# STEM Energy Lesson Plan Elements Inclusion

**Purdue University**

**2016 Duke Energy Academy**

## Lesson Plan Title: Home Energy Audit

<table>
<thead>
<tr>
<th>Teacher Name:</th>
<th>Dr. Leo Procise</th>
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<tbody>
<tr>
<td>School:</td>
<td>The McCallie School</td>
</tr>
<tr>
<td>Grade Level:</td>
<td>11th-12th</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.

- How much energy is used where you live during a typical 24 hour day and can you reduce or supplement the amount of non-renewable energy that is used?

  Specific questions to consider:
  - How much energy is used during a typical day where you live? What type of energy is used where you live? Can you think of a way to reduce the amount of energy you currently use or supplement the energy you use with a renewable energy source? What circumstances result in the most cost efficient energy usage in your home?

- How to read your gas/electric meter: [https://www.edfenergy.com/for-home/help-support/read-meter](https://www.edfenergy.com/for-home/help-support/read-meter)

- Natural gas conversion: [https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_m.htm](https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_m.htm)


- Comparison conversion: [https://www.duke-energy.com/indiana/savings/heating-costs.asp](https://www.duke-energy.com/indiana/savings/heating-costs.asp)

**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).

- **Environmental Science:**
  - Env.2.5 Give examples of the various forms and uses of fossil fuels and nuclear energy in our society.
  - Env.2.7 Differentiate between renewable and nonrenewable resources, and compare and contrast the pros and cons of using nonrenewable resources.
  - Env.2.8 Cite examples of how all fuels, renewable and nonrenewable, have advantages and disadvantages that society must question when considering the trade-offs among them, such as how energy use contributes to the rising standard of living in the industrially developing nations. However, explain that this energy use also leads to more rapid depletion of Earth’s energy resources and to environmental risks associated with the use of fossil and nuclear fuels.

- **Biology:**
  - B.3.2. Design, evaluate, and refine a model which shows how human activities and natural phenomena can change the flow of matter and energy in an ecosystem and how those changes impact the environment and biodiversity of populations in ecosystems of different scales, as well as how these human impacts can be reduced.

**Obtaining and evaluating information**

How will students be obtaining and/or collecting the information?

- Students will learn how to read the energy meters where they live to collect energy usage data. Other information, for comparison purposes, will be done by collecting data online from energy companies or from peer-reviewed articles.
### Analyzing and interpreting data

How will students be analyzing and interpreting the collected data?

Students will use basic algebra to find average energy usage that will be plotted with standard error bars from comparison. Students will also have to use an appropriate statistical analysis to support any conclusions they make regarding their energy consumption/conservation.

### Use of technology and software

Indicate the type of technology and software students will be using in order to implement this lesson plan.

Microsoft Excel will be used to store, analyze, and graphically represent data.

### Collaboration, critical thinking and communication

#### Collaboration

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

Students will share their data and report with their conclusions with 2 other students who will assess their data collection methods, analysis, and conclusions before the final assignment is due.

#### 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?

Students will collect energy usage data by finding the rate of energy usage during hour increments while recording what appliances are running during a typical day. The time of day will be predetermined and used consistently. The hourly rate of usage will be calculated by finding the difference between the meter reading at time 0 and time 1 divided by 1 hour. Appliance data will be concurrently recorded.

After collecting enough data for a statistical analysis, students will have to determine a way to reduce the amount of energy they used by making some hypothesized change and then recording the same energy usage data for comparison.
## Communication

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

Students will write a paper and give a presentation on their findings to the class and possibly others at school in the science department.

## References

### Teacher’s References

Include all references used to develop and implement this lesson plan.

I created this lesson from my experience in graduate school living with roommates who did not want the utility bills to be as low as possible.

### Student’s References

Include all references students will need to complete this lesson plan.

- Choosing a statistics test: [https://cyfar.org/types-statistical-tests](https://cyfar.org/types-statistical-tests)
- How to read your gas/electric meter: [https://www.edfenergy.com/for-home/help-support/read-meter](https://www.edfenergy.com/for-home/help-support/read-meter)
- Natural gas conversion: [https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_m.htm](https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_m.htm)
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## Assessment Plan

### Assessment Plan

**How will the students be assessed during and/or at the end of the lesson plan?**

There will be 3 project checkpoints, 2 peer reviews, a final paper, and final presentation that will each have specific rubrics.

Include resources that will be used to assess the students for the lesson plan.
**Resources and Costs**

<table>
<thead>
<tr>
<th>Resources Needed</th>
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<tbody>
<tr>
<td>List all the resources needed (equipment, facilities, materials or any other resources).</td>
<td>No costs outside of access to a computer with Microsoft Office</td>
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<table>
<thead>
<tr>
<th>Costs</th>
<th>Costs</th>
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<tbody>
<tr>
<td>List the estimated cost of implementing this lesson plan.</td>
<td>$0.00</td>
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Include all costs related to equipment, materials and any resource critical to the implementation of the lesson plan.

**Implementation Plan**

<table>
<thead>
<tr>
<th>Implementation Plan Timeline</th>
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<tr>
<td>Establish the timeline to implement the lesson plan.</td>
<td>This lesson will be implemented during the 2nd quarter of the first semester of school in the fall.</td>
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**Checkpoint I:** Project outline, hypothesis, list of appliances used on a daily basis at home, home specifications (energy sources, rooms, etc) Time to complete - 3 days from the introduction of the assignment.

**Checkpoint II:** Check data collection in lab notebooks for “normal use” data (2 data points per day minimum). Time to complete - 1 week after checkpoint I.

**Checkpoint III:** Check data collection in lab notebooks for “experimental use” data (2 data points per day minimum). Check statistical analysis. Time to complete - 1.5 week after checkpoint II.

**Peer Review:** Must review 2 student’s data, statistical analysis, and conclusion. Due 3 days after checkpoint III.

**Presentation:** Due 4 days after checkpoint III.

**Final Paper:** Due 5 weeks from the introduction of the assignment.