

What is our Future Energy Source?

by
Johannes Domke
Theo Bergenthal

Advanced Computer Science Class

Silver High School
Silver City, NM
Final Report
April 3, 2002

Adventures in Supercomputing
Team Number 096
Teacher: Peggy Larisch

Contents

	Page
Executive Summary.....	3
Introduction.....	4
Description.....	5
Renewable Sources.....	5
Limited Resources.....	5
Code Description.....	5
Program Output.....	7
Conclusion.....	8
References.....	10

Executive Summary

The growing World population and depending on this the annually growing World Energy Consumption led us to think about these world problems.

In our project we collected information about the different ways producing and consuming energy and compared the advantage and disadvantages in efficiency, security, amount and price for production. Based on our researches, calculations and comparisons we came up with the following solution:

Renewable Resources are proven the environment friendliest and cleanest sources available for us nowadays. But we excluded these sources because they are way too expensive and not reliable, what means you always have to have a backup power. So we decided to compare “Natural Gas”, “Oil”, and “Uranium”.

We came to the conclusion that Uranium is the overall best source we have to guarantee our future energy consumption. We based this decision on the following facts.

The biggest problem with nuclear energy is the waste and the security. But you can almost avoid the problem of waste by recycling. 97% of all the nuclear waste could be recycled but nowadays we prefer to bury it and just use new uranium. We also have very high security standards today in the nuclear power plants so that they would survive and earthquake or an airplane crash. Another very important point is the efficiency of the “nuclear energy” compared to the volume and price. Further you have no environmental pollution through the power plant in the contrast to gas, coal, and oil.

We made the audience to face the problem and came up with suggestions and solutions to change the energy circumstances.

To show the audience our problem also in another way we added a Energy-Program to our presentation. In the contrast to the presentation the user cannot only collect some dates about population and energy nowadays and in future, but also input values into the program and get more specific information. We used the C++ language to write the program. Listed below are some of the program points:

- Compare the different energy sources Coal, Gas and Uranium in efficiency and price.
- Get information about the world population in relationship to the world energy consumption. (Also some Graphs are available)
- Get future-predictions for world population and world energy consumption using linear and logistic regressions.

Nuclear Power is the only source that guarantees us a safe future without energy problems.... Not only for the next 30 years but also for the next 100 years...
...but we still have to look for newer safer more efficient and better ways to produce energy in future!

Introduction

One of the biggest problems today, which not only affect America, but the whole world, is the Production and Consumption of Energy. All of the major countries meet every year and try to find the perfect solution to produce energy clean, safe and efficient and to consume as less energy as possible.

Statistics show that over the last 100 years our environment has been severely damaged, for example the holes in the ozone layer or the increasing of the temperature. Those circumstances have to be changed and new ways found to minimize energy consumption.

Another point, to be considered, is the growing world population that uses annually more and more energy in the contrast of the natural resources which are decreasing annually and the increasing rate at which these resources are being depleted.

These are world-problems, problems, which our generation has to look after, problems, which will have consequences our generation has to face...in maybe 20 or 40 years.

These points made us think a bit more critical about this “World’s Energy Problem”. We started this project by conducting several researches on the ways to produce and consume energy. Finally we came up with a conclusion depending on the actual possibilities we have today and also made some suggestions with the most efficient and reliable source for the future.

Description

The goal of this project is to find the most reasonable energy source for the future. Therefore we researched all different kinds of sources, including the renewable sources like solar energy, wind energy or energy provided by water. But after a while we recognized and proved that all different kinds of renewable resources are not really an alternative to the limited sources because they all need a reliable backup power which could replace it completely. Furthermore the technologies to collect renewable sources (like solar panels or wind mills) are in the most cases very expensive.

So we decided to compare the major sources like gas, coal, and uranium among each other in efficiency in relationship to their prices, availability and safety.

Our program consists of about 550 lines of code written in C++. First we implemented the different energy sources and compared them in their different ratios of input compared to their output. Further on in the project we put in the different prices of the energy sources to be able to compare them also from the economical side. Another thing we put in the program is the possibility to predict our future world population based on a linear equation and a logistic equation with a limit. Initially it was difficult to decide what type of equation should be selected because the world population graph from the year 0 to the year 2000 exhibits a strong exponentially increasing trend. However several interesting trends do appear for recent history. The world population graph of the last 50 years shows a linear relationship and in 1998 the graph changes from concave up to concave down, which means that the annually change of the world population is not

increasing anymore and becomes smaller and smaller. Our problem was what function to pick to get a graph that is as realistic as possible. So we decided to give the user the choice between two different possibilities of predicting the future world population. The linear one could be used for a prediction not too far into the future, approximately for the next 30 years.

$$[F(x) = 0.717362257 * x - 137.4919423] \quad \text{- where "x" represents the year}$$

In the logistic function we put a limit of 10 Billion people to the year 2100, because of our limited resources that probably would not last for more than 10 Billion people.

$$10.3732 / (1 + 3.3068 * 2.7182^{(-0.0307E26 * x)}) \quad \text{- where "x" represents the year}$$

But all in all you can never tell the exact number. In case there is a catastrophic disease or even another world war, the world population could decrease drastically.

Besides all this, we put in another linear equation to predict the world energy consumption. This is based on our earlier assumed linear equation of the growing world population.

Two graphs were implanted into the program to enhance the visual presentation, one for the prediction of the world population and one for the prediction of the world energy consumption.

The output of the main menus in our program basically looks like the following.

Program Output

-----What do you want to do?-----

- I. Compare the energy you can get from the different sources
 - II. Compare prices of energy sources.....
 - III. Worldpopulation & Energy ... Now & In Future
 - IV. EXIT
- I.
1. Coal to Gas
 2. Coal to Uranium
 3. Gas to Coal
 4. Gas to Uranium
 5. Uranium to Coal
 6. Uranium to Gas
 7. Main Menu
- II.
1. Price of energy produced with Coal
 2. Price of energy produced with Gas
 3. Price of energy produced with Uranium
 4. Main Menu
- III.
1. How many people live in the world right now?
 2. How much energy does the world use right now?
 3. How many people will live in the world in the future (linear regression)?
 4. How many people will live in the world in the future (logistic regression)?
 5. How much energy will the world use in future?
 6. Graph of population
 7. Graph of energy consumption
 8. Main Menu

Conclusion

After all our research and comparisons of the advantages and disadvantages of the several energy resources, we came to the conclusion that nuclear power is the best future energy source. Uranium is easy and cheap to get and it produces the energy very efficiency and clean. The main problem with nuclear power is basically the safety of the power plants and the problem with the waste that is produced. But also those problems can be reduced.

Nowadays the safety standards are generally very high, at least in all first world countries. Large containment structures surround the reactor, so that even in case of a explosion inside the power plant no radiation could come outside. The outer containment shield that surrounds the nuclear power plant is so strong that it could survive a crashing airplane. The waste: 97% of the waste we produce with nuclear power plants could theoretically be recycled. We just don't do it because it is much more comfortable to bury the waste in the earth and take new uranium. But if the waste products were recycled there would be only a small fraction of unrecovered waste and those big waste problems, which many people use often as an anti-argument against nuclear power plants, would decrease drastically.

The main advantages of nuclear power, compared to the other sources, are the good volume- efficiency relationship and that it doesn't pollute the air with smoke.

Of course, the more money we put in developing nuclear power plants, the better and safer the technology and the easier our energy production becomes.

We also thought about fusion as a reliable future energy source. It would be a very efficient source that uses just a little bit of water to generating lots of energy without creating any waste.

Unfortunately, that is a “Dream Of The future” and we have to be realistic with our possible opportunities of generation energy. Nuclear Power is the only source that guarantees us a safe future without energy problems.... Not only for the next 30 years but also for the next 100 years.

References

- South Australian Chamber of Mines and Energy <http://www.uraniumsa.org>
- Oregon Office of Energy <http://www.energy.state.or.us>
- Uranium Information Centre (Melbourne, Australia) <http://www.uic.com.au>
- Energy Information Administration <http://www.eia.doe.gov>
- International Energy Agency <http://www.iea.org>