



Exploring the evolving electric grid as a strategy
to promote energy literacy among educators
and prepare students for careers in a low-carbon economy
The NC Energy Literacy Fellows Program

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CENTER FOR PUBLIC ENGAGEMENT
WITH SCIENCE

UNC INSTITUTE FOR THE ENVIRONMENT

Transitioning to a
low carbon
economy means
preparing the future
workforce...



and that means
preparing
educators!





The Grid

“It’s the world’s largest machine and the twentieth century’s greatest engineering achievement and we are remarkably oblivious to it.”

Gretchen Bakke



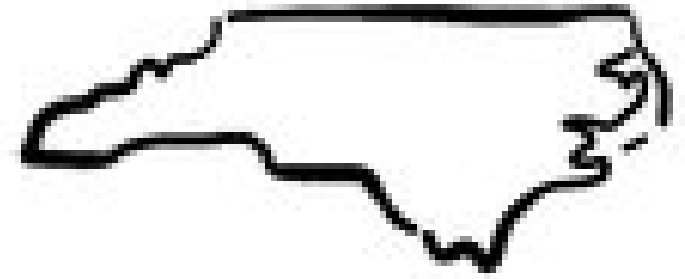
“We are missing an important component in renewable energy education. **How can we teach renewables and not spend time discussing their often unique and challenging connection to the grid.**”

– Denise Renfro, 2019 Fellow and Director of Green Technology at Douglas Byrd High School, Fayetteville, NC

What energy sources power NC's electric grid?

Electric power sector consumption by source

1,237.7 trillion British thermal units
(percent of total for all sources) 2018



Coal
312.3
(25.2%)



**Natural
gas**
339.6
(27.4%)



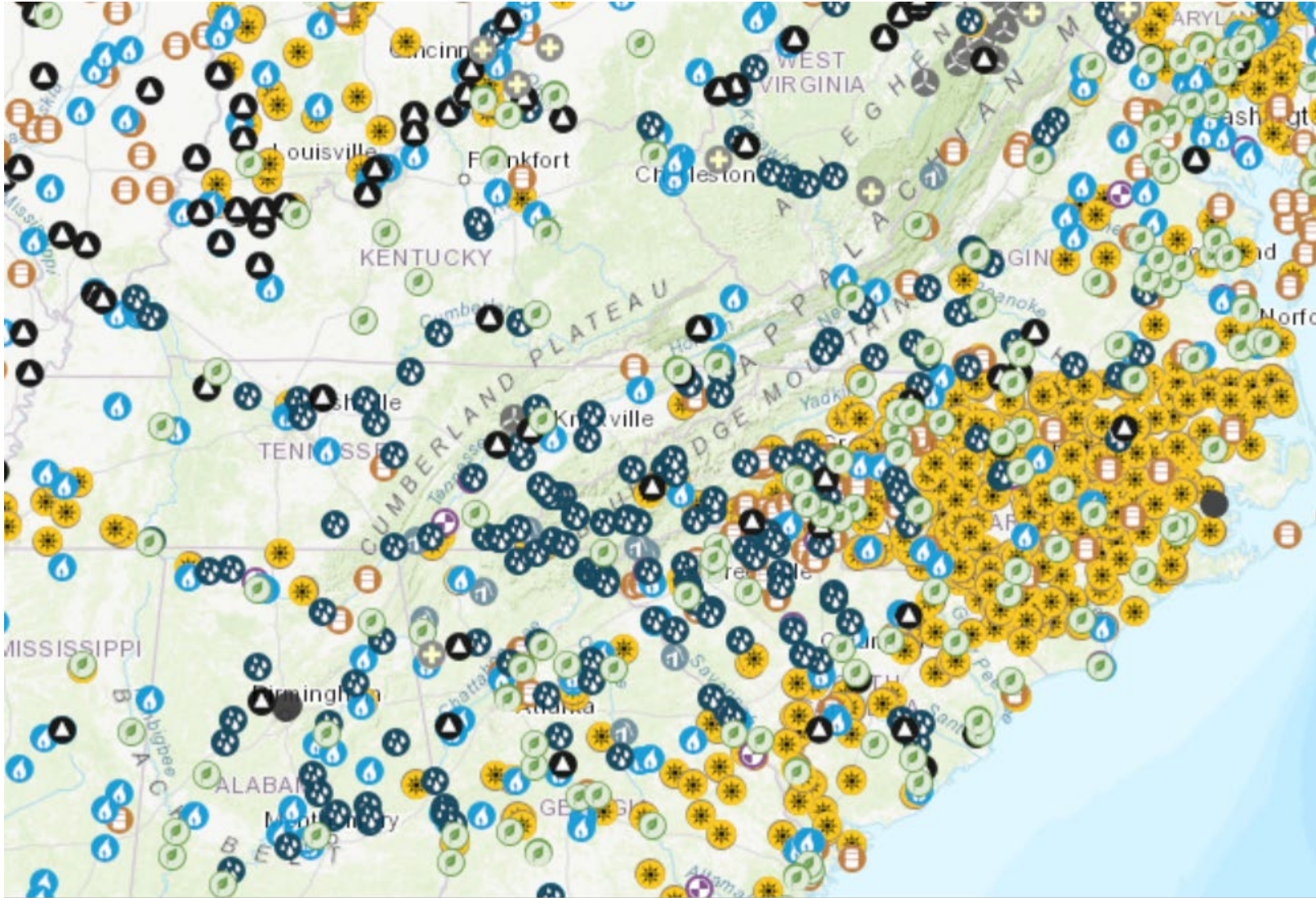
Petroleum
6.9
(0.6%)



**Renewable
energy**
138.9
(11.2%)



**Nuclear
power**
439.9
(35.5%)



NC's energy landscape

Reimagining the Grid

“It turns out that transitioning America away from a reliance on fossil fuels and toward more sustainable energy solutions will be possible only with a **serious reimagination of our grid.**”

Gretchen Bakke



NC Energy Literacy Fellows Program

20 teachers/year

Grades 8-12
STEM teachers
(science and CTE)

Interdisciplinary
cohorts

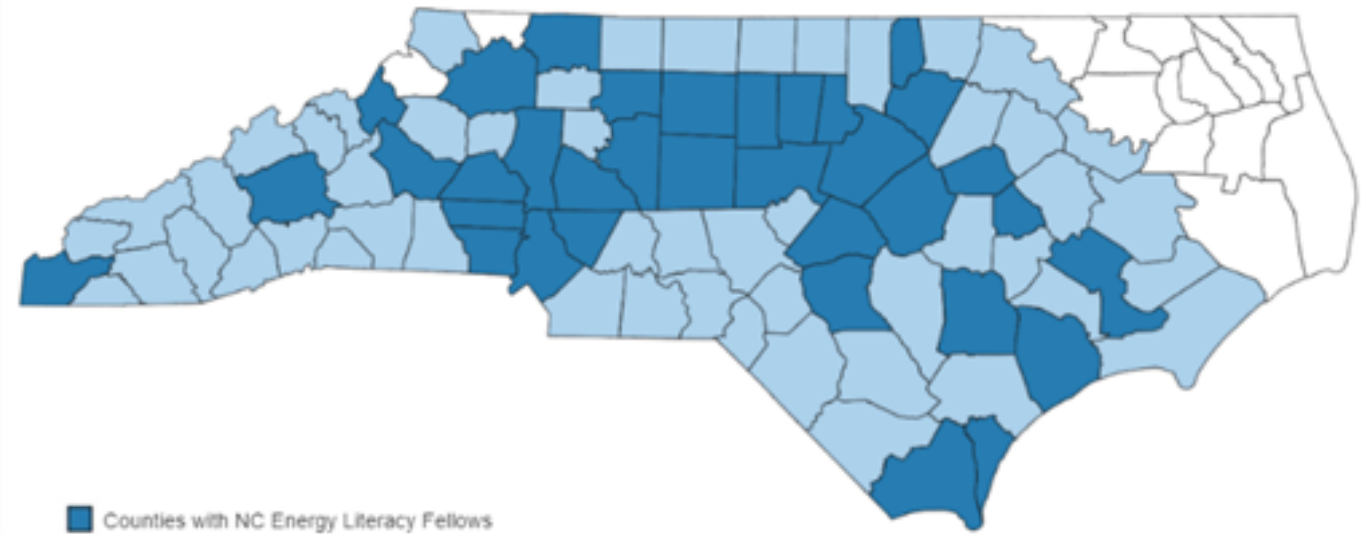
35+ contact hours



A growing
community of
practice

77 STEM teachers

35 counties



Map showing the Duke Energy Service area (blue); counties) with one or more teachers enrolled in the NC Energy Literacy Fellows Program are shaded dark blue. Searchable map available at <https://ie.unc.edu/elf/map/>



Promoting Energy Literacy

Why promote energy literacy?

Relevant to every student

Interdisciplinary

Promotes **critical thinking**

Provides **hands-on** STEM learning opportunities

Provides **solutions** focus

Inspires **innovation**

Numerous **career connections**

Foster **environmental literacy**



Connections to Environmental Education

Systems and Systems Thinking

Human Well-being

Equity and Inclusion

Where One Lives

Roots in the Real World

Integration and Infusion

Lifelong Learning

Sustainability



Program goals

Increase teacher:

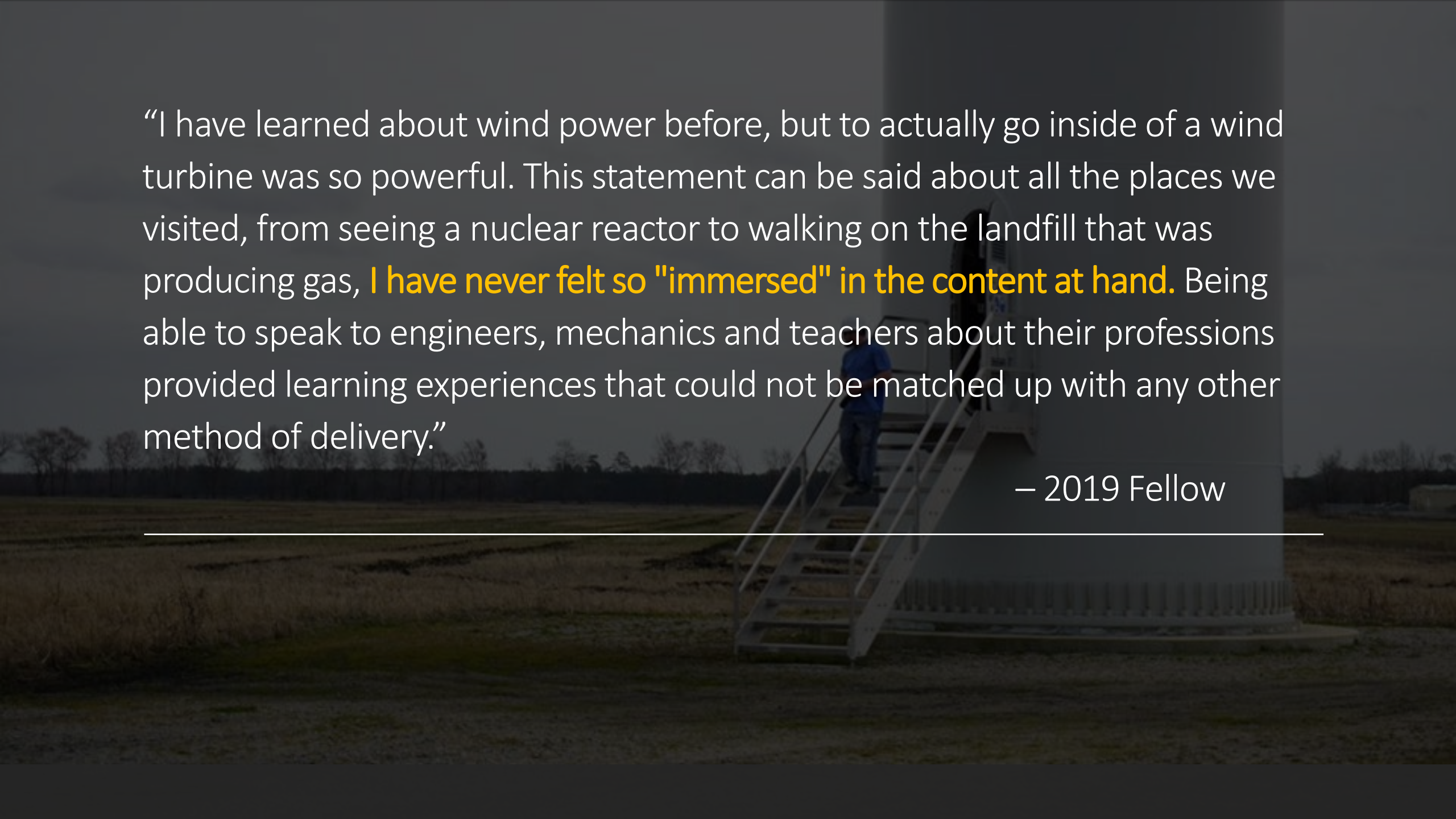
- **Knowledge of and confidence in** teaching energy science
- Capacity to integrate **STEM activities** into energy instruction
- Awareness of **energy careers**



Program features



- Up-to-date science
- Hands-on, STEM-based activities
- Place-based learning opportunities
- Access to scientists and cutting-edge research

A person is seen from behind, climbing a metal staircase that leads up to a large, white, cylindrical structure, which appears to be the base of a wind turbine. The person is wearing a blue shirt and dark pants. The background shows a flat, open field with some distant trees under a clear sky. The overall scene is dimly lit, suggesting dusk or dawn.

“I have learned about wind power before, but to actually go inside of a wind turbine was so powerful. This statement can be said about all the places we visited, from seeing a nuclear reactor to walking on the landfill that was producing gas, **I have never felt so "immersed" in the content at hand.** Being able to speak to engineers, mechanics and teachers about their professions provided learning experiences that could not be matched up with any other method of delivery.”

– 2019 Fellow



The diagram illustrates the components of a program. On the left, four rounded squares are arranged in a 2x2 grid: 'Coastal retreat' (blue), 'Summer institute' (teal), 'Academic year field trips' (green), and 'Virtual share sessions' (green). These are connected by a light blue cross-shaped arrow. To the right of this grid is a vertical stack of three purple rounded rectangles: 'Leadership development', 'Conference presentations', 'PD scholarships', and 'STEM supplies'. At the bottom is a wide blue rounded rectangle labeled 'Peer network'. A vertical line separates these components from the text 'Program components' on the right.

Coastal
retreat

Summer
institute

Leadership
development

Conference
presentations

PD scholarships

STEM supplies

Academic
year field
trips

Virtual
share
sessions

Peer network

Program
components



Program topics

Fundamentals of electricity generation

Conventional & renewable energy sources
(including acquisition and use of each)

Energy policy

Energy efficiency & energy conservation

Smart grid technology

Water & energy connection

Grid resilience

Coastal retreat

Exploring Solar, Wind & Ocean Energy



3-day summer institute

Exploring the Future of the Electric Grid



Academic year field trips



Leadership development opportunities



2017 Fellows at the Annual UNC Clean Tech Summit

2021 Renewable Energy Summit

NC Science Teachers Association's
Annual Professional Development
Institute

KidWind Renewable Energy
Challenge

Drawdown Learn Conference

Program Evaluation Plan

Pre-program survey

End of event surveys

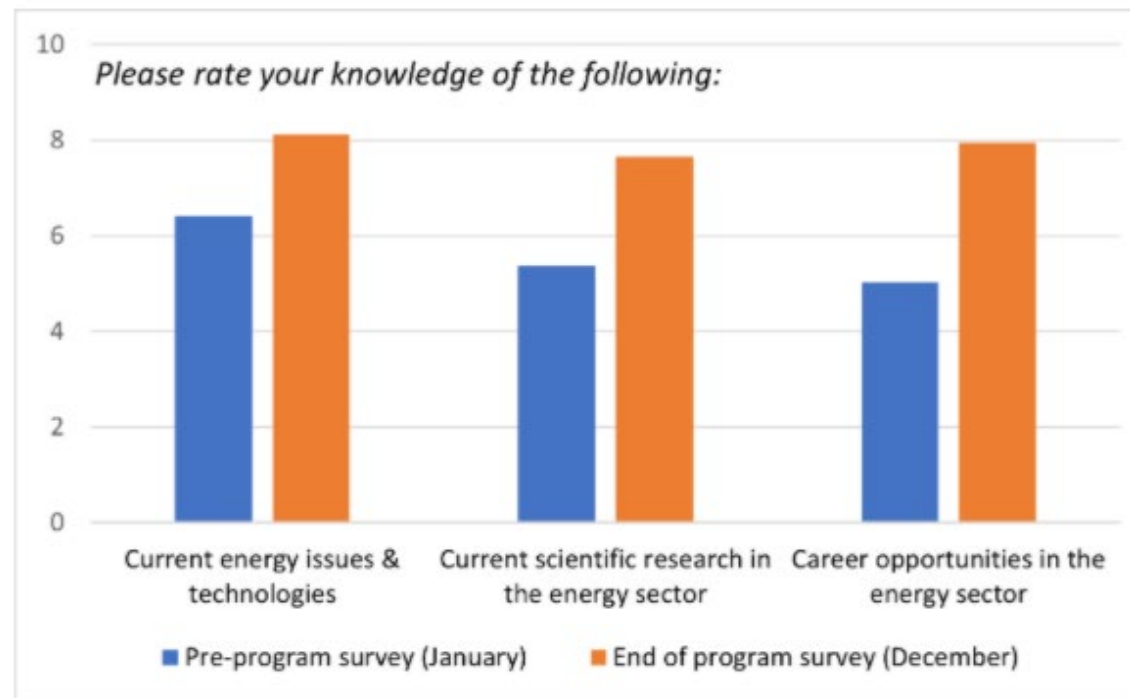
End of program survey

Alumni survey

Program Evaluation: Goal 1

Increased knowledge

Knowledge rating from 0 to 10
(Mean)



Self-reported
knowledge
pre & post
program survey
results (paired)



“I would say “when I was at the Amazon wind farm” and “when I was at the hydro-electric dam” - and my students would immediately become more engaged.

Because I was telling a story rather than just giving facts, they connected and listened at a much higher level.”

– 2017 Fellow

Enhanced discourse



100% of 2019 teachers (n=15) agreed their participation in the program had **increased their ability to speak authoritatively** with students about energy science.

Program Evaluation: Goal 2

Increased capacity to integrate **STEM activities** into instruction

100%
report **increased confidence**
incorporating
STEM-based energy
activities

98%
Report **increased use of STEM activities** in
energy instruction

100%
report **increased students' engagement**
with energy-
related content

83%
added at least
one *NEW* STEM activity

Program Evaluation: Goal 3

Increased awareness of energy careers



96% report an increased extent to which they discuss energy-related career opportunities with students

94% report they are significantly more **aware** of NC's energy "landscape"

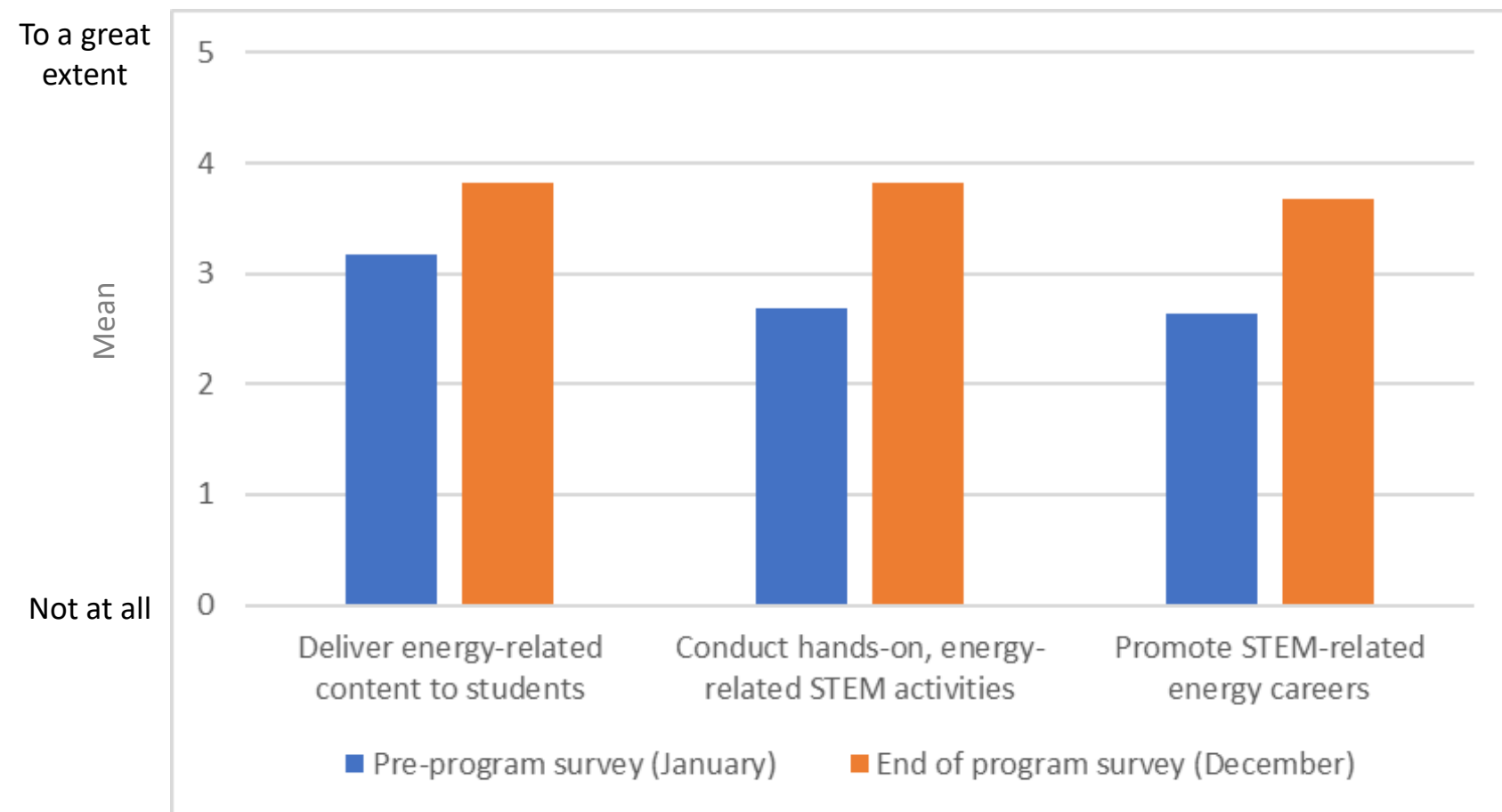
72% reported they introduced students to career opportunities in the energy sector



“It is imperative that our youth learn more about the future of the grid – their future. We have included a new **8-week unit on the electric grid** in one course, and the same motivation led to using the Drone 2 course to teach skills by focusing on the **use of drones in the energy sector.**”

– 2019 Fellow and CTE teacher

To what extent do you feel prepared to:



Progress at achieving program goals

pre & post program survey results (paired)

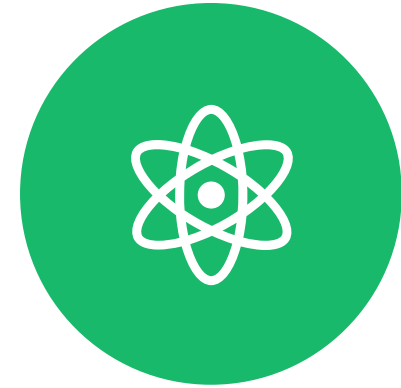
Fellows feel more prepared to:



**DELIVER ENERGY-
RELATED CONTENT TO
STUDENTS**



**CONDUCT HANDS-ON,
ENERGY-RELATED
STEM ACTIVITIES**



**PROMOTE ENERGY
CAREERS**

2020 Program

100% virtual

3-day virtual summer institute
with a scavenger hunt!

Academic year webinars

Book club discussion with author

Virtual share session

Engaged 23 alumni



High Voltage! Scavenger hunt mission

Participants were challenged to head outside and look for electric infrastructure in their neighborhood.



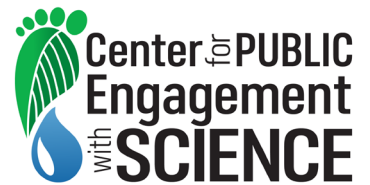


“The activities and materials I now have in my **teaching toolbox**...allow me to help students understand the **complexity of the electric grid** and the exciting **career opportunities** awaiting them in this field.”

— 2018 Fellow



Funding acknowledgements



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