Survivability in Hawaii: What’s Next After Sustainability?

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How can we in Hawaii address our sustainability needs for renewable energy, water, and food while simultaneously dealing with the impacts of climate change?

Are we currently simply talking about rearranging the deck chairs on the Titanic?
Petroleum provides nearly nine-tenths of all the energy consumed in Hawaii.

The transportation sector leads energy demand in Hawaii in large part to heavy jet fuel use by the military and commercial airlines.

In 2008, Hawaii spent ~$437,700/hour, every hour, all year* on imported oil!

* Based on average of $90/barrel, real cost ranged from $147/barrel in July to $32/barrel in December
Oahu’s Future Water Resources: Increasing Demand and Changing Distribution

Demand in million gallons per day
1970 - 2030

Increases are greatest in W. Oahu
Total Rainfall in Hawaii is Decreasing. But Severe Floods more common? e.g., Oct. 2004 Manoa Flood

This change in rainfall patterns will result in:

- **Greater uncertainty in drinking water supply**
- **Damage to watersheds and their ecosystems**
- **Agriculture put at greater risk**
- **Higher incidence of fires**
- **More flash flooding and resultant rock falls**
Hawaii’s future will be warmer, drier, susceptible to more flash floods and coastal erosion leading to stressed land and coral reef ecosystems.

As carbon dioxide rises, sea water salinity (pH) is increasing – impacting coral reefs among others.

Air temperature data demonstrate an accelerating warming trend in Hawaii.
Rising temperatures assist invasive species by increasing their range and placing natives under greater stress.

Coffee Berry Borer

Coqui Frogs
Sea Level has risen ~2 cm/decade and is accelerating!

Honolulu 5-year mean sea level

Flooding in low areas near coast

Greater risk of beach erosion and storm damage

Effect of extra 1-meter sea level rise
Segments of Waikiki to be First Affected by Sea Level Rise: 2040

Land within 1 foot of high tide: Predicted area that will be flooded for as much as 6 weeks/year by 2040

Images by C. Fletcher, SOEST/UHM
What will be the economic costs in 2040: To tourism as well as local infrastructure?
Rocky Mountain Institute estimated that Hawaii imports ~85% - 90% of all the food we consume. How do we reduce this percentage, preserve the soil, use our limited water efficiently, and become more self-sufficient?

| Estimated economic impacts of replacing 100% of imports of selected food products. |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Estimated total consumption from local production* | Potential import replacement* | Economy-wide impact on |
| (%) | ($ million) | ($ million) | ($ million) | ($ million) | (number) |
| Beef | 4.50 | 107.72 | 204.67 | 54.94 | 6.79 | 2,607 |
| Pork | 3.90 | 112.19 | 213.16 | 57.22 | 7.07 | 2,715 |
| Eggs | 20.00 | 35.92 | 68.24 | 18.32 | 2.26 | 869 |
| Fresh milk | 10.00 | 165.48 | 314.42 | 84.40 | 10.43 | 4,005 |
| Fresh fruits | 34.78 | 40.14 | 78.26 | 23.28 | 3.01 | 1,252 |
| Fresh vegetables | 33.50 | 120.95 | 249.16 | 65.31 | 9.43 | 3,181 |
| Total | n.a. | 582.40 | 1,127.91 | 303.46 | 38.99 | 14,629 |

Notes: *At farm-gate values, 2005. Hawai’i Department of Agriculture’s estimates.
GLOBAL CONTEXT
Global Air and Surface Temperatures are Increasing

IPCC Global Surface Temperatures

IPCC Global Warming Predictions
Cities are growing, and becoming less healthy

By 2025 China’s urban population is expected to increase by 293 million. Bangladesh is expected to grow to 18.7 billion by 2025.


Paris Heatwave, August 2003

~2 a.m.

Temperature (°C)

Number of deaths per day

Environmental responses to temperature change: Vegetation, melting permafrost and increased storm severity

CHANGE IN PLANT GROWTH 1982 - 2011

MELTING PERMAFROST

INCREASING STORM SEVERITY
Record dryness for U.S.

Drought conditions have been at record levels in the contiguous United States for much of July, according to the National Drought Mitigation Center, which began monitoring drought conditions in 1999. The animated map below shows the spread of drought conditions since January 2012.

Drought intensity levels

- **Abnormally dry**: Short-term dryness or lingering water deficits
- **Moderate drought**: Some crop damage; imminent water shortages
- **Severe drought**: Crop losses likely; water shortages common
- **Extreme drought**: Major crop losses; widespread water shortages
- **Exceptional drought**: Widespread crop losses; water emergencies

Source: U.S. Drought Monitor

JULY 24, 2012
Increasing ocean acidity threatens coral reefs

- Loss of fishing – loss of food
- Loss of tourism
- Increased risk of storm damage
Examples for what can UH can do

• Develop inter-disciplinary skill sets within UH System to tackle complex sustainability issues.

• Demonstrate new technologies for water, energy and soil use.

• Advocate a diversity of pilot commercial developments to save energy and water.

• Outreach to the broad Hawai‘i community: Acting now will be easier than waiting for effects to be obvious!
WESS Concept of water, energy and soil sustainability integration

Michael Cooney
HNEI
First steps in WESS implementation
Water Utilization and Design on UH Campus

Manoa flood, Oct. 30th, 2004

4 MAJOR SHORT-TERM MEASURES

- Woodman Drive Bridge
  - Build a levee at floodwall of Woodman Drive Bridge.
  - A levee is typically a wall or embankment raised above a normal water level.

- Manoa District Park to East Mānā Road
  - Excavate and raise the existing concrete channel embankment from Manoa District Park to East Mānā Road.

- Windward at Woodman Drive Bridge
  - Construct a concrete dam upstream of Woodman Drive Bridge.

- East Mānā Road Bridge and Woodman Drive Bridge
  - Build a concrete channel between the East Mānā Road and Woodman Drive Bridge.

Sustainable Saunders Initiative

The Public Policy Center of the College of Social Sciences is spearheading the Sustainable Saunders Initiative as a collaborative effort among faculty and students to make Saunders Hall a model of workplace sustainability. The initiative was designated by the UH Manoa Chancellor as a pilot project for the UH-HECO Energy Partnership.

Campus Redesign – includes water conservation
Honolulu Seawater Air Conditioning, LLC: “The project involves running a five-foot-wide pipeline hundreds of feet below the sea, which will then suck up thousands of gallons of frosty water and discharge it through air-conditioning units around the city, helping To cool off entire buildings. The warmed water is then dumped back into the ocean at a level and temperature that won’t harm nearby aquatic life.”

“HSWAC would help reduce Hawaii’s dependence on imported fossil fuels, help meet Hawaii’s renewable energy goals and would be environmentally beneficial” Hawaiian Electric Co., Inc.

But: Potential threat of algae blooms
Tackling Oahu’s Sea-Level Rise

- Retreat from the coast where possible. Make it a state policy.
- Monitor local sea level change in detail to detect salt water marsh development
- Sea level rise is slow; we can fill land and raise buildings where necessary.
- Establish a coastal buffer and buy sand-rich lands to preserve beaches.
- Engage the Community:
  - Legislature (e.g., Permit Office)
  - Business community (e.g., Insurance and banking)
  - General Public (e.g., Mitigation will be expensive)
Impact of Future Sea-Level Rise: 1 m above current high tide
UH Must continue to provide technical, impartial advice to policy makers
So is Hawaii “Survivable”?

Or are we just rearranging the deck chairs on the Titanic?