



## **Cow Power** **Science Lesson Plan**

This lesson has been designed to support *the.News* video “Cow Power.” The video can be found online at [http://www.pbs.org/newshour/thenews/thedollar/story.php?id=3876&package\\_id=631](http://www.pbs.org/newshour/thenews/thedollar/story.php?id=3876&package_id=631).

**Lesson Author:** Amir Raza

**Subject Area:** Science

**Lesson Plan 1: Middle School Level (Carbon cycle and the environment)**

**Lesson Plan 2: Upper School (Methane and chemistry of methane)**

**Lesson Plan 3: Upper School and Middle School (Anaerobic Respiration)**

The lesson plans can be taught consecutively or individually.

**Background:** Global warming is a grave concern that has, over time, become an impending crisis. There has been no easy fix put forth, as most scientific solutions carry heavy economic repercussions. Lately, a concerted effort to address the problem using both economics and science has arisen. Many states, especially California, have been leading the way towards implementing legislation designed to reduce the stress on the environment. The major contributors to global warming are greenhouse gases, which include carbon dioxide, methane and ozone. Burning fossil fuels, such as gasoline, not only adds to the greenhouse gases, but also introduces more carbon into the atmosphere. Since fossil fuels were originally buried far underground, drilling for oil and then burning it causes the environment to become stressed—there is more carbon in the system than it can recycle. Cow power is an effective and ingenious solution to both the problem of greenhouse gases and the recycling imbalance in the carbon cycle. Cow manure is a major contributor of atmospheric methane. Recycling it to produce methane for industrial purposes reduces the greenhouse gas. Since the carbon in methane is coming from above the ground and is already a part of the environment, burning it does not introduce more carbon into the carbon cycle.

## Lesson Plan 1: What is the Carbon Cycle and How Does it Affect the Environment?

### Learning objectives (McRel Standards)

**Standard 1:** Understands atmospheric processes and the water cycle

**Standard 6:** Understands relationships among organisms and their physical environment

**Standard 9:** Understands the sources and properties of energy

**Standard 12:** Understand the scientific enterprise

### Key Concepts:

- The Carbon Cycle
- Recycling of natural resources
- Balance of resources in the environment
- Fossil fuels and pollutions
- Greenhouse gases and their effect
- Solar energy and radiation
- Properties of methane gas

### (Key vocabulary in blue)

After watching the Cow Power video with students, present the students with a picture or illustration of the **carbon cycle**. A simplified version is available in many biology textbooks. An excellent diagram is also available online at <http://earthobservatory.nasa.gov>. Explain to students the basic features of the carbon cycle. The reservoir for carbon is in the air as carbon dioxide. **Photosynthesis** and dissolving of carbon dioxide in the ocean are two ways that carbon is removed from the **atmosphere**. Many processes, however, add carbon to the atmosphere. Natural processes such as breathing and forest fires release the carbon that was taken away from the atmosphere -- thus only **recycle** the carbon. Explain that the presence of humans does not affect the carbon cycle as animals and plants have lived with the carbon cycle for thousands of years. Drilling for **fossil fuels** and then burning them, however, adds more carbon into the atmosphere. The presence of more carbon dioxide in the atmosphere causes the problem of increased in the greenhouse gases. Several major **greenhouse gases** include carbon dioxide, methane, nitrous oxide and **fluorocarbons** such as Freon (the gas used in refrigerators).

Greenhouse gases work a lot like a real greenhouse. They effectively trap heat energy by absorbing energy from sunlight. An interesting activity would be to build a simple greenhouse model in the class and have student study how something as simple as plastic can be used to trap solar energy to provide heat and shelter for a plant. Greenhouse gases are not bad for the environment, as they have been around for millions of years and play an important part in the presence of life on planet earth. The rapid increase in the greenhouse gases, however, is the concern that students should be able to distinguish and understand. An analogy would be to

explain how heat or cooling in a building is useful to maintain a steady comfortable temperature. An increase in greenhouse gases is similar to an increase in the thermostat temperature. Not all of these increases are good. Videos of ice caps melting and drought could be used to illustrate this example.

Methane, one of the greenhouse gases, is about twenty times more effective at trapping heat than carbon dioxide. Methane in the environment comes largely from **bacteria**. Cows have bacteria living in their stomachs that help them digest grass. These bacteria produce methane that is then released into the atmosphere. More cows result in less vegetation and more bacteria. Cow power is a way to use the methane for productive uses such as **combustion**. Since burning methane produces carbon dioxide, an interesting discussion can be generated on whether this is an environmentally beneficial plan. As the carbon dioxide being released from cow power would replace carbon dioxide released from burning fossil fuels, an argument could be made at the end that there is a net zero change in carbon and an overall reduction of methane from the atmosphere.

The thirty-minute presentation detailed above can be supplemented with several activities and further lessons. Suggested activities include building a greenhouse, construction of group posters on the carbon cycle, and internet research on the effects of global warming. Further lessons include the benefits of recycling, the other cycles, such as water and nitrogen, and the role of bacteria in the environment.

## Lesson Plan 2: What is the Chemical Nature of Methane and How Does it Combust?

### Learning objectives (McRel Standards)

**Standard 6:** Understands relationships among organisms and their physical environment

**Standard 8:** Understands the structure and properties of matter

**Standard 9:** Understands the sources and properties of energy

**Standard 11:** Understand the nature of scientific knowledge

**Standard 12:** Understands the nature of scientific inquiry

### Key Concepts:

- Balancing chemical equations
- Properties of gases
- Physical properties of methane
- Chemical properties of methane
- Combustion of methane
- Properties of a flame

### (Key vocabulary in blue)

Methane is a colorless, odorless and **combustible** gas. The **chemical formula** for methane is CH<sub>4</sub>. It burns with oxygen to make carbon dioxide (CO<sub>2</sub>). The equation for this reaction is  $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ . This is a **balanced equation**, which means the number of atoms on the left side equals the number of atoms on the right side. The purpose of a balanced chemical reaction is to determine the **ratio of elements** required to complete a reaction. This balanced equation shows that one molecule of methane requires two molecules of oxygen to make one molecule of carbon dioxide and two molecules of water.

There are several key concepts that can be taught using methane to illustrate the point between the presentations. Another option is to take the demonstration part and turn it into a lab activity; however, several key safety concerns will then have to be addressed.

If the Cow Power video has not been shown yet, it can be viewed to lead the class into the relevance of studying methane. The most common commercial source for methane is **natural gas** (mostly methane with traces of other hydrocarbons). If natural gas outlets are not available in the classroom then canisters of methane gas can be purchased at most gas stations.

To illustrate the properties of gases, a small balloon can be filled with methane (natural gas). It can be shown that it is **compressible** and has no distinct shape other than that of the container it is placed in (the balloon). The neck of the balloon can be opened to allow students to smell no odor when the gas is released. In some places a sulfur compound is added to natural gas to allow quick detection of gas leaks in houses. At this point a dramatic demonstration can be made of the

combustibility of methane. Soap bubbles filled with methane, on contact with an open flame, burst into quick, intense, spheres of flaming gas. There are several safe ways to make this an exciting **pyrotechnic** demonstration. First, all **flammable** materials near the work bench should be removed. A small amount of bubble solution in a flat non-flammable material should be placed in the center of the work bench. Using a rubber tube, a small amount of methane can be bubbled through the solution to make a stationary bubble on the surface. Remove the tube to leave the bubble intact on the surface of the bubble solution. On touching the bubble from one foot away with a long candle, the rapid and intense **combustion** of methane can be shown. An alternate and safer method to show the combustion of methane is to observe the flame of a Bunsen burner attached to a methane (natural gas) supply. It can be shown that methane burns with a clear, slightly blue gas in the presence of excess oxygen, but shows a yellow color when not enough oxygen is present.

To show the importance of oxygen for burning, a glass jar can be inverted over a candle placed in a tray of water. A tube linked to a methane supply can then be inserted into the glass jar from under the water. Thus the candle and the methane will both be present in an airtight environment. When the candle is lighted and the methane supply is switched on with the jar inverted over the whole set up, the candle and the tip of the tube burn brightly for a few seconds before extinguishing due to lack of oxygen. The students have already observed the methane burning outside on a burner for as long as the burner is on. In this set up, it can be shown that no matter how much methane is pumped into the glass jar, the candle and the methane will not burn until there is oxygen to support combustion.

Some students find it hard to believe that fire can produce water. This can be shown by placing a beaker of ice a few inches above a methane flame. Condensation of water can be observed on the underside of the beaker. To eliminate doubts that it came from the air around the flame, a large 2-liter bottle can be filled with methane. A match introduced to the mouth will cause the methane inside to combust quickly. After combustion, quickly screw the cap on tight. Let the bottle to cool for a few minutes. Two interesting phenomena will be observed. The bottle will shrink and collapse on itself as there is less gas inside and **atmospheric pressure** causes it to crush. The second will be a layer of water collecting on the inside that was not present before and could not have come from the air as it was mostly expelled due to the combustion of methane.

There are several follow-up activities that can be conducted after this lesson. Give students unbalanced equations as homework to try and balance on their own. The different part of the methane flame can be studied as a lab activity. The difference between the three states of matter can either be demonstrated with ice, or drawn up as a chart. A follow-up activity with the demonstrations could be a short paper showing how the scientific method was employed. Encourage students to determine possible flaws in the reasoning used and come up with experiments and solutions to correct the flaws.

## Lesson Plan 3: What is Anaerobic Respiration and What Role Does Bacteria Play in it?

### Learning objectives (McRel Standards)

**Standard 5:** Understands the structure and function of cells and organisms

**Standard 6:** Understands relationships among organisms and their physical environment

**Standard 9:** Understands the sources and properties of energy

**Standard 11:** Understand the nature of scientific knowledge

**Standard 12:** Understands the nature of scientific inquiry

### Key Concepts:

- Respiration and energy in living organisms
- Aerobic and anaerobic respiration
- Living anaerobic organisms
- Bread making: constructive use of anaerobic respiration

### (Key vocabulary in blue)

Scientists have known, for awhile, how to obtain methane from cow manure. The problem has been how to develop a cheap and effective way to obtain the methane. The use of bacteria and **fermentation** tanks has been an interesting development. **Anaerobic respiration** means creating energy without the use of oxygen. We use oxygen to burn **carbohydrates** and obtain **energy** for ourselves. Certain **bacteria** break down food and get energy without the use of oxygen. These are called anaerobic bacteria and are found everywhere. The most common and easily obtainable anaerobic **organism** is yeast, a fungi.

The first part of the lesson is an introduction to the process of anaerobic respiration. All living things require energy, which is obtained by the process of **respiration**. There are two types of respiration; Aerobic requires oxygen, Anaerobic does not. Human beings, animals, plants, all do **aerobic respiration**. We take oxygen from the air and use it to turn **hydrocarbons** such as **sugars** and **fats** into carbon dioxide and water. The process is carried out by the **mitochondria** in animal cells, and is a highly-**efficient** method of producing energy. Anaerobic respiration is done mostly by small organisms, as it is an inefficient method of producing energy. The advantage it holds is that it is considerably simpler and gives small organisms the benefit of living in places larger aerobic organisms cannot survive, such as near volcanic vents at the bottom of the ocean. It should be made clear that most aerobic organisms can do anaerobic respiration; however, this is only done in extreme cases and only temporarily. An illustration is how muscles produce **lactic acid** during rigorous exercise when the supply of oxygen to the muscles is severely limited.

The lesson can be concluded with a small demonstration of a living organism doing anaerobic respiration. Yeast is a living organism which, under the right conditions, breaks sugars into alcohol and carbon dioxide. A little yeast added early in the making of bread causes the familiar rising of the bread (due to carbon dioxide gas produced) and the taste -- significant especially in sourdough. Yeast is an anaerobic organism that does not use oxygen to obtain energy for itself like we do. A bread making activity can show how yeast works, that it is living, and how it feeds on sugars in bread without oxygen present. The requirements for this are an oven, flour, yeast, and basic baking utensils. Directions for making bread can be found on many websites including <http://www.post-gazette.com/pg/06064/663810.stm>. An alternate activity could be the making of a desktop digester using a gallon bottle.

The final message to obtain here is that bacteria feed on cow manure, without oxygen present (oxygen is toxic for most of them) and make methane as a waste product. This reversal is very interesting for middle school students. How what is waste for us, is food for them, and how waste for them, is of use to us. Tie this into the different food cycles of the environment such as carbon and nitrogen cycles and their dependencies on bacteria.



## **Cow Power Makes Dollars and Eco Sense**

### **Economics Lesson Plan**

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**Lesson Author:** Patricia A. Bonner, Ph.D (Economic Connections)

**Subject Area:** Economics

#### **Learning objectives (McRel Standards)**

**Standard 1:** Understands that scarcity of productive resources requires choices that generate opportunity costs (Grades 6-12)

**Standard 2:** Understands characteristics of different economic systems, economic institutions, and economic incentives (Grades 6-12)

**Standard 6:** Understands the roles government plays in the United States economy (Grades 9-12)

#### **Objectives:**

- Analyze the potential success of products made from cow manure.
- Do a cost-benefit analysis of large-scale livestock and poultry operations.
- Recognize that economic and public policy decisions can have unintended consequences.
- Explore positions of special interest groups on government efforts to reduce the negative externalities associated with the management of cow manure.
- Take a stand and defend a public policy created to mitigate air and water pollution from manure.

#### **Key Economic Concepts:**

- **By-product**
- **Cost-benefit analysis**
- **Economies of scale**
- **Entrepreneur**
- **Externalities**
- **Incentive**
- **Innovation**
- **Investment**
- **Profit**
- **Price**
- **Risk**
- **Subsidy**
- **Tax**

- **Unintended consequences**

**Key Vocabulary:**

1. **Alternative energy source**
2. **Anaerobic digester**
3. **Ethanol**
4. **Emission permit**
5. **Fossil fuel**
6. **Methane**
7. **Pollution credit**
8. **Regulation**
9. **Uranium**

**Background:**

The St. Pierre's are entrepreneurs—they were willing to take a risk in order to develop new products. They risked more than \$2 million to purchase the anaerobic digester—a system that uses naturally occurring bacteria to break manure down into useful products including: fuel, fertilizer and animal bedding. In five years, they believe the income stream created from the production of the methane gas they sell to the electric company along with their savings on bedding for their cows will pay for their investment. The digester is also helping to save their family farm and the environment.

The methane produced by the St. Pierre's in the anaerobic digester is an alternative energy source—a renewable power source that can be used in place of fossil fuels and uranium. A variety of factors are motivating people and nations to identify, develop and use alternative energy sources. Higher energy prices caused by diminishing oil and coal supplies are a major economic incentive to find alternatives. Concerns regarding the environment and public health are other factors.

## Student Activities:

### Waste: It's A Good Thing?

Most people think of manure simply as farm animal waste, but manure is also a byproduct of livestock and poultry operations. A by-product is a secondary or incidental product that results from a production process. Innovative people are sometimes able to turn an unwelcome by-product into a good thing—something that is useful and even profitable. To be profitable, the end product must be an item that people need or want and are willing to purchase.

Have students identify five ways people such as the St. Pierre family might turn their cow manure into a profitable product. These web links will help students come up with ideas beyond what was provided in *the.News* Cow Power story:

- **Japanese Researchers Extract Vanilla From Cow Dung** [[www.terraily.com/reports/Japanese\\_Researchers\\_Extract\\_Vanilla\\_From\\_Cow\\_Dung.html](http://www.terraily.com/reports/Japanese_Researchers_Extract_Vanilla_From_Cow_Dung.html)]
- **The Story of Cow Chip Shirts** [[http://www.cowchipshirts.com/the\\_story.htm](http://www.cowchipshirts.com/the_story.htm)]
- **Other Uses for Cow Dung?** [[www.cowchipshirts.com/give\\_it\\_a\\_tink!.htm](http://www.cowchipshirts.com/give_it_a_tink!.htm)]

If time is limited, provide students HANDOUT 1 as a prepared list of options. Tally student responses to find out which ideas were most popular. Discuss:

- a) On which items do you agree that there is potential? What accounts for any differences?
- b) What obstacles might exist to earning a profit? [*Obstacles that may be identified include whether the amount of manure available is sufficient to invest in required equipment, the cost of transporting the manure or final product, public acceptance of a product that is considered unsanitary and less-expensive alternatives in the marketplace.*]
- c) Are there products that might be more successful in some parts of the world than in others? [*Cow dung is sold in parts of Africa and Asia as a fuel source for heating and cooking but it has never caught on in the U.S. because there are more convenient fuel sources. Cow Chip Shirts are probably more successful in the U.S. and other developed nations versus developing nations because consumers have more discretionary income.*]

### Good Ideas Can Have Unintended Consequences

Manure is not new, but in recent decades, the management of manure has garnered increased interest among citizens and government representatives. One of the reasons for this attention is that efforts to improve farm production have had negative consequences on the environment and small farms.

Farmers like other producers recognize that there are economies of scale—an increase in the number of units produced can decrease the average cost of unit production. Today's livestock

and poultry farms are larger and more specialized. There has also been an increase in the number of animals per acre and regional clustering of production facilities. The lower production costs have helped make larger farms more profitable and saved the economies of some rural communities. Lower costs have also led to lower food prices for consumers.

On the other hand, the concentration of manure and manure management practices has added dust and foul odors to the air. The emission of greenhouse gases is considered a cause of global warming. Water used for drinking, swimming, fishing, etc. has been contaminated. Fish and other animals in the food chain have died as a result of toxins and oxygen depletion. People have become sick and sometimes died due to contaminated food and water. From a market perspective, smaller farms are having a difficult time competing with larger farms. All of these negatives are the costs of what at first, seems like a great idea.

Have students read one or both of these articles that provide an overview of the environmental problems created by large animal-feeding operations. Instruct students to identify the costs and benefits of these operations.

- **Animal Waste: What's the Problem?**  
[<http://www.epa.gov/region09/animalwaste/problem.html>].
- **Managing Manure: New Clean Water Act Regulations Create Imperative for Livestock Producers**  
[<http://www.ers.usda.gov/AmberWaves/Feb03/Features/ManagingManure.htm>].

Use a T-chart on the board to compile a list of student responses with benefits on one side and costs on the other. Explain that when producers make decisions, there are sometimes benefits and costs that were not anticipated. The term economists use to describe these unexpected results is “unintended consequences”. Discuss:

- Do you think farmers realized all of the negative things that would happen when they expanded their operations? Why or why not? *[Anyone who has ever spent just a few minutes on a farm would probably not be surprised that the large operations might emit foul odors into the air but students may argue some farmers did not realize how serious the other pollution problems would become. Even today, there is disagreement on whether global warming exists.]*
- If you were a farmer would you think the benefits of large-scale farming are worth the costs?
- How might your opinion differ if you were a small versus large farmer? An environmentalist?

Looking for more information on the technology behind anaerobic digesters? Start with these web links:

- **Anaerobic Digesters for Farms and Ranches**  
[[http://www.eere.energy.gov/consumer/your\\_workplace/farms\\_ranches/index.cfm/mytopic=30002](http://www.eere.energy.gov/consumer/your_workplace/farms_ranches/index.cfm/mytopic=30002)].

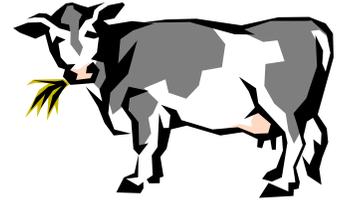
- The U.S. Department of Energy explains anaerobic digesters and their benefits to farmers.
- **What is an Anaerobic Digester?** [[http://manure.unl.edu/adobe/v7n10\\_01.pdf](http://manure.unl.edu/adobe/v7n10_01.pdf)]. A Nebraska agricultural engineer explains the anaerobic digestive process and when it might make economic sense.
- **Turning Manure into Gold** [<http://www.nature.com/embor/journal/v3/n12/full/embor005.html>]. A look at the varied sources of methane gas—including cow manure. This analysis says the potential for methane may be somewhat overstated but the development of its production and use is still important.
- **A Load of Manure** [[www.nytimes.com/2006/03/04/opinion/04niman.html?ei=5088&en=5e4ccc3f6d2d3f6d&ex=1299128400&partner=rssnyt&emc=rss&pagewanted=print](http://www.nytimes.com/2006/03/04/opinion/04niman.html?ei=5088&en=5e4ccc3f6d2d3f6d&ex=1299128400&partner=rssnyt&emc=rss&pagewanted=print)]. A cattle rancher presents the opinion that cow power may turn out to be a poor source of energy that creates more environmental problems than it solves.

Want a follow-up activity that shows how economic incentives encourage changes in consumer behavior? Try this on-line lesson.

- **Be An Energy Saver** [<http://www.econedlink.org/lessons/index.cfm?lesson=EM526&page=teacher>]. How individual consumers can help reduce our nation's dependence on fossil fuels and how government incentives influence consumer choices in the marketplace.

## Handout 1

# 15 Ways to Use Cow Manure



These are some of the ways that people around the world are using animal manure.

1. **Energy** – Historically, animal dung has been burned to provide heat. Capturing methane gas from cow manure is a relatively new energy source.
2. **Fertilizer** – Manure adds nutritional value to soil used for other crops.
3. **Bedding** – The anaerobic digester creates a substitute for straw that can provide bedding for animals.
4. **Creams, lotions and other medicines** – Cow dung has been found to have antiseptic qualities. In India, remedies are available to treat everything from diabetes to acne to PMS.
5. **Construction** – When added to mud and water, manure acts like cement and improves the quality of bricks. Applying cow dung to mud floors makes them less slippery and reduces dust.
6. **Mosquito repellent** – The smoke produced by burning manure keeps away mosquitoes.
7. **Pot cleaner** – Used dry, manure absorbs oil and fat.
8. **Brass polisher** – Manure helps remove oxidation and polishes.
9. **Fan for fire** – Large dried dung patties can be used as make-shift fans.
10. **Recreational device** – Sun-dried patties are used as Frisbees. Cow Chip Bingo—a game of chance—has become a “fun” fundraiser. People purchase squares marked off in a field. When all the squares have been sold, a cow is brought from the barn. Can you guess who wins this game?
11. **Seed protector** – Covering seeds with dung before planting helps to protect against pests.
12. **Art** – Painter Chris Ofili won England's 20,000-pound Turner Prize in 1998 for some paintings spruced up with elephant dung from the London Zoo.
13. **Dye** – Various processes have used dung to add color to fabrics and paper. A company in Hawaii uses manure to dye Cow-Chip shirts.

**14. Bleach** – Fabrics and paper can also be whitened using a cow dung treatment. A paper used for Indian folk art is treated with cow dung.

**15. Vanilla Extract** – Japanese researchers have found a way to distill this extract from manure. It can be used to scent hair shampoos and candles.

## Handout 2

# Government Targets Negative Externalities



Externalities exist when some of the benefits or costs associated with the production or consumption of a product “spill over” to third parties who are not the direct producers and consumers of a product. The air and water pollution caused by the disposal of cow manure are negative externalities—they impose costs on persons other than farmers and the consumers who purchase the farm products. For example:

- Neighbors may pay for foul odors through reduced home values.
- The fishing industry may experience reduced profits caused by water pollution.
- Insurance companies (those who purchase insurance) and taxpayers experience higher health care expenses when a pollutant physically harms people.
- Taxpayers may also pay for the cost of cleaning up the pollution

To correct for these externalities, government uses a variety of tools that fall into three broad categories.

**Regulation** - One way that government tries to control pollution is through rules or regulations. A government can entirely prohibit the production, use, or disposal of the pollutant. This is the most restrictive way to deal with a problem.

In other situations, producers are allowed to pollute, but there are restrictions on the amount that can be emitted or they are required to use special equipment to reduce how much is emitted. Producers who don't follow these regulations may be fined.

Another regulatory approach that government can take is to issue licenses for the possession, use or handling of pollutants. Typically, an applicant must get special training and show he or she knows how to properly handle the pollutant.

**Economic Incentives** - Traditional incentives used by government to encourage both producers and consumers to act in a certain way are tax policies and subsidies. Tax breaks, grants and low-interest loans are examples of fiscal policy that has been used to encourage producers to install new equipment that will cut pollution.

A relatively new approach to protecting the environment is to try to transfer the actual costs of pollution back to the producer. With emission fees, government places a dollar value on the externality. Individual producers are allowed to decide how they will respond—they may pay for their share of the pollution or find a way to reduce their emissions.

Another way to pass the cost on to the producer is through an emissions permit. Producers are given a limit on the amount of pollution they can produce. Those that are able to reduce their pollution below this level can earn credits that they can bank for use in a different operation or at a future date. They may also be allowed to sell their credits to those who want to

offset an equal amount of excess emissions. Market forces versus the government set the price of the credits.

Regardless of who sets the price and how the producer pays, at least some of the cost is usually passed on to the product's consumers through higher prices. In some cases, producers decide it is better to switch to a more profitable enterprise.

**Information** - The final and least coercive tool of environmental regulation is providing information that will attract public attention to an issue and perhaps, pressure producers to voluntarily change behaviors that lead to pollution. A government agency might offer a seminar or produce a manual that tells people about a pollution problem and how it might be minimized.

### Handout 3

## Environmental Policies: Who are the Winners and Losers?

When government officials consider public policy options, they consider whether the benefits of a policy will outweigh the costs. They must also assess who will enjoy the benefits and who will bear the costs. Listed below are ten different public policies that have been used to address pollution caused by cow manure. Imagine you are a special interest group and decide whether you will support (+) or oppose (-) each policy. Outline the reasons for your positions.



### What special interest do you represent?

Policy	+ / -	Reason(s) for Your Position
1. Large-scale animal feeding operations are prohibited within a certain distance from homes and waterways.		
2. Zoning rules restrict the size of animal feeding operations to a certain number of animals per acre of land.		
3. All farms are required to install a lagoon for storing waste.		
4. Large farms and animal feeding operations must install anaerobic digesters to reduce the odor and amount of water pollution.		
5. Anyone who hires himself or herself out to apply manure as fertilizer must become licensed as a commercial waste technician.		
6. An income tax deduction is offered to farmers who install an anaerobic digester.		
7. Low-interest loans are offered to farmers who develop systems that compost animal bedding for commercial sale.		

<p><b>8.</b> Farmers are given a limit for the amount of manure their farm can release into the environment. If they can reduce their waste below this amount they earn credits that they can sell to others.</p>		
<p><b>9.</b> A university is given government funding to research alternative uses for manure.</p>		
<p><b>10.</b> Farmers are invited to a free seminar that introduces them to the best practices in manure management.</p>		



## HOW COW POWER BECAME A STORY FOR *the.News* Language Arts/Media literacy Lesson Plan

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**Lesson Author:** Julie Weiss, Ph.D

**Subject Area:** Language Arts/Media Literacy

**Key Concept:** Journalists select what stories to cover based upon specific criteria. Sometimes when a journalist is investigating a story, the main topic or “lead” changes as facts reveal new information.

**Background:** Cow Power tells a story that teaches useful facts by providing information on a topic that sounds funny.

**Goals:**

1. To understand that there may be several different stories, a journalist could tell about a single topic.
2. To demonstrate this concept using the 5 *Ws* of journalism.
3. To demonstrate how a serious topic can be informative and entertaining at the same time.

**Learning Objectives (McRel Standards)**

**Language Arts Standard 9:** Uses viewing skills and strategies to understand and interpret visual media

Level III Benchmarks 1, 2, 3

Level IV Benchmarks 1, 2, 4, 6, 11

**Language Arts Standard 10:** Understands the characteristics and components of the media

Level III Benchmarks 5, 7

Level IV Benchmarks 1, 2, 8, 12

The first thing a journalist has to decide is why the topic is newsworthy.

The topic for this story is alternative energy sources--specifically electricity generated with fuel made from cow manure. How did the journalists for *the.News* decide on the topic? Probably a few people sat down together to talk -- or talked by sending emails back and forth. Maybe one of them had heard a story about using manure to make electricity. Maybe another one of them had a contact in Vermont. Those kind of factors -- they're not at all mysterious, or even all that interesting -- shape how Cow Power went from being an event to becoming a news story.

Of course, there's the topic itself, too -- manure. The journalists at *the.News* could have decided to do a story about solar panels. But they didn't. They chose cow manure. Why? In part because - face it - bodily functions are amusing. Energy from solar panels? Eh. Energy from cow poop? Pretty funny.

Once they chose the topic, the reporter and producers must decide what story they're going to report. Not as easy as it sounds and Cow Power is a good example. Listen closely to what reporter Stacey Delikat says at the start of this news segment.

“We thought it was an interesting story about finding an alternative energy source to reduce pollution. What we learned is that what really makes cow power work is that it is good business.”

Stacey is telling you something important. She's telling you that the journalists who decided to report this story started with one idea of what the story was about: reducing pollution. Then they went out and talked to people and gathered information, and they found out that the story was really about something a little bit different: money.

### STUDENT ACTIVITY #1

Let's step back and explore what that means about news, including what you see on *the.News*. Many people decide what's going to make it into the news; producers, reporters, researchers, -- often more than one on each story. They sit and talk things over, share story ideas, and make many decisions because there is more than one way to tell a story. In fact, there's more than one story to be told on any given topic, Cow Power is a good example.

**Activity:** Try this simple exercise to get a sense of what journalists do. Pair up with a partner. Your assignment: Describe the room. The hitch: One of you faces the front of the room, and the other faces the back. Describe what you see. Have your partner describe what he or she sees. Which one of you has accurately described the room?

Well, you both did. It's just that how you see the room depends on where you stand and where you look.

The same is true with the news. The story depends on where you look.

### STUDENT ACTIVITY #2

If you were to go to journalism school and learn how to be a news reporter, one of the first things you would learn is “the five Ws and an H.” They are:

- **Who?** (Who did something?)
- **What?** (What happened?)
- **When?** (When did it happen?)
- **Where?** (Where did it happen?)
- **Why?** (Why did it happen? Why is what happened important?)
- **How?** (How did it happen?)

Every news report is expected to answer those six questions. Ask the questions, get the answers, and you've got a news story. Except: Remember how you and your partner described the room differently? You each told a different story about the room because you were looking at a different part of it.

*the.News* staff started out with a topic: alternative energy sources. They asked a *how* question-- how can cow manure be used to make electricity? That *how* dictated a *who* (dairy farmer), *when* (now), *where* (Vermont), and *why* (because it's good for the environment).

Then the *why* expanded from *because it's good for the environment* to *because it's good for the environment and good business, too*.

The result? A different story than the one they had set out to do.

You can think about changing any of the other *Ws*. For example, you're still doing a story on alternative energy sources, but you made the *where* Washington, DC instead of Vermont. Who would be the *who*? Certainly not a dairy farmer. You won't find any dairy farmers in Washington, DC. More likely it would be a senator, representative or lobbyist.

**Activity:** In the chart below, you'll find the 5 *Ws* and an *H* describing the Cow Power story and three possible alternative stories. The specifics of the Cow Power story you just watched occupy column one. In each of the other columns, one of the *Ws* has been changed, but the *what* remains the same: alternative energy. Fill in the rest of each column to fit the changed element or make up your own changed element.

<b>?</b>	<b>Cow Power</b>	<b>Change the Who</b>	<b>Change the Where</b>	<b>Change the How</b>
<b>Who</b>	dairy farmers	<b>scientists</b>		
<b>What</b>	alternative energy	alternative energy	alternative energy	alternative energy
<b>When</b>	Now			
<b>Where</b>	Vermont		<b>Washington DC</b>	
<b>Why</b>	good for environment and business			
<b>How</b>	using cow manure			<b>Wind power</b>

### **Wrap-Up [Assessment]**

With a small group, discuss how you filled in your chart. Then think about the big question: What have you learned about how a topic becomes a news story?

Here is a summary statement:

Journalists don't just report what happened. Based on specific criteria that are commonly accepted by journalists they decide what to cover and turn into a news story.

What have you learned that supports the statement? Write one sentence on each of the four following points:

- How journalists choose a topic
- How a journalist's point of view affects a news story
- Why a journalist's point of view might **change** during interviews with people
- How the *five Ws* can differ, even about the same topic

Then write a paragraph. Use the summary statement as the first sentences. Write one sentence for each of the four points above. Finally, write a concluding sentence that sums up what you've learned about the news from doing these activities.