The **US Pyramid Project** is a **501(c)3** dedicated to solving the global freshwater crisis.

Cube System Land Cycle & Production

Fresh Water, Salt and Demonstration Site Outputs

Summary

The Cube's core mechanism for producing freshwater—dispersing saltwater thinly over large surface areas in a high-heat environment to accelerate evaporation, then capturing and channeling the resulting vapor away as freshwater—commonly called **solar-driven interfacial evaporation** (often called SDIE or solar interfacial evaporation) concepts that researchers have been pushing hard in recent years.

We pass the same saltwater through the system over and over, each pass generating more freshwater and leaving the remaining water as a higher concentrated brine. We pass the water through until it **reaches 25% salinity,** the maximal salinity that can be reached before evaporative physics drop off significantly; reducing system efficiency by up to 20%.

Reduced Vapor Pressure (Raoult's Law / Colligative Property)

- Dissolved salts (mainly NaCl in seawater/brine) lower the **water activity** (a_w) and thus the **saturation vapor pressure** over the solution.
- Pure water has a_w ≈ 1.0 → full vapor pressure.
- Seawater (~3.5% salinity) has a_w ≈ 0.98 → ~2% lower vapor pressure.
- 10% brine: a_w drops further (~5–7% reduction).
- **20–25% brine: ~10–20% lower vapor pressure.**
- Near saturation (~26% NaCl): ~23–25% lower vapor pressure than pure water at the same temperature.
- Lower vapor pressure means a smaller driving force for evaporation (the difference between the vapor pressure at the water surface and the partial pressure in the air above it shrinks), so fewer water molecules escape into vapor per unit time/area.

Cube Performance (Seasonal)

The Cube's operational performance is based on environmental factors; primarily temperature, but also humidity, wind and weather. The following chart depicts the operational performance of the Cube throughout the year:

Month	Days	Avg T (°F)	Daily Production (gal/day)	Monthly Total (gal)
May	31	83.75	0.1 × (83.75 - 80) = 0.375	0.375 × 31 = 11.625
June	30	88.5	0.1 × (88.5 - 80) = 0.85	0.85 × 30 = 25.5
July	31	98	0.1 × (98 - 80) = 1.8	1.8 × 31 = 55.8
August	31	107	0.1 × (107 - 80) = 2.7	2.7 × 31 = 83.7
September	30	102	0.1 × (102 - 80) = 2.2	2.2 × 30 = 66
October	31	91.625	0.1 × (91.625 - 80) = 1.1625	1.1625 × 31 ≈ 36.04

Grand Total for One Cube (May-Oct): 11.625 + 25.5 + 55.8 + 83.7 + 66 + 36.04 = **278.665 gallons**

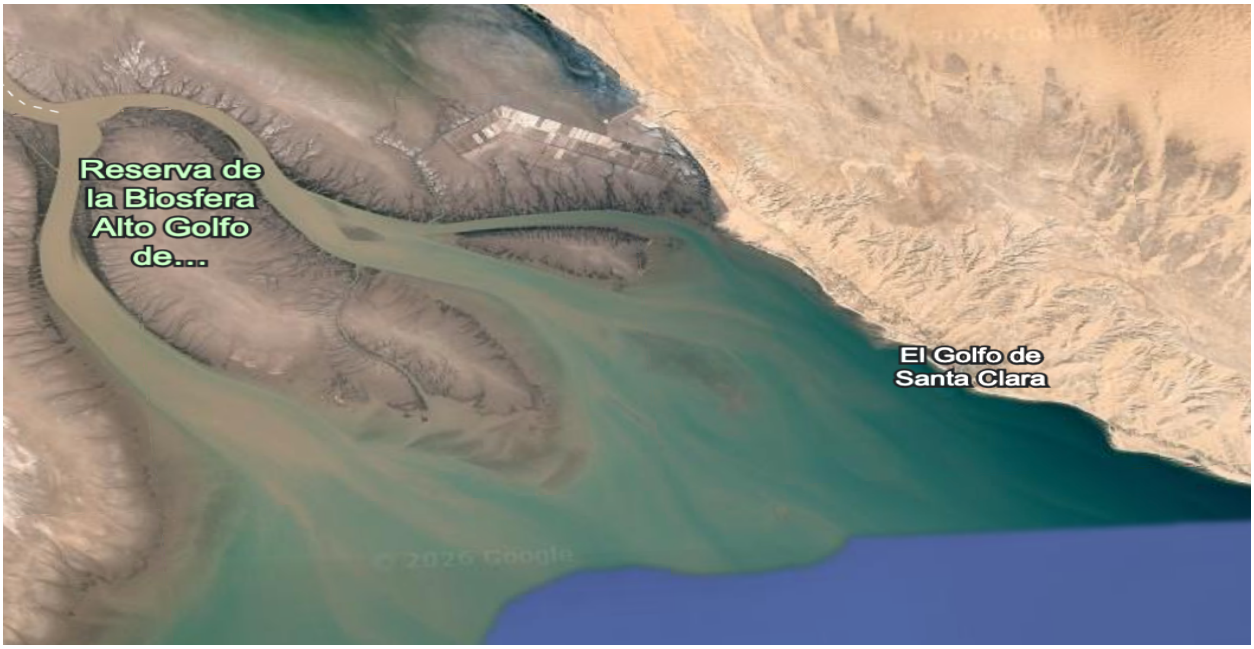
System Cycle

Our initial Cube System will be 10,000 Cubes. We will port ocean water into a sand filter, port sand filtered water into a mechanical water filter, then send the water to a salt water holding pond for system injection. This salt water holding pond will hold 60,000 gallons and be passed through the system repeatedly until the salt water concentration reaches 25%. Once this salinity is reached, the salt water is piped to an evaporation bed, where dry salt will be collected and shipped off site for processing. Depending on the time of year, this cycle lasts 2-3 days and produces 50,000 gallons of freshwater and 2,100 lbs of salt per 60,000 gallons processed.

Why 25% Salinity is the Most Efficient

Our Cube is essentially a **multi-pass or staged thermal evaporator**: Each pass concentrates the brine further by evaporating water (leaving salt behind), so higher target concentration → more total water evaporated per initial gallon of seawater → higher freshwater yield per batch/input volume.

Example math recap (using your earlier batch logic for illustration):
-Start with 60,000 gal seawater at 3.5% salinity → ~2,100 lb salt total.
-To reach 10.5%: Remove 40,000 gal freshwater → 20,000 gal brine left (concentration factor = 3×).
-To reach, say, **20% salinity**: You'd need to remove ~48,000 gal freshwater (leaving ~12,000 gal brine) → concentration factor ≈5.7× → ~8,000 more gallons
-of freshwater per batch, with only ~12,000 gal brine to dry (vs. 20,000 gal at 10.5%).
-To reach **25% (near saturation for NaCl-dominated brine)**: Remove 50,400 gal freshwater → leave ~9,600 gal brine → even higher recovery (84% freshwater yield vs. ~67% at 10.5%), and much less volume to your holding bed.
Net: Less salt "byproduct" mass is the same (~2,100 lb per batch, since all salt stays), but the **brine volume** shrinks dramatically → smaller evaporation beds, faster drying times, less land use, and potentially lower wind-blown losses.



Above: The Delta at large, Below: Proposed Real Estate for Project

Below is our proposed configuration of the proposed Real Estate.