Objectives

To inspire **teachers** to communicate the importance of Science, Technology, Engineering and Mathematics (STEM) and **energy scholarship** in their class rooms, and to provide them with resources and incentives.

To inspire **students** to enter the STEM disciplines and to consider **energy-related fields** in their educational and professional **career goals**.

“The Energy Academy will allow me to share my own vision of the future and impact the future of energy for the new generation.”

Student

“I look forward to learning about specific energy production methods that I can implement in future STEM classes at our new high school.”

Teacher
Recruitment

TEACHERS
Applications = 53; Selected = 27
Male = 37%; Female = 63%
Duke Service Territories/States = 23 (86%)

STUDENTS
Applications = 228; Selected = 53
Male = 58%; Female = 42%
Duke Service Territories/States = 44 (83%)
Interactive Lectures

Industry Leaders

- Bowen Engineering
  - Bob Bowen
  - Teddy Deahl
- Duke Energy
  - Melody Birmingham-Byrd
  - Matt Cameron
  - Doug Esamann
  - Steve Immel
- General Electric
  - Chris Prince
- Siemens Energy
  - Matt Montgomery
- Windstream Technologies Inc.
  - Dan Bates
Interactive Lectures

Academic Professors and Administration

- Rakesh Agrawal
- Robert Bean
- Peter Bermel
- Steve Beaudoin
- Stuart Bolton
- Jim Braun
- Nick Carpita
- Bert Chapman
- Jun Chen
- Abel Chuang
- Patricia Davies
- Eckhard Groll
- Steve Heister
- Xiaojun Lin
- Andrew Liu
- Maureen McCann
- Nate Mosier
- Larry Nies
- Vilas Pol
- Tim Pourpoint
- Rich Simmons
- Dennis Schatz,

Pacific Science Center
“The tour of Duke Energy was one of the coolest things I have ever done. It was like a 4D episode of ‘How Stuff Works’. Amazing!”

Student
Interactive Hands-on Activities

Wind Blade Challenge

Power Challenge

Energy

Education

Exercises
Participants Had Some Fun Too!

Visit to Cordova Recreation Facility/Bowling and Evening Games
Expectations

• To learn more about a specific topic in advance energy science and technology through research, hands-on activities, and data analysis.
• To engage with members of the Purdue community who are conducting research at the forefront of energy science and policy.
• To work as a member of a small team of fellow students and teachers to delve deeply into the project topic.
• To use teamwork to divide jobs so that the project tasks are completed in a timely and efficient manner.
• To make a team presentation on your project topic that integrates the work done both as a team (e.g. experiments/hands-on activities) and by individual team members.
• Develop a policy question/discussion and incorporate in presentation
1. Yellow/Photovoltaic Cells – *fabricating solar thin films*

2. Blue/Batteries – *design electrodes and battery*

3. Green/Biofuel – *convert biomass into glucose*

4. Orange/Hydrogen and Fuel Cells – *generate and store hydrogen*

5. Orange/Electricity from Waste Heat – *use ambient heat to do work*

6. Purple/Vertical Axis Wind Turbines – *learn aerodynamics*

7. Red/Nuclear Fuel – *learn uranium decay chain*

*Plus include a policy discussion in every project*
Teachers’ Project: STEM Energy Lesson Plans

Jerry Krockover, In-charge Teacher Projects

Expectations

• Prepare energy lesson to be implemented in your classroom settings
• Use 18 criteria as guidelines
  • PBL, asking questions and defining problems, community connections, obtaining/evaluating investigations, developing/using modes, use of technology/software, collaboration, critical thinking, creativity, communication, using mathematics/computational thinking, analyzing/interpreting date, constructing explanations and designing solutions, engaging in argument from evidence, assessment plan, implementation plan with resources (supplies/cost)
• Interact and share draft with master teachers
• Due date Thursday June 26 by 9 PM
• Inform academy staff when lesson to be given in class rooms. Academy staff will plan to observe, video record and discuss further refinements
• To be posted on academy web site for wide dissemination

1/26/2015
Duke Energy Academy at Purdue
Decreasing Biodiversity Due to Land Use Change

Ecosystem Services

Resources for Teachers

- Academy web site: Resources
- Packet from Prof. Krockover
- Packet from National Energy Education Development Project
- Book: Translating the Next Generation Science Standards for Classroom Instruction
- Policy resources by Purdue Library Sci.
  - http://guides.lib.purdue.edu/dukeenergy
- Energy Resource Materials Library
- Networking contacts with Purdue professors, students, staffs
- Networking and contacts with industry presenters
- Networking and contacts with tour representatives
• **Densborn Photovoltaic cells** by Amy Densborn, Lewis Cass Jr. Sr. High School, Kokomo, Indiana
• **Glade The Carbon Cycle** by Monica Glade, North Daviess Jr/Sr. High School, Washington, Indiana
• **Hamman Energy Unit** by Jamie Hamman, James E Davis School, Lebanon, Indiana
• **Kane Static Electricity Generates Useful Energy** by Jackie Kane, St. Ursula Academy in Toledo, Ohio
• **Lawson Narrative for STEM Energy** by Glen Lawson, Chestatte Academy
• **McSpadden Wind Turbine Design** by Moira McSpadden, DeKalb High School, Fort Wayne, Indiana
• Renewable and Non-renewable Energy Resources, Rachel Ordower, F.J. Reitz High School, Boonville, Indiana
• **Reagin Wind Power** by Patrick Reagin, Brownsburg School Corporation, Harris Academy, Lizton, Indiana
• **Rushing Energy Conversions** by Fran Rushing, Carmel High School, Carmel, Indiana
• **Schooley Solar Oven** by Cary Schooley, Corydon Central High School, Georgetown, Indiana
• **Smith Battery Lesson Plan** by Jody Smith, Paris Cooperative High School, Paris, Illinois
• **So-Comparing the Usage Cost of EV vs Internal Combustion Vehicles** by Maple So, Herron High School, Logansport, Indiana
• **Sprowsls_Engineering Solar Ovens** by Emily Sprowsls, Harmony School, Bloomington, IN
• **Stallings_Energy Unit** by Mary Ann Stallings, Paris High School, Paris, Indiana
• **Stigum Solar Energy with a Focus on Photovoltaic Systems** by Victoria Stigum, Holderness School, Holderness, New Hampshire
• **Stucky Harness the Power Within** by Michele Stucky, Seeger Memorial Jr./Sr. High School, Covington, Indiana
• **Ullom Lifestyle Impact on Local Community & Global Environment** by Duane Ullom, Lewis Cass High School, Logansport, Indiana
• **Williamson Wind Power** by Rachel Williamson, Mississinewa high school, Marion, Indiana
• **Witty Natural Gas Case Study** by Robyn Witty, Shelbyville High School, Franklin, Indiana
Example of STEM Energy Lesson Plan: Solar Ovens

Laura Swessel, Providence Junior-Senior High School, Clarksville, Indiana

1/26/2015 Duke Energy Academy at Purdue

Dan Bates, CEO and Founder Windstream Technologies, Inc.
- Spoke to ~35 students
- Donated a unit to be mounted on roof and to monitor voltage/current

Provided black paper and aluminum foil
- Build solar ovens and baked apples with brown sugar and raisins
- Achieved highest temperature 340°C!
Example of STEM Energy Lesson Plan: Solar Cooker

Emily Sprowls, Harmony School, Bloomington, Indiana

- Design an efficient solar cooker that will reach hottest temperature in shortest times
  - 60°C to pasteurize disease-causing microbes
  - 100°C to cook food with steam
  - 175°C to bake food

- $10,000 fellowship grant from Audubon Society/Toyota/Bloomington Art Commission for an art design project
- Electricity (700 watts) generated is used to power greenhouse!
- Applying $10,000 grant from Shell Energy
Example of STEM Energy Lesson Plan: Solar Cooker

Emily Sprouls, Harmony School, Bloomington, Indiana

• Design an efficient solar cooker that will reach hottest temperature in shortest times

• 60°C to pasteurize disease-causing microbes

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• $10,000 fellowship grant from Audubon Society/Toyota/Bloomington Art Commission for an art design project

• Electricity (700 watts) generated is used to power greenhouse!

• Applying $10,000 grant from Shell Energy Pinwheel Solar Culture Solar Cooker Challenge
Assessment
Optional

- Pre/post/daily assessment
- Received feedback
  - Counselors
  - Master teachers
  - Program participants
- Considering assessment round the year to learn long-term impact!
  - How many applied to colleges? What disciplines?
  - How knowledge gained is used?
Assessment

Teachers

• Enjoyed program content/interactions
• Motivation
  • 55% to improve curriculum
  • 36% to learn energy
  • 32% to deepen energy alternatives/renewables
  • 23% hands-on
  • 14% energy careers

• Statistically significant increase in energy concepts/confidence in integrating in class

• Lessons to be implemented in fall 2014. Limited time/resources.

• Program improvement
  1. Avoid back-to-back lectures
  2. Increase time allocated for tours and hands-on activities
  3. Increase guidance and time allocated to teacher lesson plans
  4. Reduce lecture times and increase informal interactions among participants

“The high school students allowed me to see first-hand which parts of the activities interested their age group the most. I really enjoyed getting their perspective on each topic as well as getting to interact with them on almost a peer level.”
Assessment

Students

- **Motivation**
  - 71% to learn energy in general
  - 42% to help in energy related major/career
  - 13% to learn energy alternatives/renewables

- **Expectations**
  - 55% for hands-on activities
  - 8% for projects
  - 7% for tours

- **Statistically significant increase in**
  energy concepts/interest in STEM disciplines (college major/career)

- **Program improvement**
  1. Increase program length to relax schedule
  2. Reduce lecture times
  3. Increase time for hands-on activities and tours

“DEAP was the best week of my life making many new friends and learning so much about an interesting topic that is energy. I was wary at the beginning at what to expect but my expectations were blown away and I had so much fun and learned so much at the same time. Thank you very much for the awesome experience.”
Total = 288

- Direct = 80
- In-direct = 208
- Facebook = 9600

Media = 17

- News = 14
- IIB, IBJ = 3

Others
- NSF proposals (Clase, Liu)

![Pie chart showing impact distribution: Direct 80, 28%, Indirect (Purdue) 80, 28%, Industry/external 22, 7%, Family members 106, 37%)](chart.png)
Impact: Social Media

Engaging participants and parents

“My son really enjoyed this experience. It was his first time being away from home; we live five hours away, so he was a bit homesick the first two days. **I enjoyed keeping up with their daily activities and seeing the pictures on the Facebook site.** Thank you again for this opportunity!!”

- Mother of 2013 participant
STEM Admission: DEAP 2013

Distribution (N = 34 students)

Science = 2 (15%)
Engineering = 11 (85%)
Expenses

Distribution

Total = $128,200 (includes estimates)

- Housing, $26,376, 21%
- Teacher/Student Counselor Stipends, $27,436, 21%
- Meals, $19,823, 16%
- Longitudinal Impact Assessment, $12,000, 9%
- Teachers Resource Development, $14,643, 11%
- Supplies, $11,165, 9%
- Transportation, $4,325, 3%
- Conference Services, $5,984, 5%
- Miscellaneous, $6,448, 5%

1/26/2015  Duke Energy Academy at Purdue
### Program components

1. **Hands-on activities:** should reinforce concepts
2. **Tours:** expose participants to both cutting edge research and real-world deployment
3. **Lectures:** interactive/engaging and short
4. **Projects:** clear objectives, safe and well-organized in small groups
5. **Energy lessons:** define expectations & provide mentoring and adequate time
6. **Student/teacher interactions:** clarify expectations and provide more opportunity for networking
7. **Resources:** requested by teachers and students (career paths and colleges)
8. **Sustainability:** include environmental/business/economics/social/policy concepts

### Program administration

1. **Staffing:** ensure adequate counselors and mentor teachers for students and teachers
2. **Diversity:** target minority schools and make sure that presenters are diverse
3. **Assessment:** conduct pre/post/daily/longitudinal to study short and long-term impacts
4. **Alumni:** engage alumni to advocate for the program and assistance
5. **Sustainability:** develop long-term growth options with business plan

### Marketing

1. **Visibility:** website/news releases/print/video/social media and stewardship
2. **Industry:** secure additional funding
DUKE ENERGY ACADEMY AT PURDUE

JUNE 21-27, 2015

INSPIRING FUTURE LEADERS IN ENERGY
## DEAP 2015 Timeline

### Duke Energy Academy at Purdue: June 21-27, 2015

(Tentative)

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* AC/PAC Meeting = Advisory Council and Program Advisory Committee Meeting
Our Sponsors, Co-sponsors and Supporters

Thank you!

1/26/2015

Duke Energy Academy at Purdue
DUKE ENERGY ACADEMY AT PURDUE
JUNE 21-27, 2015
INSPIRING FUTURE LEADERS IN ENERGY

APPLY ONLINE AT WWW.Purdue.EDU/ENERGYACADEMY/APPLY

The Duke Energy Academy at Purdue University is an immersive program for high-achieving high school juniors and seniors, and secondary science teachers. During the week-long course on STEM-related energy topics, participants will be provided with resources and incentives to inspire both students and teachers in sustainable energy solutions. The program is free to all participants.

DEADLINE TO REGISTER: JANUARY 18, 2015

STUDENTS – WHO IS ELIGIBLE?
Students (as of Fall 2015) going into their junior or senior years in high school interested in science and engineering and who would like to learn more about energy issues.

TEACHERS – WHO IS ELIGIBLE?
Secondary science teachers who are interested in energy issues. In addition to free campus room and board, each participant will receive a $400 stipend on completion.

CONTACT US
Duke Energy Academy at Purdue
Marlin Hall, Rm 105
203 South Martin Jischke Dr.
Purdue University
West Lafayette, IN 47907-1971
energyacademy@purdue.edu
Phone: 765.494.1610

GET SOCIAL WITH US!
Facebook.com/TheEnergyAcademyAtPurdue
@energyacademyPUI
#energylab15

Purdue.edu/EnergyAcademy
THANK YOU FOR YOUR SUPPORT
Any Questions?
## Revenue and Other Contributions

### Distribution

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STEM Admission: DEAP 2012

Distribution (N = 21 students)

- **Exploratory studies**: 1, 8%
- **Agriculture**: 2, 15%
- **Education**: 2, 15%
- **Health**: 1, 8%
- **Science**: 3, 23%
- **Engineering**: 4, 31%

**Applied**
- Admitted: 10, 77%
- Declined: 5, 50%

**Not applied**
- 8, 38%

**Not applied**
- 3, 23%

- Science = 2 (40%)
- Engineering = 2 (40%)
- Agriculture = 1 (20%)