Homework 3

BQOM 2521- Decision Making in a Complex Environment

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1 Introduction

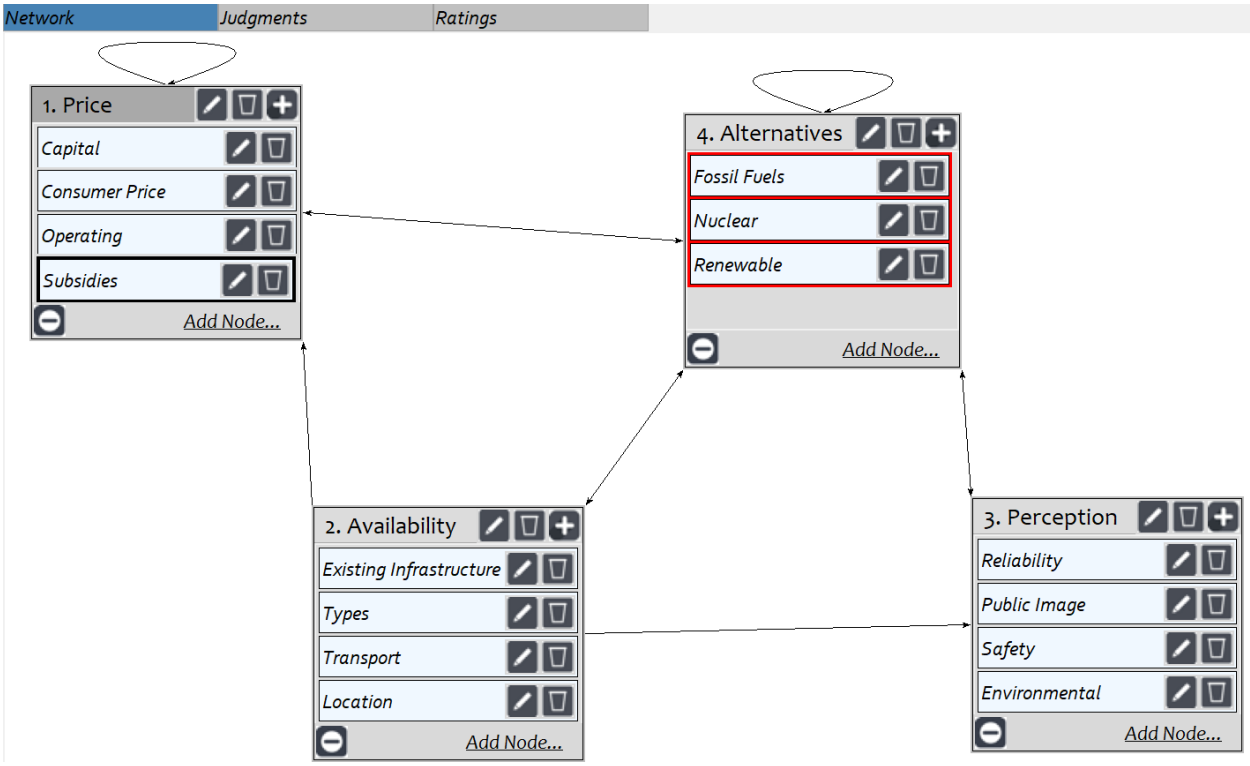
In order select an industry to evaluate the market share, it was important to choose something that I have personal knowledge of and therefore will not need to look up large amounts of data to make decisions. I decided to use the SuperDecisions to estimate the makeup of the energy source industry in the United States. There are obviously many different energy sources utilized in the United States, but they are often broken down into three main categories:

- Fossil Fuels
- Nuclear
- Renewable

I chose this topic, because I have an undergrad in mining engineering and I worked for three years in the coal industry and one year in the nuclear industry prior to attending Katz. This gives me a reasonable amount of knowledge to properly estimate the makeup of these energy sources in the US using the software

2 Network

The complete network completed in the SuperDecisions software is displayed in the following screen shot:

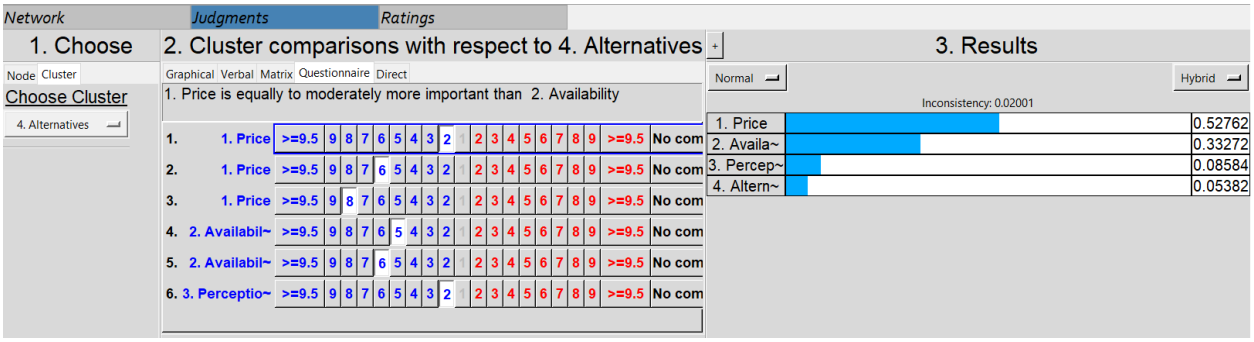


The network mostly speaks for itself, but as a summary I chose three different clusters that I thought properly represented what determines what energy is utilized in the US. There is one additional connection I made, in that consumer price is correlated to capital and operating costs.

3 Judgements

Since there are an excessive amount of judgements to be made, the only screenshot that will be shown is the comparison of clusters with respect to alternatives since these have a massive impact on the weighting of the clusters. Price and Availability have the largest impact on the energy makeup of the United States, whereas the role of perception is growing larger, it still does not have the effect that the economies of scale have to bring price down and the availability of resources throughout the country can.

Further judgements can be seen in the model itself and through the discussion in the conclusion regarding the results.



4 Final Results and Saaty Compatibility Index

As a check before retrieving results, I completed a Sanity Check within the software to ensure that I was not missing any judgements. The results of the model are shown below, as well as the actual makeup of the energy industry in the US based on Billion kWh according to eia.gov.

Name	Graphic	Ideals	Normals	Raw
Fossil Fuels		1.000000	0.487393	0.201031
Nuclear		0.481850	0.234850	0.096867
Renewable		0.569885	0.277758	0.114565

U.S. electricity generation by source, amount, and share of total in 2017[1]		
Energy source	**Billion kWh**	**Share of total**
Total - all sources	4,015	
Fossil fuels (total)	2,495	62.7%
Natural gas	1,273	31.7%
Coal	1,208	30.1%
Petroleum (total)	21	0.5%
Petroleum liquids	13	0.3%
Petroleum coke	9	0.2%
Other gases	14	0.4%
Nuclear	805	20.0%
Renewables (total)	687	17.1%
Hydropower	300	7.5%
Wind	254	6.3%
Biomass (total)	64	1.6%
Wood	43	1.1%
Landfill gas	11	0.3%
Municipal solid waste (biogenic)	7	0.2%
Other biomass waste	3	0.1%
Solar (total)	53	1.3%
Photovoltaic	50	1.2%
Solar thermal	3	0.1%
Geothermal	16	0.4%
Pumped storage hydropower[3]	-6	-0.2%
Other sources	13	0.3%

These values were put into the Saaty Compatibility Index to determine just how well my model was compared to the actual results.

Actual values before normalization

62.7
20
17.1

copy to this column the initial actual values

Normalized Actual values

0.62826
0.20040
0.17134

to normalize the values we sum them and then divide each value by the sum we found

Results from SuperDecisions

Name	Ideals	Normals	Raw
Fossil Fuels	1	0.487393	0.201031
Nuclear	0.48185	0.23485	0.096867
Renewable	0.569885	0.277758	0.114565

copy here the results from SuperDecisions

Pairwise Comparison Matrix from Actual Data

	Fossil Fuels	Nuclear	Renewable			
Fossil Fuels	1	3.13500	3.66667	***A1/A1***	***A1/A2***	***A1/A3***
Nuclear	0.31898	1	1.16959	***A2/A1***	***A2/A2***	***A2/A3***
Renewable	0.27273	0.85500	1	***A3/A1***	***A3/A2***	***A3/A3***

Transpose of Comparison Matrix from Estimated Data

	Fossil Fuels	Nuclear	Renewable			
Fossil Fuels	1	0.48185	0.56989	***A1/A1***	***A2/A1***	***A3/A1***
Nuclear	2.07534	1	1.18270	***A1/A2***	***A2/A2***	***A3/A2***
Renewable	1.75474	0.84552	1	***A1/A3***	***A2/A3***	***A3/A3***

Result of Hadamard (Cell-wise) Multiplication of Previous Two Matrices

	Fossil Fuels	Nuclear	Renewable
Fossil Fuels	1	1.510597711	2.08958
Nuclear	0.66199	1	1.38328
Renewable	0.47857	0.72292	1

Cell sum of previous matrix	**9.846930479**
Number of Alternatives	**3**
Saaty Compatibility Index = Sum/n2**	**1.094103387**

It is now important to interpret the results and speculate what caused them to be the way that they are. It is evident that the model worked in showing that fossil fuels is the most widely used energy source in the US. This is due to multiple factors that were included within the model. For instance, fossil fuels have been a staple of US energy for over 100 years. Costs are relatively low and it has been used for so long, that is available practically everywhere. Now what the model did not compute correctly is just how dominate fossil fuels are (62.8% versus 48.7% in model). It is my estimation that the factors of price and availability were not weighted high enough. When energy is typically talked about in the media, price and availability is typically not mentioned, but the environmental effects and perception tend to be highlighted. Although this is something that is fairly important to the general population, something as large as the energy usage in the United States takes an awful long time to see change and the push for renewable energy sources is a fairly new issue. In addition, most people do not have the option of where their energy comes from, it is simply provided to them by their utility. The coverage of perception in the media most likely caused me to over-value it in the model compared to what actually makes the decisions in the real-world.

In addition to undervaluing fossil fuels, I also had Nuclear and Renewable flipped in the order of magnitude. I believe a similar phenomenon happened here in that there have been some recent events that have tarnished the reputation of the nuclear industry. I must have factored these into my decision making, but in reality, these factors do not have that large of an effect in the short term for the reasons mentioned in the above paragraph.

Overall, I am fairly happy with the model as I have created it. I was able to use my knowledge of the energy industry to fairly accurately predict the market share of the US energy industry. The Saaty Compatibility index for the model is 1.09. The goal number for this index is 1, so my result seems to match my idea that my model did an acceptable job of estimating.