Lab: Mission Possible

Modified from the Need Project

Background Information: Your team has been hired by the governor of Essowess to develop a plan to expand the electricity capacity for the country. Your country is growing and has begun to experience brownouts during peak demand times. Your mission is to develop a plan that will meet the electricity demand of Essowess economically while maintaining the quality of the country's environment. Essowess has many resources that can be used to produce the electricity it will need in the future. You can use any mixture of sources and as many of each as allowed, as long as you produce the required amount of electricity while staying within your budget and maintaining the environmental quality of the country. You must convince the governor and the citizens of the country that your plan is the best possible plan for everyone in terms of jobs, the environment, the cost of electricity and changes in lifestyle.

The Goal:

CURRENT STATUS	NEEDED FUTURE STATUS
1,000 MW capacity (energy produced)	1,500 MW capacity or more
1,000 energy bucks (think billions of dollars)	1,600 energy bucks or less
1,000 enviro-units (think units of pollution)	1,000 enviro-units or less
$0.03 per kWh of electricity (cost to consumers)	$0.035 per kWh or less

You currently own 15 coal-burning power plants. Five of these are old and must be closed or modernized, although you may close or modernize more. To create a successful power portfolio, you will need to build additional power plants. Your options and their parameters are listed below. You do not need to build every type of power plant.

TO CLOSE A COAL PLANT

Investment:	10 energy bucks
Capacity Loss:	40 MW
Enviro Impact:	-100 enviro-units

TO MODERNIZE A COAL PLANT

Investment:	10 energy bucks
Capacity Gain:	10 MW
Enviro Impact:	-25 enviro-units
Cost:	$0.04 per kWh

TO BUILD AN ADDITIONAL COAL PLANT

Investment:	40 energy bucks
Capacity Gain:	50 MW
Enviro Impact:	100 enviro-units
Cost:	$0.04 per kWh

TO BUILD A WIND FARM

Investment:	25 energy bucks
Capacity Gain:	10 MW
Enviro Impact:	-50 enviro-units
Cost:	$0.04 per kWh

TO BUILD A HYDROELECTRIC DAM

Investment:	50 energy bucks
Capacity Gain:	25 MW
Enviro Impact:	0 enviro-units
Cost:	$0.01 per kWh

TO BUILD A NUCLEAR POWER PLANT

Investment:	60 energy bucks
Capacity Gain:	40 MW
Enviro Impact:	0 enviro-units
Cost:	$0.03 kWh

TO BUILD A BIOMASS ENERGY PLANT

Investment:	15 energy bucks
Capacity Gain:	10 MW
Enviro Impact:	0 enviro units
Cost:	$0.05 per kWh

TO BUILD A NATURAL GAS PLANT

Investment:	50 energy bucks
Capacity Gain:	50 MW
Enviro Impact:	75 enviro-units
Cost:	$0.04 per kWh

TO BUILD A GEOTHERMAL PLANT

Investment:	25 energy bucks
Capacity Gain:	20 MW
Enviro Impact:	-20 enviro units
Cost:	$0.05 per kWh

MISSION POSSIBLE ENERGY PLAN

FACILITY	QUANTITY	CAPACITY MW	FINAL COST* e-bucks	ENVIRO IMPACT enviro-units	PRICE
Existing Plants	15	1,000	1,000	1,000	30
Close Plants	-2	(-2)(40)= -80	(2)(10)= 20	(2)(-100)= -200	(-80)(0.03)=-2.40
Modernize Plants	(3)	30	30	-75	1.20
Coal	2	100	80	200	4.00
Wind	2	20	50	-100	0.80
Hydropower	1	25	50	0	0.25
Nuclear	3	120	180	0	3.60
Waste-to-Energy	5	50	75	0	2.50
Natural Gas	3	150	150	225	6.00
Geothermal	5	100	125	-100	5.00
TOTALS	34	1,515	1,760	950	** 0.034

** To determine the average price of electricity per kWh, use the formula below:

Sum of all sources [(Capacity for source) X (Cost per kWh)] /Total Capacity

Average price = 30 + (-2.40) + 1.20 + 4.00 + 0.80 + 0.25 + 3.60 + 2.50 + 6.00 + 5.00 = 50.95

50.95 / 1515 = 0.034

MISSION POSSIBLE ENERGY PLAN

FACILITY	QUANTITY	CAPACITY MW	FINAL COST* e-bucks	ENVIRO IMPACT enviro-units	PRICE
Existing Plants	15	1,000	1,000	1,000	30
Close Plants					
Modernize Plants					
Coal					
Wind					
Hydropower					
Nuclear					
Waste-to-Energy					
Natural Gas					
Geothermal					
TOTALS					**

** To determine the average price of electricity per kWh, use the formula below:

Sum of all sources [(Capacity for source) X (Cost per kWh)] /Total Capacity