**Getting Smart about Electrical Energy**

**Purpose:** Today we will learn about renewable energy research trending now in North Carolina. By the end of this lesson you will be able to evaluate alternative energy technologies for use in North Carolina through the lens of a National Science Foundation (NSF) supported Engineering Research Center, FREEDM Systems Center, located on the campus of North Carolina State University in Raleigh, North Carolina.

**Introduction**: Answer the following questions while viewing the FREEDM Overview PowerPoint presentation.

1. What does FREEDM stand for?  
F\_\_\_\_\_\_\_\_\_\_\_\_ R \_\_\_\_\_\_\_\_\_\_\_\_\_ E\_\_\_\_\_\_\_\_\_\_\_\_\_\_ E\_\_\_\_\_\_\_\_\_\_\_\_\_D \_\_\_\_\_\_\_\_\_\_\_M\_\_\_\_\_\_\_\_\_\_\_

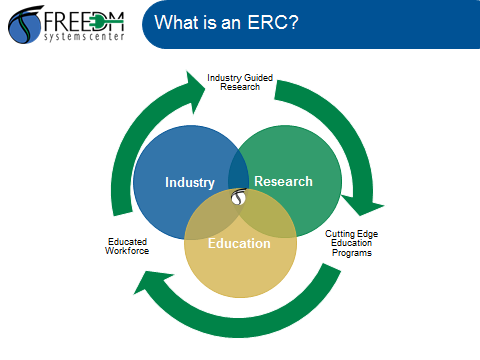
2. How is an “Energy Internet” different from the traditional power grid system?

3. Who is a part of the Global Partnership?

5. FREEDM Systems Center currently has 45 Industry members. Identify at least two industry members you recognize and at least two members you want to learn more about.

|  |  |
| --- | --- |
| **Industry Members I Recognize** | **Industry members I want to learn more about** |
| 1. | 1. |
| 2. | 2. |

FREEDM systems is one of several Engineering Research Centers across the country. The National Science Foundation (NSF) oversees several Engineering Research Centers (ERCs) across the United States. Use the diagram below in order to justify how the FREEDM systems meet the criteria of an ERC:

Think- Pair-Share: How does the FREEDM systems center contribute to the following components of an ERC?

1. Industry

1. Research
2. Education

Video Time: The Science House at North Carolina State University has developed a series of videos to help explain what the FREEDM systems center is and how it works. Using the FREEDM systems website and The Science House YouTube channel to answer the following questions.

**Part 1: Why FREEDM**

Go to The Science House YouTube Channel: <https://www.youtube.com/watch?v=fV1EUTKYtwc> and watch the Why FREEDM video clip while answering the following questions:



Why FREEDM:

1. Using evidence from the video explain why there is a need for

the FREEDM Systems Center.

1. Why is a systems approach necessary?

Go to the FREEDM Systems Homepage <http://www.freedm.ncsu.edu/> click on the About at the top of the page and answer the following questions. 

1. What three factors have contributed to the Energy Crisis?
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. List the five renewable energy sources mentioned in the article. Which ones do you predict could be utilized in North Carolina?

|  |  |
| --- | --- |
| Renewable Energy Source | How could this Renewable Energy Source be utilized in North Carolina? |
| 1. |  |
| 2. |  |
| 3. |  |
| 4. |  |
| 5. |  |

1. The proposed FREEDM Systems green energy grid includes infrastructure that will:

(add 6 bullets)

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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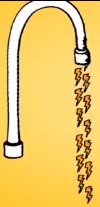
**Part 2: What is FREEDM**

Go to The Science House YouTube Channel: <https://www.youtube.com/watch?v=vCTmhtMA3A8> and watch the “What is FREEDM” video clip while answering the following questions:

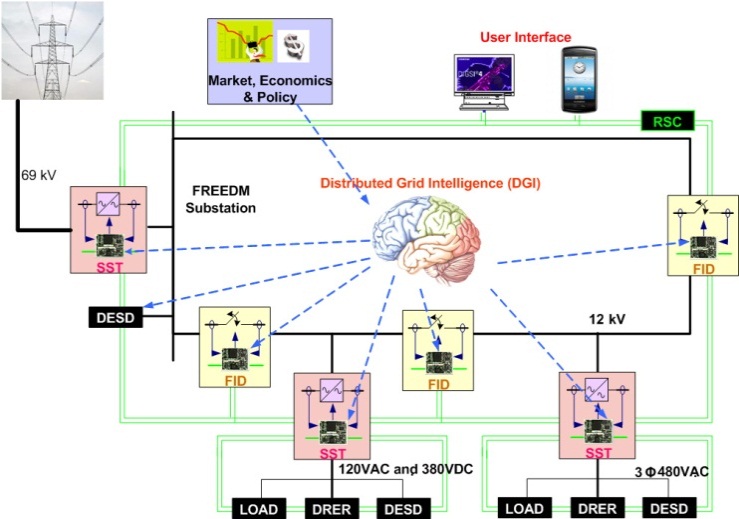


What is FREEDM:

1. Compare the Smart Grid to the Internet.
2. Using the water analogy mentioned in the video describe how our current method of getting electricity is like leaving a faucet running.



1. How is FREEDM Systems Center working to alter the current grid?
2. Apply the water analogy to the “Smart Grid” concept.

Go to the FREEDM Systems Homepage <http://www.freedm.ncsu.edu/> click on the **about tab** at the top of the page then scroll down to **FREEDM Systems page**. Use the diagram to the left and the content found on the webpage in order to answer the following questions.



1. How would you evaluate the claim, The FREEDM system is the "internet for energy".

**Part3: Who is FREEDM:**

Go to The Science House YouTube Channel: <https://www.youtube.com/watch?v=USgYafICZhs> and watch the “Who is FREEDM” video clip while answering the following questions:

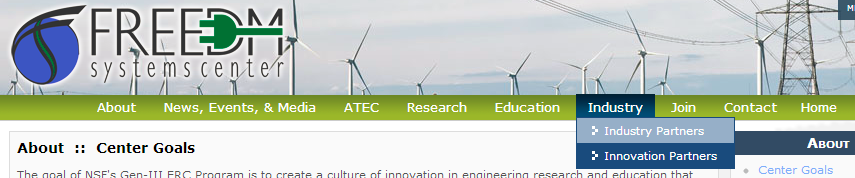


Who is FREEDM:

1. Explain the value of understanding technology in the 21st Century.
2. How are High School Students involved in the FREEDM Systems research?
3. Discuss ways non-engineering fields of study could use the research from the FREEDM Systems Center.

**Part 4: Evaluation**

Go to the FREEDM Systems Homepage <http://www.freedm.ncsu.edu/> click on the Industry tab at the top of the page. Industry Partners participate in the Center at three levels. What types of companies have joined the FREEDM Systems center? Your assignment is to pick one Industry Partner to research and create a product that answers the following questions about that industry partner.



1. What level membership (full, associate, or affiliate)?
2. Type of Renewable Energy (solar, wind, etc.)
3. How is the company connected to North Carolina?
4. What types of jobs are available with this company?
5. How does the FREEDM Systems center work with the Industry Partner
6. Explain how this partnership is helping the FREEDM Systems Center reach their goals?



Click here

Product Rubric:

|  |  |
| --- | --- |
| 4-Advanced | Address **all** six questions. Plus, supports answers with detailed explanations. |
| 3-Proficient | Addresses 5-6 of the proposed questions. |
| 2-Developing | Addresses 3-5 Questions |
| 1-Emerging | Addresses fewer than 3 of the questions. Student repeats task until proficient |
| 0-Not Submitted | No product submitted. |