the world of wind. But you, as we were getting started, you mentioned a USDA collection from Bushland?

AS:

Yes.

AW:

Where the windfarm is?

AS:

No, let’s go back, I’m going to give you a little history of how we got here. There was a gentleman up there who was in charge of—I think it’s called a research station, it’s an ag research station run by the USDA, the man’s name was Nolan Clark. And he retired a few years ago.

AW:

Nolan or Noland?

AS:

N-o-l-a-n C-l-a-r-k.

AW:

Okay.

AS:

And so he just—I’m just going to use the words, “got the bug,” if you will, the wind energy bug. I think, who knows where it came from or whatever, but he was director up there, or maybe associate director at the time, I’m not sure if he was the person in charge, I think he ran that for a number of years. In any event, he saw, because of the location up there just outside of Amarillo, all the wind. As the wind industry began to develop he said, “We can be major players in this.” I think he had a vision, you have to interview him to know the history of why he got in; and maybe there are some documents in this archive I’m going to tell you about that gives the written

origins of that, but he saw that something was coming, way back when. One of the first American Wind Energy Association Meetings, back in the eighties, the beginning of the modern wind industry in this country, it kind of got its first kick in the seventies with the Department of Energy getting involved, then some other—Reclamation was doing stuff, Ag began to get in and I think he saw the play through the great plains, with agriculture.

AW:

And so this was in the seventies that he started it?

AS:

Probably started in the seventies, the late seventies.

AW:

Let me interject real quickly that I remember traveling the Boys Ranch Road from Amarillo to Boys Ranch and directly north of it was a little installation right on the road that had several different varieties of wind turbines—some of the old vertical shaft spiral, and a couple of horizontal shaft—was that connected to all of this?

AS:

Most likely, I don't know exactly what you're talking about, but most likely.

AW:

They haven't functioned in a long time, but I remember them from the early eighties.

AS:

They actually—they didn't shut down until just a couple of years ago, so they actually were functioning on another level but they weren't as visible. So Nolan Clark started at one of the first American Wind Energy Association Meetings there back in the early eighties about the time the California stuff was starting. And there were a hundred people there or something, you'd have to talk to Nolan, I didn't go to that first meeting, but I heard about it, and that American Wind Energy Association grew to the Dallas meeting in, I can't remember what year it was, 2010, 2011, there were twenty-three thousand people—so in those thirty years, and Nolan was there during that. So this is Bushland, so I think he had that vision. And then I met him about that time that he started with the American Wind Energy Association, and he had a long history of helping support that, but he saw wind for electricity production from the Great Plains, that history, he also saw it for agriculture, and I think that's one of the big things: irrigation, wind-driven irrigation.

AW:

So lifting the water and pumping?

AS:

Right, and they did a lot of cutting edge work on that. It turns out the economics of that is very, very hard, so it never really—I don't think—went as far as it could have gone, but he was extremely key in making that happen. Then they reached out to Sandia Labs because Sandia has the Pantex facility; they don't run it completely but they have a link. And so he reached out probably, I don't know if there was a Pantex connection there but he knew that Sandia was getting in the wind business, and they needed a place to test vertical axis turbines, they were in charge, at the time, of the vertical axis development. So the biggest vertical axis turbine ever built in this country was installed at Bushland, I can't remember how big it was, and they did some of that first testing on it and then they did a blade test facility there with three other turbines, those were horizontal axis turbines, all with Sandia. So they had a partnership with Sandia right up until really they essentially said we are going to get out of the wind business, the USDA said, "We're going to shut down the wind stuff here." And then we now have the relationship with Sandia on blade design; so that was kind of how it evolved to get down here.

AW:

So they were not connected, USDA to any of the wind farms that are out in—the Golden Spread Wind Farm and such as that?

AS:

No, no, no if they had anything to do with the Golden Spread—well, when I came here in '03, I called the director of Golden Spread and asked if they were interested in wind, and he said, "No thanks." That was in '03 or '04, so and they have changed substantially since then. So anyway, I got a call, Nolan retired, the USDA said, "We're going to get out of the business of wind," and they had done a lot of irrigation and direct pumping for farmers, and he said, "We've got all of our archives back here from the seventies, all the government documents from the beginning of the wind program, etcetera." So he said, "Do you want them?" And I said, "Okay, we'll take them." And we went up, me and Jeff went in a truck and we got a whole pick-up truck load of stuff, and it's down in our basement. I just want you to know that it's here. We were going to go through it—

AW:

Do you want to keep it?

AS:

I don't know what we need to do; this is probably not my call, unilaterally. We probably need to bring some other people in. But we can take a walk down and let you see what's there.

AW:

Okay, we'll I'll just tell you, we're interested, you know, because we want to reflect certainly

what Texas Tech's interests are, and also certainly those are in wind and the development of this institute, so we're prepared to help out in whatever way you need us to help out.

AS:

We've hired, and she doesn't report to me, a young lady who is supposed to be digitizing our library down there, a page at a time or something.

AW:

Oh, that will be terrific. That will save us a lot of work.

AS:

Yeah I know. (laughs) So, I just wanted to make sure you knew and we will go take a look and then we can negotiate—

AW:

Is Nolan Clark still alive?

AS:

Yes.

AW:

And would you have contact information so that I could interview him?

AS:

Probably could get to him if I need to, yeah, I can start, I can probably get to him.

AW:

If you wouldn't mind doing that, I would love to go do an oral history interview with him.

AS:

All right, okay.

AW:

And wherever he's at, I'll go there, within reason.

AS:

I don't know where he moved to, somebody told me but I'm not sure. He may still be in Amarillo.

AW:

Well, that would be very easy.

AS:

Because he started teaching. He retired, government retired job thing and he's off teaching something, so anyway, that's that piece.

AW:

Great, thanks, and let me know when you find out and I'll go up and do that. So the other thing was, that I have, since the last time we talked, I have kept in touch with some friends in the industry, and there was that time period where there was not a whole lot happening because of the tax law, people tried to get shovels in the ground for a whole bunch of projects—

AS:

Oh, the PTC, yeah, right.

AW:

And then I know, I've got a good friend who is a Tech grad, Crystal Maker Hoffman, she was—

AS:

Oh yeah, she was my students here.

AW:

Well, she was one of my honor students too.

AS:

Yeah and she worked—sharp, sharp lady.

AW:

Yeah, kind of scary smart.

AS:

Yes.

AW:

And then we got to be really good friends, because she's also a painter and she is awfully good.

AS:

That's right, that's right, I remember, yes.

AW:

So we used to go out on painting trips and things, but she is just a sharp gal.

AS:

Her family is from Wilson or something, right down the road from here?

AW:

Yeah.

AS:

Yeah, because I met her dad, I think, one time, etcetera. And then she married one of our other students, and they live in Houston now she works for Pattern. Okay, I'm sorry end of the story.

AW:

Her work at Pattern is she is in financing, and so I give her a call periodically and she lets me know what's going on in the world of financing, and then I got a chance to interview some people in transmission, Phillip, I don't know why I can't ever remember his last name, at Tres Amigas.

AS:

Yeah, I met him. Go ahead.

AW:

And that project is still, who knows when they are going to start on that, but it still seems active; and I understand now that Pattern is now part, or has been part, but is now generating current activity in the Southern Cross Transmission Line and that whole issue of transmission, especially the things like Tres Amigas, those switches, will let power move from grid to grid seemed really interesting. I kept up with Jim Bob Swafford and the Mariah Project people, who are also finally starting to get a little bit done but not as much as they planned. So that's kind of where I've been, and I'm just curious as to what the current state of the industry in wind power looks like, and where people like us at the Southwest Collection should be spending time and energy in terms of documenting what's happening at this moment.

AS:

Sure, I want to give you one of their names before we go there, and I don't know you may have already interviewed him. Did you interview Rick Walker?

AW:

No, Rick and I have talked several times and we have met at coffee but I have never gotten an actual—

AS:

He was so busy last semester finishing his Ph.D. but—

AW:

And he was teaching a lot.

AS:

He was teaching for us, and even though he has just finished his degree, he's in his fifties, I mean, and he's—

AW:

Right, because he was in the industry before, right?

AS:

Right, he's one of the, well he and other folks—some of whom you will hear, Jamie Chapman and others, will spar about who had the first wind farm in Texas. And Rick will claim it was him.

AW:

Yeah, I would love to interview Jamie too. I have heard so many Jamie stories, I met him once, but I never had the chance to—

AS:

Yeah, well if you want his contact let me know.

AW:

He's in Houston, is that right?

AS:

No, he was, and now he's in Long Island and Hawaii.

AW:

Oh, now, maybe I can get Texas Tech to accept to do Hawaii.

AS:

But he gets here, he gets here occasionally, and if he had a reason to come to be interviewed and

stuff, you might be able to—because I think some of his stuff is still here, so, anyway. But Rick is in town, and Rick has got a little bit more time, I'm having lunch with him, well it's a bunch of people going to lunch, it's kind of a lunch group thing.

AW:

Well just—

AS:

Should I mention something to him?

AW:

Please do, yeah, because we had met at coffee one day, and what we talked about that day was the Wilson Wind Farm which I don't think has ever come to fruition but it was the first—

AS:

I think that's maybe his, I think he's developing that.

AW:

Is it now? Well it was one of the first that I had heard of at the time that used a co-op model, which I thought was very interesting, and it was a mystery to me why people hadn't tried that before, because farmers understand co-ops and—

AS:

To me that makes so much more sense, the crapshoot of, "If I get the turbine on my land I'm a millionaire, and if I get nothing I sit and look at them," you know what I mean?

AW:

Right, exactly.

AS:

To me it makes no sense.

AW:

And they have used that co-op model to some degree up at Mariah, but every time I talk to them I'm not quite sure how much, and I think it's because it didn't develop on the schedule they expected because they had really hitched their wagon to Tres Amigas.

AS:

Oh, I see.

AW:

They wanted to build a line straight into Tres Amigas and not even worry about ERCOT and the CREZ line, so I think that's really sort of altered their plans; but yes, I would love to talk to Rick.

AS:

Rick and I are finishing a book. Wiley is publishing it, he's opted to publish it, it's taken him two years to get the darned thing published, but it's called *Wind Energy Essentials*, and it's—we wanted it to be a companion book to these. Wiley does these, this is an engineering book—

AW:

I think in that first interview we did, you showed me some—

AS:

I think I showed you the draft.

AW:

The draft.

AS:

Yeah, we've been using them in class, and we hope that it gets out here so that we can be able to sell it for next fall, but I don't know.

AW:

Well, we would like to have copies for the Southwest Collection; so let us know when it's available. And it's certainly neat, I think you and I discussed last time, how disappointed I was in Richter's book. It just seemed like it was way out of date the day it came out.

AS:

The second one or the first one?

AW:

The second one, it came out like two years ago.

AS:

The first one I thought was pretty good. The second one I read through it, and I almost didn't even finish it, it was just kind of pablum.

AW:

Yeah, and it was about most of the—it was a collection of things and most of the things were ten years old that were collected.

AS:

Yeah, right, maybe—pabulum's the wrong word, because I know him from UTEP, we were at UTEP together, and he's a nice guy, and I think he's just kind of dropped out of the wind history. I had him come up and speak to our class and things and stuff, I don't know, I don't want to give him a bad time because I think he is very good, and the first book was very good.

AW:

Yeah, there was one really interesting chapter in that second book on the Danes having artists work with locals about design on towers and turbines to make them more acceptable at the social level, and I thought that was intriguing.

AS:

I think this whole aesthetic thing—I've always thought that that was important, I don't know, I read some early books on it and it's so—there just such a part of the landscape when you're done that if you can do something that's visually attractive instead of industrial-looking, you're really doing yourself a favor, but—

AW:

Yeah, we found in our oral history interviews with the folks down in Junction, that there was no one—we didn't have anybody who was opposed to the turbine—no one was not opposed to the transmission line, and most of their complaints had to do with lattice towers. And some of the complaints, of course, were “pricy.” You know, the turbine—if it's making money you're making money as a landholder—and transmission, you're just stuck, because it's a utilities model relationship.

AS:

Eminent domain probably, right of way, all that stuff.

AW:

But even things like going to monopole construction made a huge difference in landholder attitudes about transmission, so I know the aesthetic—because the physics of the transmission lines don't change when you put it on one pole or a tower.

AS:

Okay, so Rick Walker, when you're ready, just let me know; he and I are in touch all the time so.

AW:
Great.

AS:
And now your question: what's going on in the wind industry, where is it going? So, if I pull together some recent press clips—which is hard, because I am kind of an advocate, so I tend to pull stuff that's positive—there's plenty of negative stuff out there now especially related to the production tax credit, there's a lot of groups out there trying to make sure that doesn't get funded and they're happy to take all the shots, but worldwide, the numbers, I think, since 2012 or 2013 something like forty-five percent of all the new generation put in in the world was renewable power. And the leader of the renewable technologies is wind so you've got country after country trying to get into this and looking at it. Prices keep coming down in general. The PTC is a very lucrative amount of money, and so it makes the on-again off-again that it's big enough—that if it's on, players are in that wouldn't be otherwise there; if it's off, it's just a killer: supply chain, there's a whole bunch of things. And I think in some ways, I think it helped get things going but at some point, with the on-again off-again, I mean, we almost do better without it.

AW:
Yeah, because the maturity of the industry is affected by that up and down. Is it also safe to say that if there are changes in access to the grid, that the PTC will not be as important economically? In other words, if you were able to sell your power anywhere, you don't have that worry about, “Well, I can't put it into the local grid because the grid is full, and I have the chance to produce power, nobody is talking about”—when I first started doing these interviews about storage I hear a lot less talk about that now, meaning it must be more difficult to solve, and I know when I was talking to the people at Mariah their big—the key to their development plan was to have access to the national marketplace through the Tres Amigas switch and so they never came out and said it; I mean, no one was going to turn down the tax credit, but they presented their business model as being more dependent upon how can we market it to places that need it at the time we can generate it?

AS:
Yeah, that's interesting; well, I'm more on the academic side and there are a number of business models out there and I—you have got to have access to transmission. People have to be willing to pay and you have two models. You have the merchant model that you can win and sell at the current price, that's tough, the other is the power purchase agreement model, which is, much more standard in the industry and you negotiate with the utility and they get a price, but you have got to get the power to the customer so I mean that's why the CREZ Lines were such a big deal, but still, god there are PPA's going in for thirty, forty, fifty dollars—

AW:

Excuse me just a minute. Can we stop this and let me put in a new battery, speaking of power?
(laughs)

Interview paused.

AW:

Andy Wilkinson back with Andy Swift. Okay, we're back with a fresh battery. So we were talking about the models, power purchase agreement versus merchant.

AS:

Some of these latest ones have come in at very low numbers, very competitive with gas fired generation without the PTC.

AW:

Really? And what's the difference? Why are they coming in at lower?

AS:

Well, I think people just have the models and maybe these things are driven by a whole—I don't have an answer. I can speculate. Turbine suppliers have turbines available they will sell them, they want to move them, they will sell them at a discount.

AW:

Are we just getting better at it?

AS:

Okay, that's one, we're getting better at it. I can't say the name of the company, but Group NIRE is doing work out at Reese, and I'll say something about their work with storage and everything too, and kind of where I see—

AW:

Incidentally, I did really interesting interviews with both David Miller and Mark Harrell.

AS:

Oh good, good.

AW:

Yeah, I love that model and I wish—there are so many other places on this campus that we could do that and—

AS:

Yes, it just changed everything. I felt when I was director, and I guess that I can put this on tape, that I was beating my head against the wall, those years I was director, trying to make partnerships with business. We just could not move at the speed of business. That's the whole thing.

AW:

Yeah, that phrase is the phrase, that's it.

AS:

And as soon as they came in—so they've got pad sites out at Reese that they are leasing for new prototype machines. There's a company that is international, Mark would have to give you the specifics not on the company, but even on the years—I kind of feel like single turbine technology is probably kind of plateaued, there's probably not a lot out there, that shows you how wrong I am. This company has got a paid site, I think, for the next five years, for two or three future prototypes. So what that tells you is that they are investing money in new technology prototypes to be tested with new technologies in them and they have already two or three on the drawing boards of new stuff that they plan to do on single turbines, this doesn't even count. So let's use buzzwords: smart wind turbines, better technology doesn't even go to the new smart wind farm thrust that radar and other technologies—how do the turbines interact with each other so you get the whole plant operating better—so this is [how] individual turbine technology still keeps moving forward.

AW:

So that would address one of the issues that you hear, I hear, in these interviews—that the old farms are already dinosaurs and they will be junk standing up there in the air. Now if—but that won't be the case?

AS:

Let's qualify that, and this is second hand from someone else, it's kind of hearsay but it's really interesting. This person commented how quickly the technology is changing and so you feel like a lot of the stuff is old and outdated, but his comment was, and he's a European guy, he said, "The technology, the lifetime of these machines is getting much, much better." So imagine this, yes, you don't have the latest bells and whistles and all of that, but you are paying off the debt, when most of that's paid, O and M is fixed, you've got—pretty much what you do is, you think of the cost of power from this thing. No fuel cost. A couple of guys climbing a tower, changing the oil, and maybe you'll have to change a gear box or a blade or something, even if it's a small machine. He said, "That is going to be some extremely cheap power coming out of this thing."

AW:

Yeah, once your capital is paid—

AS:

You bet, and I mean, and so you just keep it going even if it's—so even if the technology is old, if it's working and producing power, an electron is an electron. So he said that he sees the—as you average all these new plants with new technology and then these old plants which may have been paid off, then the whole aggregate price of wind is going to be just this downward pressure, and I think you are starting to see some of that—that's, I think, an important factor.

AW:

Right, and the comments that I was mentioning though were more directed at the idea that the first wind farms, the ones that are prevalent now, would have a shorter life because of the added new technologies; where it sounds to me like it's the reverse. If they are still developing single turbine technology, then you could go through because the big work is already done, you have an interconnect, you have pads, you have—even if they are not in the best place under new design, you still have all that stuff done and all you have to do is put a new—

AS:

The infrastructure, it's called repowering. That's the whole repowering market and we have got a couple of guys here that are going to start doing research on repowering.

AW:

Oh great, who are they and would they be interested in talking later?

AS:

Yeah, they are just getting started, Travis Roach, he's one of our instructors, he's an environmental economist.

AW:

That Roach as in the animal?

AS:

Yes, good guy, and he's a recent Ph.D. graduate. And the other one who is just barely getting into this is Chris Pattison, they are both Ph.D.'s.

AW:

Pattison?

AS:

Pattison, P-a-t-t-i-s-o-n. And Chris is one of our own graduates in the Wind Science and Engineering Program then worked for SGS Engineering here in town, doing transmission and wind farm layout on the electrical side for this company and then came back as an instructor starting this last fall.

AW:

Cool.

AS:

Yeah, we're real happy to have him here. So, they're both looking at this. We heard a presentation from a German, and you see the Germans are probably a decade ahead of us in all this, so they've got stuff going on. Well, they have now regulations in place that if you want to repower a site there are certain—you can't just go in and do whatever you want, you have to put in turbines that are so much bigger or so much more efficient, —and they can mandate that because of the feed-in tariff that they have got in their system. So they are looking at some of these European models, but I think this whole repowering thing is going to be very interesting as this industry goes on, anyway, just as you pointed out.

AW:

So back to a comment you made earlier about negative and positive news, you know the only negative news I see any more has to do with off shore, and most of it has to do with viewscape and those kinds of issues am I just missing—?

AS:

Well, I mean, you can pull down the latest stuff from these various groups trying to make sure the production tax credit doesn't get put in again, and so they're scraping—

AW:

And those are political things they are opposed to?

AS:

It's political, yeah, there are groups and pacts and things that are formed specifically to do that, and I'm not sure, to me that kind of doesn't make sense. I think it's coming out of the coal lobby and some of these folks.

AW:

What about gas? They are so cheap now that—?

AS:

Yeah, but people see wind and gas as partners going forward, I mean, wind's not going to blow all the time so you want to partner with the gas—now what the wind does do is, you put all of the kilobyte hours on the market, it drives gas prices down, or holds them down, so if you're in the gas business you want those prices as high as possible, and so I can see where that's competition but from our overall point of view, that's just diversity.

AW:

You know, I heard T. Boone Pickens talk a couple of summers ago and he said something on that issue of wind and gas, it was interesting. He sort of dismissed the whole notion, he said it's always going to be an issue for wind affecting our prices but because we have such great reserves in gas, his notion—of course he's always two leaps ahead of everybody else—but his notion was that over-the-road transportation was going to be the difference—

AS:

Yeah, he got on that bandwagon.

AW:

Yeah I thought it was very interesting.

AS:

Yeah and that's the way to get the country off oil. If you want to really hit the transportation sector and the oil sector, we don't burn oil, everybody gets this stuff, we don't burn oil to make electricity, so you're not dealing with oil. We burn natural gas, we burn coal, we have nuclear, that was the three biggies, and some hydro-power, and then now we're pulling on renewables. I heard a talk by a guy from Xcel, and Xcel has more wind on their system than anyone else, and he said, "We've gone from the RPS model." The renewable portfolios standard, where we had to get renewables on the system by state law. He said, "Now it's in our business plan. We want renewables. And we are going into the solar market." For a lot of these reasons we just talked about, it hinges price on gas. The cost of it just keeps coming down. Those are the two big economic drivers, when cost comes down and it hedges the price on gas—

AW:

On solar, it seems to me like solar, on all of the renewables, is the most adaptable to distributed generation models versus wind or something else, and maybe the least adaptable to centralized generation because—how do they work that into their—

AS:

They are playing with some of the centralized models putting these large fields of PV out in the

boonies and feeding it in, that's fine, I'm not in the solar business. One thing I do know is that there's a real good match between solar and wind as far as the availability.

AW:

When one's available the other isn't, and vice versa.

AS:

Yeah, so you have that, and that's number one. Number two, to me the market, and this is just my opinion, I've spouted this for years and years, you have got all this free land with rooftops. And every time I talk to people they say the problem with it is, you can't cookie cutter it. If you go out and you put these things, you can buy all these panels and put them on a piece of land, you make a deal with one landowner and you try and put a module on a house. Well, every house is different, you have to get on the roof, the roof is different, who's going to own it, and we have all these separate interties, and it's very labor intensive to get it in, but from a land use—the other thing is though, that's where the load is. Instead of putting it out here and losing ten or fifteen percent shipping the power, put it right on the load. So that's the play I see and it's right on peak.

AW:

Any of the agricultural value of the land is shot with solar?

AS:

Absolutely, and you don't have that with wind.

AW:

Now here's an idea for you, I would love to have a solar panel on my house that was also a rainwater catcher, because that's the other issue that we're having to deal with is water. Okay, so repowering, the development of these better more refined technology on both the turbines and the farm, what else are the things that we should be watching for?

AS:

Okay, so you have got the repowering, my focus has really gone to the smart wind farm personally. But I think that if you get out and look at the bigger landscape as you go to research meetings, and I'm not quite as active as I was. Workforce is an issue, that's one we're addressing here with our educational program, let's hold that because want to give you an update on the education program, so the workforce. But on the technical area, I think storage is not going to zero, but it is targeted storage and I think there is some real good work on that going on right at Reese.

AW:

What is targeted storage?

AS:

Yeah, it's smaller, it depends on how you define it, it's significantly sized—

AW:

So like I buy it for my shopping mall, that kind of thing, or my building or my industry?

AS:

No.

AW:

Not that small?

AS:

Okay, I need to characterize it here. It's not necessarily distributed it's controlled by the utility and Reese with NIRE they have a one megawatt battery out there, now that's significant, a one megawatt battery, that's a thousand kilowatts, a million watts, and you can discharge it in an hour, so you can deliver a megawatt of power right now, so that's pretty impressive, it's the size of a tractor trailer truck, that's how big it is, it has all these little lithium ion batteries. And it's expensive, and it doesn't make power but it allows you to move power in and out from wind, you can levelize the wind—but you can do all this ancillary service stuff. In other words, sometimes there are frequency changes in the grid, there is a thing called reactive power, there's a lot of things that require, that you have to be able to do, and wind can help provide some of those things, but because it is intermittent it's not as good as providing *all* of those things. Again the battery can fill that gap.

AW:

It takes up the gaps?

AS:

Right, so it's not so much about delivering bulk power as it as—

AW:

It's targeting the use?

AS:

It's keeping the utilities system operating in limits, and so it's an ancillary service provider. And

for short periods of time it could also provide back-up power, to keep the lights on for a short time until breakers trip and everything is working. So I think there is some good work going on there. The other thing is this whole grid management. There's new technology called Synchrophasor Measuring Units, PMU's, and it's because of computers and global positioning systems and time sync, you're measuring the grid at a number of point over many miles apart and you know—you look at the frequency and the voltage and the power instantaneously and you can see faults on the grid that you could never see otherwise. The people who sell this technology do it like this. They say, "Now, you see, we've always been monitoring the grid," but they can never do it with this refinement. They say, "Imagine if you're on the freeway and going and your eyes are closed and once every ten seconds you can open your eyes for a second and then close them for ten, and that's how you're driving down the freeway." Okay, now this stuff goes, "You can blink every second," it's a factor of ten, so you can see how much better you could refine your—I mean, it's kind of a crazy analogy, but it helps give people some sense because the grid is changing very quickly.

AW:

Instead of snapshots of the grid—

AS:

Every ten seconds, now it's down to every second, and you can see things happening at the speed of electricity rather than waiting until the blackout occurs, and then if you can see these changes you can isolate things, you can do things, so we're doing that research. So I think there's a lot of general grid research that's going on. You know, this whole thing was built back in the thirties and forties and we're still kind of cobbling pieces together, and it's now such a critical part of society you really can't afford to have—

AW:

But still rather, if I can extrapolate from the interviews I have been able to make up to now, the other big piece of the grid is the political side, of who owns what and who controls what, and for instance, ERCOT, it strikes me, they are driven as much by their fear of being regulated by FERC as they are—

AS:

Oh absolutely, God yes, you want to get those people upset start talking about it and yeah, they are all self-contained and that's allowed them to do things that other people can't and that's why taxes—

AW:

And there are advantages, but still it seems like when you talk about the national grid you are talking about an idea, not a reality, you are talking about—

AS:

All these pieces and different states and different ISO's and all, and FERC control and state lines—yeah, okay, from that political side, and I don't know a lot about it, but that's a challenge, a continuing challenge. So I think the whole electric grid situation—well, I've got one more, is cyber security. So these PMU's, cyber security, because now you can get people coming in and hack—all these turbines have status systems and it's all computer driven and we can sit here and see what all the turbines are doing, control everything, and it's a very distributed system, but you don't want that to be hacked—who can now get in and then go other places in the system and cause problems and stuff. So I think PMU's, cyber security, batteries, ancillary services, are all key parts of—and integrating wind and then solar on the system, which—and I think there's a move towards micro-grids, just like you're talking about, and I think companies are looking at this. How do I make myself more self-reliant if there is a major grid outage and can I use renewable's for that? Apparently Google, for example, they have these big data centers, they're buying wind farms or making deals on wind farms to buy their power for them and they are probably trying to do it in a reliable way, so I think those are the hot things that I see.

AW:

Well, in that regard it seems to me also that when you think about terrorist threats to the grid, not just cyber security but somebody that just throws a monkey wrench across two big interconnect poles, one would think that the government's mania over terrorism threats would extend to why aren't we looking at more distributed generation for things like the cloud, or Google, or hospitals or the military installations, you know you can think of these things—

AS:

I think more of that's going on than what people realize. I can't speak to that—you know who you want to find out, and he will be able to tell you a lot because a lot of this stuff is actually closely held and—

AW:

Who are you talking about?

AS:

Mike Giesselmann in Electrical Engineering.

AW:

How do you spell that?

AS:

Giesselmann, G-i-e-s-s-e-l-

AW:

M-a-?

AS:

I think it's either two L's and one N, or one L and two N's. Giesselmann; no, one N and two L's.

AW:

And his first name is Tom?

AS:

Michael. He is chairman of electrical engineering, pulse-power guy, but he also teaches our grid systems class, he's been very helpful and supportive of getting all this wind and renewable stuff going and he's really good on that. His view on all of this, and he's a power systems guy, so he would be one to talk about—a more authoritative person than myself—with the interaction in the future of grid research with renewable sources such as wind. And when you say “renewable sources,” wind is really the big driver even if we get a lot of solar. I think solar is going to be smaller installations, maybe individual homes, it will grow to be a lot, but it's not bulk power delivery like a wind farm, even if you take a six-hundred megawatt wind farm; I mean that's a huge power plant, and you're controlling it so it's bulk power.

AW:

And it can coexist with crops and cattle, but the wind farm at that size couldn't—in fact I, and this may be spurious, but I read a quote in the *New York Times*, where someone had said, if you replaced all of our generation with solar, there's not enough land to do it, in the U. S., for the amount of electricity that we need.

AS:

Just run the numbers. I've seen that number it's a hundred miles by a hundred miles.

AW:

Oh really?

AS:

Yeah.

AW:

Maybe they were talking about—

AS:

I mean, that's a lot. Imagine covering a hundred miles by a hundred miles and covering it with solar panel, that's all, and that will provide—no, the resource is huge, the resource is huge. And I'm pretty sure of that because I ran the number myself one time. You take a corner of the panhandle and you have got enough kilowatt hours in there to provide for the whole country, that doesn't think about distributed, no.

AW:

But when we get to the point with climate change where some of our productive, agri-productive areas are essentially unproductive, we may have more land that's available for some other use for solar or wind for that matter. Well, I would be interested in talking to Giesselmann because we did a whole series of interviews on the Crosbyton Solar Power Project back in the seventies.

AS:

Well that technology just—and you know they have got some new central receiver technology, which is similar to that, was a single bowl type of thing, but these are the mirror fields and they're out in Vegas. I saw one, I got to go take a tour.

AW:

Are they passive or are they those that are—?

AS:

The helios has mirrors, they direct all the mirrors to a single tower, and my God you go out there, I mean, it's a huge thing, you can see, there's so much energy being directed on that tower it looks like a burning meteor sitting out on the desert—you look and it's like an alternative sun. What the heck is that? And I saw it out there and about, and I said, "Oh, that's that new solar project." But it's frying birds and it's, I think it's expensive. I just don't think that that's the way solar is going to go. And I'm with you, distributed rooftops, it's closer to the load, it makes so much sense, but I could be wrong, geez, I could be wrong.

AW:

Well, if I could figure out the economics I would have one on my house right this minute. I tried to look at the economics of my own wind—

AS:

Are you in town?

AW:

I'm convinced that, you know—out of town it's even tough, but you can, it depends on what

you're paying and how patient you are, but all that money is up front and it takes a lot of years to make it back. But the solar, you know supposedly there's a big tax credit, I hear it advertised on the radio now.

AS:

Me too, but—

AW:

Have you run the numbers?

AS:

No I haven't seen any evidence of it I just hear it or see it in magazines.

AW:

Yeah, I get nervous that it's a little bit of a scam type of thing while the tax credits are in place.

AS:

You want to go see the—?

AW:

You were going to mention, before we go do that, the other important thing is workforce and what we're doing.

AS:

Oh, thank. I have got an eleven-thirty so if we can, maybe ten or fifteen minutes.

AW:

A real quick word about what we're doing here.

AS:

I think that's important at Tech. So, I think with our lead in wind, and our forty-year history and things, the Texas Workforce Commission came to us to put together a program. And had they not done that we would have the Ph.D., we might have a few graduate classes, but we wouldn't have what we have now, so credit to the Texas Workforce Commission for putting the seed money in to making it happen. They saw—there was a recent article Andy, the value of wind to Texas, twenty-two billion a year, have you seen that?

AW:

No.

AS:

Do you want me to try and send that to you?

AW:

Yes, great.

AS:

Gosh, I hope I saved it.

AW:

Or if you remember the source I could look it up.

AS:

So that's the only thing I've agreed to—Rick Walker, you're going to contact me when you want it, and Nolan Clark I'm going to try to—so I've got two to-dos. Find Nolan and this article. It's a huge value to the state. What's going on? Well, you have got people like Crystal, she's trained as a civil engineer, she's doing wind finance. She never had a formal course in it, she's real smart, she's good, this industry grew up as: "I want to do a project." "Well, go talk to Bill down the hall, he did one." You can't have a serious multi-billion dollar industry by having—you have to have some people that are trained. So, and not just the windsmiths climbing the towers, we've got those and there are a lot of schools doing that. But very few schools are training the professionals and there's a lot of people retiring from the electric utility industry, power system technology for double E's has been something that is kind of waning, has been waning, everybody getting into the micro-computers and all that—so the power system programs went away. Luckily, we still have one here, and those are very highly technical people, but you still need the utility to hire people who can do projects and understand wind and how it's integrated and how it works and how the utility works, and kind of this whole business; so we have this program and it's growing; and so with seed money from the Workforce Commission, we put in place an undergraduate major, it's the only one in the country, I'll give you the handout here you can take with you. So that's the summary of it, and we have one hundred and seventy students now.

AW:

One hundred and seventy.

AS:

A hundred and seventy wind energy majors.

AW:

Now that's, am I right, that that's almost double from about two years ago?

AS:

Yeah, we started from nothing in 2011, so in three years we have gone from zero to one seventy.

AW:

Yeah, that's—

AS:

And plus fifty or sixty people minoring in wind, and that's all at the undergraduate level. And at the graduate level we are partnered with a company called DNV GL, which stands for Dutch Norske Varitas Germanischer Lloyd, it's a big conglomerate that does certification of renewable energy projects worldwide, and they're delivering case studies now by distance, and we have a graduate program that is listed in there too. We have two courses specifically in wind and then we have courses in power systems and things and project management that you can kind of flush out a graduate certificate. We see ourselves moving to a masters degree in wind science and engineering, which would be a feed into our Ph.D. and then a lot of our students who want to get the masters are doing the—there's a new STEM MBA program out of the business school—science technology engineering and math in general—but wind is kind of a little subset of that. And they're taking all of these credits at the graduate level, and then the kids do the business on top of it, so we have got some kids who are going to come out with a bachelor's degree in wind energy, so they understand the electric system, renewable energy, and really understand a focus on wind. And then they are going to pick up the business MBA piece, and they will do very, very well. All of our kids are getting jobs. Companies like NextEra are coming here recruiting. G. E. is coming here and recruiting. Where do you go find somebody who has got a bachelor's degree in Wind and knows the industry? A few classes here and there and that's it.

AW:

One other quick question before we go downstairs? One of the things that John Schroeder talked a lot about was the difficulty of having an NWI integrated into a university that is not built to integrate things. And I went to a water symposium on Tuesday, I heard integrated—

AS:

How was that? I wanted to go but I couldn't, I had class.

AW:

You know the best part about it, everything else we kind of talked the same thing over and over again, but the very best part was the opening remark by the chancellor, he knows water. He

knows the science, he knows the politics, he knows the economics. It was refreshing to listen to the head of your university system come in and go, "Here's the deal."

AS:

Me, Ken Rainwater, Jamie Chapman, did a wind-water project when we were trying to get some stuff going and he was senator, and I sat in the meetings with him to try and get stuff going. We were going to try and do some wind-diesel out at Reese and some other places, and it never kind of crystalizes for a whole bunch of reasons. But he was right there, very interested, and this was a long time, this was eight, ten years ago. And he was right there focused in. So he's not a Johnny-come-lately to this water stuff.

AW:

No, and I think that was the best part. If I would have left right then it would have been worth going to the thing.

AS:

This is Robert Duncan the chancellor not Robert Duncan the VPR?

AW:

Right. The VPR was talking, "We have to have interdisciplinary, and everybody talks interdisciplinary but the problem is if you're in engineering and another fellow is in architecture and you're working together in an institute that uses both, how do you do your T and P? How do you get your name?" And it struck me—

AS:

We have got to get some faculty in this center or—we're supposedly, the point is, a spear on that, it's the way Kent Hance explained it and I think Nellis bought into that, and as leaders turn over, are they going to maintain the value of this? I don't know. We have got a search committee being formed for a new director, John stepped down, we have an interim director now, we're losing years of momentum because of a lack of leadership. And we have to get somebody and bring them in, we're trying to get faculty, I'm allowed to hire instructors, faculty instructors, but no tenure track positions. Now I'm tenured in civil, and I'm kind of a legacy thing, so who comes next? Are you going—like these young guys whose names I gave you, if they don't have a career path they are going to bail, they'll teach a few years and bail, and we don't want that.

AW:

Is it possible that, rather than reinventing the university system—which is kind of what needs to be done for this—is it possible, or will it happen, that this other model, that NIRE's is an example of [something that] transcends that. In other words, if you can work for a state university but still have one foot in the business world and you know?

AS:

I'm not sure.

AW:

NIRE needs to scare people in the administration—not scare them, but they just don't get it. When I mentioned NIRE—whatever you think it is—I can see them looking at me like, “What have you been taking, what are you on?”

AS:

No, I think that because we are so tied to the electric industry, the wind industry, NIRE, you want to move these things quickly, it may be our faculty. See NIRE, but NIRE is our access to internships for our students and jobs. They have got all the industry contacts so it's a great synergy. And some of our faculty is coming in and saying—Rick Walker was one—said, “Rick, hey, you want to teach?” I shouldn't have used his name, please don't use—well, now I can't say it because I'm on the tape.

AW:

That's all right, we'll turn it off. Well—

AS:

Let me go just in general, let me back up, and I shouldn't have said names. So, in general, because there are several people I've talked to, they really aren't that interested in the tenure track, they say “I'm happy to teach, I want to work with these kids, I'll teach, you pay me, I'm good. I've got this consulting going on here, I've got this opportunity here.” So they are not just in the teaching-only mode. The trouble with that is somebody has got to be—you have to have a critical mass of people for leadership, turnover, you can't have everybody just kind of in and out, you can't, you have got to have some critical mass, so I don't know what the future of all of that is.

AW:

That's great, well that's a good place to get started, and we want to go downstairs and look, so I'm going to say thanks.

AS:

Sure, Andy, well thank you. I always enjoy talking about this and it's great, we always like to talk about what we are doing.

End of interview.