



# ENERGY AND HEALTH

## Overview

Energy is critical to modern societal function. We depend on energy for food production, heating and cooling, transportation, and many other activities. Our current energy system has contributed to major advancements in food production, manufacturing, and transportation, allowing developed countries to prosper on many human indices. Yet, the adverse health impacts associated with reduced air quality are on the rise. This Exploration Station encourages learners of all ages to think critically about the interrelationships between humans and energy, with an emphasis on human health. One goal is to help learners understand these connections and how they relate to a clean and sustainable energy future promoting both human and environmental health. Another goal is encouraging learners to think across scales: how does energy impact humans globally, and how can it impact me personally?

## What is an Exploration Station?

“Exploration Stations” are educational activities that invite learners to interact with materials in a hands-on manner, and at their own pace. Learners can spend as much time with the activity as they choose. One or more facilitators lead the activity, taking cues from the learner and encouraging scientific inquiry and experimentation.

## Description of Activity

Learners are introduced to the “Energy Landscape,” a tabletop poster that functions similarly to a game board. Facilitators begin the activity by asking learners to identify sources and uses of energy. Sources and Uses are designated on the board with game pieces. This initiates a conversation about where energy comes from and what it is used for. Then facilitators encourage conversation about the waste products of energy production from fossil fuel combustion, or emissions. Learners try to match clouds that are sized to the scale of emissions volume to the emissions sources as a way to realize the contributions of various sources to air quality. Advanced discussion about the physical and chemical composition of gaseous and particulate emissions can be pursued at the discretion of the facilitator based on the level of the learner audience.

A model of the lungs and diaphragm are used in conjunction with the Energy Landscape poster to help

learners realize that some local emissions can impact their respiratory health even during brief, intense exposures. Learners can experiment with the lung model to understand the basic mechanism for air pollution’s impacts on health.



*A close up of the Energy Landscape.*

## Materials Needed:

- Energy & Health Landscape Poster (printable PDF attached)
- Source and Use chips (printable PDF attached)
- Emissions clouds (printable PDF attached)
- 15-20 Poker Chips
- 6 Free-standing photo holders

## Lung Model

- 1 Empty 2-liter bottle (i.e. cola or juice container)
- 2 Balloons
- Packing tape
- Clay or play dough
- 2 Drinking straws
- Plastic wrap
- Plastic bag



*An example of the lung model.*

## Assembling the lung model:

See attached instructions from the Museum of Science and Industry activity or view the activity online

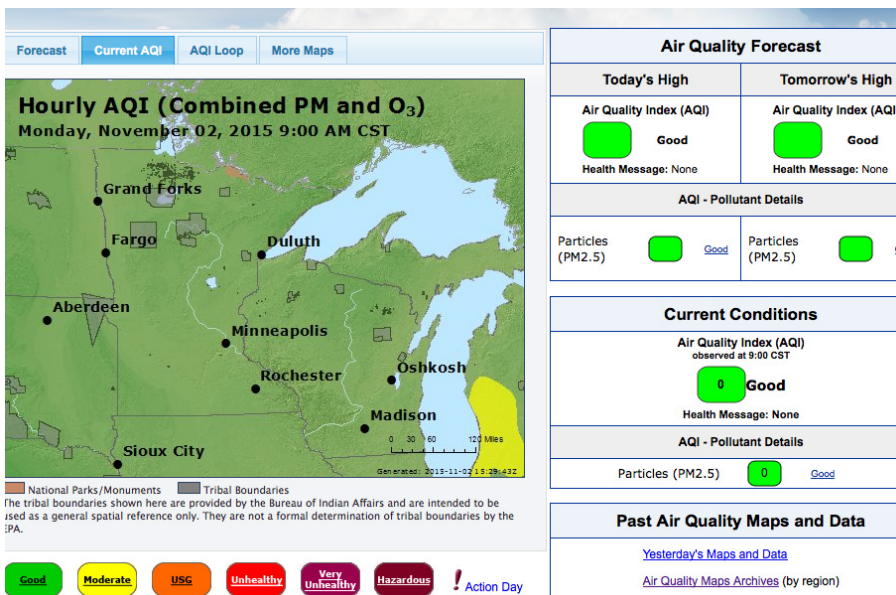
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## Activity Extension:

EPA's Air Now website or app:  
<http://www.airnow.gov/>

Computer, tablet, or smartphone  
Internet connection

To extend the activity, a computer, tablet or smart-phone with the EPA's AirNow website (<http://www.airnow.gov>) or app allows learners to check the air quality locally and in real time, empowering them to come to their own conclusions about air quality in their own communities. Facilitators should show learners that they can type in their zip code or select a state and view the current air quality index.





## Guiding the Activity

The main message behind this activity is that humans and the environment are impacted by energy use in complex ways, some of which are not immediately obvious. Encouraging curiosity and inquiry about these subjects is the role of the facilitator. The nature of an Exploration Station encourages learning to proceed without a linear design. Learners can decide what elements are interesting or familiar to them and the conversation led by facilitators can be structured around this interest. Below are some sample questions that can help initiate conversation and critical thinking.



*Participant examines emission clouds.*

### Sample Questions: Introducing the Concepts

Can you point to (or circle) the things on the poster that relate to energy?  
 What do you do that involves energy?  
 Where does energy come from? Or, what are some sources of energy?

### Sample Questions: Challenges to our Energy System

Have you ever heard of fossil fuels? What do you know about them?  
 What are some waste products from burning fossil fuels?  
 What sources or uses of energy generate the most emissions?  
 What is air pollution?  
 How does air pollution affect you?

### Sample Questions: Coming up with Solutions

What can we do as a country to reduce our emissions?  
 What can you do to reduce your contribution to emissions?  
 What can you do to protect yourself during poor air quality events?  
 What do you know about renewable or “clean” energy?



*Learners use chips to identify energy uses.*



*Participants learn about the components of energy and health.*

## Note for Educators

This activity was created to complement the Next Generation Science Standards (NGSS). When used in conjunction with other activities and materials, this exploration station can help students connect to these NGSS:

**MS-ESS3-3:** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment

Scientific and Engineering Practices:	Disciplinary Core Ideas	Crosscutting Concepts:
<ul style="list-style-type: none"> <li>Developing and using models</li> <li>Asking questions and defining problems</li> </ul>	<ul style="list-style-type: none"> <li>Definitions of energy</li> <li>Ecosystems: Interactions, energy and dynamics</li> </ul>	<ul style="list-style-type: none"> <li>Systems and system modeling</li> <li>Energy and matter</li> </ul>

## Printable Emissions Clouds

The images on the next pages can be printed and used to represent the magnitude and composition of emissions released from various sources. Percentages of emissions by sector are based on 2014 data from the Intergovernmental Panel on Climate Change (IPCC). For more information about emissions and air quality, visit the Environmental Protection Agency's website.

<http://www3.epa.gov/airquality/urbanair/>



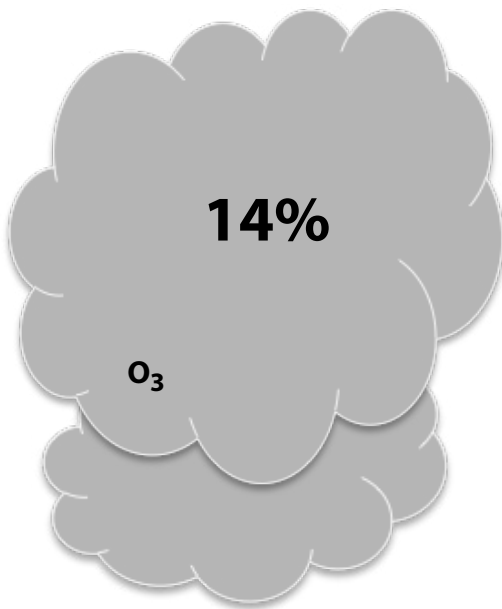
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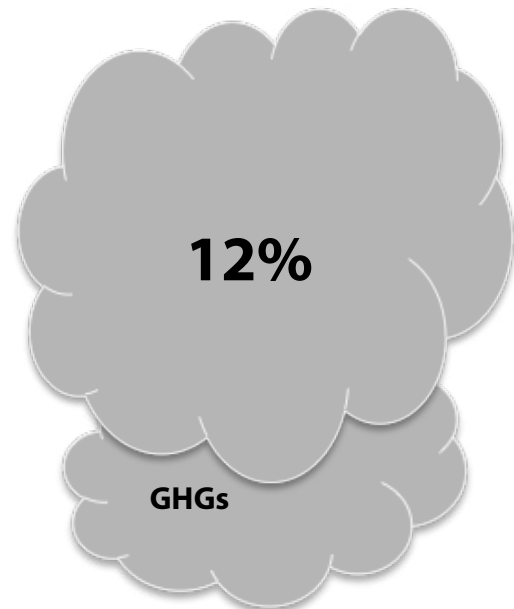
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Pollutant	Abbreviation
Green House Gases: Carbon Dioxide, Methane, Nitrous Oxide, fluorinated gases.	GHGs
Particulate Matter	PM
Ozone	O <sub>3</sub>
Mercury	Hg
Sulfur dioxide	SO <sub>2</sub>
Lead	Pb
Volatile Organic Compounds	VOCs

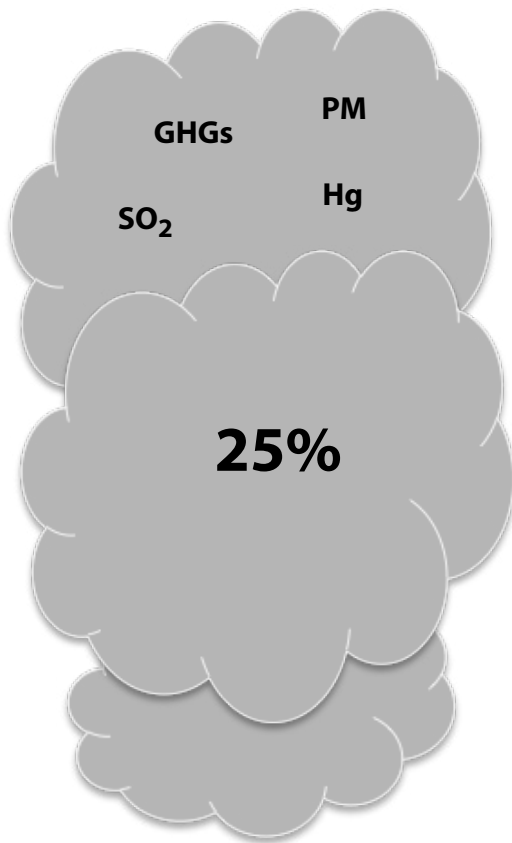
### Agriculture



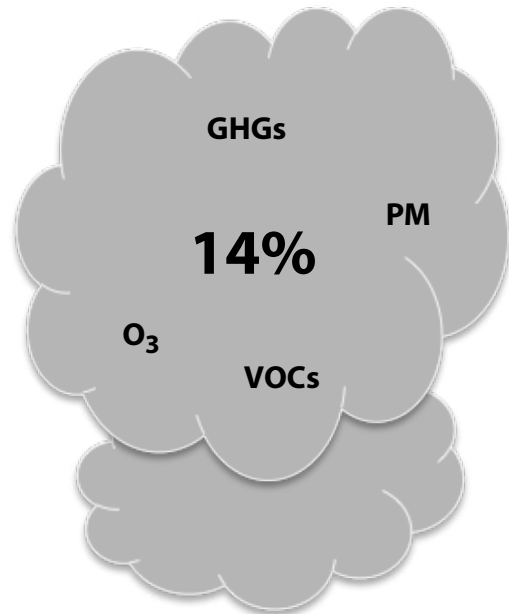
### Land Use Change



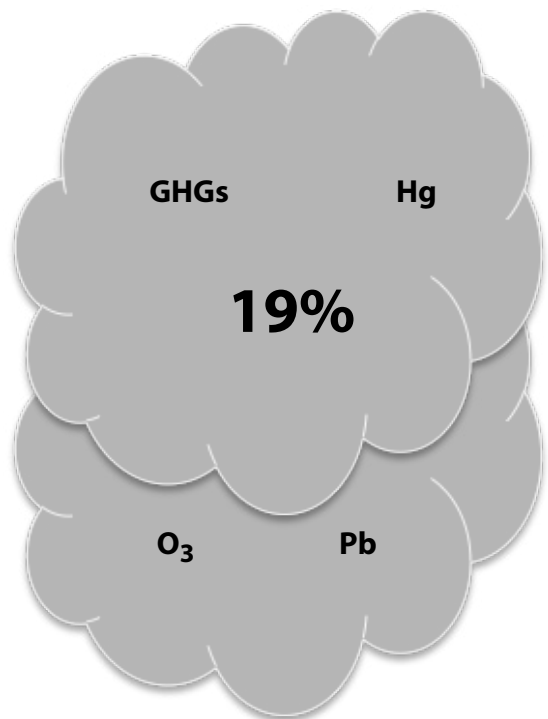
## Electricity and Heat Generation



## Transportation



## Industry



## Buildings

