



Why Algae?

An investigation into algae-based biofuel

Fossil Fuels

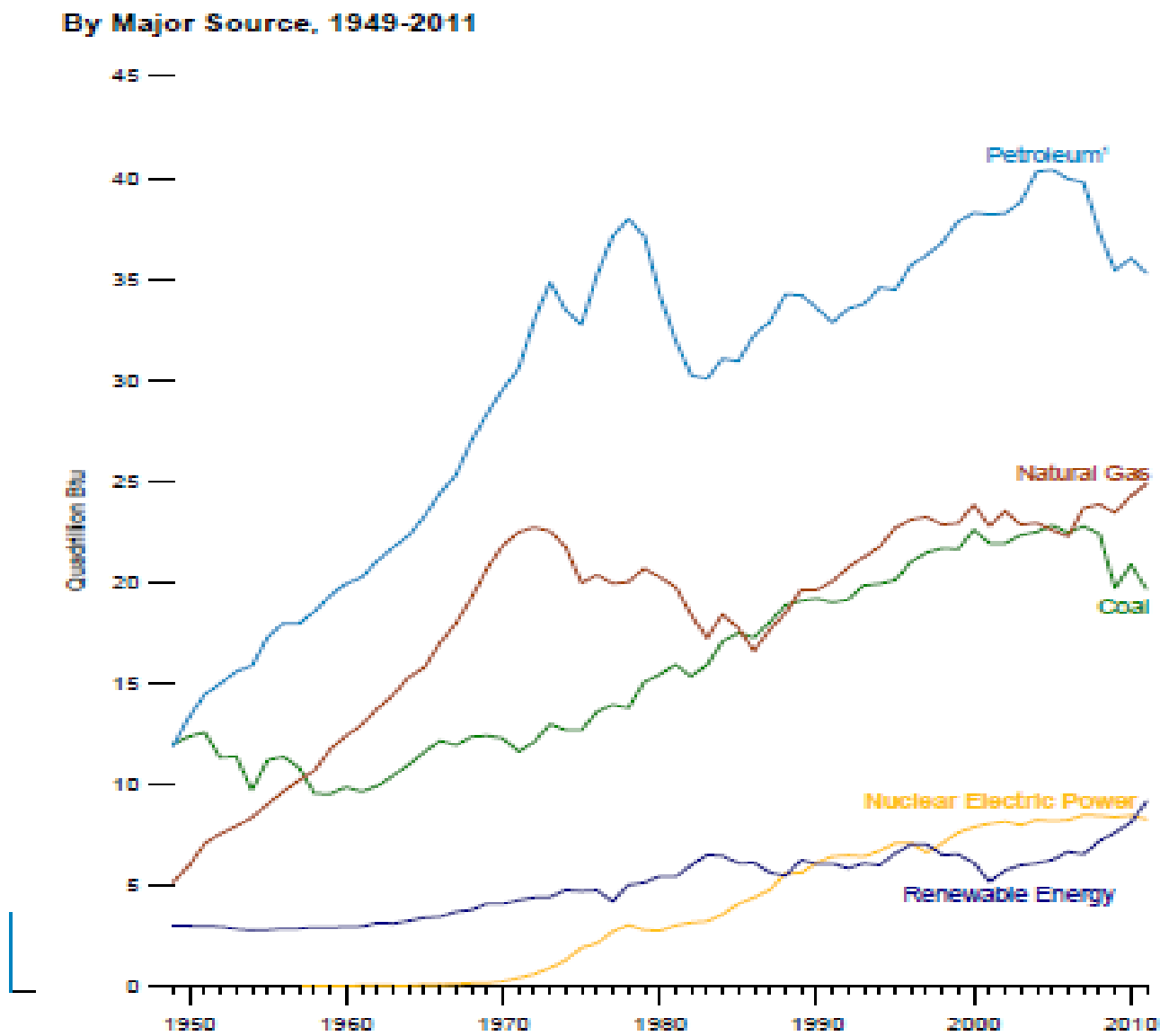
- ▶ Fuels composed of the organic remains of ancient plants and animals
 - ▶ Coal
 - ▶ Crude Oil (Petroleum)
 - ▶ Natural Gas
- ▶ Advantages
 - ▶ High amounts of chemical energy
 - ▶ Infrastructure and drilling techniques are well established.
- ▶ Disadvantages
 - ▶ Nonrenewable
 - ▶ Pollution



Fossil Fuel Consumption

- ▶ The Energy Information Administration estimated in 2011 that the US's primary sources consisted of
 - ▶ Petroleum: 40%
 - ▶ Coal: 23%
 - ▶ Natural Gas: 22%
 - ▶ Nuclear: 8%
- ▶ AMOUNTING TO
 - ▶ 93% total use of nonrenewable fuels
- ▶ We are very dependent on nonrenewable resources

Figure 1.3 Primary Energy Consumption Estimates by Source



¹ Petroleum products supplied, including natural gas plant liquids and crude oil burned as fuel. Does not include biofuels that have been blended with petroleum—biofuels are included in "Renewable Energy." For petroleum, product supplied is used as an approximation of

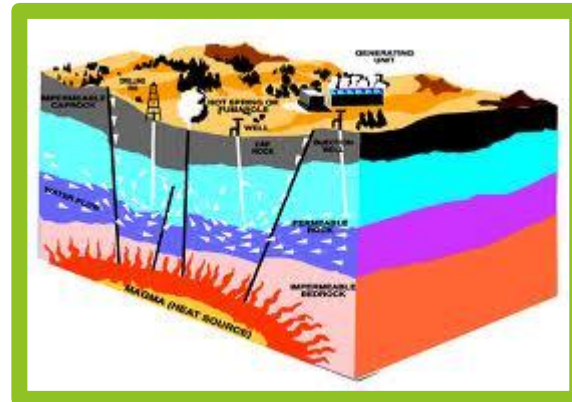
petroleum consumption. See Note 1, "Petroleum Products Supplied and Petroleum Consumption," at the end of Section 5.
Sources: Tables 1.2 and 1.3.

What's the problem with dependence?

- ▶ Fossil fuels are **NONRENEWABLE**; they will run out
 - ▶ We've known we've been running out of fossil fuels since the 1990s
 - ▶ We still haven't done anything about it
 - ▶ British Petroleum
 - ▶ Statistical Review of World Energy shows that the world still has enough "proven" reserves to provide forty more years worth of consumption at the current rate
- ▶ **OUR GENERATION NEEDS TO TAKE A STAND**
- ▶ **MAKE A CHANGE, ENJOY RETIREMENT**

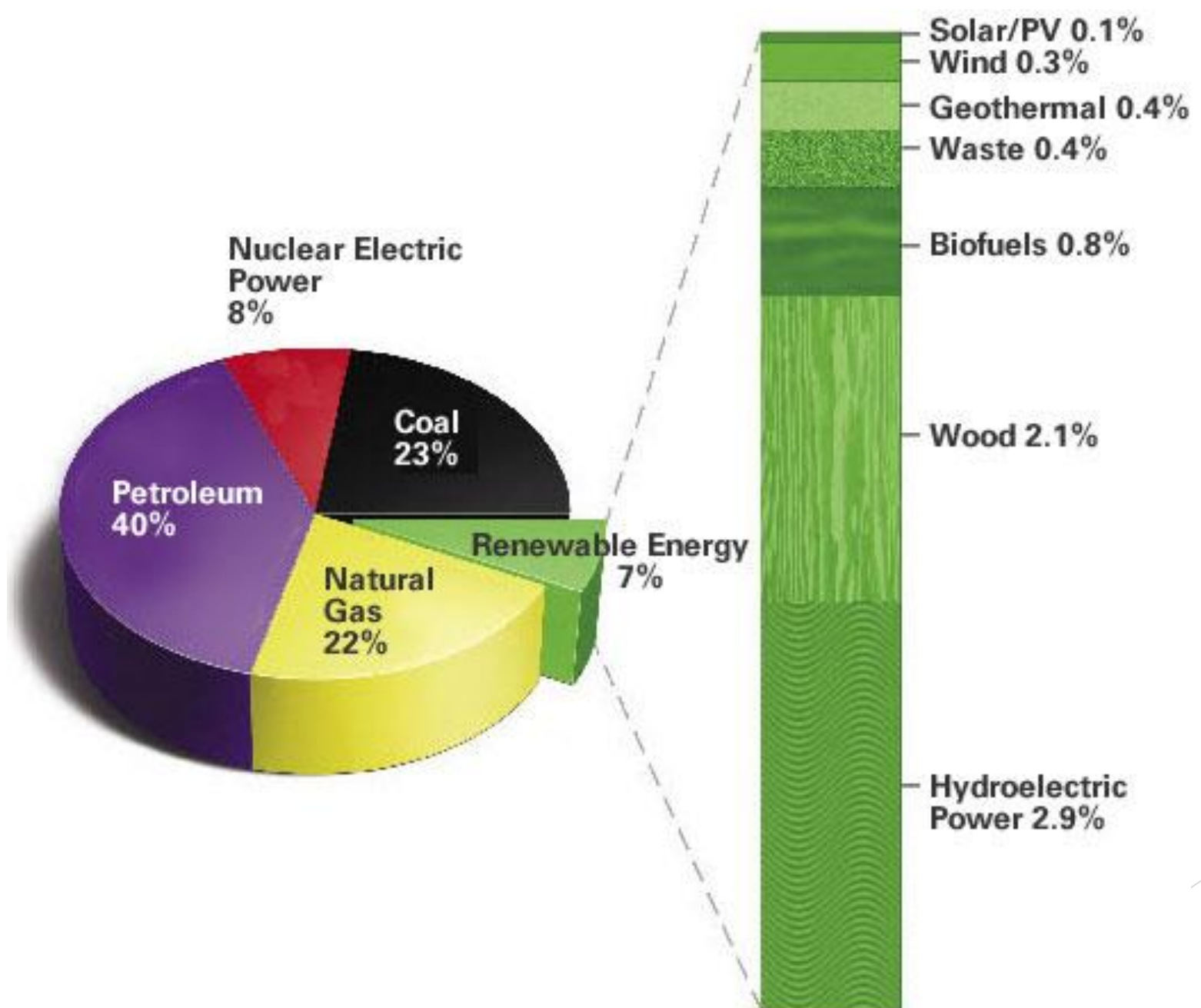
The Solution....

► Renewable Energy!



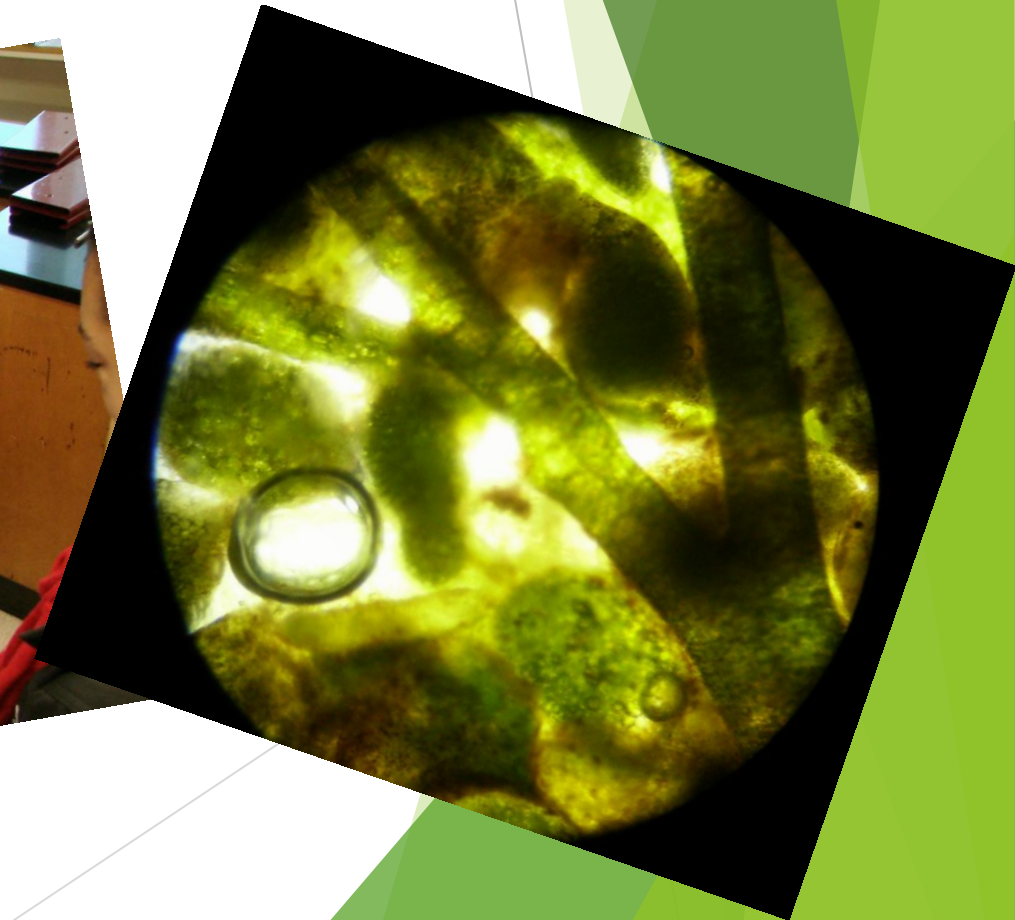
Renewable Energy

- ▶ Accounts for 7% of total U.S. energy consumption
- ▶ Solar (.1%)
 - ▶ Makes energy from sunlight, but no potential for future improvement
- ▶ Wind (.3%)
 - ▶ Depends on location
- ▶ Hydroelectric (2.9%)
 - ▶ Depends on flowing water
- ▶ Geothermal (.4%)
 - ▶ Expensive, not feasible on a high school level
- ▶ Biofuel (.8%)
 - ▶ Young industry, huge potential
- ▶ Other (2.5%)



The Solution...

► Biofuel!



Corn

- ▶ Ethanol - most common biofuel
- ▶ Limitations
 - ▶ Space
 - ▶ Single Harvest
 - ▶ Seasonal
 - ▶ Climate



Other Biofuels

Plant	Yields(gallons per acre per year)
Corn	18
Soybeans	48
Safflower	83
Sunflower	102
Rapeseed	127
Palm	623
Algae	5,000-15,000

Benefits of Algae

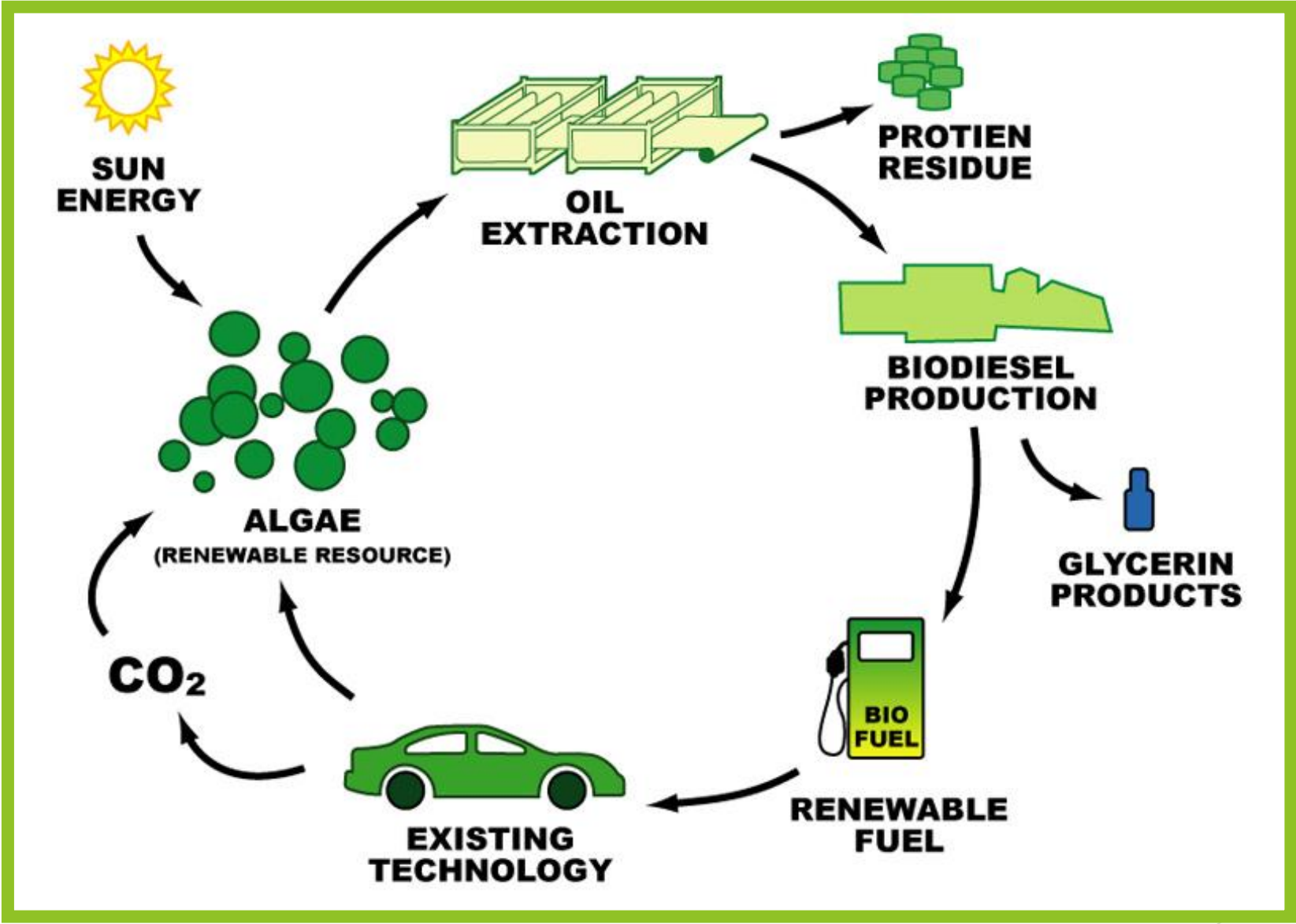
- ▶ Algae
 - ▶ Very efficient and fast producing source of fuel
 - ▶ Under optimal condition, can double quantity in 24 hours
 - ▶ Extremely abundant
- ▶ Algae can produce approximately 100 times more fuel per acre than other renewable resources
 - ▶ Vertigro vs. Pond
 - ▶ Controlled vs. Open



More Benefits

- ▶ Able to control factors
 - ▶ Light
 - ▶ Water Temperature
 - ▶ Fertilizers
 - ▶ Carbon Dioxide or Oxygen
- ▶ Carbon Sequestering
 - ▶ Uses Carbon Dioxide from its environment
 - ▶ Reduces Carbon Dioxide emission by 50%-70%





Benefits of Biodiesel Over Diesel

- ▶ Biodiesel can be produced in the U.S
 - ▶ Decreases dependence on foreign oil
- ▶ Air Quality
 - ▶ Using biodiesel in conventional biodiesel engines substantially reduces tailpipe emissions
 - ▶ CO, hydrocarbons, particulate matter
- ▶ Enhances Engine Operation
 - ▶ Lipid oils lubricate engine, preventing premature wear
- ▶ Safety
 - ▶ Nontoxic, less combustible (lower flashpoint), safe to environment

How We Began

- ▶ Started as a research project
 - ▶ Researched benefits of biofuel, algae
 - ▶ Different kinds of algae
 - ▶ Best environment for algae growth
- ▶ Decided to take it to the next level
 - ▶ Physically building the reactor
 - ▶ Money and Grants
 - ▶ Time/communication
 - ▶ Construction



Importance

- ▶ Raise awareness
 - ▶ Educate the community
- ▶ Save our future
 - ▶ Economic impacts
 - ▶ Supply/demand
 - ▶ STEM Careers
 - ▶ Rapidly growing
 - ▶ Change the world

Accomplishments

- ▶ Research
- ▶ Construction
- ▶ Algae collection
- ▶ Biodiesel production
- ▶ Informed the public
- ▶ Working with others



Completed Goals

- ▶ Research
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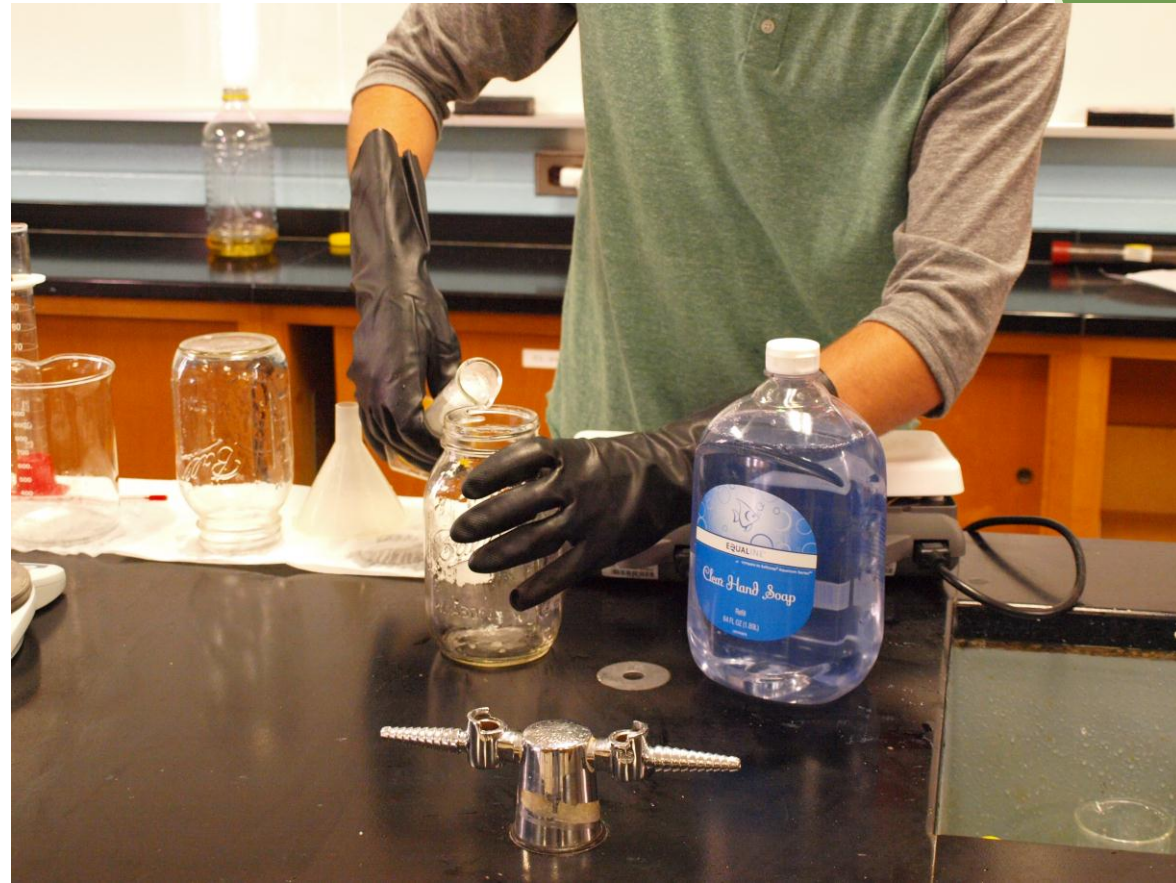
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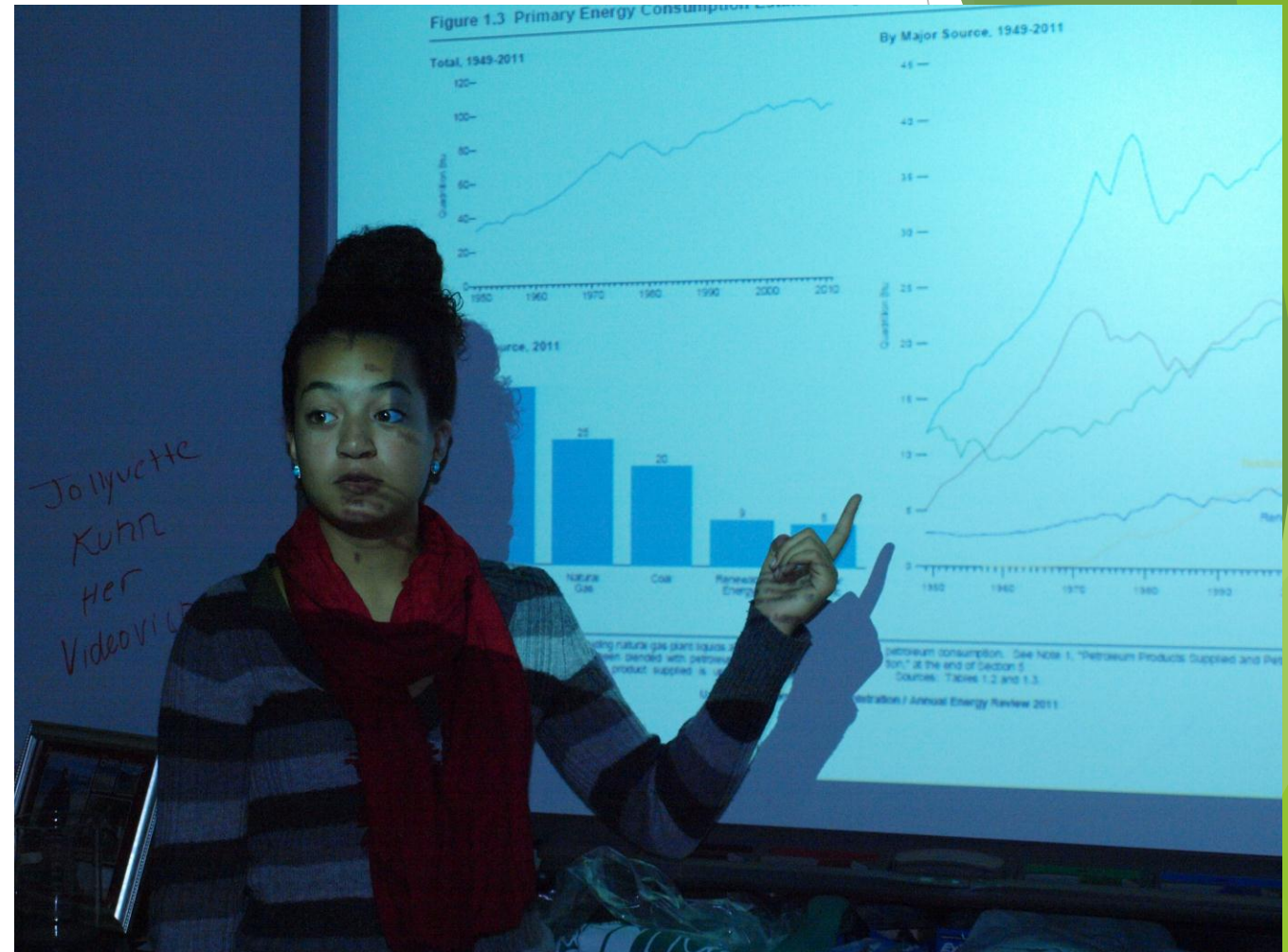
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Long Term Goals

- ▶ Continuation
 - ▶ Juniors
- ▶ Greenhouse
- ▶ Grounds Keeping
 - ▶ Fertilizer
 - ▶ Fuel
- ▶ School/Community involved

Check out our website:

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