Oral History Interview of
Ken Starcher

Interviewed by: Monte Monroe
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Transcript Overview:

This interview features Ken Starcher. Starcher discusses his work with wind energy and the Alternative Energy Institute. Starcher talks about working with industries, manufacturers, and federal programs on alternative energy endeavors. Starcher also discusses the technical elements of wind energy and gives a brief overview of the materials he is donating to the Southwest Collection.

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Monte Monroe (MM):
This is Monte Monroe. I am at the Alternative Energy Institute, Palo Duro Research Facility at West Texas A&M University. It is October the 27. It is roughly 11:30 here. We are in Ken's former office. I am with Mr. Ken Starcher today who was the former associate director. We are picking up a lot of these records relating to their work here at the institute and Ken is going to start off by telling us how this institute got its start, who was affiliated with it, who was the director, and then the type of work that they do. Ken, I'm going to let you get going here.

Ken Starcher (KS):
(laughing) I can meander back to the beginning. In about 1972 a physics professor here at West Texas State University, Dr. Vaughn Nelson, started studying the wind patterns. He did this in conjunction with a professor at Amarillo College, our local community college, Dr. Earl Gilmore. And what they did was put together the NOAA, the National Ocean Graphic Atmospheric Association's set of data for all of Texas to try and figure out what the resource potential was because that was back in the Oil Crisis, '72 to '74 times. They came up with a paper that they presented to the governor's Energy Advisory Council here in Texas, and it was well received. And then, they started looking at the potentials for setting up their own wind research institute here at the college. Working with a former employee of the helium plant here in Amarillo, Dr. William Barrio [?], they put together a proposal and the state funded it through straight line-item funding starting in 1977. And so that was actually the beginning of AEI was that year funded by the state. So the research had begun before, but it wasn't an institute until '77. From that time on, we've been looking at probably five different areas which is: data collection, making sure what the resource are for our state; testing of systems to find out what actually works and what does not work in our area, so that would help small businesses, homes and ranchers on picking the right of systems that would work in our region; education through our classes here at the university; information dissemination which was having available enough documentation that if somebody called us on any topic of renewable energy we would try to be able to answer their questions or at least point them in a direction that would get those answered; and then consulting, working with industry, trying to improve products that they were offering. And we've done testing then on several small renewable energy systems, total of eighty-five different ones of all different magnitudes from fifty watts, which is a very small—almost like a fan on a desk- size wind turbine, up to 500 kilowatts, which is the largest Sandia project that we ever worked with up at Bushland, Texas. Starting in '77, the federal government, through the ag Research Service, ARS, said that this is something they'd be interested in because they knew the potential for rural development through the ag placement of renewable energies was something they were going to look at. Dr. Noland Clark at Bushland, Texas, who was then the researcher leader for all wind-related work in the U.S. Department of Agriculture joined up through a cooperative program with AEI that was in existence for almost thirty-five years, that is every five years renewed because the work that they did coupled with the support that we give them was recognized nationwide as being significant for the ag development of renewable energies. And

so, that program stayed in place until about two years ago when they shut their portion down. The advantages of working in our region is in the Panhandle area, we're one of the places of Texas that has all three major renewable energy resources in abundance: wind, solar, and biomass or bio-waste if you want to consider it that way. And so we're the leading region of having access to all those resources for doing testing or evaluation or doing proposals. So, that made us a spearhead institute in the middle of the richest resources that the state had to offer of all three different types of renewable energy that were easily developed at the time. The efforts that we've done then since I joined in 1976 as just a student worker were then testing of systems, and we've tested water pumpers, old farm windmills compared to new electrical windmills, we've tested electrical production, we've tested the style of wind desist in both irrigation and water pumping modes which was the agricultural bent, we've tested new airfoil designs and the manufacture of airfoils to reduce the dangerous loads on typical wind turbines. And so that's some of our work that we've done working with manufacturers here in Texas and the federal government aerodynamicist on trying to develop newer types of airfoils that would still do the job but be insensitive to maybe bug buildup on the leading edge or would not get so sensitive to the changes in direction of the wind flow over the blades. We call it a wind-flow patterns. And so we were instrumental in developing techniques to observe those patterns that the federal government then used for their test facility up in Colorado. We've been working well with industry; I've gone out to California for months at a time to help people in the wind farms they're installing and then developing new products for the industry, and then our educational efforts have been that we have had students come from all over the world to work with us, anywhere from three months to a year at a time. Now, these students are either interns, which is a program that the colleges over in Europe have where a student has to do a project for a company between his sixth and seventh semester. And coming over here gives them three big advantages: they get to practice their English, they learn hands-on renewable energy, and then they get the exposure to America, and that is a valuable resource to them. Once they get that on their—not application, vitae, so that they can say, "Hey, I'm used to dealing with Texas." And that's a, you know, a pretty big thing. A lot of our students that have gone through it, we've had a total of about thirty-five different ones have stayed in the renewable energy business and are high up in specific companies like Siemens or Intercon or some of the big manufacturers over in Europe or they're working here in the United States on renewable energy based supply systems, things like that. And so that's been a big asset is our international exposure that way. We've also had visiting professors who have come, Fulbright scholars, things that like, stayed with us anywhere up to a year. Professor Ido [?] who stayed with us almost ten years ago just visited again not a month ago on a trip here through Texas. The last thing was this—a close connection with the test facilities that the federal government had up in Boulder, Colorado. The National Wind Technology Center there prides itself on being a good test facility because of their high average wind speed. The trouble is they get 115 mile-an-hour winds for a couple of weeks and then 6 mile-an-hour winds. And so their average is great, but we can have production in our test facility 65 percent of the time in a year. And so it speeds up data collection, performance reviews, things like that by putting it in the area that has workable winds most of the time. And that was one of our big claims to fame is that our winds were not real high but they were real consistent ,that you put up a wind turbine it's going to work within that first two weeks; I can get you a power curve within a month. I can get you 2,500 hours of testing in six months, easy, even though its only four months' worth of time we had to make sure that we had a little leeway in case of breakdowns or modifications, things like that, but operational winds most of the time, that's what we had to offer. Our data collection service was gathering wind speeds from all over the state based under a state funded program through the General Land Office and the State Energy Conservation Office, SECO and GLO, so S-E-C-O and General Land Office, G-L-O, and they were the were the two big supporters of our data collection efforts because the state owns most of the land in Texas. You have to remember right-of-ways of roads, things like that, a lot of state land that's part of the school funds, things like that is all state-owned. Now, other people may use it and rent it but it's still state property, and if they knew that there was one more money-making opportunity like renewable energy could be then they were very interested in defining their resource. So it's just like doing an assay of mineral rights or test drill for an oil well, things like that. That's what our wind data collection was all over the state. We ended—did it in the areas that were predominately very poor areas, the southernmost tip of Texas and if you believe that driving fourteen hours just to change an anemometer then driving fourteen hours back is fun, well, it was. You know, you got to go through Abilene, and we always had a great time in Abilene. But it was—you know, we never could convince a lot of other schools to share the effort. We would have loved to have some of the schools in the south: Kingsville or Pan America or somebody like that to say, "Hey, use one of your local guys," but they never had the interest in it because they didn't see the need until we took the data and proved that the resource was there. And now there's wind farms there, they don't need the resource anymore. (KS laughs) The developers have already said that there's enough there to make money and that's all they needed to know, convince the bankers, put in the projects. And there's probably eight projects down there from San Antonio south now, mostly along the coast but some out closer to Laredo, it's called Oilton or Mirando City, those kind of places, Starr Counties. And it is helping those areas because now it's putting in a tax base in an area that was predominantly very poor and reducing the effect on all the consumers, all the people in that county because now the taxes are being paid by industry instead of by personal property tax. So, those are the kind of effects we've had over the years just by doing the work we started doing thirty-eight years ago.

MM:
Well, that's very intriguing there, Ken, and let me ask you a number of questions that we can drill down on here just a little bit. Who was the governor that first got this going, do you recall?

KS:
Oh, good one.

MM:
This would have been 1977, right?

KS:
Seventy-seven would have been—and we do have that document maybe under the history of AEI, but I put it in a box.

MM:
That's all right, we can look that up.

KS:
It should've been like, maybe Dolph Briscoe or somebody like that.

MM:
Yeah, it may have been Briscoe that makes some sense. What about—you talked about you worked with various types of manufacturers here in doing your research. Tell us a little bit—expand on that if you would.

KS:
Sure, okay. The name manufacturers that we worked with was DAF, D-A-F, and this was the egg-beater type wind turbines, but they were a French manufacturer of the aluminum type egg-beater style wind turbines. We did all their models form a four-kilowatt to a forty, to effectively a sixty and a hundred kilowatts. And then we did it for experimental units that were even bigger, but Darius Airfoils, was DAF. Carter Wind Systems was based in Burkburnett, Texas, a Texas manufacturer. And we had some of the very first units that he sold, tested at Bushland, and then bought for a demonstration project for the city of Canyon where we wind-assist, water pumped water for the city. There's a well field to the west of town, and we put the two turbines out there to make electricity to assist that electrical water pumps when the wind was blowing. That is, instead of buying electricity from the utility we'd use ours first, if we needed more, we'd buy it, if there wasn't any wind we'd buy it all, if we were making more than we needed, we had enough excess generation we could do all the pumping and turn the meters backwards. And it worked out real well, both cooperation between the city, between the state government for helping fund the project, and then the local utility for allowing us to hook those up electrically.

MM:
Tell me how that's done technologically?

KS:
Oh, easy. An electrical motor draws electricity from the utility when it needs it. You flip on the switch, it's going to have a big load for a little bit until it gets up to speed and then it's going to

settle in on a steady state rpm. A wind turbine is basically that big electric motor where you spin it a little bit faster. The trouble is the utility sets the rpm based on that sixty cycles per second hertz coming out of the utility outlet. And so it can't spin faster, but what it can do is send the amperage back toward the utility instead of drawing from. And so the electricity fades, the electricity voltage are set by the utility but the amperage is going toward it instead of away from it.

MM:
Okay.

KS:
And so that's all you're doing. So, the advantage to the utility is that stuff is exactly in step with the way I want it. It's exactly the voltage I want, no harmonics or anything from an induction motor getting into my line, it's just the current's going toward me so I can pass it on to the guy down the road.

MM:
Do they measure it somehow or another—

KS:
They can.

MM:
—and quantify how much is coming back to them?

KS:
Yeah, a power meter, just like the utility meter on your house, would monitor the total energy or the power flowing at any one instant. And so we did that over time to compare true power versus what the wind speeds were blowing at one time to develop a power curve, generate a series of dots of wind speed and power, wind speed and power, wind speed and power, and then start seeing what was the general trend of this system over time? And we did that for, like I say, eighty-five different types of systems.

MM:
Okay, so you talked about DAF and Carter, who else? Anybody else?

KS:
Another one, UTRC, was United Technologies Research Center, and this was a unique cooperation between our program and the oil companies, Phillips Oil up at Borger, Texas. So, it was one of our very farthest field experiments. Well, we put a system in with seven different

stripper oil wells, because their electrical power tube, you know the big pump jacks and stuff have an electric motor on the back that helps spin it through a bunch of fan belts, and then the counter weights on the backend of the pump jack and the weight of the oil being pulled up is pretty well balanced but it still takes a little bit of electric power to get the thing running and keep it running. By putting a wind turbine in the middle of this field of seven different stripper wells, when the wind was blowing and they were pumping, we were using renewable energy to make oil. And so that was one of the first processes we had like that, and it worked pretty well. They ended the project, we moved the turbine down here to our facility here north of campus and then the turbine itself was damaged, and we kept the tower and the lay-down system and have used it now for five different other turbines.

MM:
It dawns on me that the casual listener will be interested in some of the descriptions that you're using here, terms, the tower, the lay down unit, things of that nature. Explain that just a little bit-

KS:
Sure—

MM:
—visually.

KS:
Imagine, you're a professor with a bunch of stupid students. Do you want them climbing a tower, or not? Okay, the advantage that we had here at our facility was we would alter a tower so that it could be lowered or laying down and all the work performed at ground level, and then the tower raised back up. And we had that on several of our systems. The advantages that you have the—all the work at ground level a lot less risk, no climbing necessary. The disadvantage is you're risking the entire system every time you raise and lower it. And so that's what you have to be aware of, that there's always a risk for all the rewards. But the advantage was is it really reduced a lot of our tower climbing necessity and so that we always preferred working on the ground level and a lot of our training was how to do this properly: following the manufacturer's recommended practices. The Carter System was designed to be a lowerable system that way he wanted it to do the work on the ground, and so that's how we liked working with that system as one of our first ones, we liked that idea of doing everything on the ground. You could walk over to your truck and get a tool instead of climbing back down to get the tool, climb back up. And so, the speed of maintenance and operation were improved but the risk was always there that you were risking the system every time you raised and lowered.

MM:
Tell me what time period we're talking about especially with the Phillip's project.

KS:
That would have been about ’81 to ’84, and we’ve got a report on that we’ll make sure you get one.

MM:
Okay, and then what did Phillips—what was their perspective on how this went? Did they get the benefit that they were seeking on that?

KS:
They took the data under advisement. The electrical prices that they were being charged at the start of the project fell during the time that we were collecting data. And so the necessity of reducing electrical use was not as prevalent at the end—

MM:
—as vital for them at that time. Okay, very good. Any other manufacturers that you can think of that y’all worked with?

KS:
Intertech was a major player out of Norwich, Vermont, for years and years and we tested probably five different sizes of their system, one-point-eight kilowatt, a five kilowatt, a twenty-five kilowatt, a forty kilowatt, and a sixty kilowatt. Now, that was either here at our facility or in cooperation with the U.S. Department of Agriculture. And so the point there was, it was a very consistent unit, wind-speed based, that is it monitored the wind speed when the wind was strong enough it would just turn on, when the wind speed is too high, turn off, when it’s in the middle, keep running, and so it was a rugged, reliable, stall-regulated, that is the speed of the wind actually determined how efficient the blade was. And so, at really high winds it would become less and less efficient, and self-protected, you know, there’s more power there in the wind at high-winds, but it was grabbing less and less of it and so it was still never exceeding its limits, that kind of thing. The unit we have right now, the five-kilowatt unit, we quit testing it in the nineties, and then we gave it to some university to the south, and they’re using it at the Reese Airforce Base test facility—

MM:
Really?

KS:
—for the water purification demonstration.

MM:
Yeah, yeah, very good. Any other manufacturers that you can think of?

KS:
There's a bunch more but we'd have to go down the list. Those are just the major ones who were players, U.S. wide—

MM:
Okay, all right.

KS:
—that I can remember. Everything else—a lot of our stuff is prototype or the first-off type testing where they'd come and say, "Okay, now, we want to just check out this one little tweak that we had, put it up and run it for two months, make sure it works, tell us the results." Then they'd take it back home and decide whether to incorporate it in the production line or not, okay? Systems that we did test that were already industry-ready were companies like Bergey out of Oklahoma, Norman, Oklahoma, he's the- pretty much the Cadillac of small wind turbine manufacturers. International Systems, we probably had eight different international systems that have come in and just wanted put a footprint in the United States say how well our system worked here in the middle of the county, but they weren't—there not famous names unless you consider, oh, Sumitomo was a heavy industry maker. We tested a small unit for them.

MM:
Okay. Now, talk a little bit about your collaboration with the federal program in Colorado.

KS:
Yes.

MM:
And go into some detail there about what y'all did and how you worked together with them.

KS:
Okay, at the National Wind Technology Center which is part of the National Renewable Energy Labs set up was an outgrowth of the plutonium purification center there south of Boulder. Rocky Flats was the place where we purified plutonium in the United States. There was all the time radical outburst of, you know, No more nukes, This is poisoning the water, things like that. So as a gesture, the federal government installed a renewable energy test facility, the wind test facility on the north side of the facility. Now because it was still a plutonium processing plant no one could get in there except for the government employees. It was very difficult to access the site. Foreign nationals almost all were excluded, that kind of thing. And so, what they did with—they started treating anyone else interested in research, "Could you do a project in your place? We'd fund it, but it's done out there it's easier for people to access, see, that kind of stuff, and we don't have to let them over here in the nuclear facility." Rocky Flats then became SERI and then

became NREL and NWTC. NREL really moved down to Golden which is the town south of Boulder.

MM:
Tell us what these acronyms stand for.

KS:
Okay, NREL: National Renewable Energy Lab, SERI is: Solar Energy Research Institute, and Rocky Flats was just Rocky Flats, the name of the actual processing plant. The NREL is really a collection of labs all over the United States, and they include Albuquerque, up in the northwest Pacific Northwest Laboratories, some Tennessee Valley authority there's a group there, but they all were all assigned to the coverage of ENRL which was now based in Golden. So, they have every renewable energy concern based there, that is biofuels, solar energy, solar heating, solar electric, wind energy, bio energy—not bio energy—geothermal, hydropower. So, all those are grouped at Golden, but their national test center then is just north of them in Boulder. Okay and it's stayed there as part of that Rocky Flats northern part of the plant.

MM:
Okay.

KS:
The advantage that we had was that with better resources than they had, more working time in a year for wind turbines to run, they could put stuff here or cooperate on testing with us and the cooperative program was joined up with this U.S. department of Agricultural emphasis at Bushland, Texas. Bushland is just outside of Amarillo about fourteen miles to the west and on the interstate, and so their crop production research was implemented or augmented by the manure and renewable energy research. They were trying to figure out ways to use the biomass from local feed yards. We have sixty percent of all the fed beef is within a 150 miles of Amarillo, and so there was a lot of resource there for bio waste. And they did some studies on drying out that product and then adding it to coal plants and seeing how well it improved the performance or degraded the performance for burning it for electrical power, things like that. But the wind program then tied together with the National Wind Technology Center, said, "Is there a program that'll fit?" And the side program was Sandia National Labs, Sandia was focused on vertical access wind turbines. They were gung-hoing it; they thought it was the best thing since sliced bread because all the good working parts of the turbine are down at the bottom. Just like we laid our towers down to work, vertical access already has everything at ground level that's of any importance: the gear box, the generator, control. It's just these two big blades and a pipe. And so, they wanted a place to test. Agriculture was interested in trying to make sure it would fit in with their program which was irrigation, water pumping, crop drying, those kind of things that renewable energy could be used for. So, we began pumping water with small, vertical access

wind turbines under the auspices of Sandia National Labs out of Albuquerque, New Mexico, under the National Energy Renewable Energy Labs. And so that was the tie-up between the U.S.-wide energy lab system, the U.S. department of Agriculture, already U.S.-wide, and our group was doing it—basically USDA would get the money by working with another federal agency, easy, and we supplied the people and the parts to do the tests. So, basically, we had full-time people up there since about 1978. Dr. Gilmore was the very first one to actually work out there as, you know, our cooperative founder and—

MM:
His full name?

KS:
Earl Gilmore, Earl Gilmore. And the students and faculty that worked out there would go swap in and out or two would work Monday, Wednesday, Friday, and another two would work on Tuesday, Thursday. We always had a full-time presence out there of AEI personnel then since that time and that's basically what we were doing is we supplied people under our subcontract because they couldn't easily hire people under the federal system. And then scientific equipment, we could procure it easier than the federal government could, and so we'd buy stuff and supply people, and they defined what kind of project, how the study was going to go, what the application would be, that type of thing. So, it fit in well that the turbine got tested, Sandia's happy, the application was applicable to rural and agricultural use, and we had this nice, full-time income stream to supply people to do all these projects and be able to work on a multitude of different types of system under the federal government's value—decide what was good or bad without it costing the school anything.

MM:
Well, that was one of my other questions. Where did the funding come from; was this all by contract with Sandia?

KS:
Contract—not Sandia.

MM:
Or with the federal government?

KS:
Federal government.

MM:
Okay.

KS:
And so USDA and Sandia had their contract, and the U.S. department of Agriculture had a five-year contract repeated seven times with AEI. And so we had, you know like I say, that federal money then was—we used our little bit of money that we had from the state every year to leverage those type of contracts.

MM:
Okay, so this went on from the late 1870s—

KS:
Seventy-eight.

MM:
--or the early 1980s?

KS:
No, '78.

MM:
Seventy-eight through when?

KS:
Two years ago, 2013.

MM:
Okay, and why did it stop?

KS:
The U.S. department of Agriculture lost their best guy, Dr. Nolan Clark retired. There was no one there willing to pick up the same level of effort for the same studies, and so the wind focus at the U.S. department of Agriculture was abandoned back then.

MM:
So we had nobody working under him all this time that cared to do that.

KS:
They did, several people but they've gone to the water development board of Los Angeles or they're working in Saudi Arabia or they're private aerodynamicists, or they're out here working for underwriter's labs, you know, so. We had lots of people through the system, but, you know,

government employee, if he's not moved up to upper level, he's using that as a step-stone to get into industry and go on from there. So, a lot of our guys would move on to industry.

MM:
Okay, okay. Now, you talked about working with people in California, tell a little bit about what you did there and over what period of time.

KS:
Okay, yeah, from the 1980s—

MM:
And the various entities that you worked with-

KS:
Right.

MM:
—collaborated with.

KS:
1980s, the wind farm growth started U.S-wide in California. California was always the lead state because of their very beneficial rates that the state set for renewable energy production. It was called the standard offer and you had two types of standard offers that you could either get paid a set amount, fixed, no matter when you made the kilowatt hours, or it could be adjustable based on match and when the utility needed it, you'd get a better price, when I don't need it so much, get a less price. But, if you timed your system right and the winds were just right, you'd make a lot more money. But one was very stable, easily bankable, where the other one was taking a bigger risk, but then had the opportunity for making more money. And both of them were tied in with the federal tax support that anybody could put up three broomsticks and a motor and make money because you had a big tax rebate for the installed cost of the wind turbines back in the early eighties that said, "No matter what you put up, whatever it's rated, power is, take, you know, the total cost divided by the rate of power, and we'll pay you 70 percent of that over time on your taxes." Well, now it's only 30 percent of the real cash is all you have to put up, you're getting the rest back from taxes. A lot of fly-by-night type systems went up. Eighty-five of that tax stuff quit. Now you had to be a good system to actually make money, and so now the companies out there started asking for, "How can we improve?" Now, the trouble is a lot of these systems were foreign built, foreign design, tractors on a stick is what we called them because they were so heavy and rugged. That's why they lasted, but they weren't highly efficient, so we started looking at aerodynamics, a control mechanisms or methodologies to improve the performance of these systems or at least make them work better when the values were higher—

the middle of the day type operation. The companies that started asking for help were typically located in three areas: San Gorgonio Pass is like the valley between Los Angeles and Palm Springs. Edward's Airforce Base is called Tehachapi just to the west of it toward Bakersfield. And then there's Tracy and Livermore which just east of San Francisco Bay, and those were the three main wind areas, and we started working with anybody who needed help out there. We did our most time-intensive work was with a group called Dynergy [?] in San Gorgonio Pass where I spent from Thanksgiving or before Thanksgiving through Christmas helping them install a series of turbines that were much like the Carter Wind Systems, but we had to test them first and so I was responsible for bringing in like a mega-watt sized generator, diesel generator doing the wiring to hook up each system and them powering them up, running them to full power and then doing emergency stops, test out the brakes, things like that. So, again, it was because the systems were so much like the ones we'd already worked with, I was able to do that kind of work very easily. Working with a group in—

MM:
Who was the manufacturer of those by the way.

KS:
Dynergy was American Wind Shark, so they were a one-off type turbine. It was a copy of the UTRC, and so we had an advantage with it because we had already worked with a smaller sized unit, fifteen kilowatts—

MM:
UTRC?

KS:
Yeah, the United Technologies Research Center. That was that one that we had tested here, that was our commercially bankable or was famous for doing their stuff. They did helicopter blades, things like that for the government. And then—but American Wind Shark then improved their system, put in a bigger one, and now we're doing this 300 kilowatt size systems. And so we helped them on installation, trying to beat the deadline of getting them all done by December 31, you know, we had to get them installed to qualify for more tax incentives. So that was the biggest one I actually did consulting work for out there. Other stuff we've done is working with the National Renewable Energy Labs on wind data, you know, they started doing tests in this valley floor, and they found that their censors were not responding the way that they thought. They were using the real fancy government-issued, just like at the airport type of censors that work perfectly for airport stuff, but the trouble is when we put them in the middle of this big field of wind turbines, every time this thing would do a little wiggle, shifting side to side like a fish going upstream, then it would lose a little bit of the wind speed coming through it and it would give a lower-than-average wind speed. And so they started finding out that comparing the

wind speed to the power, this turbine was putting out more than it could possibly could compared to the physics behind it, and it was because it was doing a lower wind speed than what was really hitting the wind turbine. So they had to find out that this type of instrument used to measure the wind speed was very dependent on the type of terrain and the type of interaction between the turbine and the instrument. And so we started figuring out methods of putting the instrument in front of or even to or put enough of them that you'd have a wall of wind censors to be able to see what true wind speed was doing as it hit the wind turbine. Then see how well power output versus wind speed was once you knew the real wind wall that was hitting it, not just one isolated censor. And that was again, comparing our wind data to theirs is what helped them sort of find that out because we only used cup-anemometers instead of these propeller type airplane looking ones.

MM:
That had a propensity to move—shift—

KS:
Yeah, they were getting two censors in one though: wind direction and wind speed. But, if the wind's real wiggly, it's fishtailing all the time and not giving an accurate wind speed reading, even though it was giving a consistent one, it was not really what the wind was hitting it.

MM:
Let's stay with Colorado here just a little—

KS:
Sure.

MM:
—I mean, I'm sorry, with California just a little bit longer, butI want you to also talk about in this discussion how key is terrain in judging this wind speed and then analyzing the wind speed?

KS:
Vital. The software companies like Riso National Laboratory in Denmark developed a program called WASP, Wind Assessment Package, and it was supposed to consider the effects of terrain on wind speed estimates across a field. So if you measured here at the low end of the mountain you should be able to predict what's happening at the high end if you knew how much wind was coming from each of these different directions and how often. The trouble is that their estimates were often 30 percent off. We started taking those software programs and comparing them. Real wind data measured at one spot and use that as input to the program and predict what it should be half mile, a mile, two miles out, and then we put censors at those same places and see if we actually measured what the thing predicted. And again, we started seeing these big discrepancies

between the two. And so we started feeding back to the model developers what our field data was showing us. And we didn't have highly topographic lands to put it on. It was here in the north side of Amarillo. Basically, we put four different wind sites around a one major met tower and then fed the numbers in. That was project for one of our graduate students, did this—took her a year and a half and saw how even a slight terrain effects could push the data faster with the model than what you'd really get from the real world measured. And so they had to scale back on some of their modeling efforts or adjust to incorporate the data that we were feeding to them. So they saw that there was a difference. They're much better now, and so it comes down to methodologies of using high-wind data that you can get from satellites or radiosondes predicting what you see at ground level and then adjusting in the middle to define this mesoscale wind flow. And that ties in with a lot of the work that's being done at other places. So, it's trying to incorporate all the different ways of monitoring wind speed and get them reconciled at a certain level where the wind turbine is going to work. And now, adjusting that to the terrain that's around it too and seeing how well this first row of turbines may be doing to the second row, to the third row that's on the hill. What are the different winds that they're really seeing at the same time? And so, our work was verifying software that then turned out to be inaccurate but correctible and though the systems now are working much better but that's because they do understand the push of it. There's a new conference that's coming on next year in 2016 just to study this effect also.

MM:
But, before we—let me pause this thing for just a minute and put some new batteries—

Pause in Recording

MM:
Okay, we are back from a little break here with Dr. Ken Starcher—

KS:
Just Ken.

MM:
Just Ken Starcher, and he's going to continue his conversation about some of the activities they undertook out in California.

KS:
Sure. Like I say, the main reason for the focus on California is because of the tremendous growth they had beginning of the wind industry was out there.

MM:
Why is that? Why was that?

KS:
The state and federal tax incentives were the main drivers along with the California Energy Commission's, Public Utility Commission standard offers. So you had a very good sell price or buy price, you had excellent tax benefits at the federal level, it would've worked anywhere in the United States, but you also had benefits from the state level. Okay, so couple all those together you had very minimal cash outlay, you'd get your money back in three years is effectively what it was, so you had high investment in the industry on the California wind farm because doctors, lawyers, anybody who could invest and get their money back in taxes in three years independent if it worked or not. If it did work the sale price was so good that it made money and everyone was happy. All that ended in '85.

MM:
Okay.

KS:
So, now, again, only reputable working wind turbines stayed, and most of those were foreign made. It was the effort to try and help the U.S. industry that led to a lot of our efforts here for testing and out there for installation or supervision, assistance, that kind of thing. But, once it got past the nineties, California stood on its own, didn't really need any help. That's when that photo was made that you'll see all the wind turbines. At one point California was famous, you could go to once place, the edge of Patterson Pass and look north across the big open valleys and see 10,000 wind turbines working at once and you couldn't see that anywhere else in the world. That's what drew the crowds out there, but it also drew the complaints. Bird damage, you know, loss of habitat, noise issues, visual pollution, all that kick-back started from the improper close spacing of all these relatively smaller sized wind turbines. These were 300 down to 100 down to 60 kilowatt, so it wasn't big monster utility-sized wind turbines like we have now. They were much smaller and therefore you needed more of them to have an impact. The thing that we saw, and if you look at this, you can see this at a website called windpoweringamerica.org, the growth of installation, California was beating everybody, it was the first one to reach a thousand megawatts installed, stayed 2,600 for a long time. Texas finally started catching up, and we passed them 2004, I guess, and that's why I need my computer to make sure, maybe have to edit that, but I want to get on the computer and we'll double check. But it shows this growth and once we passed them we never slowed down. Texas now is the number one installed capacity of wind energy out of any of the United States. We're around 14,000 megawatts and that's easy. Iowa, California, oh, who else? Maybe Illinois around us, but there's ten states that are maybe a thousand or above, but we're ten times that. So, we're number one and we're staying there.

MM:
Well, that was one of my question, Ken, is why was Texas so laggard to begin with when obviously by 1977 they were starting to think about all of this?

KS:
Yeah, but they were thinking about because the Oil Crisis. You know, they were just looking at everything. They didn't do nothing until 1995 when we put in our first commercial wind farm down in the very south Guadalupe Pass or it's a Culberson County I guess is the county that you look at, Texas Wind Power Project, and so '99 is when we really set a target. The Renewable Portfolio Standard, was the driver for Texas where they said, "We will not impede you connecting up to the utility lines. We demand that you have this stable step-by-step growth in the state to reach this definite target by this definite time period and the Public Utility Commission will do all it can to beef up the wires where you're planning to grow." So that was the very first thing that we did. It was Senate Bill I think number nine. Then, the trouble is this is the first time it ever happened. Here's this new law, the business guy said, "Great! Texas wants us! Let's grow!" And so now, three years into this seven year plan we're ahead of schedule, way above target, didn't cost the state nothing, so it's under budget, what's the state going to do? Well that's never happened before. Under budget? Ahead of schedule? Doing better than it's supposed to? Let's raise the target. So Senate Bill number seven then came in and said, "You know, let's raise that target another couple of thousand megawatts and say we really desire it to be 10,000 megawatts by 2025," type of thing. And wind industry said, "Great! Keep growing!" And we're beating the stair-step progress ladder that they set in place. We're 5,000, 6,000, 8,000 ahead of that. So, we reached our target way ahead of time, did it without state money but with state support on putting in new lines and things like that, the CREZ lines, or the competitive renewable energy zone, swept across the Panhandle, did a lot of work down there on far West Texas up to the Midland/Odessa area and then really beefed up the area between Abilene, Sweetwater, and going in toward Dallas/Fort Worth, the I-20 corridor is the way you'd look at it. So now all the energy being made by renewable energy was getting delivered to the places that needed it for energy growth, Dallas, Fort Worth, Abilene, Austin, San Antonio, and all the way to Houston. So, you're sending the energy to where it's needed, but making it out here in the rural areas where it's a good business and then getting it there by having state-supported power lines.

MM:
Explain for a layperson—explain how this energy gets transmitted from these fields to the distribution source.

KS:
Okay, well, think of it this way: If you had a battery and a lightbulb and two wires connecting them, it's pretty to see load, source, transmission. Okay? The trouble is the utility grid right now

is 118 million light bulbs and about forty-nine different really big batteries, and it's getting them all connected at the right time and never knowing when somebody is going to turn on or turn off a switch at any one moment. The utility company has a difficult job on trying to meet the needs and projecting what those needs are going to be ten, fifteen, twenty minutes ahead as far as forty-eight hours ahead based on weather conditions of the general area that they're serving. So, wind energy, solar energy, any of the renewables are just add-in sources. Now, they're also variable and they have allow for that. But, the advantage is is that they can set fixed prices for that energy. If you make it, you make ten kilowatt hours, I'll pay this much. You make a hundred kilowatt hours, I'll pay you ten times as much, but you're getting a fixed price per kilowatt hour for every one you make. So it's a good value for the utilities, they just don't know when it's going to happen unless they study the weather patterns and say, "Oh, it's going to be shiny. I'm going to have some sun. Oh, it's real windy; I'm going to have some wind," and then incorporate that into their estimate of how much they need to make to deliver the estimated load that they're going to see. And so now it's just all these good guessing games, but they have enough historical data that they can predict very closely what any one individual time period is going to need. And so the hard part is, what happens if it's being made way out here, but I need it over here, and that's the transmission line dilemma. There wasn't sufficient robust transmission lines to guarantee that every bit I was making got through to where it was needed. It was being bottlenecked in a couple of areas, and so the CREZ line opened up the bottlenecks and made it nice highways for electrical transmission to happen. So whenever the energy's being made, it can be readily delivered to the places that need it, and then they account for that by saying, "Oh, the winds blowing good in Abilene, I'm here in Dallas, I can cut back on plant number six because it needs maintenance anyway because I'm counting on it to go ahead and grow for another two hours, and it'll easily offset any energy that I need right here in the bottom part of Dallas/Fort Worth area," whatever. So, they're doing a lot of prediction, planning, and statistical what's happened in the past time, temperature, whatever, number of people, knowing what the loads are going to be. And the energy mix has been stable. The energy value has been stabilized because now I don't know what I'm going to pay for natural gas next week, but I know what I'm going to pay for wind next week, next year, ten years from now because of the long-term contracts I already have with them. And the developers of wind power are saying, "I got this stable price. It was easy to finance this project, and I know what the winds are going to do. I'm easily going to make enough kilowatt hours over the next ten years to pay off this project and do another one." So that's the style we needed but we need that trunk line, the CREZ lines to do that. Now the disadvantage: political pressure, got the CREZ lines planned and in place. Political pressure last year almost killed them because what happened was is we reached this 12,000, 14,000 megawatt target, we've got it installed right now working. But the government goal was only 10,000, so some senators are saying, "We don't even need this stuff anymore; we reached our target." Well, if you turn off the CREZ lines, there'll be no more continued growth, you'll only stop at what you have. And so we're trying to make sure that they see that this was a starting step and a definite goal but business can keep growing if you keep supporting it with the CREZ lines, the power lines that get that from production to market. And so, we've got plenty of room to expand the lines we already have. The wires are already in there on half the towers, that is they only put it on the left side.

MM:
Oh, I see.

KS:
And so you could put the same amount of wires on the right side, double the capacity of the line, and not do any new stuff. I mean, you don't have to deal with lawyer fees or nothing, you already own the right-of-way. The tower's already in, you don't have to build nothing, it's just stringing some more wires on the other side to add a whole other circuit, and so, they're pushing to keep that option open, but again the state politicians have considered this as an option of just stopping it because we reached our target. So we have to be aware of that kind of thing happening in the future.

MM:
Okay, in general to your knowledge do the West Texas politicians support—?

KS:
All three of them.

MM:
Okay, uh-huh.

KS:
But remember, there's 27 senators and 114 in the representative side, you know, so—the voice, you know, they can speak loudly and it's still just one little yip in the background sometimes. So they have to be aware of that, that all the guys from Midland, Odessa, all the way through the Panhandle going over to Wichita Falls, are supporting it usually. And so, David Swinford was the main driver of this whole plan back the years he was down there. And he's the former representative of this now up at—based out of Dalhart.

MM:
Okay. Let's go back to California again and talk about the complaints because we have heard about complaints over time—

KS:
And they're still there.

MM:
But kind of take each one of those and from your perspective explain whether they're valid or they have validity or not, especially in the modern age with modern industrial turbines.

KS:
Got you, the three things that are most complained about are avian impact, noise issues, human audio concerns, and visual impact. Okay, bird issues are a problem specifically in the California wind farms because of their growth in areas that were the big flat grasslands that were typically just ranging, you know, cattle, not much farming, typical cows. But it's also the perfect hunting grounds for raptors, the hunting birds like hawks, eagles, things like that. And their ground-based prey, the rabbits, squirrels, mice, that kind of stuff. When you start putting in the wind turbines, the old style wind turbines had these cross-braced latticed towers. A perfect perching point where there were no trees before, now there's these metal trees and I can sit in it, and I can look from here and say, "Oh, there's a rabbit, I'm going to get him." The bird, being an aerodynamic master knows that if I take off into the wind, I will get going faster instead of jumping off downwind because the winds blowing behind me and takes away from my speed, and so the net airspeed over my wings isn't so great and now I'm going to lose lift. He's got this all figured out in his head. So he turns around and takes off into the wind. A lot of the wind turbines have the blades on the up-wind side of the tower. He's looking at the rabbit, he does not see the blade coming in at 170 an hour whacking him from the side, and so that lead to a lot of avian impact on birds that were protected were actually, you know, listed, and so the wind farmers had to start doing a lot more notice of fly-pass or habitats where these protected birds are and stay out of those areas. Before they didn't concern themselves so much about it and it cost them. Visual impact, I cannot say that they're beautiful, but a wind turbine operating in the breeze is graceful that some people consider it wind flowers. Some people look at it and just say, "My god, the terrain is just covered with these terrible units," but it all comes down to what side of the fence you're on. We have the same complaint with the pump jack here in West Texas, that noisy, stinking, ugly thing on that side of the fence is worthless. Well, the guy on my side, "Well, that's perfume. Oh, that's the sound of money. Oh, I like seeing it move up and down because every stoke is another dollar," and it's what side of the fence you're on. No one's ever seen an ugly baby if you're holding it—it's the way to look at it, you know. Last thing, noise: noise is a valid concern because the types of noise being produced by the turbine are very dependent on the wind conditions, its operating speed, and its height above ground, and then how far away you are when you observe the noise. The difficulty is that it's not proven to be medicinally a problem, but a lot of people have tried to make it that way. There's been case studies from up in Washington state where an observer lived next to a wind farm and the site and sound of that turbine would trigger almost an epileptic type reaction into him. But he was also the main gunner on artillery stuff in Vietnam War, and he was used to loud noises and the sound of that ripping sound of a blade going through the air was just like artillery shells passing, and so to him it would triggered bad memories that would trigger episodes, that type of thing. But that was the

main case that they tried to use to show that this was affecting someone, too. People who live inside wind farms or very close to wind farms have been monitored to see how well or how badly it affects them, but we have people who live in wind farms here in the Panhandle that they're benefitting from the wind farm because they're landowners and they live in the middle of it and they say it's great. You know, it's noise just like the washing of the ocean or if the winds really blowing hard you don't hear it anyway because the wind carries it off and it doesn't ever effectively get down to ground level, that type of stuff. The worst part is when it's very light winds and the sound is coming sort of at a forty-five degree angle, and you get the gear box noise, the whines and the thumps and things like that that are more noticeable. So that's the work. It's not something that's going to go away, but it is something that's manageable. The story we have is that there was a windy land owner in California in the middle of like 800 wind turbines. His wife hated them because of the noise they made, but for Christmas the owner of the wind farm gave her a mink coat and a mink stole; she went deaf, so we know natural fur causes deafness. (both laugh) That's the kind of think, you know. They were able to accommodate her, but you know, it did not take away the noise issue itself; it just placated her is the way you look at it. But sometimes you do that.

MM:
Let's go back to birds. You know, there are arguments about migratory—that it affects migrating birds, you know, migration patterns and things like that.

KS:
It does.

MM:
Okay, talk about that.

KS:
Every turbine that's two miles high is going to hurt a, hurt a bird. But if you've ever looked how high up are those whooping cranes or the sand hill cranes and stuff when they're actually moving, it's only when they're starting to come down.

MM:
Oh, I see.

KS:
And it's these known areas where they're going to have rest or water or feed that you try and stay away from. If I give them like a two mile gap around everywhere I know that they've historically been coming, then they they've got a nice glide path to be able to get down, do their

stuff, get up in the morning, climb back to cruising altitude, and take off. But, if they're 700, 800 feet high, they're above a wind turbine that we have today.

MM:
Well, I've even noticed them down in, down around Roscoe, you know, grazing right there by the wind turbines.

KS:
Yeah, but those guys have gone through a couple of seasons maybe of seeing how you get in and out.

MM:
So they—yeah, and they've figured it out.

KS:
Well, the ones who survived have survived.

MM:
Okay, this is all very interesting. Now, tell me a little bit about the materials that you're giving to us today and, you know, what they relate to.

KS:
Four things were focused on the WEPL documents, the Wind Energy Publication List, and this is a set that was put together by the National Renewable Energy Lab at National Wind Technology Center but was meant for holding all the base information of wind energy development, that is, what kind of testing has being done, what kind programs are out there to help model blades or aerodynamic behavior, things like that. And so, it's the background of wind research from all different departments. This is from Rocky Flats itself, from the Department of Energy, through the Sandia National Labs, through Pacific Northwest Laboratories, through Ames, Iowa, NASA, NASA has a lot of reports in there, also. And so, it's every document that was pure research to help wind development that they felt was not so much a standard but as a bedrock, that you could start from this report and move forward and maybe do another good research report here, but it was still based on this one, but this is now the current findings and go from there. But, it's the bedrock of wind energy studies is what this report's wound up to be. And so they come from a lot of different government and university agencies, but they were listed in order by what they do, who did them, when they did them, the dates and stuff will shuffle, but the numbering system is the important part, that they thought it was important enough to go ahead and identify, number it, and then put it in order. And so the advantage of the list that we gave you is that at least it's a searchable database, you know, you can look for it by author by subject or by date or by publication, where it came from, and try and find stuff up quick or research the database, too.

It's searchable, you know, you can just sort by, that kind of stuff in an excel file. That was done by one of our Russian interns who came in, and that was what she spent her semester doing was putting that in and double checking it and matching each one against the book and seeing if we had it. The second thing then is the proceedings. The American Wind Energy Association started in the late seventies and had some of their opening meetings here in Amarillo, and so the first proceedings from those meetings as well as the meeting itself and how that meeting's set up started here in the '78, '79, 1980 and then went on. What we did is we had a tie-in with AWA where we would assist them at every meeting, and then in return we got to sit though the meetings, but we may have to take three or five students to go to the meeting and each one would work in one of the break-out sessions and do the gofer, keep everything on time, keep the lights running, keep the sound up, run the slides if you need it, do overheads if that's what they were doing, you know, so we were just assistants to them all the way until like, Chicago, was it Chicago meeting? No, Denver, I guess it was Denver. Nope, Chicago, they finally just gave us an award for all the service we had done since this was 2005, I guess, and because they had to start using such big venues they had to rely on union people to do the work instead of just this group from Texas, but it worked out well, that way we got more people exposed at the national level and they got to sit through, you know, the students will mostly go to sleep, but if you have to keep turning the pages on a report you have to stay awake during the whole presentation, and it exposed you to a lot of good resources. Those AWA proceedings then is also a good cross-sectional snapshot by year of all the different changes in the wind industry, so you're getting that set. The second thing is the applications and that's our wind diesel workshops coupled with the groups up at Atlantic Wind Test Center in Canada, this is Prince Edward Island, the far east side of Canada. The people up in Alaska who were dependent on a lot of diesel operation for their electrical needs so any of the wind diesel workshops show how wind coupled with microgeneration of a grid, you know, diesel set up that was actually run on a power grid, how you could combine the two. And the research we did at the U.S. department of Agriculture was leading that on how to make sure you take whatever the wind's doing, match it to whatever the load is, and then throttle up or down the diesel, or maybe even turn it off if there's enough wind power to keep everything going without needing the electric—the diesel. And all the sudden you've got these big savings of fuel for these isolated micro-grids and that's a big savings back in the—they're paying fifty cents a kilowatt hour for some places on the small grid, and now I'm saving half their gas in a year? All of the sudden that price is twenty-five cents, and more people can use electricity, so that was a big setting of proceedings that you'll get. And then the last one was our international proceedings. We've got a lot of international proceedings through China, Brazil, places like that of just wind background where we've gone and presented or assisted at the conferences and so those proceedings will come in again; it's all wind related. The last thing you have is a lot of EPRI, Electric Power Research Institute focused on solar energy. And so those are documents that you'll get too that'll match up with your solar program,

MM:
Talk a little bit about them.

KS:
EPRI was more how does energy production affect the energy grid, the electric grid. They're more interested in keeping the grid alive. So Electric Power Research Institute is they know the electric grid is a live thing, they know it's split into three parts in America. There's the Hippies, there's the Yankees, and there's Texas. Each one's a separate electric grid run by its own supervisor, for us it's ERCOT, Electrical Reliability Council of Texas, and the other one's it's WEPO and MESO. So each area has its own group, but there's very little interconnection between the edges. It's very difficult to get my frequency exactly matched up to what it is in Missouri unless I touch the wires together. But, the only way to safely do that is turn off Texas for fifteen minutes, connect them, and then turn Texas back on. Well, nobody wants to do that, and so we stay separate, each one exactly sixty hertz but not exactly in step, and so that's what you have to be aware of, that our grids are functionally the same but physically disconnected. And it's—

MM:
Will there ever be a technological fix for that?

KS:
Yes, and it's called Tres Amigos, and it's a plan here just north of Clovis to be a three-cornered interconnection between all three grids. This is the only physical place in the United States that has all three grids relatively close together. I now have, because of the CREZ lines, access to the ERCOT grid. I now have Southern Power Pool which is part of the East Coast grid which is everything from Panhandle up through Minnesota. And then we have the West Coast grid which starts just the other side of Clovis, New Mexico, Tucumcari-ish area. By putting in a three-cornered station there with DCDC interconnect, that is they change the AC to DC and then the DC back to AC at the other corner. I can send it any one of the three ways. And so that's what they're thinking is going to happen here in the very near future. We'll have this one physical place that it can happen, space far enough that we can build it up to handle more and more power over time, and then connect East to West, West to Texas, Texas to East, East to Texas, you know, we can go any one of the three ways. We've got to pause. Hit your pause.

MM:
Now here we are wrapping up here with Ken Starcher.

KS:
Well, you know, finishing up the electrical grid problem. There's a very good website called NERC, the National Electrical Regulatory Commission, N-E-R-C, and so you should look at that

on their grid map you'll see, like I say, the East Coast, West Coast and the Texas grid and understand the separation between them. And the advantage of this Tres Amigos potential is connecting them to move power across a boundary that was pretty much a solid boundary, and now if I can start making renewable energy in the Midwest and shipping it to California, Nevada, and places like that that need it and the time of day may be a little different, you know, that I'm making it at two in the afternoon and they're only noon, two hours different, but it may be when they need it and now the value of it's going to be higher and so the potential for income for this bread basket of wind energy that we have in the middle states is what we see as a big potential, a big possibility. Okay—

MM:
Students.

KS:
Students, the interns. You know, we were real successful in working with a group called the Council for International Education Exchange on setting us up with students who wanted to come and study renewable energy and study it here in the United States, and they needed it as a requirement for their degree plan in the colleges they were working at. And it effectively gives us trained student workers who we could teach our techniques to and they could learn from us how to get along in the United States: what's a quarter inch? When they're used to the metric system it drives them insane, a quarter inch, five-eighths, four-sixteenth, that's just not done. Why not 230 millimeter or whatever? So learning how to express something that is so common back where you're from, and it's the exact same thing here but it's a different name. So we often had a database of terms that we would give them that they could now recognize, "Oh, that's what a nut, a washer, a bolt, tighten, loosen, lift, pull," in their native language. So it worked real well. And, like I say, we've stayed in contact with lots of these students. We've been to Europe maybe two or three times where we visited with former interns, stayed with them, or had parties or whatever. So, the feeling is that it was a memorable, enjoyable experience, that they did learn something. One of our girls, Matilda, is actually an expert now for the company for the company that created the software for the software she worked. Remember I mentioned WASP, the Wind Assessment Package from RISO. She's working there now as their improver of this package because I forced her to work on it for four months to do a job just for us where we did a site characterization for Vermont. And so she had to dig into all this stuff, convert it from German to English, understand the English, apply it with no help. You know, I know how do it in English, I didn't know how to explain it in German, so she had to do almost all the work herself, but now just doing that made her effectively bare bones expert in that system. And then she went and studied at the same institute that developed this software, and they were saying that they had this problem, said, "Oh, that's easy," bah, bah, bah. "How do you know this?" She said, "I've been to Texas."

MM:
Yeah.

KS:
And so, they then realized that the work she was doing was not as important as helping them fix the problems in the software, and so she's been working on that now for two years. So we see that what they learn here can be applicable to the industry in a maybe a—maybe even a little niche market, but it's one that's going to affect everybody because they use this software as a standard program for doing estimates. If you only take a little bit of data you try to predict what is going to be big area, why. That way it saves you having to install met towers for everything; you do just a couple and then predict what it's going to be and then say, "Well, my best turbines are going to be here, here, here, and here," and turbine layout, "Oh, that's too far a distance." This software does that and she's helping to improve it.

MM:
Interesting.

KS:
Some students have done their own wind companies in Europe. Charles Roseal (1:14:26) is a French student who came here, a true engineer, he even told our engineer that's not the right way to do it, and was this close from being explained, "You don't teach old engineers." But he was right. His learning of installing met towers—he's doing that as a company now in Europe, installing met mass for developers and maintaining wind data equipment. But the first time he did it he was scared. He says, "There's no way that's safe. You know, it's only a few wires holding this tower together, and when we raise it up with this little tiny wench, it's a possibility of failure." And so it's like, we have a system where one guys stands on one side of the tower at the ground wires, another one's at the other, two people are at the wench, and we couldn't find Charles. And he was 300 yards away behind the only tree there was; it was a little tiny mesquite bush. You know, he says, "I'm not getting close; it's not safe." I said, "You've got to do your job." He did his job, and then when it was over I showed him every piece of this hardware from an American company, "fabrique en France." It was made in France. Well, then it must be okay. And he was calmed, okay. So those kind of things. And, like I say, he's gone on to do it himself. But he understood after a few times, "Oh, this really is an equilibrium. Oh, they have calculated." If you do it the right way, there's no extra stress on the tower, you can just pull it up, and it takes a while but everybody does their job, everyone keeps everything in equilibrium. You never allow any one guide wire to get too tight. He learned all those techniques and then realized it is a good system and is applying it back home.

MM:
Wow.

KS:
So—

MM:
Now—

KS:
Us.

MM:
This program—

KS:
Yeah, Alternative Energy Institute, like I say, started in '72 from the research efforts, began in '77 as our first years of funding. And our funding has been very consistent from the state as in it being a line-item budget written into the state budget for wind research, wind research study here at West Texas A&M. And we use that money for base salaries and then leverage to get more contracts. That is, if I'm paying somebody a salary and his benefits out of this state money then it doesn't cost as much at the local level and I can say, Oh, I'm putting in this benefits as a match to a proposals and use it that way to help get outside contracts. It's gone up and down; there's been years that it was pretty high, there's been years it's been very low, but it's been pretty consistent overall the thirty-eight years. But the school decided when they made a deal with Underwriters Laboratory about two years ago. Underwriters Laboratory offered them a large cash bonus to set up a five-year program where they would fund a certain set number of employees, put in a building, help install the electrical facilities to do large wind turbine testing. And that was perfect because then they could do big wind mills like utility-sized wind mills. We do our small wind mills here at the Alternative Energy Institute; everybody's happy. The contract that they wrote to the university though, we were never allowed to be part of, and our director at that time, Dr. Yunyec Chang [?], he tried every means at his disposal to try and see what was in the contract, try to make AEI apart of this, or at least in cooperation with them, offer them as, you know, a resource, you know, to all of our expertise, history, documents, whatever they needed, but it was finally rejected. Basically, UL said, "No, here's the deal: we do these areas. There's a non-compete clause now between us and the university. The university can't work on any of these areas." And because our budget status was so poor at that time, the only income stream we had was from testing wind turbines that would have paid off our deficits in a reasonable amount of time. Two years was the plan we had to pay off everything. But when they said we couldn't test anymore we had to cancel all of our contracts. And now, without any

income coming in, we're a liability to the school. And so, they effectively said, "We've got to close you; you're just too much bleeding." So, they got large money, they'll get large benefits from having large wind turbines tested if they ever do any and then shut down our stuff, but then we get to take over everything that we had, so that's the advantage to the school. The school came out okay. I and all the student workers here got reassigned, you know, so we're not lost, we're not hurting, it's just we're not doing what I've done for thirty-eight years.

MM:
What are you doing now?

KS:
I'm a teacher in engineering, computer science and mathematics.

MM:
I see.

KS:
But that's what I've been doing for the last five years anyway. AEI was the—I was only training education and outreach. You know, answering public questions, that kind of stuff. But, my main focus has been teaching. No big change there I just increased my teaching.

MM:
Okay, so, you had to shut down this office; you had to distribute these materials that y'all have amassed over time. Some of them have gone to WT Library, some of have gone to the National Wind—

KS:
American Wind Power Museum.

MM:
American Wind Power Museum there with Coy Harris and then some are coming to the Southwest Collection at Texas Tech.

KS:
Correct, and so there's no lost link to where they are as long as we remember where they went. We can still point people to where the good stuff is.

MM:
Now manuscript materials and things of that nature—

KS:
Well, we've got a full set of some reports and we'll try and get you a copy of each one that we've tried to talk about during the day—

MM:
Personal files and things of that nature over time?

KS:
Most of that's been trashed. Dr. Nelson came up a week and a half ago and went through the eighteen file cabinets, and most of them was empty now.

MM:
Anything that's left over we'd probably be interested in—

KS:
Okay.

MM:
And it's really been a pleasure to talk to you today here, Ken, as I say, we may have one of our other oral history experts come back and visit with you. But anyway, thank you. Any further comments or last comments you'd like to make?

KS:
No, I can say this, I never worked. I got paid for playing every day for thirty-eight years, so I can't complain. My opening story is that when I came up here to WT, I was going to be a vet or an oceanographer. Well, I don't like horses and there's no ocean up here, so I wound up my first day of classes being late to my first class which was Physics 101 taught by Dr. Nelson. And he said, when I came in the class, "Sit down in the back; don't ever be late again; shut up." But a couple of weeks later, I'm walking down the hall, he's walking down the hall, I say, "Hey, Dr. Nelson," he looked at me and he said, "Are you in my class?" And I said, "Yes, sir." He said, "You want a job?" I said, "Yes, sir." And I've been working there ever since. You know, so it was serendipity in that the skills as I had coming from a real small school, ag mechanics, which is a Future Farmers of America's contest—welding, wiring, electrical, stuff, plumbing, tools. I was one of the best ones in our area. Won it because I had to; my older brother had won it too, so I had to at least tie him.

MM:
Where was this?

KS:
In Spur, Texas, and so this was in the Lubbock region that that happened. But those skills that I had were what we needed then to get windmills installed and running. And everything else: data collection, installation of censors, running computers, you know, all that other stuff I learned as we needed. And so it was just everything happened, that I had what we needed, I grew with what we started doing and then wound up, this has been the best place there ever was.

MM:
And you basically have been on the cutting edge of this technological shift and this wind—or this energy source from the beginning.

KS:
We have and we were recognized. Like I say, the one map that we have that shows all the international participation of people that have either come here or where we've gone to test. We've been to almost every continent except Antarctica, Australia, so I mean, people need this kind of resource; they need to know what works and what works well so that they don't make the same mistakes the industry made in the seventies and eighties, that they can apply the good stuff in the 2010s and the 2020s.

MM:
Now where is this map?

KS:
It should be here on the wall.

MM:
Well—
KS:
Let's go look.

MM:
Then we need to get it. Thank you very much, Mr. Starcher, we appreciate it.

KS:
You're welcome.

End of Recording