Sustainable Synergy in GSL: Exploring a Dual Approach to Reduce Evaporation & Generate Solar Power

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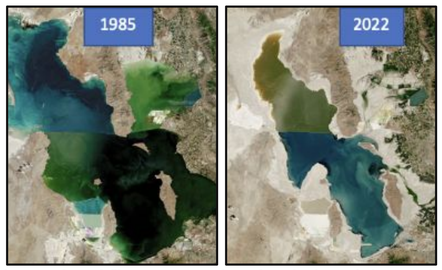
Background

The Great Salt Lake (GSL) is a crucial indicator of regional climate; only outflow is evaporation.

- Shrinking rapidly over last decade with new record low in 2022 at 4,189.6 ft. (NASA, 2022)



This has significant ecological, health and economic implications:

- Reduced inflows from rivers, lower precipitation, and higher human consumption
- Airborne contaminants, brine shrimp production, bird habitat, mineral extraction costs, salt harvesting operations, magnesium mining, and recreational activities

Objectives

What is a cost effective solution to maintain higher levels of the GSL?

- Explore technical and economic feasibility of floating solar panels to reduce evaporation losses to help raise the GSL level, while paying for this water savings through sales of the "green" electricity produced
- Learn from past installations of solar panels to customize a cost-effective solution

(SHSF, 2023)

Methodology

Data analysis and solar production calculations estimates average annual energy production, evaporation reduction, and costs

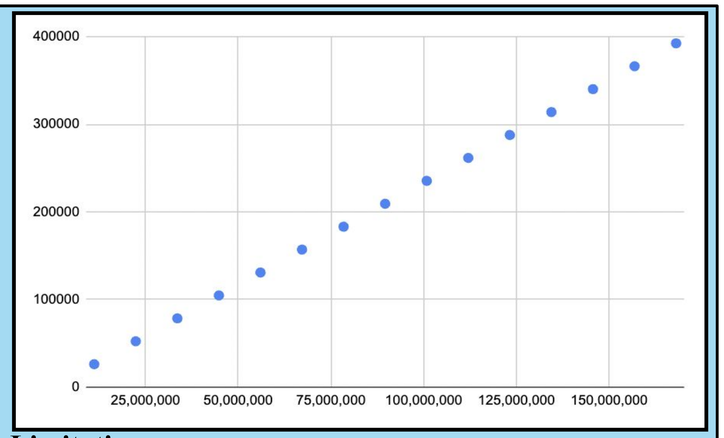
- NREL used for tools, data on solar radiation, capital and operating costs, and environmental impacts
- Revenue assessed based on average and energy contract prices corresponding to solar w/ battery storage and w/o battery storage from spot market electricity prices and utility companies (PGE, 2022)
- Established relationship between variables and identified patterns to decide ideal panel coverage in GSL

Panel Coverage (%)	Net Annual Rev w/ Storage	Electricity Producction (MWh/year)	Total Evaporation Reduced (m^3/year)	Annual Water Saved in ac-ft
.01	11,204,340	2,240,868	32,271,400	26163
	22,408,680	4,481,736	64,542,800	52326
	33,613,020	6,722,604	96,814,200	78489
	44,817,360	8,963,472	129,085,600	104652
	56,021,700	11,204,340	161,357,000	130814
	67,226,040	13,445,208	193,628,400	156977
	78,430,380	15,686,076	225,899,800	183140
	89,634,720	17,926,944	258,171,200	209303
	100,839,060	20,167,812	290,442,600	235466
.10	112,043,400	22,408,680	322,714,000	261629

Preliminary Findings

Results

- Evaporation can be reduced by approx. 70% by floating solar panels
- Electricity production from covered region can range from 4–33.6 billion MWh/year, scaled to represent about 1/10th of whole US energy demand
- Levelized annual cost (w/o storage) and annual revenue ranges from 134 million–2.02 billion dollars, depending on coverage (1% to 10% of lake area)
- Annual water savings achieved through reduced evaporation range from 26,163–-392,443 acre-feet, depending on lake area covered
- Net Revenue with batteries included lies at a value of 11,603,200



Limitations

- Lack of up-to-date data, assumptions in regards to calculations

Areas for Further Study

- Tracking systems for solar panels can optimize energy production by adjusting the panel's position throughout the day to maximize sunlight exposure

Discussion

Research highlights the potential benefits of using floating solar panels on the GSL, including reduced evaporation and significant electricity generation.

- Implementation can lead to potential rev. generation and water resource conservation
- Thorough consideration of associated costs and environmental impacts is essential before large-scale adoption
- Findings can inform further research and decision-making on the sustainability of using solar panels in GSL.
- Applications to address ideal angles of solar panel for exposure and wind and bird factors

Conclusion

- By using floating solar panels backed by battery storage over 10% of the GSL area, on average 26,1629 Ac-ft/year of water loss can be saved while generating a net annual revenue of approx. 11,603,200
- This is a potentially outstanding solution to the problem since instead of a cost for water saving there is a co-benefit
- Ecological impacts of the floating solar panels may be impacts on bird habitats. These may need to be investigated

Acknowledgements

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