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Women Champions in Solar Energy

Velissa Sandoval
Office of Science, Student Undergraduate Laboratory Internship (SULI)
University of Denver

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Sandra Begay-Campbell, Sandia National Laboratories.

Participant: Velissa Sandoval, Signature on File
Signature Date

Research Advisor: Lizana Pierce, Signature on File
Signature Date

Research Advisor: Sandra Begay-Campbell, Signature on File
Signature Date

ABSTRACT

Women Champions in Solar Energy. VELISSA SANDOVAL (University of Denver, Denver, CO 80210), Sandra Begay-Campbell (Sandia National Laboratories, Albuquerque, NM 87185), Lizana Pierce (U. S. Department of Energy, Golden Filed Office, Golden, CO 80401).

Women have made many remarkable advances in society in the past century. Advances for women working in renewable energy are no exception. Because I was able to work with women with several different experiences, this internship has been a worthwhile and empowering experience. This summer, being able to attend a workshop specifically for women interested in photovoltaics (PV) has demonstrated that women want to be involved in the PV field. Yet, women in PV are still underrepresented. Why is this? Despite growing support, women still have barriers to overcome before stepping into most technical fields and succeeding. Social, economic and cultural barriers have prevented women from entering technical fields for years. Today, the opportunity for women to enter a technical field, such as photovoltaics, is available. But with gender barriers still present, two women have stepped beyond the traditional boundaries and entered the PV field of renewable technologies. Deborah Tewa, a Hopi woman who was formerly the project manager and electrician of NativeSun, and Vircynthia Charley, a Navajo woman who currently works with the Navajo Tribal Utility Authority, are two phenomenal examples of women working in PV. They have not only been an inspiration to women in PV, but have also made enormous contributions to their Native people through renewable energy. The two different experiences of women in PV allowed me to learn technology via interviews, field visits and observations. The tribal renewable energy experiences of these two women will inspire and convey the work being done on tribal lands.

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GENERAL DESCRIPTION OF PROJECT

Women have made many advances in society in the past hundred years. Today women are able to work and participate in most any career of their choosing. The growing technical area of photovoltaic system design and installation is a new field for women's participation. After attending the American Solar Energy Society (ASES)-sponsored, Women in Photovoltaic Design and Installation workshop in Austin, Texas at the ASES 2003 conference, it was evident to me that women are making an important and sizable contribution to the renewable energy industry including photovoltaics. Two women in particular have made great contributions not only to the photovoltaic industry, but also to the Native American communities of the Southwest. Without these Native American women champions pioneering new ideas and strategies, solar energy advance within the Hopi and Navajo tribes would not have been as significant. These women in particular have made significant contributions to their Native American tribes. These women are Deborah Tewa, former project manager and electrician for NativeSun and current intern at Sandia National Laboratories, and Vircynthia Charley, an electrician for the Navajo Tribal Utility Authority (NTUA). They have aided in the design, installation and sustainable maintenance of several photovoltaic systems while educating others about the solar energy systems and their use. These women have played an instrumental role in advocating the use of photovoltaics. Working alongside these women this summer, and seeing their contributions to photovoltaics is inspiring.

Coming from different environments, they are able to accomplish the task of photovoltaic operation and maintenance both effectively and efficiently. Deborah Tewa's role with NativeSun has ended, but her role within her community as an advocate for solar energy is still alive. Vircynthia Charley, also an advocate for solar energy, has developed her own way of

performing photovoltaic system operation and maintenance (O&M) within NTUA's Kayenta District. Her process of O&M had not been documented, which led to my assigned task this summer. The summer intern task was to document NTUA's O&M process. Because Vircynthia's methods of O&M have been successful and efficient to date, other districts within NTUA may use her methods as a model. It is hoped that the developed flowchart will be used; however, the ultimate decision must be made by the Navajo Tribal Utility Authority.

With the aid of solar energy advocates like Deborah and Vircynthia, a flow chart documenting the O&M process for NTUA was developed. This document will hopefully play an instrumental role within NTUA because it is essential to document the successful O&M processes in order to implement the same process throughout the districts so that a standardized method will be understood by all electricians. In addition, the O&M documentation is important because there are many people who carry equivalent amounts of knowledge, but there are not many women advocates like Deborah and Vircynthia who make such positive impacts and technical advances within their communities; therefore, this must be documented. An overall goal of this assignment was to identify the champions of tribal solar programs, such as NativeSun and NTUA.

Vircynthia Charley and Deborah Tewa have taken it upon themselves to advocate for photovoltaic and hybrid system use within various rural communities. These women have stepped beyond the stereotypical barriers that tend to keep women out of technical fields, and they have educated others about their work in a technical field and have become champions for the use of photovoltaics.

WOMEN CHAMPIONS IN SOLAR ENERGY

Imagine being out in humid, 100-degree weather atop a roof with thirty women. Why were these women out on the roof in this type of weather? They all shared an interest in renewable technologies, particularly solar energy. In June 2003, more than thirty women took part in an empowering experience that demonstrated just how successful women could be in the field of photovoltaic systems. This experience, called Women's Photovoltaic Design & Installation, took place in Austin, Texas, as part of the 2003 American Solar Energy Society (ASES) Conference. This workshop provided women with a comfortable yet energizing environment for teaching women the basics of photovoltaic design and installation. Furthermore, the class led to the study of a broader research topic, which is understanding women champions in solar energy. The successes and advances in the photovoltaic field have not been made exclusively by men. A few women have taken it upon themselves to make further progress in the field of photovoltaic design and installation in both the business and technical aspects.

The ASES workshop consisted of more than 30 women who were interested in the design and implementation of photovoltaic systems. The women attending the workshop were of various technical backgrounds and education levels. Their interest and enthusiasm to learn a trade that is not common among women empowered the group as they learned the theories behind photovoltaic design and installation. Working with power tools and solar electric equipment, these women developed confidence and knowledge in a field not common to women--photovoltaics. The instructors of the class served as role models of what women can do in fields often occupied by men.

The instructors for the class all had technical backgrounds. They included Marlene Brown and Deborah Tewa of Sandia National Laboratories; Janet Hughes, the owner of Austin-based Janet's Electric; and Jaya Jackson of the Conservation Services Group. These women all shared the enthusiasm of the class as they taught other women the skills of photovoltaic installation. Being able to learn hands-on photovoltaic installation from other women was inspiring because seldom do women get a chance to learn such skills, much less from other women. These women demonstrated that women could become involved in any technical field of work, and in particular photovoltaics. In addition to self-empowerment, it was evident that even in the growing field of renewable energy a woman can champion among her colleagues and pave the way to newer and improved methodologies.

As photovoltaic technology has evolved, so has women's interest in it. Interest in photovoltaic technologies has increased among women over the last decades and continues to increase. Despite the growing interest in photovoltaics, the number of women who work in the field is slim. Why is that? There are many reasons why a woman does not enter a technical field, not just photovoltaics. Lack of experience and exposure to technologies as well as social and cultural identity issues are just a few reasons why women do not enter technological fields. Many women do not have the hands-on experience with technologies and are apprehensive when approaching such an experience. In addition, women traditionally have no experience with tools and other types of equipment. These traditional roles are unknowingly reinforced in society. Stepping beyond these traditional roles and getting that hands-on experience is what the Women's Photovoltaic Design & Installation workshop accomplished.

Women of all fields and experiences were involved. Some were engineers and electricians; others were teachers, homemakers, and students. As one woman from the workshop wrote, "I

would not have taken this class if it was coed because I feel I would've held the class back and I wouldn't have as much knowledge/experience as males." Another woman wrote, "I would not have signed up for this class if it had been a male/female workshop. I wanted the benefit of feeling comfortable asking questions, and I did in the all-female class." In an interview with one of the instructors from the class, Marlene Brown, she said she believes that women are not comfortable in technical fields because they have minimal belief in their abilities in addition to gender obstacles they encounter. She thinks that women are less aggressive compared to males and have to work hard to gain respect from male colleagues. A workshop like the one she taught offers women a nurturing and empowering environment. Exposing women to the unfamiliar might make some feel uncomfortable, but the feeling is lessened in a single-gender classroom. Ms. Brown believes that women in a technical field will provide perspective into the field in a different way as well as provide alternative ways to pursue answers. Women like Marlene Brown are changing women's views of themselves and boosting their confidence in performing technical tasks.

Hearing or reading about a woman performing technical tasks is a great success, but witnessing a woman performing a technical task is a greater success. As mentioned before, workshops, like the Women in PV design and installation, demonstrated women's want to get involved with PV. In order to see first hand what and to document what women are doing in PV, field to actual PV sites installed by the two women were conducted. Making trips to actual PV sites on the Navajo and Hopi reservations were key to understanding why their work was so important. During these field visits, interviews were conducted with women to obtain their own personal experiences and to gain perspective on their work. Observing where Deborah and Vircynthia work was an eye-opener. When first asked to describe where they work, they

commented that the residences they serviced were in rural areas. Rural was assumed just a place outside of town with a dirt road. This was not the case. After traveling on the highway for about forty-five minutes and taking a dirt road through winding canyons, the customer's residence was finally reached. Such is the case with many of the customers that Deborah and Vircynthia work with. Having to travel for hours at a time to reach one customer who has no electricity, no running water and none of the other modern day conveniences was a shock. Even today in the United States, people still live without electricity. After collecting much information from these women, other relevant literatures were researched to gather other information. After doing much researching and interviewing, conclusions were drawn about these women in technical fields. These women were not ordinary women; instead, they were champions among their people and in PV.

DEBORAH TEWA, HOPI TRIBE

Like Ms. Brown, Deborah Tewa has confidence in her technical abilities and works to help others (see figure 1). Being the only woman in a room full of men is something familiar to Ms. Tewa. A resident of Hoteville, a village on the Hopi reservation, and a member of the Coyote Clan, Ms. Tewa found her niche working with her people. Since beginning her career as an electrician, she experienced some tension in being a woman in a technical field. Ms. Tewa began her technical career when she decided to go to school to obtain her electrician's license. Having confidence in her abilities and determination, Ms. Tewa earned an electrician's license. Despite constantly having to prove herself to some of her male colleagues, she stepped beyond the stereotypical boundaries and began to work with an electrical company doing commercial work.

She worked as an electrician until 1987 when the Hopi Foundation asked her if she would like to participate in a photovoltaic training workshop provided by Solar Energy International. Ms. Tewa and others from surrounding villages participated in the workshop. The training she received from the workshop was instrumental when she joined NativeSun, a grassroots renewable energy business, in 1991. Ms. Tewa installed photovoltaic systems on the Hopi reservation and surrounding communities. In addition to this, she also educated the Hopi and others on solar energy and conservation. Having the knowledge of the NativeSun business and the respect and trust of her community, she took on the role as project director for NativeSun. After many rewarding years working with NativeSun, Ms. Tewa left to pursue an Indigenous Studies degree at Northern Arizona University while interning at Sandia National Laboratories. She found that working with Native people has been a rewarding and satisfying experience, because she is teaching and giving back to her community. She feels that she is helping improve the quality of life on the Hopi reservation by making solar electricity accessible to the rural areas. Using a traditional source of energy is a great accomplishment and satisfying experience.

While making this journey into solar energy and working in a non-traditional field, Ms. Tewa reflects on her experience working in varying technical environments. She comments that people within the photovoltaic industry are more accepting of women than they are in the electrician's trade. More gender issues arose while working as an electrician in a commercial business. Being a woman in solar energy, Tewa has taught many women who have no technical experience in PV by teaching classes such as the one in Austin. She serves as a role model to younger women not just in the solar industry, but also in her community. She provides a great example of a woman who is not limited by gender stereotypes. She did not let technology intimidate her nor did she allow herself to conform to a traditional role. As Ms. Tewa said in an

issue of *Home Power* magazine, "Just get in there and do it. Sometimes it may be hard, but it's like life. If you decide that's what you want to do, you just have to do it." Deborah Tewa rose to the challenges required in a technical field and stepped beyond stereotypical boundaries, two of the many accomplishments that make her a woman champion in solar energy.

VIRCYNTHIA CHARLEY, NAVAJO NATION

Being a woman in the electrician's trade was not the calling for Deborah Tewa, but is has been for Vircynthia Charley. A Navajo woman working as an electrician for the Navajo Tribal Utility Authority (NTUA), Charley has found her calling. Being one of a few women working as an electrician among the numerous men for NTUA has been a rewarding experience. As a child, she was naturally curious and experimented with solar energy. She recalls trying to fix a PV install once:

> "I don't recall who had originally installed the PV but I noticed that the system was out for months before I started playing around with it. When I finally got power out of it, I hooked up a small 13'' black/white TV, an AM/FM radio, and a DC light fixture onto the unit. Later, I found out the main source was the battery, so we had one of our relatives bring back a diesel battery for us from the coal mine."

Experimentation, such as the one mentioned above, aided Charley in her pursuit of her electrical career. After being in the military, Charley took an electrical course. Having prior experiences with electricity and tools, she was confident in her abilities because as she said, "It came natural to me". From this, she began her career as an electrician and started to work for NTUA. She continues to work there today.

Vircynthia plays a crucial role in her district, Kayenta, of NTUA. She is a Journeyman Electrician who does a variety of tasks (see figure 2). She aids in the operation, maintenance, and construction of the water wells, pumps, houses, and photovoltaic systems. In addition, she troubleshoots individual customers' utility systems and aids in all other utility areas. Ms. Charley works in the most PV populated districts of NTUA. Working with more than 100 PV systems, she has helped with the development of the Kayenta district's operation and maintenance plan. Having confidence in her work and knowledge of the PV systems in the district, she aids other NTUA districts as well. She provides support by offering advice and technical assistance with troubleshooting and testing of NTUA's PV systems. Her methods, philosophy and hard work are assets to the Kayenta district of NTUA.

Ms. Charley has become an asset to NTUA because she has helped develop ways to recognize problems within the PV systems as well as become a leader by documenting her work. Ms. Charley has recognized that within NTUA's many districts, not all the same procedures and methods are used. For the Kayenta district, she has helped develop worksheets and checklists to make sure the same procedures are followed in each troubleshooting and maintenance call. Since her ways of handling the operation and maintenance (O&M) process for NTUA PV systems are a success, an O&M process chart was developed based partially on her work. This process chart will serve as a draft to bring together all the NTUA districts and have continuity in the O&M processes. Through observation, conversation and documentation, her methods of O&M for PV systems were transcribed for the first time. Using Ms. Charley's O&M procedures and the feedback of other NTUA districts, it is hoped that a consensus will be reached and NTUA will have a standardized methodology of how to conduct their operation and maintenance process. Currently, a flowchart has been developed and accepted by NTUA with some

modifications. With Ms. Charley's efforts in PV system operation and maintenance, it is clear that she is a woman champion in solar energy. Being able to educate her people on the use of solar energy as well as being able to tackle technical problems, she has become a leader and teacher in her community. She recognizes that the need for electricity in rural areas, and the need especially among the elderly who do not know the luxury of electricity. Ms. Charley feels that it is important to have Native Americans in such work because as Ms. Charley says to "have more individuals in this field recognize the needs of our Nation and people will increase our independence." Being a Native woman in the trade is also another unique quality. Ms. Charley believes that being a woman in this non-traditional field has opened doors for other women, especially Natives, by moving beyond past aggressions and revolutionizing an industry that was once male dominated. Like Deborah Tewa, she is truly an advocate not just for solar energy, but for women who want to get involved in solar energy or in any technological field.

CONCLUSION

Meeting these women and working with them for such a short duration was an honor. Much can be learned from their different experiences in renewable energy. They have shown that women can excel and succeed in a non-traditional field and even help revolutionize it. Their efforts in renewable energy have led to many wonderful changes in their community. Being a Native American in renewable energy is rare; being a Native woman in renewable energy is even more rare. Deborah Tewa has shown us that even though there is a gender barrier in technological fields, it is not impossible for a Native woman to overcome and help lead a grassroots renewable energy business. She has shown us that it is important to educate people about solar energy and to encourage others to pursue a career in solar. Vircynthia Charley has

demonstrated that a Native woman can help with the progression of a commercial business while improving the methods of PV operation and maintenance. She has demonstrated that women can succeed in a male-dominated environment. Both women have promoted sustainable living and advocated for such technologies to support sustainability. They have both led incredible lives that show how much a woman can accomplish in renewable energy and in their communities.

People like Deborah and Vircynthia make solar energy and sustainability successful ventures. These women show that it takes hard work and effort to ensure the sustainability of their communities. These women are champions in solar industry not only because of their accomplishments, but also because of their persistence and dedication to their peoples. Working in two different environments, yet striving for the same goal of sustainability, helped make businesses like NativeSun and NTUA successful. After observing these two women in the field as well as the classroom, it is easy to see why they stand above the rest. Deborah and Vircynthia both know what it takes to succeed in a capital-driven business while still being true to their beliefs, values and culture. For all these reasons, they are true and rare champions of solar energy technology.

Working among so many talented women this summer has been inspiring. Being a Native American woman in a technological field can be trying due to restrictions in career choices and constant competition with male colleagues. Even though these women have made vast accomplishments, there are still gender-biased incidences that occur in the work field or in meetings with their male counterparts. Seeing how these women handle these situations with poise, knowledge and patience, demonstrates how they have made it this far in the industry. They bring different perspectives, skills and insights to the industry. They show the difference a woman can make in the PV field and serve as role models for women within their community,

and the world. These two women are a couple of examples of how women have progressed in renewable energy technologies, particularly photovoltaics. They have shown that a woman can enter into and succeed in a traditionally male-dominated field as well as revolutionize and diversify the renewable energy field.

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FIGURES

Figure 1: Picture of Field Visit to Hopi with Deborah Tewa. The pictured installation was done by Deborah when she worked at Native Sun. Pictured from left to right: Shaun Tsabetsaye, Velissa Sandoval, Keith Candelaria, Deborah Tewa, and Marlene Brown.

Figure 2: Picture of Field Visit to NTUA with Vircynthia Charley. Vircynthia takes readings from a PV installation using her laptop. Pictured from left to right: Vircynthia Charley, Melissa Parrish, and Deborah Tewa.