
Engaging Middle and High School Science & Math Teachers in Sustainable Energy Engineering Research, Guided-Inquiry Teaching, and Community Empowerment

Mark A. Nanny, Professor

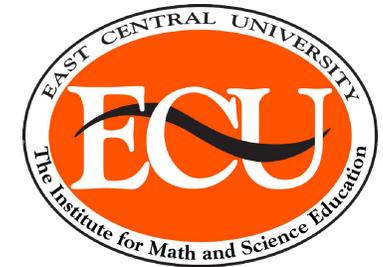
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Solar Energy in Schools - Senate Interim Study 19-5

Why Sustainable Energy? ^{1,2}

Oklahoma Wind Energy Generation and Capacity

2nd in U.S. total wind generation

3rd in U.S. installed wind capacity (8,072 MW)

Predicted total wind capacity (359,434 MW)

OK Wind Energy Jobs (2019) 7,000 – 8,000

OK Wind Energy Economy

Capital investment since 2018 \$14.7 billion

Annual state and local taxes \$23.5 million

Annual land lease payments \$20 – \$30 million

Why Rural Schools? ^{3, 4, 5}

Oklahoma Rural Population

33.8% of total population

1,333,000 rural residents

Poverty Rates (2015)

~ 17% rural Oklahoma

~ 11% urban Oklahoma

Rural Public School Districts*

75.2% of all OK school districts

385 Districts with < 1000 students

Rural School Students*

21.0% of all OK students

146,709 rural K-12 students

*school districts with < 1000 students

Why Sustainable Energy? ^{1,2}

Why Rural Schools? ^{3, 4, 5}

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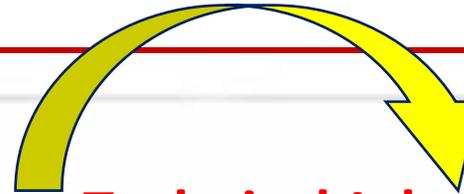
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Integrate and support Solar and Renewable Biomass industries



**Technical Jobs
Local Revenue**

How do we stimulate this process?

**Educated Workforce
Retain Rural Youth**



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Our Central Thesis.....

“[The] dependence of community on school can lead, it seems, to either sustenance or devastation. This relationship can nourish a rural community socially, or it can cause segregation and inequality. It can fortify a rural economy, or it can produce shrinking populations and shuttered farms and rural decline.”

Why Rural Schools Matter (2014) Mara Casey Tieken

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- Community – school relationships are critical to student achievement and well-being regardless of being urban, suburban or rural.
 - How to integrate the sustainable energy industry into this relationship in a lasting, positive, nurturing and productive way?
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Teachers are the key audience and STEM curricula is the critical entry point

- Materials, resources, and experiences related to STEM content
- Develop, improve and expand pedagogical methods
- Provide a network of professionals:
 - Scientific and engineering researchers,
 - Industrial representatives,
 - Educational pedagogy experts,
 - Other peer STEM teachers,
 - School administration
 - Community (parents, businesses, and leaders)



National Science Foundation - Research Experiences for Teachers Program

Sustainable Energy Engineering for Empowering Rural Communities

University of Oklahoma & East Central University

Summer Research Experience

- Six weeks with OU engineering faculty conducting real-world engineering research.
- Stipend and lab materials / supplies
- Develop authentic teaching, guided inquiry STEM lessons using Engineering Method
- Prepare lesson plans with budget for classroom supplies
- Engage with:
 - OU engineering faculty
 - graduate students
 - education experts
 - industry representatives



Wind, solar and biomass research

Fall & Spring Academic Year

- Receive financial support for materials and supplies
- Implement STEM lessons in classroom
- Lessons integrated with Sustainable Energy Technology & Industry representatives
- Interactions with OU faculty and graduate students – classroom visits, field tips
- OU faculty & graduate students – 24/7 content experts
- Pedagogy support from Institute for Math & Science Education (ECU)
- Community STEM nights at school highlighting lessons; meets researchers and industry representatives
- Teachers conduct regional workshops to disseminate lessons and results.

Teach authentic, guided-inquiry STEM lessons focusing on sustainable energy engineering



Final Points.....

- Sustainable Energy Industry + School & Community = Win-Win
- Directly engage STEM teachers!
- Integrate Sustainable Energy Engineering into STEM curricula
- Use Sustainable Energy Technology for authentic teaching
- Maintain personal connections with teachers, students and school.



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