DOE / SANDIA INDIAN ENERGY – INTERNSHIP PROGRAM

Immersion into Indian Energy

U.S. DEPARTMENT OF ENERGY | Office of Indian Energy

June 12, 2018 Update

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AI / AN STEM Higher Education Reality

Unique challenges as the most under-represented group in education. To close the achievement gap:

- The National Caucus of Native American State Legislators:
  programs developed with community and tribal collaboration
  - Including representation at federal levels
  - developing culturally (tribally) based curricula
  - buy-in includes culturally (tribally) appropriate standards.
- American Indian Science & Engineering Society (AISES)
  - programs for STEM access & success at post-secondary institutions, and
  - creating initiatives centered around STEM leadership & (systemic) change with STEM professionals

American Indian & Alaska Native STEM Students – AI / AN
(US Engineering workforce illustrated)

0.3% (3 out of 10,000) AI/AN in the US Engineering workforce (2010)

0.07% (1 out of 13,000) AI/AN women in the US Engineering workforce

0.4% earned Engineering Bachelor degrees of the US students (2012)

Approximate Average / year US Engineering degrees awarded between 2001 – 2013:
300 BS, 75 MS, 10 PhD

Only 7 of 100 AI/AN kindergarten students will eventually earn a bachelor's degree compared with 34 of every 100 White kindergarten students.

Key Elements of Sandia / DOE IE Internship Program

Unique interactions with professional connections with tribal leaders & staff based on personal rapport. Tribal field visits showcased tours welcomed.

- **Southern CA:** ***Campo Band*** (wind farm), ***Ramona Band*** (ecotourism), ***Agua Calente Band*** (off-grid trading post, on-grid solar)
- **Southwest Tour:** ***Navajo Nation*** (off-grid homes, large solar farm, LEED buildings), ***Hopi Tribe*** (village power, off-grid homes, energy efficiency), ***Hualapai Tribe*** (large scale microgrid, building solar)
- **Northern CA:** ***Blue Lake Rancheria*** (large scale microgrid, Green Gas Station)
- **Oregon:** ***Warm Springs Tribe*** (utility hydro plant), Bonneville Power Administration (large hydro facility)
- **DOE IE Golden Site Office:** *IE Deployment team*
- **DOE IE Headquarters:** *IE Leadership team*

Sandia National Laboratories
Unique Energy Facilities & Researcher

- Distributed Energy Testing Lab (DETL)
- Solar Power Tower
- Photovoltaics Systems Evaluation Lab (PSEL)
- Energy Surety Incubator Summer Program
- Subject Matter Experts (SME)
- American Indian Outreach Committee (AIOC)

Seminars / Conferences

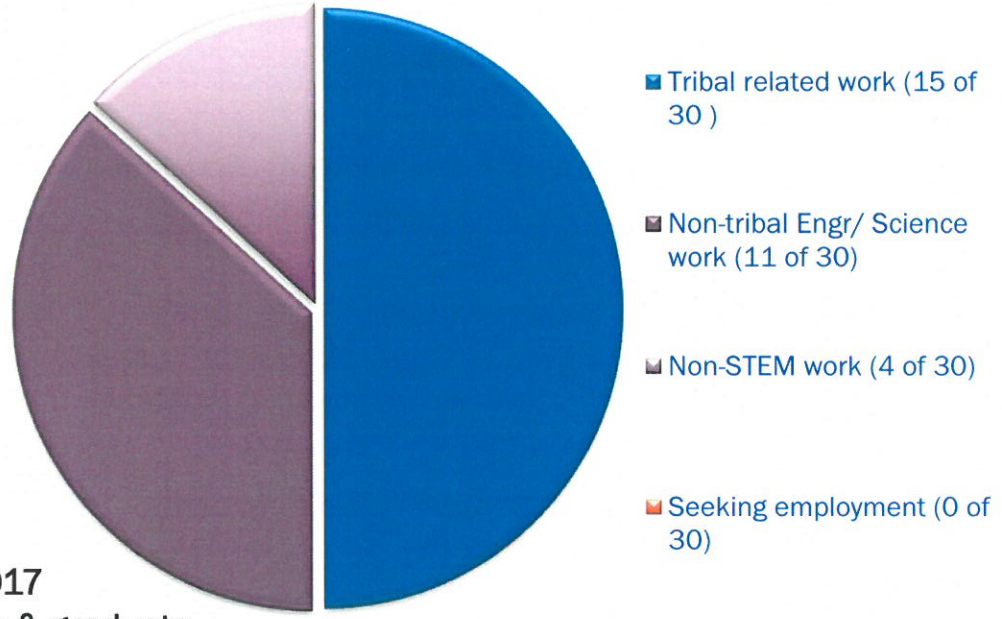
- Enabling Advanced Power Electronics
- American Solar Energy Society Conference / NREL visit

Showcase tribal energy projects and meet tribal energy leaders / staff

Overview: 2002 – 2017 Statistics

Intern Gathering at Navajo Energy Summit – Flagstaff, AZ
Pictured: Debby Tewa, Suzanne Singer, Terry Battiest, Len Necefer, Carson Pete, Sandra Begay, Thomas Jones

Type of Work for Former Interns



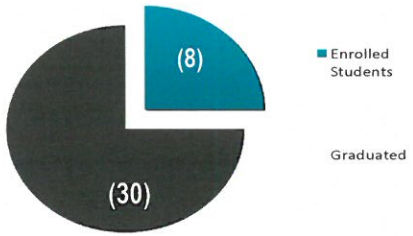
2002 - 2009

- 18 undergraduate & graduate interns have participated.
- 10 different tribal affiliations
- 9 different majors
- 28 % of the interns converted to year-round status (5 of 18)
- 17% of the interns hired as FTEs or contractor (3 of 18)
- 56% female interns (10 of 18)

2010 - 2017

- 20 undergraduate & graduate interns have participated.
- 11 different tribal affiliations
- 10 different majors
- 20% of the interns converted to year-round status (4 of 20)
- 15% of the interns hired as FTEs or contractor (3 of 20)
- 75% female interns (15 of 20)

Graduation Rate of All Interns



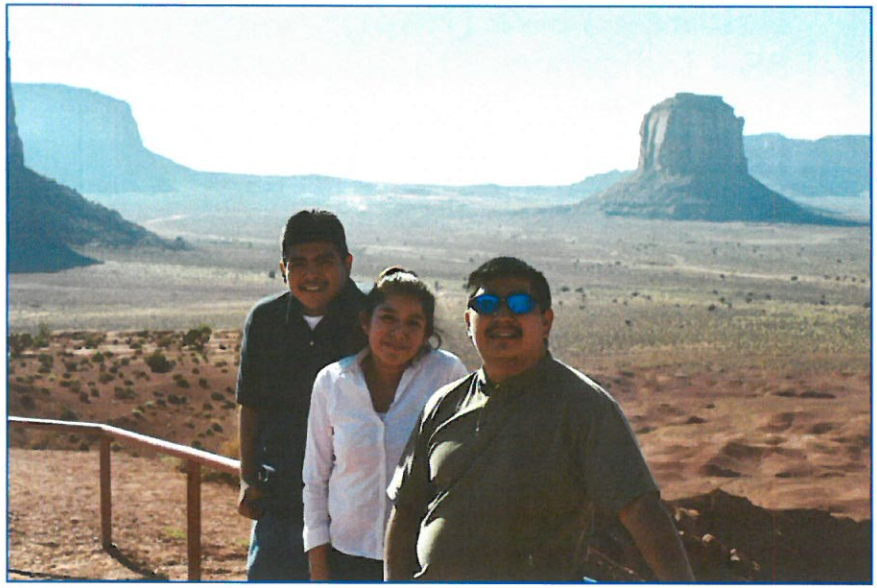
2002 Sandia Student Intern

Pictured at Sandia's PV Laboratory, NM:
Deborah Tewa (certified electrician & solar installer)

Deborah Tewa (Hopi)
BS - Indigenous Studies, Northern Arizona University
Her research focused on tribal off-grid PV systems and tribal RE systems.

"While I had worked with photovoltaic systems for several years including my experience at NativeSUN, the internship complemented my prior work 'in the trenches' and has been a gratifying experience. "

2003 OS / Sandia Interns



Pictured at Navajo - Monument Valley, UT:
Keith Candelaria, Velissa Sandoval & Shawn Tsabetsaye

Office of Science (OS) Program

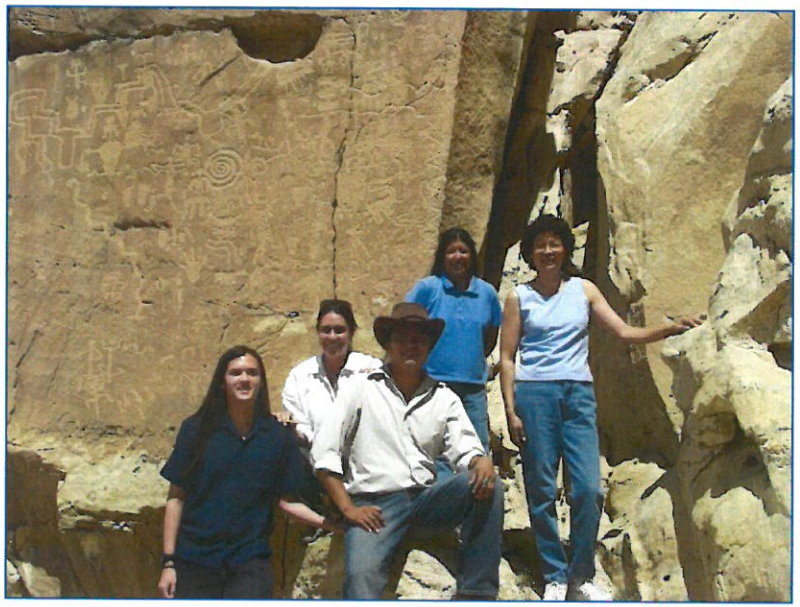
Keith Candelaria (San Felipe/Jemez), BS - Environmental/Earth Science, Dartmouth College
His paper entitled, *"Native American Renewable Energy Approaches: Navajo Tribal Utility Authority and NativeSun."*

Velissa Sandoval (Navajo/Zuni), BS - Electrical Engineering
Her paper entitled, *"Women Champions in Solar Energy."*

Shaun Tsabetsaye (Zuni) is a graduate student in electrical engineering, University of New Mexico, BS – Electrical Engineering.
His paper entitled, *"Navajo Tribal Utility Authority: Electrification Demonstration Program - Developing a Sustainable Tribal and Rural Co-operative Solar Program".*

"Native Americans believe that the sun, wind, and geothermal waters are all gifts from the Creator. As people use these resources today, they should always remember to give thanks for all that is provided."

2004 TEP / Sandia Student Interns



Pictured at Hopi Tribe Petroglyphs:
Benjamin Mar, Jennifer Coots, Colin Ben, Deborah Tewa & Sandra Begay-Campbell

Tribal Energy Program (TEP)

Benjamin Mar (Cherokee), BS – Electrical Engineering, Worchester Polytechnic Institute
His paper entitled *"Navajo Tribal Utility Authority: Photovoltaic Hybrid Operation and Maintenance Process for a Sustainable Program"*

Jennifer Coots (Navajo), MBA – Finance, University of New Mexico, BA Finance
Her paper entitled *"A Decade Of Changes To An Alternative Power Source For A Rural Utility."*

Colin Ben (Navajo), MA – American Indian Studies, University of Arizona. His paper entitled *"Researching Renewable Energy Systems Available to Indian Country"*

Deborah Tewa (Hopi), BS - Indigenous Studies, Northern Arizona University.
Her research focused on DOE's Solar Reliability Database for Off-grid PV systems.

"With our diverse backgrounds, we shared our perspectives as well as analyzed situations through different points of view whether cultural, technical or financial."

2005 TEP / Sandia Student Interns

Pictured at Hopi Old Oraibi Village: Tanya Martinez, Deborah Tewa, Sandra Begay-Campbell, and Jennifer Coots.

Tanya Martinez (Mi'KMaq) Power Engineering graduate student, University of Massachusetts – Lowell, BS - Electrical Engineering.
Her paper entitled *"Remote Monitoring System Design - Sustainable Systems For The Navajo Tribal Utility Authority".*

Deborah Tewa (Hopi) BS - Indigenous Studies, Northern Arizona University.
Her paper entitled *"NativeSUN: A Model for Sustainable Solar Electric Systems on Indian Lands".*

Jennifer Coots (Navajo) MBA - Finance, University of New Mexico.
Her research focused on the tribal housing mortgage finance for renewable energy systems.

"Tribal Nations do have unique cultures that must be considered for any government project and it increases the success of the project when that awareness is there."

2006 TEP / Sandia Student Interns

Pictured at Navajo Nation - Monument Valley, UT:
Thom Sacco, Terry Battiest, Jonathan Biron,
Sandra Begay-Campbell, Lani Tsinnajinnie & Debby Tewa

Terry Battiest
(Choctaw)
MS – Telecommunications, University of Colorado – Boulder, BS - Industrial Engineering
His research focused on the Navajo Nation's Internet-to-the-Hogan Project.

Jonathan Biron
(Sault Ste. Marie Tribe of Chippewa)
BS – Biosystems Engineering, Michigan State University
His paper entitled, *"Tribal Renewable Energy Integration: An Analysis of Current Tribal Infrastructure"*

Lani Tsinnajinnie (Navajo/Filipino)
BS – Environmental Science & Native American Studies, University of New Mexico Her paper entitled *"Benefits of Renewable Energy for Native Nations from the Environmental and Native Perspectives"*

"...it has given me insight to what I want to do professionally..."

2007 TEP / Sandia Student Interns

Pictured at Navajo Nation's Canyon De Chelly, AZ:
Debby Tewa, Thom Sacco
Cherylin Wilson, Nick Johnson & Terry Battiest

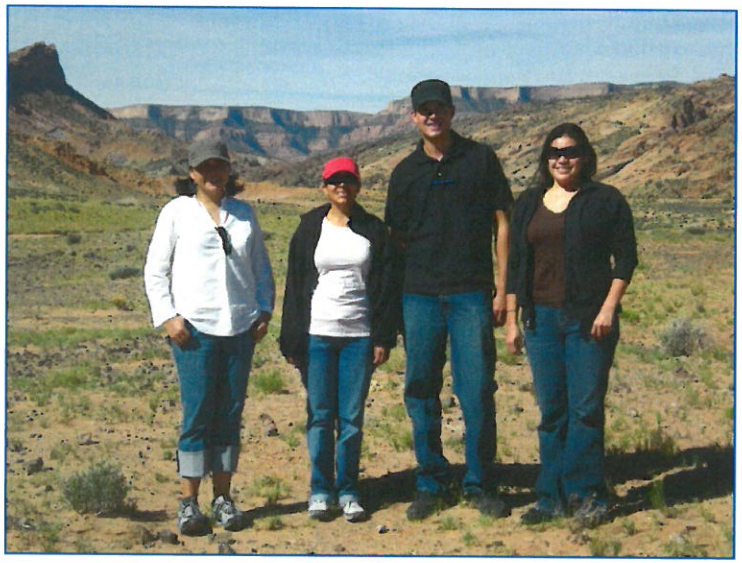
Terry Battiest
(Choctaw)
MS – Telecommunications, University of Colorado – Boulder
BS Industrial Engineering
His paper, *"Navajo Tribal Utility Authority Solar Program System Data and O&M Initiative"*

Nick Johnson (Three Affiliated)
BS – Mechanical Engineering
University of Colorado – Denver
His paper, *"Sustainability of Small Wind Turbines on Native American Tribal Lands"*

Cherylin Wilson (Navajo)
BS – Biology, AS – Environmental Science
Oklahoma Panhandle University.
Her paper, *"The Ecological Effects of Native Wind Energy Projects"*

"Since day one, I have felt like a valuable member of the team, which is important because not only am I learning a great deal, I also feel like I am contributing to the group."

2008 TEP / Sandia Student Interns



Pictured at Navajo Nation, AZ:
Gepetta Billie, Amanda Montoya,
Carson Pete & Suzanne Singer

Gepetta Billie (Navajo)
MS – Regional & Community Planning; BA – Envr. Planning & Design, UNM, AS – Civil Engr Tech, SIPI

Amanda Montoya (Taos)
MS – Regional & Community Planning, University of New Mexico; BA – Business Administration
Her paper entitled, *"Renewable Energy and Energy Efficiency Initiatives on the Laguna Pueblo Reservation*

Carson Pete (Navajo)
MS – Mechanical Engineering; BS – Mechanical Engineering, Northern Arizona University
His paper entitled, *"North Leupp Family Farms Project – Sustainable Agriculture Systems Using Photovoltaic Cells and Small Wind"*

Suzanne Singer (Navajo)
PhD – Mechanical Engineering; MS – Mechanical Engineering, University of CA, Berkeley; BS – Mech. Engr

"This internship has allowed me to learn and see first hand what it means to plan and build sustainably on Native lands."

2009 TEP / Sandia Student Interns

Pictured: Prestene Garnenez,
Sandra Begay-Campbell & Gepetta Billie
(not pictured Suzanne Singer)

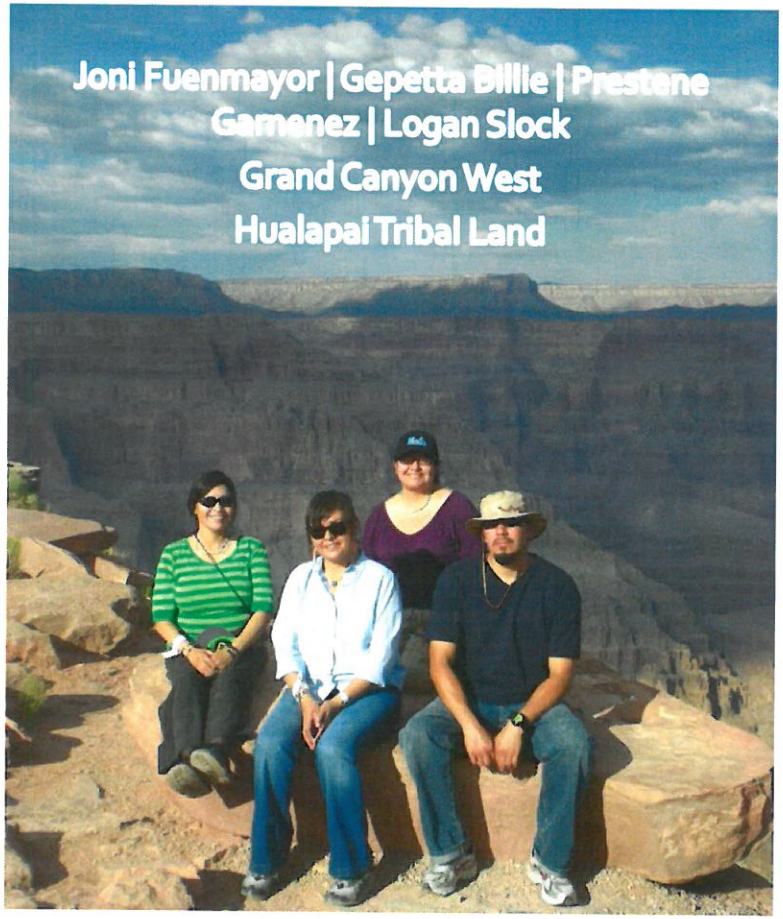
Gepetta Billie (Navajo)
MS – Regional & Community Planning; BA – Environmental Planning & Design, University of New Mexico, AS – Civil Engineering Technology, SIPI
Her paper entitled, *"Renewable Energy: Planning for Sustainability & Self-Determination for the Navajo Nation"*

Prestene Garnenez (Navajo)
MA – Urban Planning, University of California – Los Angeles; BS – Biology, New Mexico State University
Her paper entitled, *"Green Gas Stations: A Guide for Tribally Owned Gas Stations"*

Suzanne Singer (Navajo)
PhD – Mechanical Engineering; MS – Mechanical Engineering, UC-Berkeley; BS – Mechanical Engineering, University of Arizona

"I think what I learned that is important in all the tribes we visited, is the importance of 'ownership' of the project. If you're investing part of what you have - your time, money, energy, pride - into these projects, [then] the projects can be successful, long-lived and sustainable."

2010 TEP / Sandia Student Interns



Joni Fuenmayor (Navajo)

AAS – Energy Systems, Navajo Technical College, Crownpoint, NM
BA – Studio Art, Dartmouth College, Hanover, NH
Her paper entitled: *"What's in 880 Watts? An Exploration of the Basic Electrical Power Connections between a Residential PV System and an Appliance"*

Gepetta Billie (Navajo)

MS – Community & Regional Planning, UNM; BA – Environmental Planning & Design, UNM; AAS – Civil Engineering Technology, SIPI

Prestene S. Garnenez (Navajo)

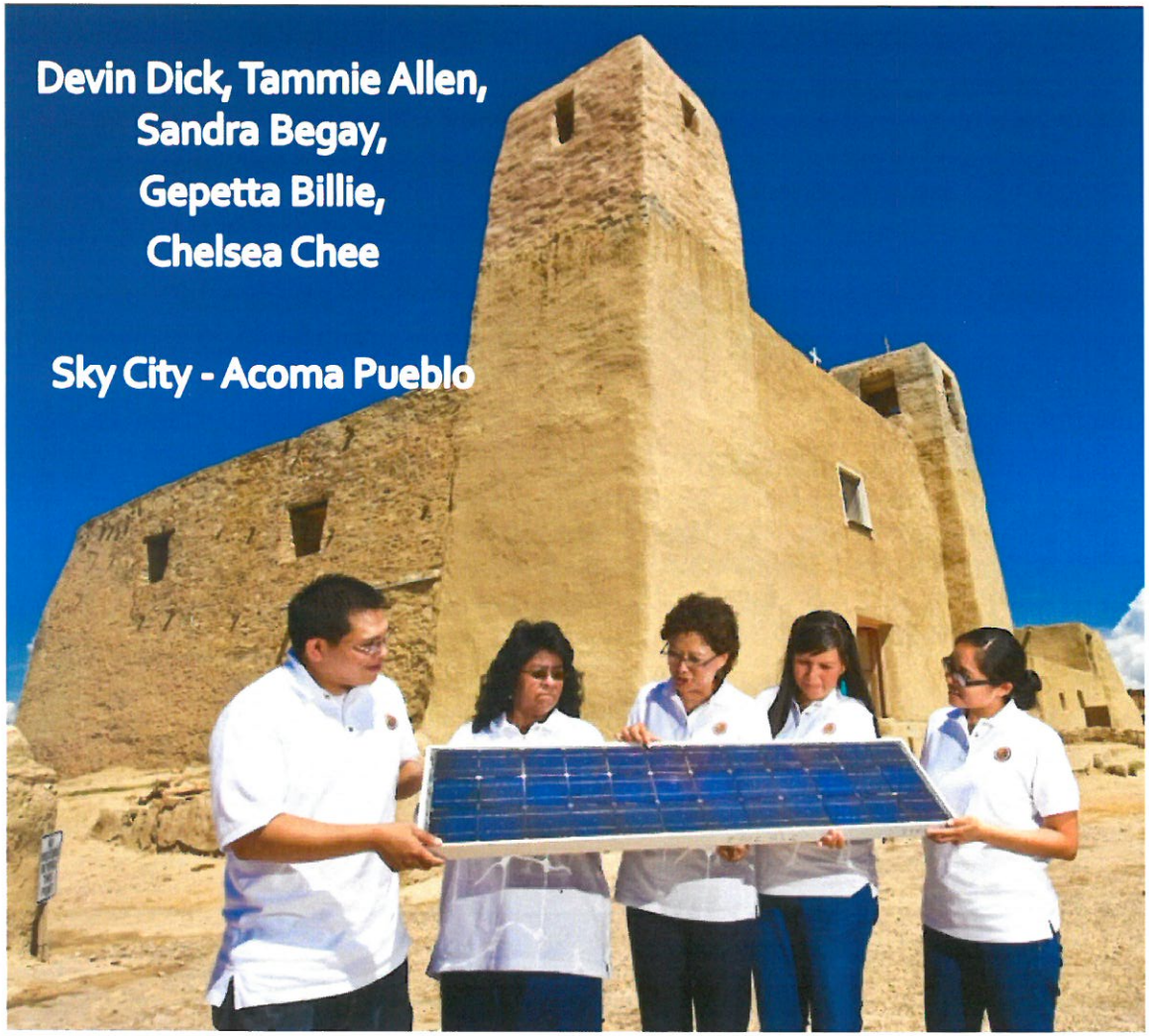
MA-Urban Planning, University of California, Los Angeles; BS-Biology and minor in Mathematics, New Mexico State University
Her thesis entitled: *"Renewable Energy in Indian Country: Working to Build a Sustainable Community Using Renewable Energy Resources in Hualapai Nation"*

Logan Slock (Hopi/Choctaw)

BA – Environmental Studies, Johnson State College, Johnson Vermont
His paper entitled:*" Tribal Energy Internship Program Reflections: Achieving Overall Improvements of Renewable Energy Resources in Tribal Communities"*

"It was really nice when an elderly community member…told me he was 'happy to see young Indians involved in these issues and getting their education.' His comment gave me a sense of pride in what we are doing and it made me realize that we are making a difference."

2011 TEP / Sandia Student Interns



Tammie Allen (Jicarilla Apache)

MS – Community & Regional Planning, UNM;
BA – Art, College of Santa Fe
Her paper entitled: *"Using Renewable Energy For Economic Development: Off-Grid Ecotourism on the Ramona Band of Cahuilla Mission Indian Reservation"*

Gepetta Billie (Navajo)

MS – Community & Regional Planning, UNM; BA – Environmental Planning & Design, UNM; AAS – Civil Engineering Technology, SIPI
Her thesis entitled *"Addressing Renewable Energy Development at the Local Level by Learning How to Plan through Green Building: An Example of Community-based Planning on the Navajo Reservation"*

Chelsea Chee (Navajo)

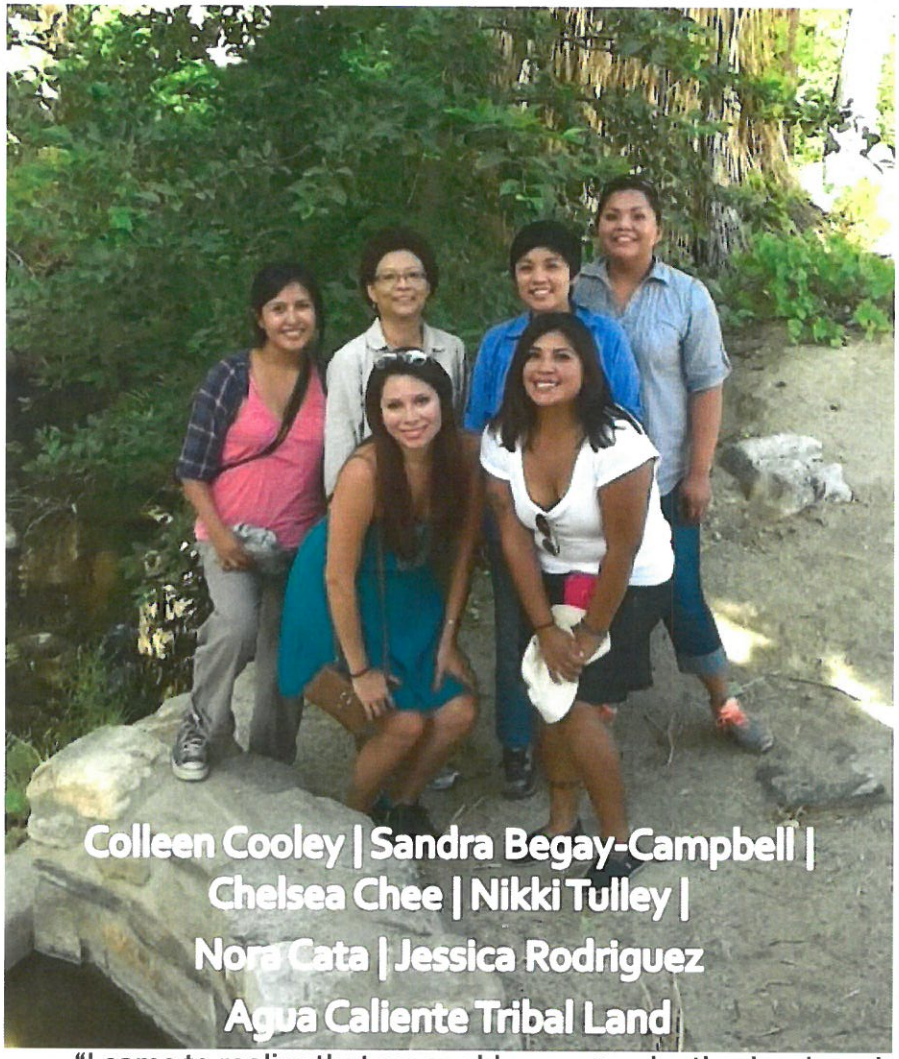
MS – Community & Regional Planning, UNM; BS – Environmental Planning & Design, U of AZ
Her paper entitled: *"Energy Efficiency and Renewable Energy Benefits Agua Caliente Band of Cahuilla Indians via Implementation at Their Indian Canyons Trading Post"*

Devin Dick (Navajo)

AAS – Energy Systems, Navajo Technical College,
His paper entitled: "*Suggested Alternatives' For Navajo Tribal Utility Authority: Utilizing Excess Power Generated By Stored Hybrid Units"*

"One of the most useful and biggest learning aspects of our field visits are the people we are introduced to and visit with outside of the meetings and conferences."

2012 TEP / IE Sandia Student Interns



Tribal Energy (TEP) & Indian Energy (IE) Sponsors

Nora Cata (Seneca-Cayuga) - TEP

MS – Environmental Studies, San Jose State; BA – Environmental Studies, UC-Santa Barbara

Her paper entitled: *"Sustainable Rural Electrification on the Navajo Nation: What Makes a Successful Off-grid Photovoltaic Installation?"*

Chelsea Chee (Navajo) - TEP

MS – Community & Regional Planning, UNM; BS – Environmental Science, U of AZ

Colleen Cooley (Navajo) - TEP

MS – Climate Science & Solutions, Northern Arizona University; BS– Environmental Studies, NAU

Her paper entitled: *"Mitigating Climate Change on a Tribal Level"*

Jessica Rodriguez (Laguna) - IE

BS – Environmental Studies, Haskell Indian Nations University

Her paper entitled: *"How the Sale of Tribal Renewable Energies to the US Military can be Mutually Beneficial - Case Study Pueblo of Isleta"*

Nikki Tulley (Navajo) - IE

BS – Environmental Studies, University of New Mexico

Her paper entitled: *"Adapting Renewable Energy Systems for a Changing Climate in Remote Tribal Communities–Navajo Nation, Arizona"*

"I came to realize that renewable energy adoption is a learning process for everyone involved....Each tribe had its own motivations & perspectives with implementation as unique as the individual cultures themselves."

2013 TEP/CCI Sandia Student Interns

Pictured at Indian Canyons Trading Post –
Agua Caliente Tribal Lands, CA:
Sandra Begay-Campbell, Shalynn Summer Trancosa,
& Chelsea Chee

Tribal Energy Program (TEP) & Community College Internship (CCI) Program Sponsors

Chelsea Chee (Navajo) - TEP

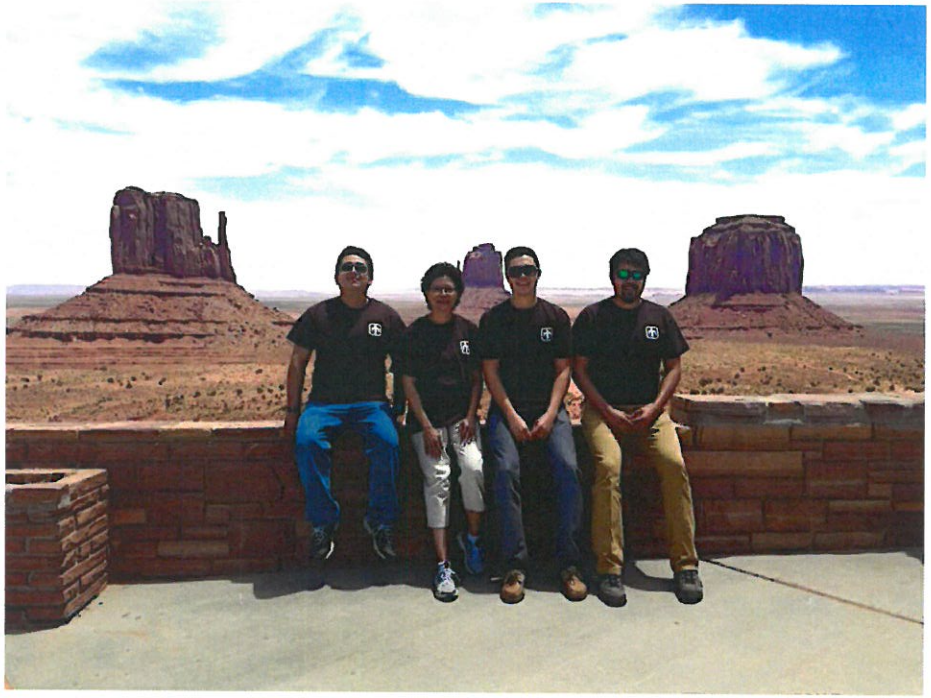
MS – Community & Regional Planning, UNM
BS – Environmental Science, U of AZ
Her paper entitled: *"Microgrid Implementation on Tribal Lands"*

Shalynn Summer Trancosa (San Felipe Pueblo) – CCI

AS – Applied Technologies in Solar Technology, UNM Los Alamos Branch
Her paper entitled: *"Applying Green Practices on Tribal Lands"*

"The places I have seen, the people I have met, and the things I have learned are in no comparison to what I imagined this internship would entail. The opportunities I have had this summer to meet and learn from many different people have changed the way I see and think about tribal lands and green initiatives."

2014 IE / Sandia Student Interns



Pictured at Monument Valley, UT – Navajo Nation:
Aaron Cate, Sandra Begay-Campbell, Thomas Jones,
Len Necefer

Aaron Cate (Santo Domingo Pueblo)

MS – Industrial Engineering, NM State
BS – Civil Engineering, NM State
His paper entitled: *"Evolving Infrastructures – Greening up a Pueblo Indian Gas Station"*

Thomas Jones (Aleut / Cherokee)

BS – Biology & Spanish, Oklahoma City U
MS – Tropical Conservation Biology & Environmental Science, U of HI
PhD – Natural Resources & American Indian Studies, U of AZ
His research entitled: *"Can Native Nation Building Theory Help Address Barriers to Renewable Energy Development on Native American Lands?"*

Len Necefer (Navajo)

BS – Mechanical Engineering, U of Kansas
PhD – Engineering & Public Policy, Carnie Melon
His research entitled: *"Energy System Optimization Tools Informed by Indigenous Cultural Values for American Indian Nations"*

"My time with the Indian Energy Program has directly benefitted my desire to learn and understand the barriers in Indian Country with renewable energy development.... This understanding will not only benefit my dissertation work directly, it has motivated me even further to improve energy resource development throughout Indian Country and the United States in general."

2015 IE / Sandia Student Interns

Pictured at Monument Valley, UT – Navajo Nation:
Len Necefer, Brittany Anstead, Kimberlynn Cameron,
JoDonna John, Sandra Begay-Campbell, Thomas Jones

Brittany Anstead (Haliwa-Saponi)

MS – Natural Resources & Enviro, Sustainable Systems, U of Michigan
BS – Environmental Technology & Management, NC State
Her paper entitled: *"Methods for Tribal Sustainable Development, Adaptation and Mitigation of Climate Change through a Sustainability Framework"*

Kimberlynn Cameron (Standing Rock Sioux)

MS –Engineering Mgmt / Sustainable Engineering Minor, SD School of Mines & Tech
BS – Geotechnical Engineering, SD School of Mines & Technology
Her paper entitled: *"Building Geothermal Greenhouse Potential for the Standing Rock Sioux Tribe"*

JoDonna John (Navajo)

BS– Electrical Engineering, AZ State
AS – Sustainable Systems / PV, Navajo Technical U
Her paper entitled: *"Community Energy Storage on Tribal Lands with Integration of Renewable Energy"*

Thomas Jones (Aleut / Cherokee)

BS – Biology & Spanish, Oklahoma City U
MS – Tropical Conservation Biology & Environmental Science, U of HI
PhD – Natural Resources & American Indian Studies, U of AZ

Len Necefer (Navajo)

BS – Mechanical Engineering, U of Kansas
PhD – Engineering & Public Policy, Carnie Melon

"...the tribes have progressed primarily on their own as the primary accountable party to build capacity and put forth the energy that goes into establishing and following through with sustainability projects."

2016 IE / Sandia Student Interns

Pictured at Tribal Leader Conference, CA:
Thomas Jones, Sandra Begay, Kimberlynn Cameron, Diana Fuller, Rachael Gutierrez, & Len Necefer

Kimberlynn Cameron (Standing Rock Sioux)

MS –Engineering Mgmt / Sustainable Engr Minor, SD School of Mines & Technology
BS – Geotechnical Engineering, SD School of Mines & Technology
Her paper entitled: *"Microbial Fuel Cell Possibilities on American Indian Tribal Lands"*

Rachael Gutierrez (Yomba Shoshone)

MA - City and Regional Planning, Pratt Institute's School of Architecture
BA - International Relations - Latin American & International Business, Boston University
Her SAND report entitled: *"An Asset-Based Approach to Tribal Community Energy Planning"*

Diana Fuller (Mescalero Apache)

MA – Sustainable Development and Policy, University of Illinois - Springfield
BS – Renewable Energy, Econ Public Policy / Native Amer. Studies Minor, Illinois State
Her SAND report entitled: *"Identifying Sustainable Design Opportunities in Tribal Hotels and Casinos Focus: Mescalero Inn of the Mountain Gods Hotel & Casino"*

Thomas Jones (Aleut / Cherokee)

PhD – Natural Resources & American Indian Studies, U of AZ
Co-Author SAND report entitled: *"Identifying Barriers and Pathways for Success for Renewable Energy Development on American Indian Lands"*

Len Necefer (Navajo)

PhD – Engineering & Public Policy, Carnie Melon
Co-Author SAND report entitled: *"Identifying Barriers and Pathways for Success for Renewable Energy Development on American Indian Lands"*

"This gave me the opportunity to learn first-hand from tribal members & become aware of the current challenges tribes are experiencing. It also allowed me to learn from the success of tribes and try to understand why projects work in some instances & fail in others. "

2017 IE / Sandia Student Interns

Pictured at NTUA Solar Farm, Kayenta, AZ – Navajo Nation:
Sandra Begay, Teri Allery, Kathryn Hall

Teri Allery
(Turtle Mountain Chippewa)

MS – Construction Management, ND State
BS – Civil Engineering, ND State
AS – Engineering, Turtle Mountain Community College
Her paper entitled: *"Renewable Energy Technologies for Turtle Mountain Band of Chippewa Indian Reservation"*

Kathryn Hall
(Turtle Mountain Chippewa)

MS – Chemical Engineering, Univ. of ND
BS – Chemical Engineering, Univ. of ND
Her paper entitled: *"Solar Energy Technologies and the Utilization on Native American Tribal Lands "*

"Seeing all these tribes being successful in renewable energy gives me hope that my tribe can also be successful in renewable energy projects and I want to help make that possible."

Where are the IE /Sandia former interns working?

Internship graduates working on DOE or energy related activities:

- ✓ Serves as new Navajo Nation's tribal utility renewable energy engineer
- ✓ Serves as DOE National Lab - Sandia Corporate Planner, NM
- ✓ Serves as DOE National Lab – Sandia Corporate Planner, CA
- ✓ Served as DOE National Lab - Sandia corporate procurement representative
- ✓ Serves as DOE National Lab - Sandia R&D engineer
- ✓ Served as DOE Wind Program Manager; now in private industry
- ✓ Served as past Navajo Nation's tribal utility renewable energy engineer; successful implemented Navajo's EECBG ARRA funds & TEP funds.
- ✓ Serves as a private commercial scale PV design engineer
- ✓ Serves as a tribal solar and energy efficiency consultant
- ✓ Serves as Taos Pueblo environmental staff
- ✓ Serves as Taos Pueblo community planner
- ✓ Serves as technical tribal energy sub-contractor, DOE Office of Indian Energy
- ✓ Serves as community energy coordinator NGO
- ✓ Serves as community college Sustainability Facilities Lead
- ✓ Serves as Bureau of Indian Affairs engineer

Of the current graduate student research (past & current interns):

- ✓ Researching barriers to development for Alaska Natives (DOE IE)
- ✓ Researching large scale off-shore wind energy turbines (NSF Fellow)
- ✓ Researching tribal climate change mitigations and adaptations (EPA Fellow)
- ✓ Pursuing renewable energy systems designs (DOE National Lab - NREL)
- ✓ Researching Pueblo leadership decision making (Kellogg Foundation Fellow)

US Engineering Institutions awarding the most engineering Bachelor degrees to AI/AN (interns' universities):

- ✓ Arizona State
- ✓ University of Oklahoma
- ✓ New Mexico State
- ✓ North Carolina State
- ✓ Northern Arizona University
- ✓ South Dakota School of Mines and Technology
- ✓ University of New Mexico