

Alternative Power Source To Draw Underground Water

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Team 01

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Overview

Project Description

Problem Statement

Concept Generation

Concept Selection

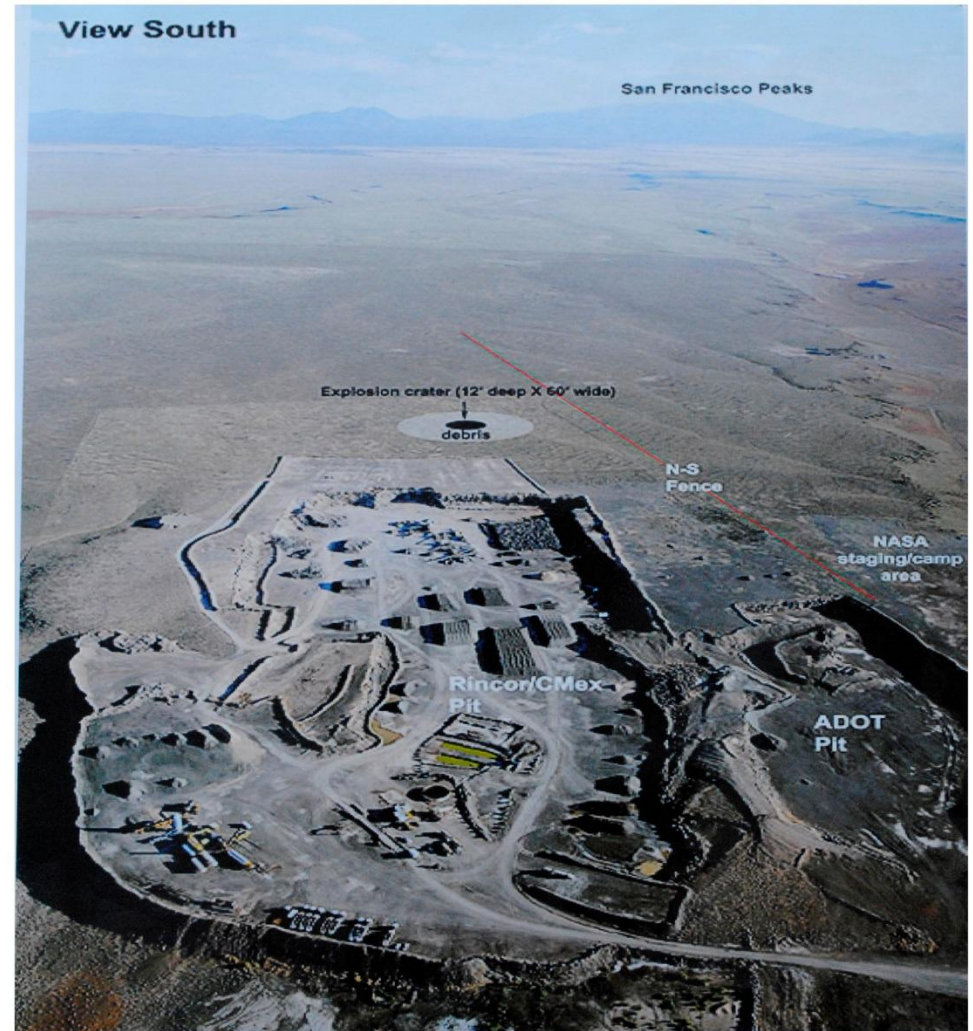
Gantt Chart

Conclusion

References

Project Description

- Cemex
 - Mining pit on Babbitt Ranches
 - Pump 0.3 m³/min from 520 meters



Courtesy: NASA

Problem Statement

The Client requests a solution that will draw water from 520 meters while maintaining the current flow rate of $0.3 \text{ m}^3/\text{min}$ while reducing overall cost.

Concept Generation



www.nrel.gov

Concept Generation



www.solarrochester.com

Concept Generation



www.evworld.com

Concept Generation

Capture		Option 1	Option 2	Option 3
	Solar	PV array	Concentrator--Steam	Concentrator--Sterling Engine
	Wind	Wind Turbine	Array of Turbines	Vertical Axis
	Geothermal	Vertical Loop	Buried Loops	
	Bio-Mass	Wood	Old Construction Materials	Cellulose
Back Up				
	Thermal	Diesel	Gas Turbines	
	Electric	Batteries		
	Water Storage	Status Quo	Increase Capacity	Dig Water Pit

Concept Refinement

- Geothermal
 - Lack of availability in Northern Arizona
- Biomass
 - Associated transportation cost
- Battery Backup
 - Insufficient to meet power demands
- Natural Gas
 - No readily available source

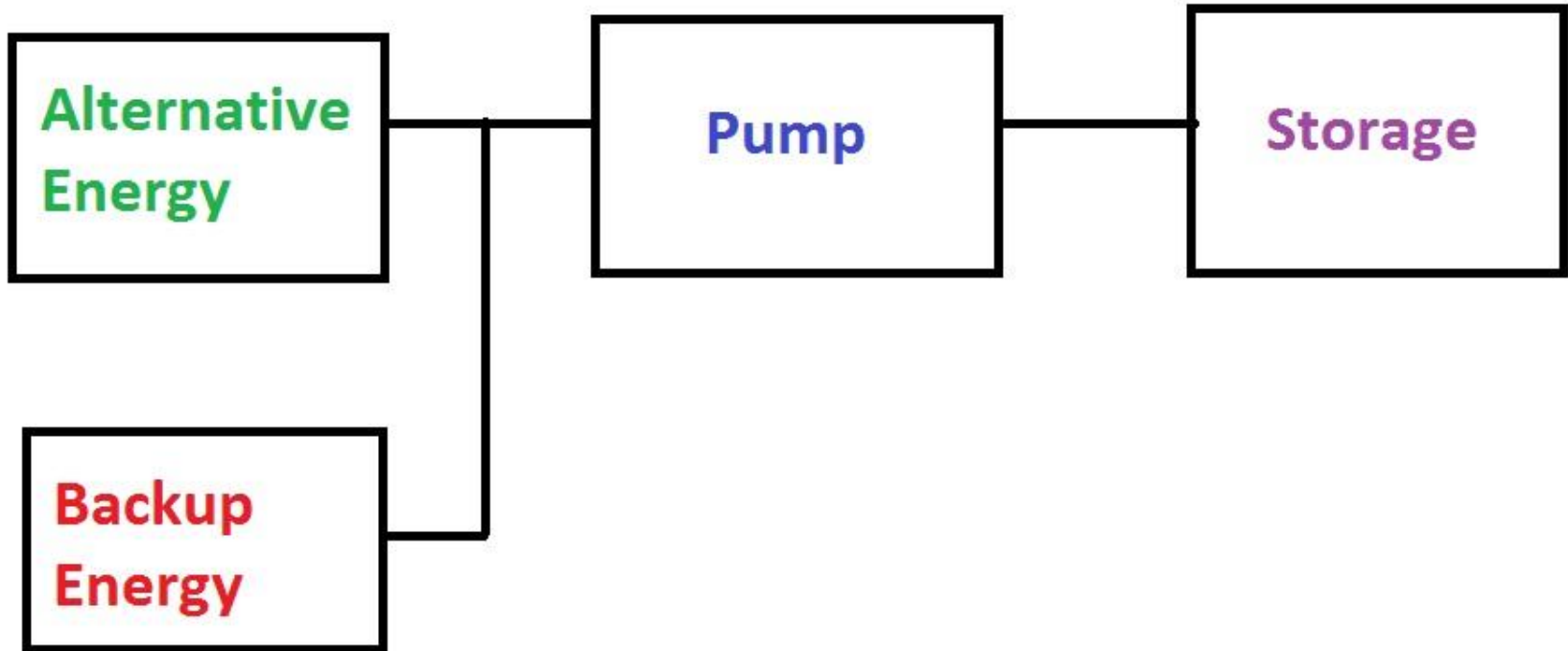
Evaluation Criteria

Performance Level	Criteria Metrics		
	Value	Cost \$	Power (kW)
Perfect	10	<100,000	>100
Excellent	9	<200,000	>90
Very Good	8	<300,000	>80
Good	7	<400,000	>70
Satisfactory	6	<500,000	>60
Adequate	5	<600,000	>50
Tolerable	4	<700,000	>40
Poor	3	<800,000	>30
Very Poor	2	<1,000,000	>20
Inadequate	1	<1,500,000	>10
Useless	0	>2,000,000	<10

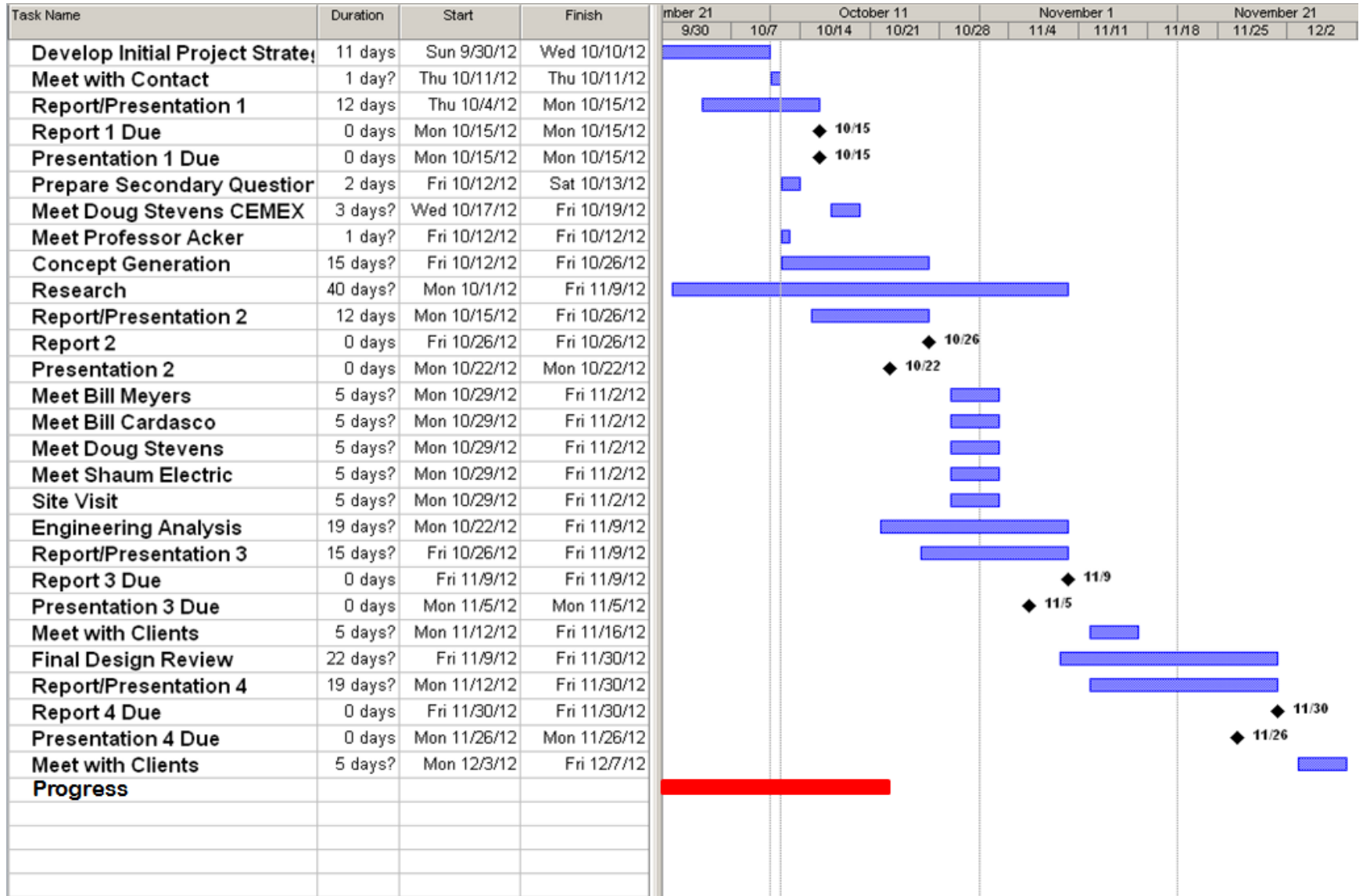
Decision Matrix

Criteria	Units	Design Option					
		Solar (PV array)		Wind (Turbine)		Stirling engine	
		Raw Score	Value on Scale	Raw Score	Value on Scale	Raw Score	Value on Scale
Cost	\$	305000	7.9	380000	7.2	1100000	1.8
Power	kW	50	5	50	5	50	5
Total			12.9		12.2		6.8
Normalized total			0.40		0.38		0.21

Looking Forward



Gantt Chart



References

Doug Stevens – Cemex

Bill Cardasco – Babbitt Ranches

www.energy.ca.gov

www.lipower.org

www.usasolarwind.com

<http://www.azgs.az.gov/geothermal>
nau.edu