BIOFUELS NOW: PETROLEUM FROM PLASTIC

2008 Hawaii Conservation Conference
Biofuels Session
Create a Market for Plastic Trash

July 29, 2008

Hawaii Convention Center

State of Hawaii

Department of Business, Economic Development, and Tourism

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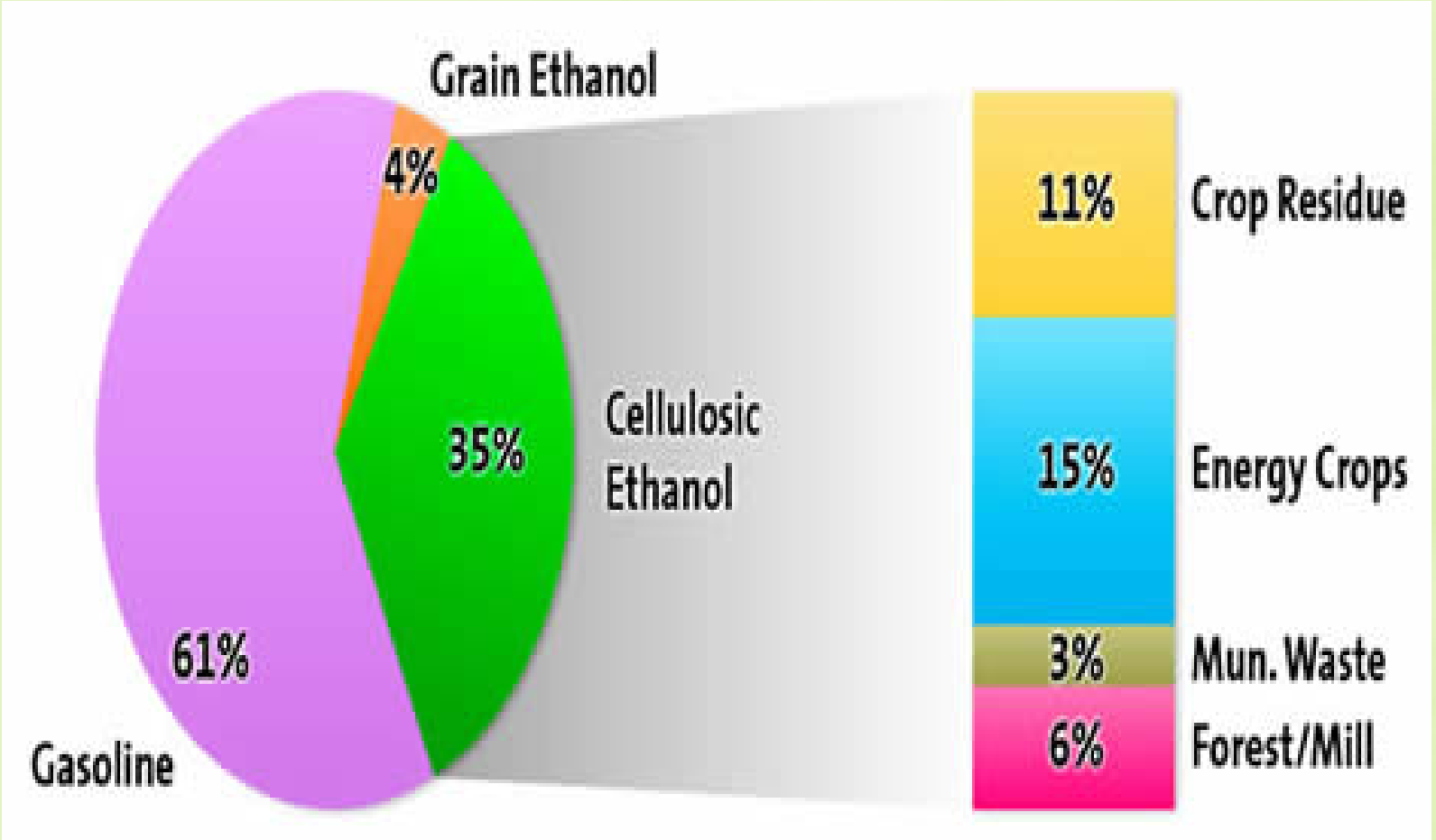
DBEDT
THE DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
STATE OF HAWAII

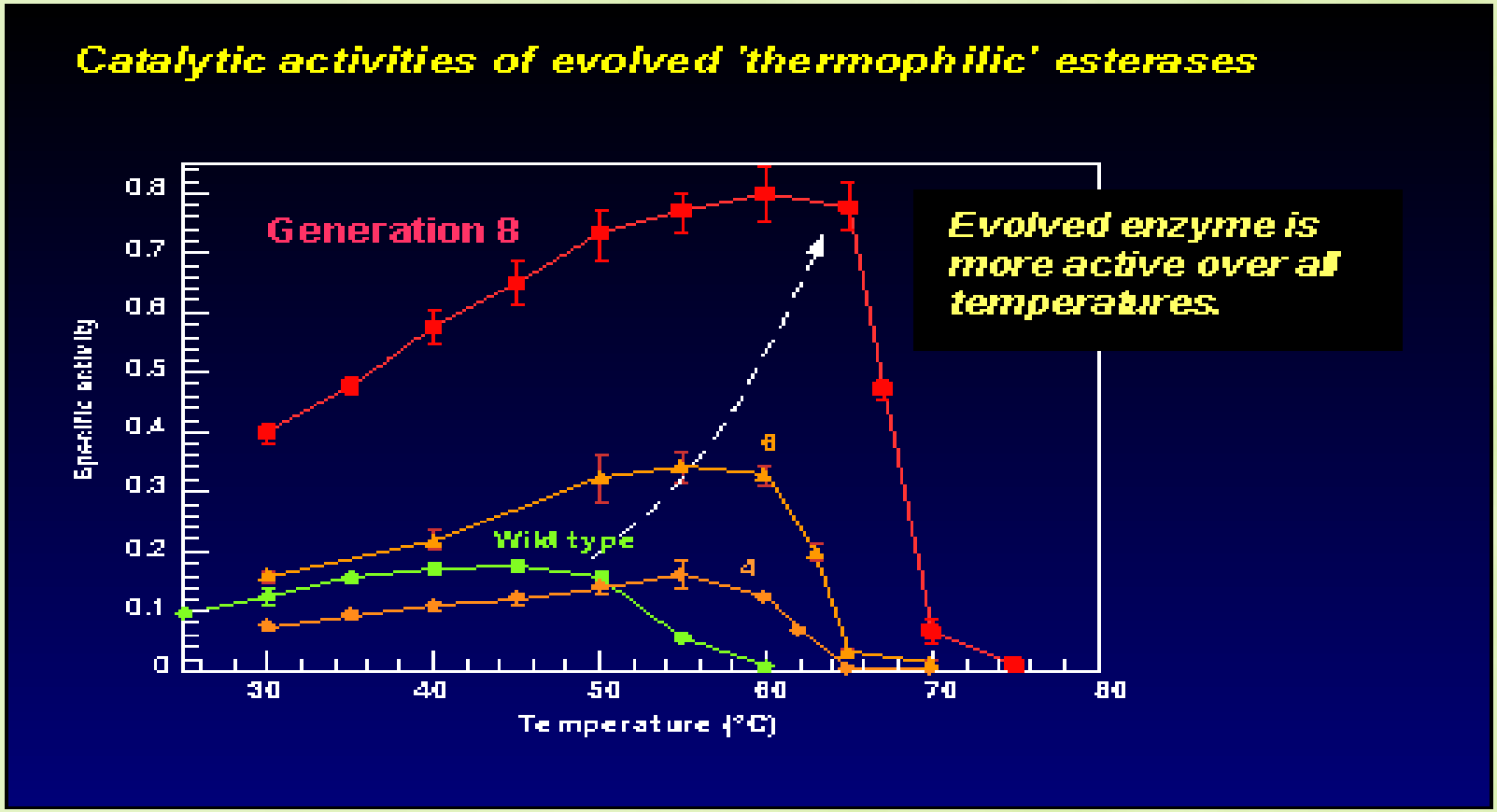
THREE TOPICS COVERED

1. **Overview of biofuels from cellulose. Previous papers have examined specific sources of biofuels. Some of the cutting-edge researchers featured.**
2. **The huge problem of plastics in the North Pacific Ocean. It's killing sea birds, seals, reefs and may be deforming us.**
3. **One solution is a plastic-to-fuel refinery suitable for Hawaii, and perhaps for Midway Island.**

Where will Cellulosic Ethanol Come From?

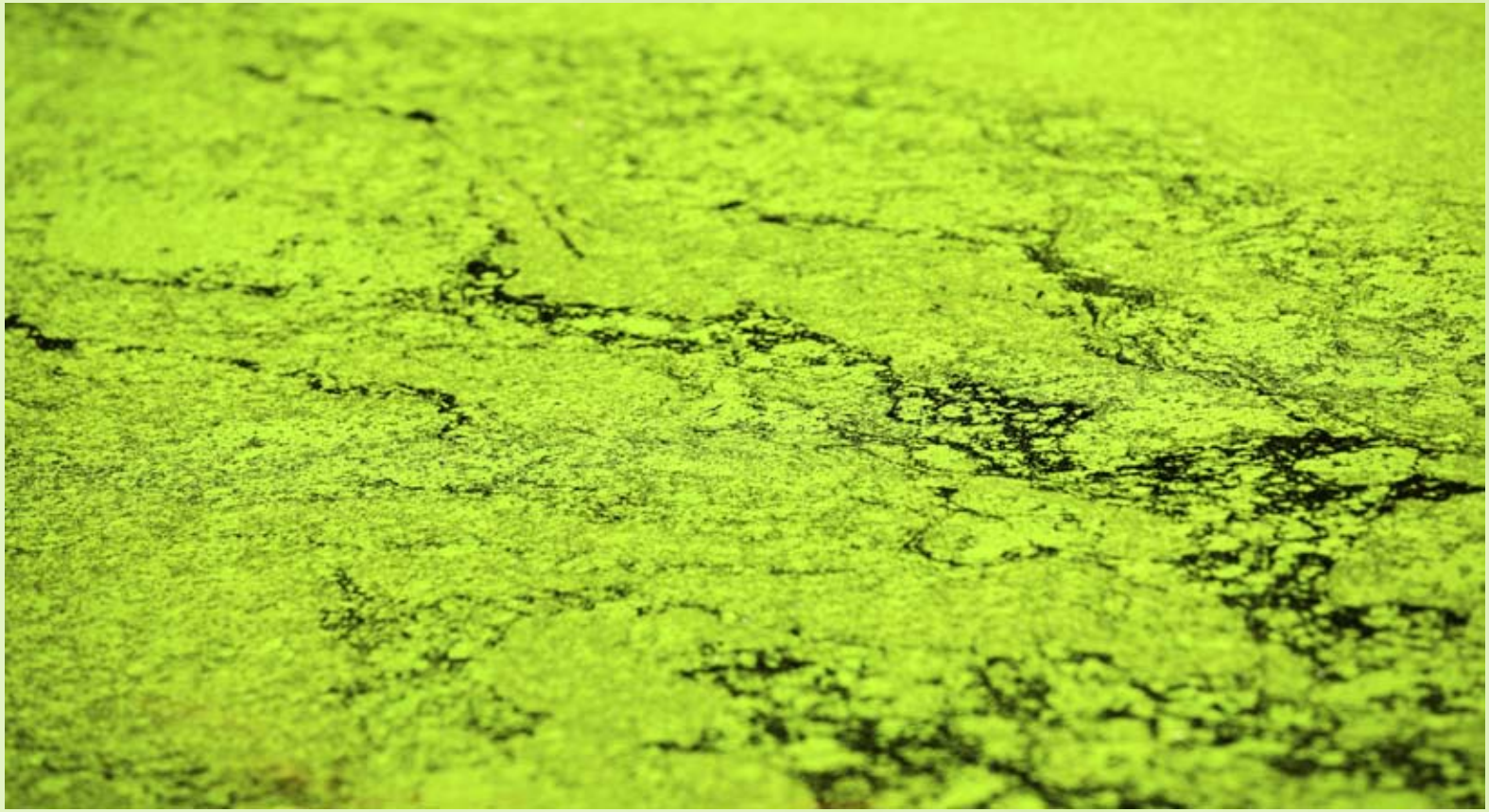


Frances Arnold of Caltech tests enzymes called cellulases to convert cellulose to ethanol

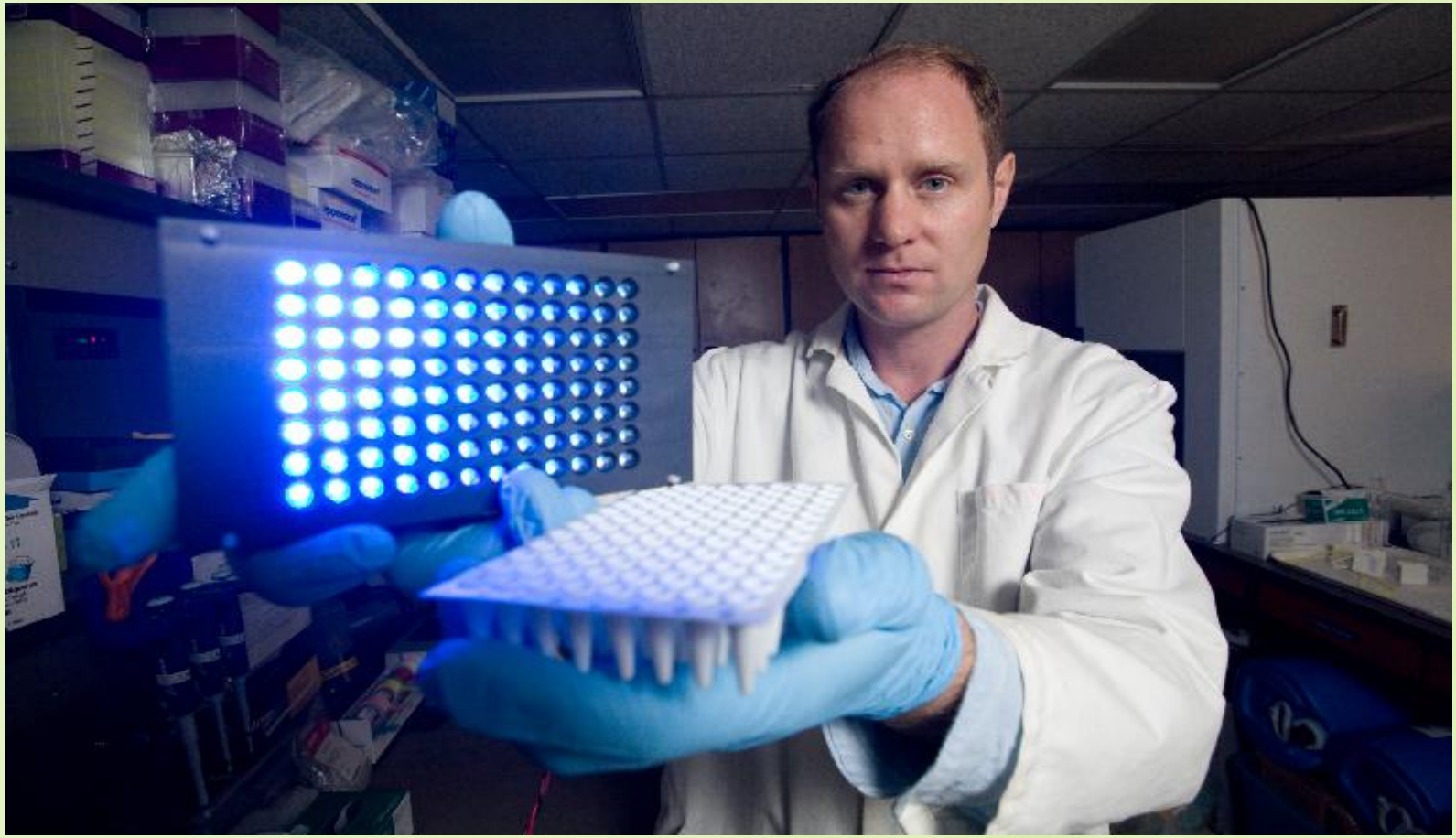


Pilot plant of HR BioPetroleum, Inc., and Royal Dutch Shell at the Natural Energy Laboratory Hawaii Authority at Kailua-Kona, Hawaii Island. On July 15, 2008, Alexander & Baldwin, Hawaiian Electric Industries, and HR BioPetroleum, Inc., announced a partnership to develop a commercial microalgae facility on Maui for biodiesel.

Algae thrives in Hawaii, requires very little water, and can be re-used many times.



UH Professor Zackery Johnson growing different algae cultures.

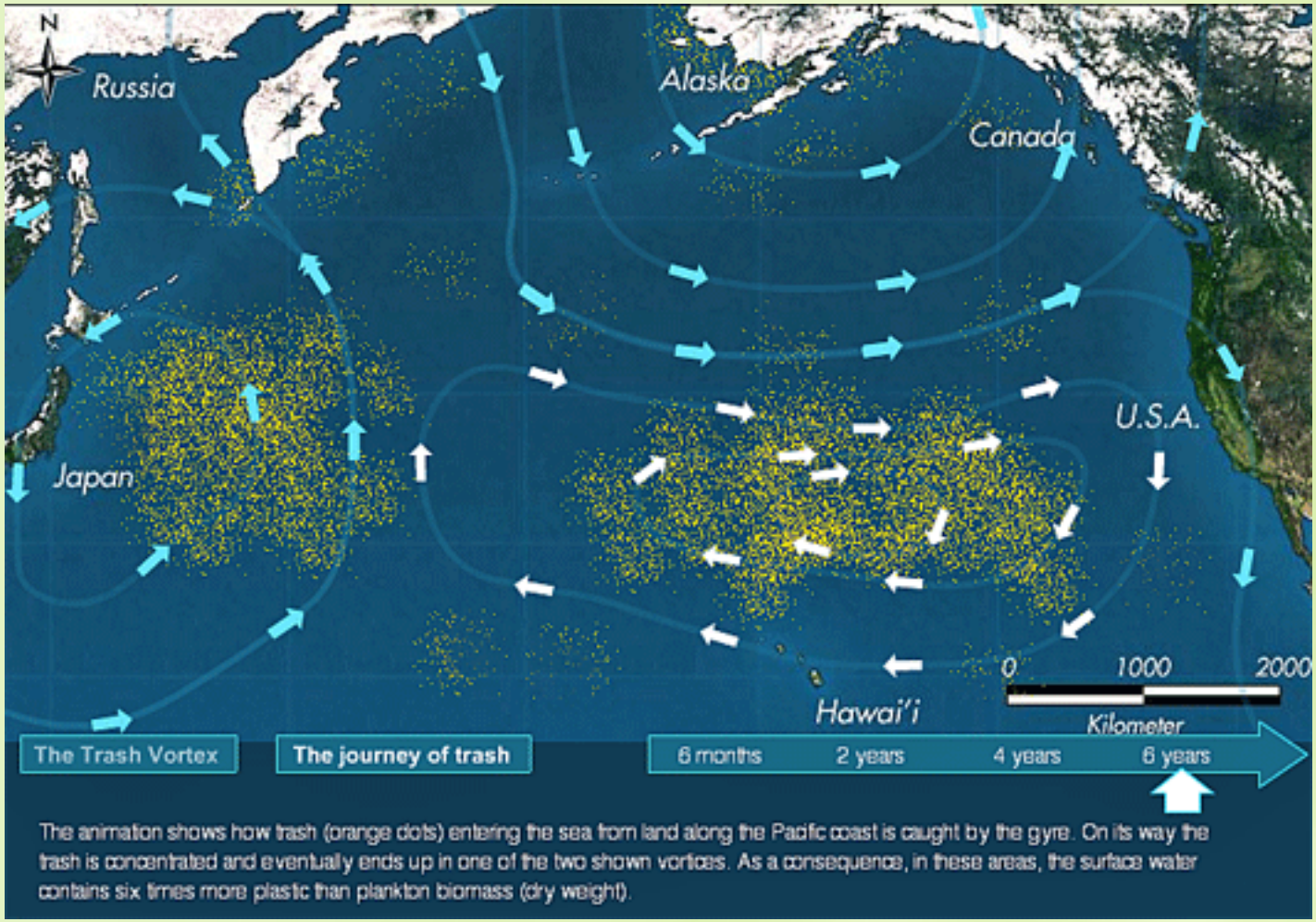


Major algae farm on Maui

- On July 15, 2008, Alexander & Baldwin, Hawaiian Electric Industries, and HR BioPetroleum, Inc., announced a partnership to develop a commercial microalgae facility on Maui for biodiesel. The partnership is planning a major algae farm next to MECO's Maalaea power plant. The plant's carbon dioxide exhaust will be fed into the ponds to stimulate growth. The potential output is 10,000 gallons per acre per year, compared to 600 gallons from palm oil and 48 gallons from soybeans. Projected output is 35 million gallons of ethanol per year. The byproduct can be used as animal feed.

The passion that erupts when UCLA Professor James Liao engineers E. coli to sugar to butanol.

Coskata's Richard Tobey with a bioreactor tube to convert grass or old tires to ethanol.



A super-abundant fuel source is discarded plastic. The yellow marks indicate areas of intense plastic concentration in the North Pacific Ocean. Much it reaches Northwest Hawaiian Island beaches.

From a problem to an electricity-producing solution

- The North Pacific Ocean debris include mounds net, which are harvested, cut up by Schnitzer Steel, and taken to H-POWER for fuel for to generate electricity.

- The Hawaii Longliner's Association is taking this leadership to the next level by voluntarily retrieving ghost nets from the high seas. They deposit the net at Honolulu Harbor where it is taken to Oahu's garbage-to-energy plant at no cost to the taxpayer .

Some 50 million tons of plastic goods are produced yearly and much of it accumulates on the high seas. This debris was trapped before drifting seaward.

What if a market were found for debris to encourage retrieval?

There may be 6 pounds of plastic for every one-pound of plastic in the gyres.

- Plastic photo-degrades by sunlight.

  Smaller pieces are still plastic polymers and are too tough for anything to digest.

- Research indicates that the levels of plastic particulates have at least tripled in the last 10 years

- When the pollutants dock at our cell's receptors, they have negative effects on hormone receptors.

This is why fishermen call the area “the toilet bowl.”

- Fish congregate under floating objects, bringing in fishermen.

We haven't yet a "toxins-to-supermarket" link

- Research needed on plastic particulates and their propensity for serving as magnets for PCBs, DDT and other oily substances, and their ability to interfere with mammalian cell performance.
- Technology is needed to harvest vast quantities of particulates.

- Midway is famous for its 500,000 Laysan Albatross, or “Gooney Birds.”

When Gooney Birds and plastic debris mix.

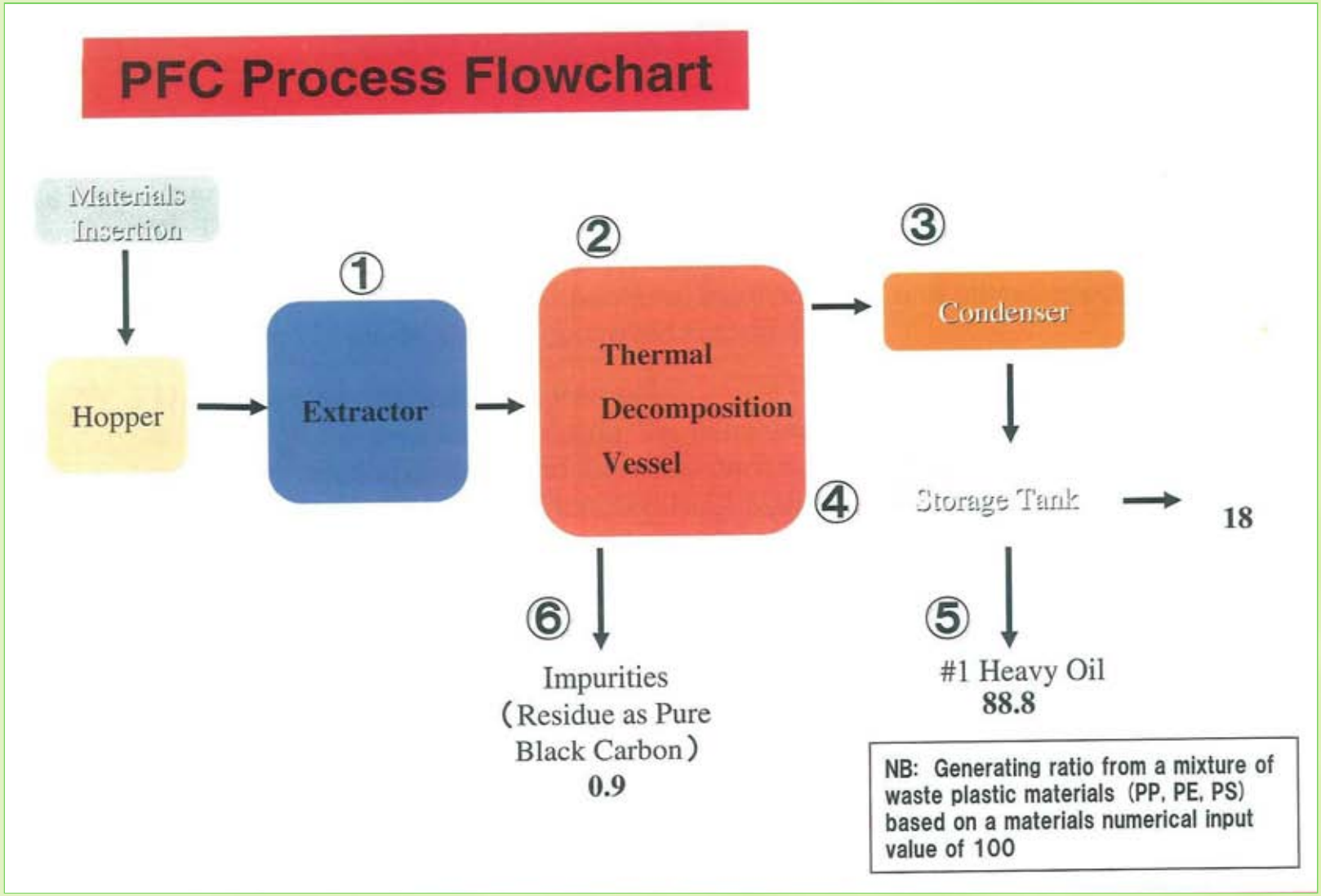
A sample of debris that wash up on Midway's beaches

- Lighters accumulated on Midway Beach. NOAA has received funding to draft a plan to determine the quantity of debris accumulating on Midway, and how best to dispose of it.

Midway's Albatross Ingest Debris

Create a market for plastic trash with a Plastic to Fuel Converter. It is deployed in over 70 locations in Japan.

Converter is self-sustaining, using only 7% of the fuel produced. Carbon black is the residue

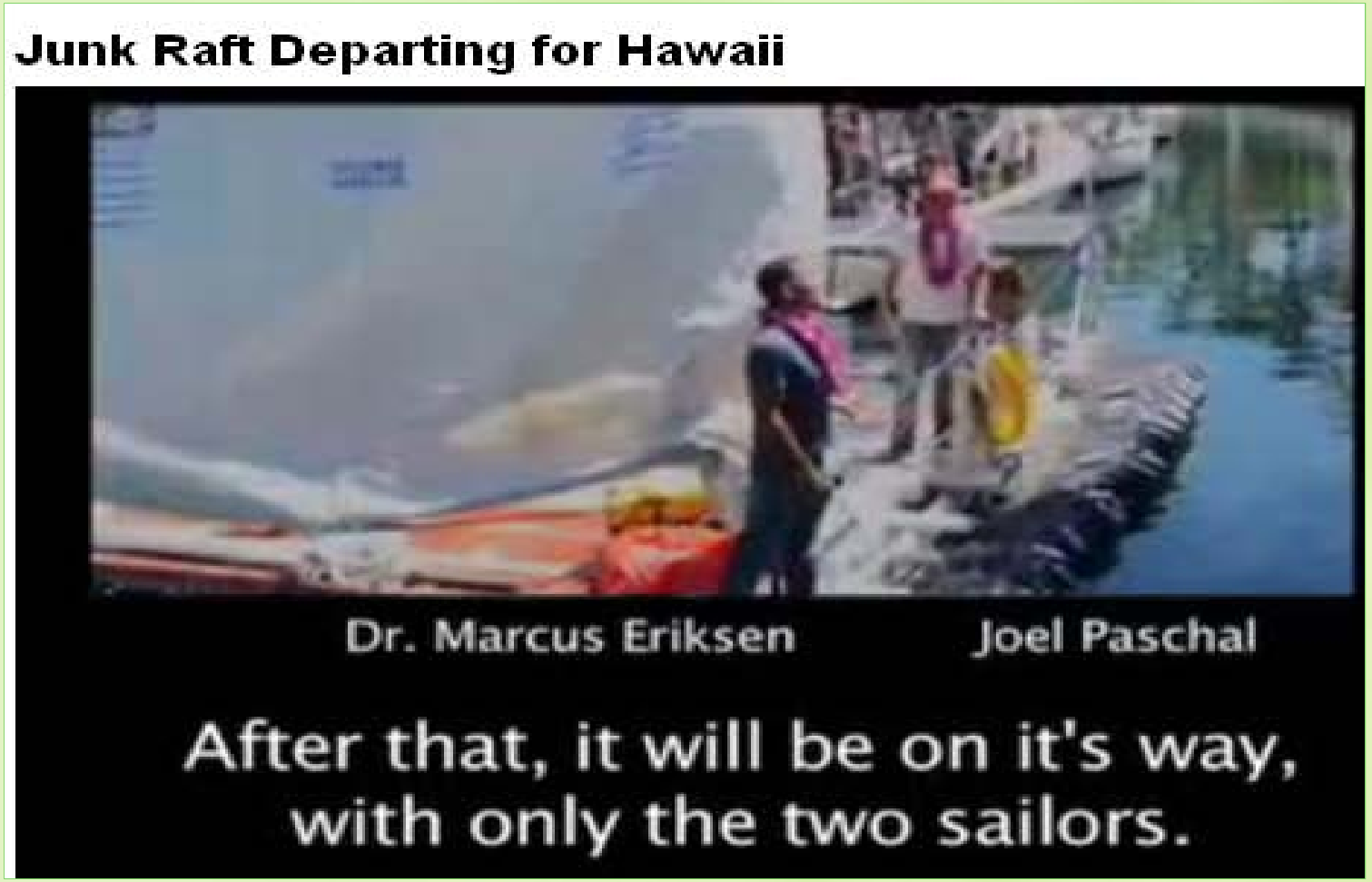


ADVANTAGES TO MIDWAY

The advantages of Midway's serving as a test site include:

- The eco-technology aligns with Midway's National Monument status.
- The abundance of scientists helps to ensure that the refinery will be closely monitored, and the data published.
- The "sustainable tourist" projected to visit Midway is likely to view the refinery as an attraction.
- The refinery is clean burning, emitting only carbon black
- The island's aesthetics will improve with the incentive to convert marine debris to fuel.
- Midway will produce some of its own diesel fuel

Finally, to call attention to the problem, a boat built from an airplane cabin and 15,000 plastic bottles, funded by Captain Charles Moore, is sailing from L.A. to Honolulu on recycled sail power. It should arrive any day now.



Collaboration is sought in writing and publishing papers :

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The ultimate reason for converting debris to fuel.