PROJECT REPORT

Northern Wyoming Community College District / National Science Foundation Summer Energy Education Program 2011

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Aug.10th,2011

TITLE

Rock to Energy Project

(Science behind porosity & permeability of rocks/soil in the process of oil-well drilling)

SUMMARY

The practice of utilizing geological principles, applying geological concepts to the discovery of rocks and recovery of different forms of energy from these rocks are greatly appreciated. It is an amalgamation of knowledge of science, mathematics, engineering and technology. The most interesting part of this education is the field trips to actual formation sites and resources.

ENERGY CONTEXT

Geologists, engineers design industry devices to drill crude oil or coal or minerals that are then converted into the type of energy we need. Drilling oil wells or mining any minerals or coal involves many people, their effort time and money. Above all it takes millions of years. he earth needs very long time to produces these resources. How can we conserve these forms of energy? Are there other alternatives to this problem?

INTENDED STUDENT LEVEL

Grade 9-12

ASSUMED PRIOR KNOWLEDGE

This project will assume that students have prior knowledge of:

- Basic mathematics
- Basic report writing
- Basic science
- Group work etiquette

LEARNING OBJECTIVES

- Students will know the three types of rocks and their basic definitions.
- Students have a working understanding of how oil forms.
- Students will be able to take independent notes in a science log/notebook from the class discussion.
- Students will be able to participate in large and small group discussion before, during, and after the lecture &labs
- Student is able to use graph paper with ¼ or ½ inch size squares to create drawings.
- Student is familiar with the mathematical term “mass” and “volume” can determine area with teacher guidance.

MATERIALS

Photographs, computers with various software, electric bills, water bills, log book, pen, pencil board to present for the project. However, for the lesson—beaker, weighing machine, volumetric cylinder, water, Paper towel.(for today’s trial lab)

1. Gigapan.org (god for virtual trip, a collaboration of NASA)
2. American wind energy association: www.awea.org
3. Home energy assessment in NJ : www.36chestnut.com
4. www.entecheng.com
5. Carbon foot print sites ----google it
6. Offshore Renewable Energy Park
7. www.detect-inc.com/wind.html : wind energy Project bird & bird Survey.
8. www.eere.energy.gov/industry/bestpractice/pdf/sdo

INTRODUCTION / MOTIVATION FOR STUDENTS

Students will be shown U-tube on oil technology

Hiking, collecting rocks, web search . Here is some of my experience with Field Work:

PROCEDURE

- Students will work individually. Ask them to go to different websites and record information relevant to the topic.
- Record the work that they are doing
- Arrange trips to areas where there are reports of sedimentary rock deposition nearest to your school
- Take students to oil refineries, if possible
- Ask students to bring their electric bills, water bills.
- Read and record
- For today's simulated lab---
- Students will first find the mass of rock/soil from earth's strata –
- Record its volume by using measuring jar or by displacement method
- Soak in water and find the mass
- Record your data from each step and
- Calculate and write the result

SAFETY ISSUES

Make sure to follow all the district guide lines for field trips.organization and clean up after the lab.

TROUBLESHOOTING TIPS

Keeping the log of their work/ week. Check and recheck

ASSESSMENT

Pre- test sheet #1 at the beginning of the project
Rubrics for the board assembling of the entire year 's work plus their presentation in school science symposium.
Some of the questions to ponder :
Q.1 Are all rocks capable of producing oil?
Q2. What do you think about a rocks?
Q3. Is it possible to distinguish different ways of energy production?
Q4. Identify alternate sources of energy
Q5. Identify the ways of mineral processing that are economic.
Q6. Group discussion: Look at the rocks that contain oil or minerals and discuss how long it takes to form such rocks.
Q7. How many people need to work to explore oil, gas, or minerals?
Q8. How could we solve the problem of limited resources and its use?
Some of the Websites that students will use are
www.google earth .com
EIS Environmental assessment

SUGGESTED EXTENSIONS

Science of Porosity and Permeability in oil well drilling (power point presentation)

Name---------- Date----------

POROSITY – SIMULATION LAB

Aim: How could one measure the porosity of rock/ soil ?

Note : Porosity = mass of saturated soil-mass of original soil/volume

Hypothesis:

Material required:

Procedure:

Data:

Calculation:

Result:

Conclusion

Analysis
Q1. What is porosity?

Q2. What precaution did you take?

Q. 3. While performing the experiment, what went well and what did not go well? Write in complete sentences.

Q4. What is permeability?

Rock or soil porosity and permeability in drilling oil wells

Important Science words :

Porosity= Volume of void space/ Total volume of the solid

[This is a good way for soil, If you have the initial volume of the soil then all you have to do to find the void space is saturate it with water. As long as you know the weight different between before and after saturation you can find the void space because we know that water's density is about 1g/cm^3.]

Porosity= ((mass of saturated soil - mass of original soil) Density of water) / Volume of original soil

Permeability= **Petroleum geology** refers to the specific set of geological disciplines that are applied to the search for hydrocarbons (oil exploration).

Permeability calculates how easily hydrocarbons will flow out of them.

Force= mass x acceleration due to gravity

Pressure = force/unit area , Density = mass/volume

Pore Pressure = h x d X g where h = height, d= density, g= gravity

Formation fluid = oil, gas, water under pressure

Circulation fluid = drilling mud that counter acts well bone pressure

In oil fields pore pressure is generally expressed as h x d x 0 .052Psi

where h= height of fluid column in feet

d = density of fluid in lbs/gallon

.052 is conversion factor

For example; 1000' of water column will exert a a hydrostatic pressure at the bottom

1000' x 8.33 x .052 = 433.16 psi

(density of fresh water is 8.33lbs/gal)

In other words gradient fresh water will be 433/1000= 0.433psi/feet

[Gradient/.052= density in lbs/gal]

Activity sheet #2

1. Bring a copy of electricity bill from home past month and think of ideas or the ways of reducing the bill.

2. Look for the bill following week and compare it with last month. Note the monthly payment.

3. Note what percent of the electricity you could save from last month?

4. Record this every month and report at the end of the semester.

5. Repeat this type of experiment with water bill, gas bill.

6. Why are we doing this activity? How do we account for this activity?