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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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?

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Consumption</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>312.3</td>
<td>(25.2%)</td>
</tr>
<tr>
<td>Natural gas</td>
<td>339.6</td>
<td>(27.4%)</td>
</tr>
<tr>
<td>Petroleum</td>
<td>6.9</td>
<td>(0.6%)</td>
</tr>
<tr>
<td>Renewable energy</td>
<td>138.9</td>
<td>(11.2%)</td>
</tr>
<tr>
<td>Nuclear power</td>
<td>439.9</td>
<td>(35.5%)</td>
</tr>
</tbody>
</table>

Electric power sector consumption by source
1,237.7 trillion British thermal units
(2018)

[Source: https://www.eia.gov/beta/states/overview]
NC’s energy landscape

https://www.eia.gov/state/maps.php
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
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
“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
Program components

Coastal retreat
Summer institute
Academic year field trips
Virtual share sessions

Leadership development
- Conference presentations
- PD scholarships
- STEM supplies

Peer network
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

- 2021 Renewable Energy Summit
- NC Science Teachers Association’s Annual Professional Development Institute
- KidWind Renewable Energy Challenge
- Drawdown Learn Conference

2017 Fellows at the Annual UNC Clean Tech Summit
Program Evaluation Plan

- Pre-program survey
- End of event surveys
- End of program survey
- Alumni survey
Program Evaluation: Goal 1

Increased knowledge

2017-2019 cohorts, paired pre- and post-survey data (n=43, p <0.000001 for each)
“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
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

Results from End of Program Evaluations (2017-2019 cohorts, n=47)
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

Results from End of Program Evaluations (2017-2019 cohorts, n=47)
“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
Progress at achieving program goals
pre & post program survey results (paired)

To what extent do you feel prepared to:

- Deliver energy-related content to students
- Conduct hands-on, energy-related STEM activities
- Promote STEM-related energy careers

2017-2019 cohorts, paired pre- and post-survey data (n=43, p<0.000001 for each)
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
“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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