Hawaii’s Climate Change Challenge

2017-Forward

Earth Day is Everyday
CO2 – HUMAN CAUSES & EFFECTS

Energy, Water, Land, and Climate Interactions

- Water
- Energy
- Land
- Society

Environment

Water-Energy

Climate Variability and Change

Water-Land

Land-Energy

Economy
Alarms bells are ringing all over the world...
‘warning bells’ of *human contributions to* rising temperatures and sea levels, increasing *coastal flooding* that has more than doubled in US since the 1980s...
human-induced global CO2 increase

400,000 years, carbon dioxide levels have never breached 300 ppm. Now they’re at 400 ppm.
Latest CO₂ reading
October 22, 2016

401.77 ppm

We are here

800,000-year history of carbon dioxide levels in Earth's atmosphere
Primary Greenhouse gases that humans emit:

- **Carbon Dioxide (CO2).** Accounts for around three-quarters (75%) of the warming impact of current human greenhouse-gas emissions. The key source of CO2 is the burning of fossil fuels such as coal, oil and gas; deforestation is also a significant contributing factor.

- **Methane (CH4).** Accounts for around 14% of the impact of current human greenhouse-gas emissions. Key sources include melting ice caps and tundra (feedback loop), agriculture (especially livestock and rice fields), fossil fuel extraction and the decay of organic waste in landfill sites. Methane doesn't persist in the atmosphere as long as CO2, though its warming effect is much more potent for each gram of gas released. *Methane is roughly 30 times more potent than CO2 as a heat-trapping gas.*

- **Nitrous Oxide (N2O).** Accounts for around 8% of the warming impact of current human greenhouse-gas emissions. Key sources include agriculture (especially nitrogen-fertilized soils and livestock waste) and industrial processes. *Nitrous oxide is even more potent per gram than methane.*

- **Fluorinated Gases ("F gases").** Account for around 1% of the warming impact of current human greenhouse-gas emissions. Key sources are industrial processes. *F-gases are even more potent per gram than nitrous oxide.*
NASA – JAN 2016 GLOBAL TEMPERATURE MAP
(Reuters) - Earth temperature rise continues at an unprecedented rate, year-after year, with 2016 breaking another all time high...

The Paris Climate Agreement, ratified late last year, set a 1.5 C increase cap in global temperature rise, but is already in danger of being breached before fully implemented.
Sea surface temperature anomaly, Great Barrier Reef

Sea surface temperature departure from the 1961-1990 average

°C

-1.5

-1

-0.5

0

0.5

1

1900 1920 1940 1960 1980 2000

Guardian graphic | Source: NOAA, BoM
HOW CLIMATE CHANGE IMPACTS WEATHER
THE SCIENCE
CHANGES IN THE WATER CYCLE ARE INCREASING THE RISK OF DROUGHTS AND FLOODS.

Higher temperatures mean there is more evaporation from the land and sea into the atmosphere.

As air gets warmer, it can hold more water vapor. This can lead to more intense rainstorms.

Intense rainstorms increase the risk of flooding. Much of the water runs off into rivers and streams, doing little to dampen soil.

This, combined with increased temperatures, increases the risk of drought.

Hawai‘i Reef / Marine Impacts
Scientists monitor global atmospheric change atop 13,677-foot-high Mauna Loa. Their observations in combination with the rest of world’s scientific community are recording unprecedented record high increases in man-made CO2 and other industrial emissions that are now impacting Hawaii.
Satellite mapping overlay of 15 cyclones around the Hawaiian Islands during 2015.

Hawai‘i Island

Weekly SST Anomaly

2015/06/28 - 2015/07/04

NOAA/ESRL/PSD

Base Period: 1981-2010

EL NINO

Globetrans EC  http://globetrans-ec.com
Climate Change and Weather Linked

Global warming impacts do not merely increase the overall likelihood of heat waves, or the volume of rainfall — it also changes the flow of weather itself.
“weather-destabilizing and extreme weather-generating” are the recent scientific findings linking climate change consequences to shifts in the of a jet stream.
SUPER STORMS
Today, Climate Impacts on the Mainland
SUPER STORMS

Today, Climate Impacts in the Pacific
SEA LEVEL RISE
25-50 Year Climate Impacts on Hawai’i
What's behind the rising seas?

There are three main causes for rising sea levels:

1) The expansion of warmer ocean water,

2) melting mountain glaciers, and

3) ice loss from the massive Greenland and Antarctic ice sheets.
Climate Change Impacts on Hawai’i

- Sea Level Rise,
- Super Storms,
- Flooding of shoreline and low lying island areas,
- Erratic and Decreasing Trade Winds,
- Declining Rainfall and Stream Flow,
- Overall Warming Temperatures – Agricultural Impacts,
- Warming and Acidification Impacts on Hawaii’s Marine Ecosystem and Fisheries
INCREASED CO₂ EMISSIONS AND HAWAI’I

“...the best research indicates Hawaii will get wetter in wet areas, but drier in dry areas—deepening the divisions between the different zones of the Islands...”

Kevin Hamilton, of the University of Hawai‘i’s International Pacific Research Center
What is biggest global security concern in the 21st century?
DoD Message to Trump …

“...climate change presents a significant and direct risk to U.S. military readiness, operations and strategy, and military leaders say it should transcend politics.”

DoD’s concerns goes far beyond protecting military bases from sea-level rise.

“Stresses from climate change can increase the likelihood of international or civil conflict, state failure, mass migration and instability in strategically significant areas around the world”.

November 2016 report - U.S. Department of Defense and the Climate and Security Advisory Group, a voluntary, nonpartisan group of 43 U.S.-based senior military, national security, homeland security and intelligence experts, including the former commanders of the U.S. Pacific and Central Commands
2016 Paris Climate Accord agreed by 195 countries

Paris Agreement under the **United Nations Framework Convention on Climate Change**

Parties = Orange areas on the map
Signatories = Green areas of the map

The agreement **commits world leaders to keeping further global warming increases below 2C** -- seen as the threshold for safety by scientists, but who are pursuing a tougher target of 1.5C.
Overall, solar power capacity grew >10x over from 2009 to 2015, and >100x over from 2002 to 2015.

Global Solar Energy Capacity (GW)

NO Emissions

U.S. Energy-Related Carbon Dioxide Emissions by Major Fuel,

million metric tons carbon dioxide

2011 total = 5,480.63*

Coal
1,874.36 (34%)

Natural Gas
1,295.78 (24%)

Petroleum
2,299.08 (42%)

*Includes small amounts of CO₂ from non-biogenic municipal solid waste and geothermal energy (0.2% of total).

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3 (May 2012).
$5 Trillion Annually in Fossil Fuel Subsidies
- 2015 International Monetary Fund study

($5.3T trillion in annual subsidies; does not include environmental and associated public health costs)

The fossil fuel industry risks losing $33 trillion in revenue over the next 25 years as global warming may drive companies to leave oil, natural gas and coal in the ground, according to a Barclays Plc energy analyst.

July 11, 2016
Will fossil fuel money and interests control the destiny of the human race?
The 2017-18 budget plan Trump submitted to Congress will slash domestic programs to fund a $54 billion boost in military spending.

The biggest cut, 31 percent, would come from the Environmental Protection Agency, terminate four earth science and monitoring programs at the National Aeronautics and Space Administration ...that scientists see as critical to studying the effect humans are having on the climate.
Total Coverage Of Climate Change
In 2015 And 2016

Number Of Minutes On ABC, NBC, CBS, & FOX*

- 2015 Coverage
- 2016 Coverage

*FOX does not have a nightly news program
Crowds massed in the US capital and around the world Saturday to support science and evidence-based research -- a protest partly fueled by opposition to President Donald Trump's threats of budget cuts to agencies funding scientists' work. CNN. Apr 23

Editor comments: Bill Nye, Science Guy, Stylin' the Bowtie to testify. Multiple videos of AAAS President Rush Holt, Joe Romm, and other are on C-SPAN. -PD

Earth Day
April 22, 2017

Why they march: "Science and scientists are under attack."
The March for Science is a response to the Trump administration's distaste for science — or at least the kind that gets in the way of profit — but it is also a celebration of those among us who have devoted their lives to understanding how the world works. The Intercept. Apr 23

Scientists, feeling under siege, march against Trump policies.
Thousands of scientists and their supporters, feeling increasingly threatened by the policies of President Trump, gathered in Washington on Saturday under rainy skies for what they called the March for Science. New York Times. Apr 23

Giant waterfall in Antarctica worries scientists.
Scientists poring over military and satellite imagery have mapped the unimaginable: a network of rivers, streams, ponds, lakes and even a waterfall, flowing over the ice shelf of a continent with an annual mean temperature of more than -50°C. EcoWatch. Apr 23
2016 Post Election Analysis –
the role the Federal Gov’t

Managing Climate Risk
In Trump’s America ...

“The rest of the world, and some individual states, may have to forge ahead on reducing emissions without U.S. leadership.”

Robert Kopp, Civil Beat, Nov. 11th, 2016
Solutions for Answering Hawaii’s Climate Change Challenge
Pathway to Mitigating Global Warming Impacts

1) CLEAN ENERGY

Transition to a Zero Emissions, Clean Energy Economy with environmental and economic benefits for all of Hawai‘i...

Key finding; Hawaii’s Clean Energy Economy will create more local and sustainable jobs

- Nationally, more than 1 million additional jobs by 2030 and up to 2 million jobs in 2050 nationally, including 1.2 million additional jobs in the construction sector; increase U.S. GDP by $145 billion, or 0.6%, in 2030 and by $290 billion, or 0.9%, in 2050 compared to the reference case; (2015 ICF, Berkeley National Laboratory, PNW National Laboratory study)

- Increase household disposable income by $350-$400 in 2030 and by as much as $650 in 2050;

- Save families $5.3 billion on energy bills in 2030 and $41 billion in 2050. ...and that’s just the beginning.
HELCO DIRTY DIESEL POWER PLANT – 2016 WEST HAWAI'I EMISSIONS EXAMPLE
Pathway to Mitigating Global Warming Impacts

2) INFRASTRUCTURE
Develop Sea Invasion Coastal Counter Measures: mitigation policies; planning, construction, roads, airports, utilities, etc.
Pathway to Mitigating Global Warming Impacts

3) ECONOMIC & ENVIRONMENTAL SUSTAINABILITY AND SELF SUFFICIENCY
– Adjust and Transition To New Climate Change Realities; Agriculture, Infrastructure, Clean Energy, Housing, et al.
Hawaii’s Assets for Mitigating *Global Warming Impacts*

1- Its **People** (culture)
2- Its **Location**
3- Its **Environment**
http://www.globetrans-ec.com

1998-2012  enabling clean energy technology

2013 – Present  ...working for a sustainable Hawai’i