



Green Schools Network

ACTIVITY SHEET

February 2011

Why talk about Nuclear Power?



470,000 Megawatt by 2050 - this would be the total capacity of India's nuclear power plant's if our Prime Minister's plan was realized. To give you an idea about what we are talking about: With 470,000 Megawatt you could supply more than 100 mega cities like present Delhi at peak time.

"It's safe, it's clean, it's economical and uses national resources!" In a nutshell this is why many citizens and politicians want nuclear power to become one of India's major energy sources.

But is it really safe, clean and economical? Let's explore this in the following activities!

Name

School Name

Class Date

Activity 1: How is India's electricity generated?

So far the Prime Minister's plans have not been realized. Have you ever wondered where the electricity that you consume comes from? To find it out go online on <http://www.powermin.nic.in>. Then click on "Indian Electricity Scenario". You can now see how and from which sources India's electricity comes from and complete the table. Using the percentages from the chart also complete the blank circle below to make a pie chart.

Source of Energy	Percentage	Capacity in MW	Colour legend in pie chart
Other Renewables (RES)			
Hydro Power			
Nuclear			
Natural Gas			
Oil			
Coal			
TOTAL			
How much electricity is planned to be produced by nuclear power in 2050? Read the Introduction again and write it here.			

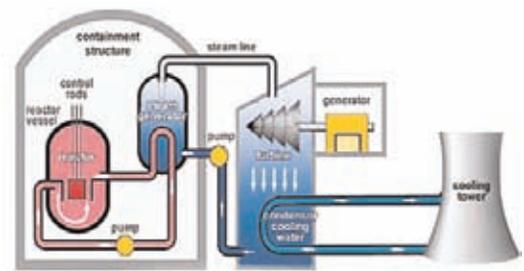
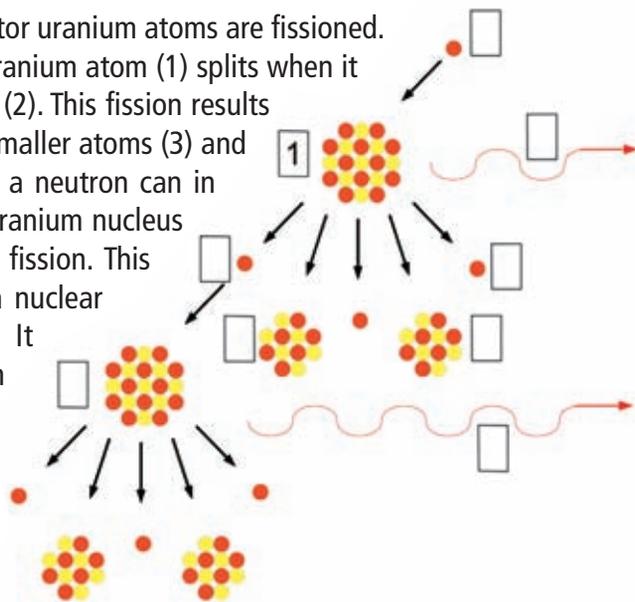
Activity 2: How does a nuclear power station work?

Let's now try to understand what a nuclear power station is and how it works. Both the text and diagram on the next page explain what is happening in a nuclear power plant's reactor. Match the different steps of the nuclear chain reaction in putting the numbers given in the text in the diagram's boxes.



Hi! I am Pandit Gobar Ganesh. You will find me in Gobartimes—a magazine that tells you how your everyday life is linked to the world around you. Hooked, huh? If you want to know more about me and Gobartimes visit us at: www.gobartimes.org

In the nuclear reactor uranium atoms are fissioned. The nucleus of a uranium atom (1) splits when it is hit by a neutron (2). This fission results into two or more smaller atoms (3) and neutrons (4). Such a neutron can in turn hit an other uranium nucleus (5) and trigger its fission. This process is called a nuclear chain reaction. It releases energy in form of heat (7).



The heat (7) generated through the nuclear chain reaction is converted into electrical energy with the help of a steam reactor and a turbine.

Gobar Gyan: Are nuclear power stations safe in operation?

Uranium used in a reactor and some of its fission products are radioactive. This means that they emit radiation which damages and kills cells of our body. Even the tiniest amount can be very harmful. For this reason, it is essential that all radioactive elements are safely contained within the reactor.

Let us now introduce Dr. Doubt and Professor Pro. Both are renowned experts in nuclear power, still they have most contrasting opinions. Let's see what they tell us about a nuclear power plant's safety.

Prof. Pro: "Imagine a country which has two reactors which it has operated for the past 30 years. The total number of operating years would be 60. The total number of all reactors world wide is more than 14,000 years. Despite this huge number only few accidents which led to a substantial release of radioactive material into the environment have occurred. The fatalities in the context of fossil fuels such as mining accidents or respiratory diseases of a single year easily outnumber those caused in context of nuclear power during the last 50 years.

A nuclear power plant has various safety mechanisms. And for the most unlikely case that they all fail the reactor is located within a containment made of steel & concrete. In case of an accident it will prevent any leakage of radioactivity into the environment."

Dr. Doubt: "Fast Breeder Reactors are designated to be the future backbone of India's nuclear power generation. But in the present plans the armoured concrete containment is too weak. It would not withstand a severe explosion of the reactor. Is this safe?"

In Jaitapur, Maharashtra two new reactors of European design will probably be built by the French company Areva. Because of safety concerns approval of the same reactor type was rejected in US. And consider one more thing: A nuclear accident may be very unlikely but if it happens it's consequences can be devastating."



Activity 3: Nuclear accidents - How harmful is radioactivity?

The most severe nuclear accident took place on 26 April 1986 in Ukraine when one reactor of the Chernobyl Nuclear Power Plant exploded and caught fire. Huge amounts of radioactive material were released into the atmosphere. Find out more about the Chernobyl accident. How many people were killed and how many were injured on the spot?

How many people had to be resettled because their land was too contaminated?

Do people still suffer from diseases caused by exposure to radioactive material produced by the accident? Which are these diseases?

How many people suffer from such diseases?

People in India have been exposed to radioactive material. Do you know about any recent exposures of people to radioactive material in Delhi? Write what happened.

What are the health consequences on affected people? How did the public come to about their exposure?



Gobar Gyan: What is nuclear waste and why is it hazardous?

Uranium is commonly used as a reactor's fuel. Its fission leads to several radioactive products. Together with unusable uranium they form nuclear waste. Since some of its components degrade extremely slowly it will take hundreds of thousands of years until they do not radiate any more. Until then the waste has to be shielded from the living environment.

Dr. Doubt: "Did you know that there is not a single final storage site for nuclear waste in operation world wide? And this is for good reason. We simply cannot guarantee safe nuclear waste disposal for such a long time period. How should we today find a place which will still be safe after hundred thousand years if we have not the slightest idea how the world will be at that time. The nuclear waste generated today is an enormous

threat to the health of future generations."

Prof. Pro: "Although there is no final repository in operation now there are various promising sites which are being examined at the moment. With our geological knowledge we can find a place which is safe for as long as the radioactive waste is dangerous. And did you know that the amount of electricity leading to 1 gram of nuclear waste would lead to approximately 3 tons of waste in form of CO₂ and SO₂ if produced by a coal fired plant".

Activity 4: How long-lived is nuclear waste?

Technetium 99 is a fission product generated in Uranium fuelled reactors. It remains radioactive for long period. Around 5 per cent of the initial amount generated in the reactor will still be present after one million years.

How old were your parents when you were born. Calculate the average and write it here. _____
Divide 1.000.000 by that average age. Write your result here: _____ This is the approximate number of generations which will still be threatened by the nuclear waste we are producing today.

Activity 5: Discussion

Have you followed the debate between Dr. Doubt and Prof. Pro carefully? Now it's your turn to find out discuss if you want still nuclear energy to be one of India's primary sources of electricity. Try to structure your debate as suggested in the chart. One of you should write a protocol in form of a similar chart and summarize the key arguments of your debate. Before you start also research on topics not discussed on the sheet like energy security, costs, consumption of space and pollution due

Topic	Reasons Pro Nuclear Energy	Reasons Contra Nuclear Energy
Costs		
Risk of accidents		
Waste		
Climate		
Energy Security		
Health		



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