1. How do different blade shapes affect wind turbine performance?
2. What percentage of students in after school program have asthma and how does it compare to national averages?
3. How do Horace Mann students get to school?
4. What is a Horace Mann’s student’s family carbon footprint? How can they reduce it?
5. What do student in after school program know about energy efficiency?
6. Design a model green building.
7. How much particulate matter is in our school air? Why does it matter? How do inside and outside air differ?
8. Design a passive solar heated home.
9. What does the IV curve of a solar cell look like and how does it depend on light conditions?
10. Build a better solar oven
11. Build a working water wheel
12. Design a webpage to help people use energy efficiently
13. Design an educational energy pamphlet
14. Water wheel
15. Wind Turbine
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

**Research Question or Design Goal**
How do different blade shapes affect wind turbine performance?

(This goes on your poster!!)

**Diagram of your experiment or what you will design**
OR List of survey questions
**Materials List**
1. Generator (made in class)
2. Stiff cardboard for blades
3. Scissors
4. Tape
5. Strong glue
6. Small fan

**Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)**
1. Come up with 3-4 different ideas for blade shapes and draw a diagram for each.

2. Cut each one out of cardboard and put a hole in the center just big enough for the nail on your generator.

3. Attach one blade to your generator. Make sure it is taped so that it makes the magnets spin when it spins.

4. Hold the generator and turbine very close in front of the fan. Measure the current and voltage.

5. Put the numbers into a table:

<table>
<thead>
<tr>
<th>Blade</th>
<th>Current</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Repeat for each blade.
7. Make a bar graph of the results.
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

**Research Question or Design Goal**
What percentage of students in after school program have asthma and how does it compare to national averages?

(This goes on your poster!!)

**Diagram of your experiment or what you will design**
OR List of survey questions

1. Do you have asthma?

2. If yes, how long have you had asthma?

3. What neighborhood do you live in?

4. List your siblings and whether they have asthma

<table>
<thead>
<tr>
<th>Sibling</th>
<th>Asthma (yes or no)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Materials List
1. Pencils and paper

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
1. Give the survey to each class in the after school program
2. Go through the surveys and make a table of the results
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

Research Question or Design Goal
How do Horace Mann students get to school?

(This goes on your poster!!)

Diagram of your experiment or what you will design
OR List of survey questions

1. How many days a week do you take the bus to school?

2. How many days a week do you walk to school?

3. How many days a week do you get a ride to school?

4. When you get a ride, how many students are in the car?

5. Same questions for getting home.
Materials

1. Pencil and paper

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)

1. Write survey questions.
2. Give survey to students in after school program
3. Average how many days a week students use each mode of transportation
4. Make a bar graph of the results
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

**Research Question or Design Goal**
What is a Horace Mann’s student’s family carbon footprint? How can they reduce it?

(This goes on your poster!!)

**Diagram of your experiment or what you will design**
OR List of survey questions
Materials List
1. Computer with carbon footprint calculator
2. Pencil and paper
3. 
4. 
5. 

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
1. Go through the carbon footprint calculator and write down all of the questions

2. Each student in your group should ask their family the questions and bring the answers back next week (**Some students will forget-so ask all of them to do it. Consider getting home phone numbers and calling to remind them.**)

3. Calculate the carbon footprint of one particular student or of a “typical student” using either one student’s family’s answers or combining the answers from all families

4. Try to reduce the footprint by changing some of the answers to questions. Write down what you changed and how much the footprint changed.

5. Put your results in a table that is easy for people to understand.
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

Research Question or Design Goal
What do student in after school program know about energy efficiency?

(This goes on your poster!!)

Diagram of your experiment or what you will design
OR List of survey questions

1. What is efficiency

2. How can you tell the difference between a fluorescent and incandescent bulb?

3. Which is more efficient, fluorescent or incandescent?

4. ...
Materials

1. Pencil and paper

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)

1. Write survey questions.
2. Give survey to students in after school program
3. Count how many students got each question right. Also how many students total took the survey.
4. Make a table or bar graph of the results
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

<table>
<thead>
<tr>
<th>Research Question or Design Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design a model green building.</td>
</tr>
</tbody>
</table>

(This goes on your poster!!)

<table>
<thead>
<tr>
<th>Diagram of your experiment or what you will design</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR List of survey questions</td>
</tr>
</tbody>
</table>
Materials List
1. Cardboard for constructing building
2. Large cardboard or foam for base for building and landscaping
3. Construction paper in many colors

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
1. Figure out what the goals of your building should be based on the climate it is being designed for (California)

2. Draw a design of the building. Include as many things as possible from your research (solar hot water system, window strategies, etc)

3. Design landscaping

4. Build house and landscaping

5.
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

Research Question or Design Goal
How much particulate matter is in our school air? Why does it matter? How do inside and outside air differ?

(This goes on your poster!!)

Diagram of your experiment or what you will design
OR List of survey questions
**Materials List**
1. 2 or more petri dishes with lids (Maria has these)
2. Petroleum jelly or 2-sided tape (Maria has petroleum jelly)
3. Digital camera if possible
4. Support of someone who is at school on Thursday/Friday (like Ms A)

**Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)**
1. Wash your hands
2. Put the petroleum jelly or tape all over the bottom of each petri dish. Make sure it’s clean and that each dish is the same.
3. Put the dishes in different places inside and outside of the school
4. Leave them for 1-2 days. Make sure you leave each of them for the same amount of time.
5. Put the lids on and bring them inside
6. Take pictures
7. Make a table or bar graph comparing the different places you put them
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

Research Question or Design Goal
Design a passive solar heated home.

(This goes on your poster!!)

Diagram of your experiment or what you will design
OR List of survey questions
Materials List
1. Cardboard
2. Styrofoam
3. Clear plastic that can be cut by utility knife
4. Black construction paper
5. Glue
...

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
1. Design the house in detail. Make sure everything is labeled
2. Build the house
3.
4.
5.
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

Research Question or Design Goal
What does the IV curve of a solar cell look like and how does it depend on light conditions?

(This goes on your poster!!)

Diagram of your experiment or what you will design
OR List of survey questions

![Diagram of solar cell experiment](image-url)
Materials List
1. Solar Cell
2. Multimeter
3. Flashlight
4. Colored filters
5. 5-10 resistors around 1-1000 ohms (?)
   maria can get these from the physics electronics shop, or they can be bought at radio shack
6. Alligator clip wires

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
For each lighting condition:

1. Hook the solar cell up to one resistor and the multimeter
2. Measure the current and voltage and record
3. Repeat with each resistor
4. Graph the voltage on the x-axis and the current on the y-axis
5.
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

<table>
<thead>
<tr>
<th>Research Question or Design Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build a better solar oven</td>
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</tbody>
</table>

(This goes on your poster!!)

<table>
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<tr>
<th>Diagram of your experiment or what you will design</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR List of survey questions</td>
</tr>
</tbody>
</table>

**Materials List**
1. Styrofoam cooler lid or cardboard box
2. Aluminum foil
3. Hard plastic that can be cut with utility knife for lid
4. Black construction paper

**Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)**
1. Draw a design of your solar oven. Explain why it will be better than the one we built in class
2. Build your oven
3. Test your oven by leaving it in the sun and measuring its temperature every 5 minutes.
4. Make a graph and a table of the results.
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

Research Question or Design Goal
Build a working water wheel

(This goes on your poster!!)

Diagram of your experiment or what you will design
OR List of survey questions

[Diagram of water wheel with a spoon inserted into a container through a hole]
**Materials List**

1. Cork or styrofoam circle

2. Square milk jug

3. Plastic spoons

4. Generator (one that doesn’t have magnets glued to nail)

5. Long (6 inches or more) wooden or metal dowel to couple generator to cork

6. Hand drill (screwdriver handle + drill bits, Maria has this)

7. Scissors or utility knife

8. Glue that bonds metal-superglue/epoxy...

**Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)**

1. Stick spoons into the curving sides of the cork at regular intervals

2. Drill holes one opposite sides of the milk jug

3. Cut off top of milk jug

4. Drill a hole through the center of the cork, through the 2 circular sides

5. Hold the cork inside the milk jug so the hole through its center lines up with the holes in the sides

6. Stick the dowel all the way through the generator, milk jug, and cork and glue
**Project Plan**

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

**Research Question or Design Goal**
Design a webpage to help people use energy efficiently

(This goes on your poster!!)

**Diagram of your experiment or what you will design**
OR List of survey questions
Materials List
1. Paper and crayons/colored pencils/markers
2. Laptop computer
3. Internet (helpful, but not essential)

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
1. Make a list of things people can do to use energy more efficiently
2. Think of ways to get peoples attention/engage them in the webpage
3. Draw a design of how the webpage should look
4. Make the webpage using google sites or word
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

(This goes on your poster!!)

Diagram of experiment or what you will design

pamphlet about energy efficiency
Materials List
1. tagboard / good quality paper
2. markers, colored pencils, paint??
3. computer
4. printer - kinkos?
5.

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
1. generate list of ways to save energy
2. decide who you will give this to, how it will be distributed, and how you will generate funds to print enough
3. decide on a small graphic for each way to generate energy
4. design layout of pamphlet - how will it be folded, will it be done by hand and photocopied or done on computer
5. finish pamphlet. teach other students & teachers about pamphlet
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

Diagram of experiment or what you will design

build a water wheel to demonstrate hydropower
Materials List
1. water wheel
2. motor
3. LED
4. yogurt cup
5. epoxy

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
1. assess materials and draw design of assembled water wheel
2. measure RPM of water wheel with cup of water pouring over it, measure RPM of motor required to light LED
3. assemble water wheel
4. finish assembling water wheel and test with different water flowrates
5. finish testing of water wheel and make poster
Project Plan

Your project should be a design challenge or research question. You will spend 1 session researching, 2 doing the experiment or building, including making any graphs, and 1 making a poster to present at the Energy Fair. Today your job is to choose a project and write a project plan, including a diagram for your poster.

(This goes on your poster!!)

Diagram of experiment or what you will design

build a generator with pinwheels to demonstrate wind power
Materials List
1. pinwheels, long wooden dowel
2. magnets, copper wire, epoxy
3. LEDs
4. 2L pop bottle or similar container
5. household fan, preferably with multiple speeds

Step-by-Step Instructions for experiment, survey, or design process (include creating diagram/graph/chart for poster)
1. assess materials and draw design of assembled generator / wind turbine
2. build generator
3. add pinwheel to generator. measure RPM of turbine with fan blowing on it. think about how you'd design a better pinwheel & draw designs.
4. try designing your own pinwheel. measure RPM of motor required to light LED. test required RPM of diff LEDs
5. finish testing of wind turbine and make poster