# Lesson Plan Title: The Energy We Use “Your Carbon Footprint”

<table>
<thead>
<tr>
<th>Teacher Name: Doug Dimmer</th>
<th>School: Hartford Union High School, Hartford WI</th>
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</thead>
<tbody>
<tr>
<td>Subject: STEM- Introduction To Engineering</td>
<td>Grade Level: 9-12</td>
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## Problem statement, Standards, Data and Technology

### Asking questions and defining problems

Establish driving question for the lesson plan or define problem students will be solving.

Attach any documents used to establish the driving question or define the problem.

The purpose of this lesson is for students to learn the basics of how electricity/energy is used within their home and how they can monitor how much they consume in a period of time, their Carbon Footprint. Students will be collecting the energy their family uses on a daily basis off their electric meter and through an appliance/fixture survey which will determine products which consume the most energy in their house. From the information they collected in the surveys they will reflect and create an *Energy Action Plan* on how to conserve or change the amount of energy they use either in their home, at school or in the community.

### Incorporating Next Generation Science Standards, Common Core, or State Standards

State the standards that will be covered during this lesson plan. Include all standards which may apply (NGSS, Common Core, or State Standards).

**Wisconsin Standards for Technology and Engineering (TE)**

**Content Area: PE/Power and Energy**

**PE1.b**: Analyze, use and discuss machine and tool use relating to energy and power systems.

**PE1.c**: Identify and analyze responsible and efficient management of energy resources.

- **PE1 c 11 h**: Demonstrate efficient use of energy in a related project or lab.
- **PE1 c 12 h**: Develop and perform tasks related to responsible use of energy systems and/or resources.
### STEM Energy Lesson Plan Elements Inclusion

**Purdue University**  
**2016 Duke Energy Academy**

<table>
<thead>
<tr>
<th>Observation</th>
<th>Description</th>
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<tbody>
<tr>
<td>PE1 c 13 h:</td>
<td>Demonstrate efficient use of energy resources related to power and energy technology.</td>
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<tr>
<td>PE1 d:</td>
<td>Develop necessary skills in problem solving for future energy systems.</td>
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<td>PE1 d 10 h:</td>
<td>Explain and apply skills using new technology and tools to solve energy problems.</td>
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<tr>
<td>PE1 d 11 h:</td>
<td>Write a technical report on a researched energy problem and the steps used to solve the problem.</td>
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<tr>
<td>PE1 d 12 h:</td>
<td>Apply/Demonstrate the safe use of test equipment and tools required to properly diagnose problems for (green) energy systems.</td>
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**Obtaining and evaluating information**  
**How will students be obtaining and/or collecting the information?**  
Students will be obtaining and/or collecting data on how much energy their family uses on a daily basis off their electric meter which is done by reading the digital display or understanding the dial read out (Activity: Meter Reading), and through an appliance/fixture survey which will determine the products which consume the most energy in their house by reading the appliances UL rating label of the appliance and performing a Watt meter Test on the appliance. They will chart the data on an activity guide supplied to them by the instructor.

**Analyzing and interpreting data**  
**How will students be analyzing and interpreting the collected data?**  
Students will be analyzing and interpreting their electricity use by collecting data from their homes electric service meter and then calculating their overall consumption for a week. They will then take the overall kilowatt per hour (kWh) amount from the week, multiply it by the their Utilities bill rate per kWh and find out how much they spend on electric energy for the week, and then multiply by the year rate. At the end of the first survey they will then take home an appliance survey to find out which electronic fixtures around the house are the biggest electricity consumers. With the combination of this information, they will create an Energy Action Plan to propose to show how they are going to help reduce their carbon footprint.

**Use of technology and software**  
**Indicate the type of technology and software students will be using in**  
Students will be using the internet to provide research on energy and how it is provided through their utility company. They will take the electric utility meter on their house to collect data of their family’s daily use. Students will use a calculator and guide to formulate the total amount of electricity used and then apply the usage to the data they collected from their appliance/fixture survey to evaluate their consumption.
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<table>
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<th>order to implement this lesson plan.</th>
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**Collaboration, critical thinking and communication**

**Collaboration**  
Indicate how students will be collaborating during the implementation of the lesson plan

| Students will share the data they collected through both the meter reading activity and the appliance survey with their classmates and create either an individual or a small group Energy Action Plan which will promote energy/electricity savings. |

**Critical Thinking**  
How will the students evaluate the question or defined problem to reach an objective conclusion? How will the students being using the learned content and collected data to be able to critically think about the established question and/or problem on this lesson plan?

| Once the students have evaluated their electricity consumption and have come to a conclusion of how they have to change their ways, the student/s will present a proposal of an Energy Action Plan which they will attempt to send a message of energy conservation out to their family, school, or community.  

**At the end of the lesson, student will be able to:**
1. Express and analyze ideas about energy.  
2. Discriminate between scientific and common definitions of energy.  
3. Measure/collection data / calculate and reflect on the units of electricity that are consuming throughout their residence.  
4. Analyze and evaluate how much power specific items/appliances in their homes  
5. Make critical decisions on how to conserve energy and become more efficient users.  
6. Discuss and debate alternative resources and the problems facing current energy dilemmas. |

**Communication**  
How will the students communicate their findings and conclusion regarding the established question and/or problem?

| Students will be reflecting on data they collected throughout the lesson and create a final report and present an Energy Action Plan which they will be presenting to their peers and instructor for evaluation |

**References**
**STEM Energy Lesson Plan Elements Inclusion**  
**Purdue University**  
**2016 Duke Energy Academy**

### Teacher’s References
Include all references used to develop and implement this lesson plan.

<table>
<thead>
<tr>
<th>Reference</th>
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<tbody>
<tr>
<td><a href="https://s-media-cache-ak0.pinimg.com/originals/4e/6d/b6/4e6db69f7060ff2ce9d28ed91d78fa11.jpg">https://s-media-cache-ak0.pinimg.com/originals/4e/6d/b6/4e6db69f7060ff2ce9d28ed91d78fa11.jpg</a></td>
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<td><a href="https://www.youtube.com/watch?v=VQQCtKLZpwQ">https://www.youtube.com/watch?v=VQQCtKLZpwQ</a></td>
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### Student’s References
Include all references students will need to complete this lesson plan.

<table>
<thead>
<tr>
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<tr>
<td><a href="https://edpuzzle.com/assignments/576880ebcf3a1cfb26d73eb8/watch">https://edpuzzle.com/assignments/576880ebcf3a1cfb26d73eb8/watch</a></td>
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<td><a href="http://www.uwsp.edu/cnr-ap/KEEP/Pages/default.aspx">http://www.uwsp.edu/cnr-ap/KEEP/Pages/default.aspx</a></td>
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<td><a href="https://create.kahoot.it/#/preview/1db3f9b0-63e1-4639-9194-3ac33d309569">https://create.kahoot.it/#/preview/1db3f9b0-63e1-4639-9194-3ac33d309569</a></td>
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### Assessment Plan
How will the students be assessed during and/or at the end of the lesson plan?  
Include resources that will be used to assess the students for the lesson plan.

**Assessment Plan**

Students will be assessed through learning objectives, discussion participation and group feedback. Students will be assessed on their Utility meter reading survey and their Home appliance survey by a participation/completion grade (*Feedback Grade, Skyward Grading System, general homework grade for HUHS)*.

Students will also be assessed through digital quizzes, assignment assessment, peer feedback forms, project and presentation *rubric listed below.*
### Resources and Costs

<table>
<thead>
<tr>
<th>Resources Needed</th>
<th>Internet access/Computer</th>
<th>Kill-A-Watt EZ Meter - 15 loan out</th>
</tr>
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<tbody>
<tr>
<td>Home Electric Meter location</td>
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<tr>
<td>Calculator</td>
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**Costs**

- List the estimated cost of implementing this lesson plan.
- Include all costs related to equipment, materials and any resource critical to the implementation of the lesson plan.

Paper Cost incurred by school and all other equipment costs would be established by family’s energy consumption or cost by the student for their Action Plan = $0

Kill-A-Watt EZ Meter - 15 loan out @ $30 (Home Depot) = $450.00

### Implementation Plan

Students will also be able to reflect upon the lesson content through a lesson exit survey.
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Implementation Plan Timeline
Establish the timeline to implement the lesson plan.

Provide an estimate of time and days in order to complete the lesson plan.

Description of Energy Lesson (Day class periods = 45 min.)

I. Day 1: Energy Ideas Discussion
   A. Introduction - KEEP Activity Guide pp 15-18
      - Student Handout: Lesson Outline Sheet Handed out day before Flipped Internet Research
        (see Appendix A KEEP Website/other sources).
   B. Definition of Energy
      - The ability to do work or to organize it or change it.
      - Work involves force and motion.
      - The ability to do work or to organize it or change it.
      - Work involves force and motion.
   C. Energy Conceptions and Misconceptions
      - In-class Assessment: True or False quiz / Kahoot (pg. 18-Activity Guide)
      - Flipped Classroom Assignment: How to Read a meter Youtube video on EDPuzzle.

II. Days 2 – 7: How to Read a Meter Exercise.
    - EDPuzzle: In-class discussion and exercise prep. (www.youtube.com/watch?v=VQQCtKLZpwQ).
    - Handout: Student book, “How to Read A Meter” (pp.211, 213-217).
   A. Where to find Electric Meter, (Overhead pg.211).
      - Define Kilowatt Hours?
   B. What is the Meter is Reading?
      - Define Kilowatt Hours.
   C. In-class Activity: How to Read the Meter
      - Activity Guide pp. 214-217
      - Assessment Pts. = 5pts.
   D. Take Home Assignment: Observing Daily Meter Readings
      - Student Book (pp. 220-222).
      - Duration: 5 days
      - Evaluate amount of energy used in 1 week in family’s home.
      - Chart energy use and answer questions on pg 222.
      - Assessment total: 25 pts. Rubric

III. Days 3 - 8: Power Usage in your Home
   A. In-class Discussion
- What appliances are the largest consumers of energy?
- What does “Leaking Electricity” mean, and how do you calculate for it?

B. Measuring Electricity Usage.
- Power Formulas:

C. Activity: At Watt Rate?
- KEEP Student Handbook (pp.43, 45,46)
- Data Collection and explanation of assignment.
- Take home assignment for the week to understand appliance power use in the home and how they can conserve energy.
- Activity Assessment: 25pts (Rubric).

IV. Days 7-10: Energy Action Plan

A. Discussion:
- What can we do to become more efficient at using electricity?
- What is the next step

B. Activity: Energy Action Plan
1. Individual or Group Project
2. Family, School, Community
3. Fund Raiser and Public Awareness Project
   - Bright Ideas Fundraiser through KEEP.
   - To be discussed and see if possible to complete.
   - To help fund for new curriculum ideas in Intro to Technology class.
   - Present Proposal of Action Plan
     - Assessment: 25 pts. Rubric

C. Exit Survey:
- Written survey to see if students took value in lesson and if new information is necessary in learning process.
## Energy Action Plan Presentation Rubric

<table>
<thead>
<tr>
<th>Elements</th>
<th>5 Points</th>
<th>4 Points</th>
<th>3 Points</th>
<th>2 Points</th>
<th>1 – 0 Points</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
<td>The information included is accurate and completely addresses each component of the assigned topic or research question.</td>
<td>The information included adequately addresses each component of the assigned topic or research question.</td>
<td>The information included inadequately addresses the assigned topic or research question. The information included is sometimes inaccurate.</td>
<td>The information included does not address the assigned topic or research.</td>
<td>There is no evidence of accurate content information.</td>
<td></td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>The content has been organized using the appropriate method. The required information is easy to locate within the report.</td>
<td>The report content has been mostly organized using a logical sequence, but some flaws exist. The required information is generally easy to locate within the report.</td>
<td>The report content has been disorganized. The required information is difficult to locate within the report.</td>
<td>The report content is disorganized. The required information is difficult to locate within the report.</td>
<td>The report does not include evidence of organization.</td>
<td></td>
</tr>
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</table>
# STEM Energy Lesson Plan Elements Inclusion
## Purdue University
### 2016 Duke Energy Academy

<table>
<thead>
<tr>
<th>Documentation</th>
<th>A wealth of high quality sources are used in the report. The sources are all properly documented in the appropriate APA format.</th>
<th>The required number of high quality sources is used in the report. The sources are properly documented in the appropriate APA format.</th>
<th>Fewer than the required number of sources is used in the report. Not all sources are of substantial quality. Minor APA documentation errors may exist.</th>
<th>Few sources are included. No attempt is made to document sources using appropriate APA format.</th>
<th>There is no evidence that sources are used in the report. No sources are documented using the appropriate APA format.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery</td>
<td>Effectively and creatively delivers the information while staying on topic and considering the audience. Excellent use of voice, posture, eye contact, gestures and pace. Interesting and vivid to hear.</td>
<td>Good delivery of information while staying on topic and considering the audience. Speaks clearly and confidently although may not demand attention or inspire interest.</td>
<td>Adequately delivers the information while staying on topic. Lack of confidence, appears nervous and fidgety. Marginal use of posture, eye contact, gestures, pace. Poor voice volume and intonation.</td>
<td>Delivers the information but does not stay on topic. Little consideration of audience. Uses incomplete sentences. Speaker appears anxious. Difficult to hear.</td>
<td>Little attempt is made to stay on topic. Does not consider audience. Presentation is difficult to follow and understand.</td>
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</tbody>
</table>

**Comments:**

**Total**