Mini-Project

The instructor's comments have been added in red.

My mini-project will consist of representing the real world problem of a need for alternative energy sources. The project will describe the different options in terms of efficiency, cost, availability, safety, and various other aspects. This will all be described or defined using discrete math in order to define and compare the different types of energy. I will attempt, to the best of my ability, to fully describe the problem of the depleting sources of fossil fuels, and to outline what other sources of energy could provide a solution.

Energy Sources = (Types, locations, efficiency, abundance, byproducts, $\Re$)

<u>Set *Types*</u>

This set contains the 5 different types of energy sources being examined

- |Types| = 5

Types = {fossil fuels, solar, nuclear, wind, hydroelectric}

- From this point on the following short-hand will be used to represent each of these elements of set "Types"
    - fossil fuels $\to$ ff
    - solar $\to$ s
    - nuclear $\to$ n
    - wind $\to$ w
    - hydroelectric $\to$ h

<u>Function *locations*: Types $\to$ *P*(latitude, longitude)</u>

This function takes a member of set Types and returns the set containing the points on the globe where the energy source can be obtained from.

locations = {(ff,A),(s,B),(n,C),(w,D),(h,E)}

- where A,B,C,D,E each represent a unique set of points and are subsets of the Cartesian product of latitude and longitude:

A,B,C,D,E $\subseteq$ latitude x longitude

- latitude = {x | -90<x<90}
- longitude = {y | -180<y<180}

This means that A,B,C,D,E are each a set of coordinates, for example assume:

A={(40,13),(-84,53),(22,-120)}

Then when function *locations* is called with 'ff' it would return the set A meaning that there are fossil fuel deposits at latitude 40 degrees and longitude 13 degrees and so on.

Function *efficiency*: Types $\rightarrow \Re$

This function is used to determine the efficiency of a specific energy source. efficiency will be defined as:

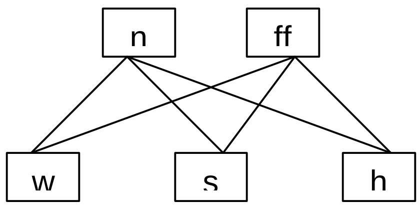
efficiency = (power generated) / cost

where the higher the efficiency the better the source of energy.

efficiency = {(ff,e1),(s,e2),(n,e3),(w,e4),(h,e5)}

- where e1,e2,e3,e4,e5 are real numbers representing the result of the calculated equation

These real numbers are due to many factors however and without extensive research it would impossible to know the exact value of each, however using a Hasee Diagram it is possible to represent a possible hierarchy of these numbers.



Function *efficiency* does not by itself create a poset at left. Another relation that specify the partial order is needed.

(analogous for function *abundance*)

Function *abundance*: Types $\rightarrow \Re$

This function represents the total amount of resources needed to use one of the mentioned processes for obtaining energy.

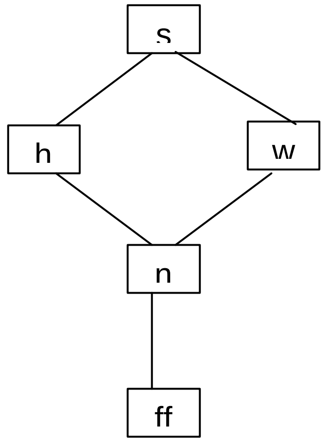
abundance = {(ff,a1),(s,a2),(n,a3),(w,a4),(h,a5)}

- where a1,a2,a3,a4,a5 are real numbers. These numbers would be obtained by determining how many resources are needed to produce a specific amount of energy. Then, divide the total amount of resources available on the earth by this number. This would result in a standard number that can then be compared with other energy sources.

For example:

assume that it takes 10 kg of coal to produce 1000kJ of energy. Also assume that there are 1,000,000 kg of coal on earth. Then its abundance factor, a1, would be 1,000,000 kg / 10 kg or 100,000.

These numbers can also be represented with a Hasee Diagram to get an idea of their general magnitude.



Function *Byproducts*: Types → ~~(V ∨ W ∨ X)~~ {V, W, X}
This function returns sets containing the byproducts of each energy source.

Byproducts = {(ff,V),(s,W),(n,X),(w,W),(h,W)}

- where V,W,X,Y,Z are sets and:
  - V = {CO_2, SO_2, NO_2, CO, H_2O}
  - W = ∅
  - X = {radioactive waste, radiation}