



## **PROBLEM STATEMENTS**

### **(Department of Chemical Engineering)**

#### **1.Pump-It**

Pump-It challenges you to design a centrifugal pump from scratch and power it by a voltage source. Apply your brilliance in fluid mechanics and process control to force the fluid to the desired height. Working on the basic principle of conservation of energy, pumps play an important role in industrial operations. Gear yourself to come up with the design of pumps and play with parameters to achieve the desired flow rates.

#### **2.Utilizing and storing of renewable energy resources.**

Cost-effective storage of solar energy (including solar energy embodied in wind and ocean currents) to enable distribution at times of peak human demand (on rainy days) remains a critical issue. Development of reversible processes for energy storage and utilization that have rapid start-up and shut-down characteristics is therefore of prime importance. Develop an energy providing and storing system with maximum efficiency you can.

#### **3.Biodiesels: Converting oil into clean fuel**

Most of the energy and fuel that we use in is derived from burning fossil fuels. Fossil fuels are a nonrenewable source of energy. Once we have used up the fossil fuels that are present on Earth, we will have to wait millions of years to have access to more. What will happen when our reserves are tapped out? This is a question that has many scientists and citizens concerned. One answer to this question is to develop alternative ways of creating energy, and one such alternative source of energy is biodiesel. Biodiesel is a clean fuel that can be made on-site in villages or in local communities from locally grown resources. Biodiesel can be used in specially converted car engines, or along with conventional gasoline in regular engines.

In this project, you will make biodiesel using several different types of oil. You should research different ways of making biodiesel and the best oils to use. How do the properties of the oil affect the biodiesel? Experiment with the temperature at which you mix the components, as well as the time you allow the mixture to settle. Can you design an apparatus to efficiently filter the undesirable byproducts of the reaction? Remember, you'll also need to devise a way to compare the biodiesels you make.

#### **4. Biodegradable Plastics**

Plastics are made of polymers, chemical structures containing many repeated subunits. How does the polymer type of a plastic affect the biodegradability of the plastic? Do research on how plastic is made and what types of polymers are used for making different plastics. Can you learn to make your own plastic? What materials can you use for making plastic that is biodegradable? Test biodegradability by burying plastic samples for different lengths of time. Reducing solid waste and consumption of non-renewable resources are both worthy goals. Coming up with a biodegradable plastic gets you only part of the way there. In order to be a substitute for petroleum-based plastics, a biodegradable plastic needs additional material properties that available plastics have. For a more advanced project, consider these other properties, too. For example, would a biodegradable plastic be strong? Inexpensive? Would it last long enough to do its job.

#### **5. Design concept or simulation to improve energy efficiency in a petroleum refinery**

Carbon Dioxide emissions and reducing greenhouse gases in the atmosphere is a prime focus for every industry nowadays. The vision behind this project is to optimize the operation in a steam generation and distribution network in a petroleum refinery such that the electricity produced is optimized while lowering the natural gas input into the steam generation system. Consequently, more electricity can be sold to the grid and lowering the amount of fuel gas will result in cost savings and reduced CO<sub>2</sub> emissions into the atmosphere.

#### **6. Design of a solar thermochemical plant for hydrogen production**

The focus of our project is to design a continuous solar plant that utilizes the sulfur ammonia thermochemical cycle for production of hydrogen. The design project aims to develop a simulation model, after investigating and analyzing several design variables and perform a cost analysis/sizing of the equipment and the solar field. The project also covers sizing a hydrogen storage system to meet the daily hydrogen demand. The aim is to optimize the cost of hydrogen production from solar energy.

#### **7. Design and construction of bio filtration unit for air pollution control**

This project aims to design an efficient and economically feasible control technology that can be used to eliminate contaminants from air. A bio filtration unit was designed to remove 90% of the contaminants it processes. The approach taken involved equipment design, construction of the bio-filtration unit and process simulation modeling of the bio-filter. The prototype will be beneficial to the Chemical Engineering faculty since it has the potential to be integrated into the laboratory curriculum.