

NANO - Role Play

Nano-based solar cell

With the world's population set to rise and demand for energy set to increase, energy production is one of the most pressing global issues that humanity must address over the next few decades. Alternative technologies must be developed to reduce the dependence on highly polluting fossil fuels, whilst still being economically viable. By harnessing the energy from the sunlight, the sun could provide the



answer to all our energy needs. Solar cells convert sunlight into electricity. Current commercially available solar cells show moderate efficiency at converting the sun's energy to electricity but are expensive to produce. This is because they rely on highly pure materials, need very high manufacturing temperatures and often require expensive "dopant" materials.

Recently, new solar cell architectures have been designed which utilise nanomaterials and can be made flexible and lightweight. This is because they have a very high internal surface area for capturing the sunlight (due to their nanostructure). They also use chemicals to capture the sunlight, similar to the way a plant harnesses the sun's energy. These chemicals are bound to a highly porous scaffold of nanoparticles of titanium dioxide, which is very efficient at transporting the electrons produced by the chemicals to the outside circuits.

When these nanomaterials are encapsulated or contained within a device, the risk of them coming into contact with the user is very low. The problem may occur when the device comes to the end of its lifetime. There may be problems with disposal of the device, especially if the regulation and control of these devices lags behind their development.

The Dilemma:

Should solar cells incorporating nanoparticles be commercially manufactured before any associated risks are fully established?

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Stakeholder: Manufacturer

You represent a company that has developed a very cheap method of producing solar cells using nanoparticles and wish to begin selling them.

Your primary motivations are:

- To provide a valuable product to consumers.
- To generate profit for stockholders.

Consider the following:

- Your company invested a lot of money into developing the product, so are keen to sell as many devices as possible in order to show a profit.
- Your company has competitors within the solar cell market. Your goal is to be sure that your product remains cheap and reliable.
- Society has already embraced many technologies with which there are risks.
- Traditional silicon-based solar cells are not the ideal solution either. They are expensive to make and often need unpleasant processing steps.

• **Share your opinions with the group**

I think.....

• Note: You may come up with additional ideas, do not feel limited by the information above.

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Stakeholder: Government

You represent the government which can make and enforce laws.

Your primary motivations are:

- Promote any technical innovation that can provide energy that is both green and more efficient is definitely worth investigating.
- Promote and preserve technological superiority of the nation.
- Protect the citizens from harm (even if they want otherwise).

Consider the following:

- Nanostructured solar cells are an exciting new technology which aims to solve many of the current and potential environmental problems.
- Concern has been raised about the safety of this technology; therefore restrictive legislation would have to be put in place.
- Society has already embraced many technologies with which there are risks.
- The speed of technology regulation has always lagged behind product development. Science and technology is such a fast moving field.
- The risk must be weighed up with the advantages that such a technology could bring.

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Stakeholder: Consumer

You represent the consumers seeking for a reliable safe product.
Your primary motivations are:

- Wanting to maintain our current lifestyle.
- Make sure that you get the most cost – effective product.

Consider the following:

- Society has already embraced many technologies with which there are risks.
- With this nanostructured solar cell technology the aim behind it is to solve many of the current energy problems.
- Cheap, plentiful energy is something which I've grown used to. I don't want to have to spend more on products and food and fuel. If we continue to rely on fossil fuels, everything will get much more expensive.
- Green energy through nano solar cells is the ultimate goal. Even if it had to be achieved by putting potentially toxic waste into the environment.
- Obviously green energy through nano solar cells is the ultimate goal. But it is not to be achieved by put potentially toxic waste into the environment.

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Stakeholder: Environmentalist

You represent the agencies and groups seeking to provide the best outcomes for the human and natural environments both now and into the indefinite future.

Your primary motivations are:

- Maximize the use of electric power generated by sustainable, economic, and environmentally acceptable technology.
- Provide a long-term commitment to energy research, development, and demonstration.

Consider the following:

- Obviously green energy through nano solar cells is the ultimate goal. But it is not to be achieved by put potentially toxic waste into the environment.
- Society has embraced many technologies in the past which had been proved to be risky.
- The aim behind it is to solve many of the current energy issues, but unexpected effects such as nano particles could prove to be harmful to human health and the environment in the future.
- At this point in time cautions and monitoring means have to be taken before using the nano solar cell solutions.

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Stakeholder: Scientist

You represent the community of scientists and researchers in the nano science and nano technology field.

Your primary motivations are:

- To seek knowledge and understanding of the natural world on an atomic and molecular level
- To control matter on an atomic and molecular level
- To create many new materials and devices with wide-ranging applications, such as in medicine, electronics, and energy production

Consider the following:

- Discoveries, invention and developments are the "driving force" for human progress in different areas of our life
- These discoveries are based on research held by scientists
- There is always a balance to be considered when potential risk is put against potential development. There are always compromises.
- Energy and environmental solutions are at the moment paramount for our society and to restrict development in this area would be wrong.
- Society has embraced many technologies in the past which had been proved to be risky.

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Stakeholder: Child (you)

What is your opinion?