Tesoro Hawaii
Renewable Energy Initiatives

Presentation to the
Hawaii Energy Policy Forum
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Agenda

- Tesoro's Renewable Energy Strategy
- Advanced Biofuels Technologies
- Other Renewable Energy Initiatives
- Key Takeaways

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Tesoro's Green Strategy Statement

Tesoro will actively pursue business opportunities related to our core business which will position the company to profitably participate in the evolving global movement to produce greener energy.

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Tesoro's Biofuels Strategy

- Participation in First Generation will focus on compliance with regulatory requirements at lowest cost
  - Ethanol
  - FAME-based biodiesel
- Actively participate in the development of advanced biofuels technologies, and participate in projects which leverage the value of Tesoro's existing refining and logistics assets
  - Technologies which allow renewable feedstocks to be processed in refinery facilities
  - High density products, compatible with the existing product distribution system
- Follow the guidelines of the Roundtable for Sustainable Biofuels "Standards for Sustainable Biofuels" in evaluating business decisions

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RSB Sustainability Standards

- The International Roundtable for Sustainable Biofuels released "Version Zero" of its proposed standards for sustainable biofuels on August 13, 2008

1. Biofuel production shall **follow international treaties and national laws** regarding such things as air quality, water resources, agricultural practices, labor conditions, and more.
2. Biofuels projects shall be designed and operated in **participatory processes** that involve all relevant stakeholders in planning and monitoring.
3. Biofuels shall **significantly reduce greenhouse gas emissions** as compared to fossil fuels. The principle seeks to establish a standard methodology for comparing greenhouse gases (GHG) benefits.
4. Biofuel production shall not violate **human rights** or labor rights, and shall ensure decent work and the well-being of workers.
5. Biofuel production shall contribute to the **social and economic development** of local, rural and indigenous peoples and communities.
6. Biofuel production **shall not impair food security**.
7. Biofuel production shall **avoid negative impacts on biodiversity**, ecosystems and areas of high conservation value.
8. Biofuel production shall promote practices that improve **soil health** and minimize degradation.
9. Surface and groundwater use will be optimized and contamination or **depletion of water resources minimized**.
10. Air **pollution shall be minimized** along the supply chain.
11. Biofuels shall be produced in the most **cost-effective** way, with a commitment to improve production efficiency and social and environmental performance in all stages of the biofuel value chain.
12. Biofuel production shall not violate **land rights**.

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Initiatives Aligned with HEPF Priorities

- Fuel Security
  - Integrating Tesoro's existing assets into the developing infrastructure for renewable energy enables Hawaii to minimize its dependence on future importation of finished fuels
  - Refinery is an integral component of the State's emergency preparedness and business recovery plans
- Biofuels Supply
  - Near term: Tesoro's partnerships with renewable energy companies to develop technologies that can lead to successful commercial-scale implementation
  - Longer term: Technologies under development will enable the refinery to transition from refining only fossil-based fuels to a combination of fossil-based and renewable fuels

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Renewable Fuels Feedstocks

- Current – First Generation
  - Ethanol (non-cellulosic) – corn or sugarcane
  - FAME based biodiesels – renewable oils (palm oil, tallow)
  - Production economics and carbon footprint impacted by feedstock availability
  - In the short term, largely are imported to Hawai'i
- "Fuels of the Future" – Advanced biofuels
  - Many potential feedstocks and technologies are in various stages along the road to commercialization
    - Ligno-cellulosic feedstocks (banagrass, sugarcane bagasse, eucalyptus)
    - Renewable oils (palm, peanut, jatropha)
    - Municipal Solid Waste
    - Algae
  - Key sustainability issues:
    - Carbon intensity
    - Land productivity
    - Suitability in terms of land and water use
  - Ultimately must be grown in-state for true energy independence

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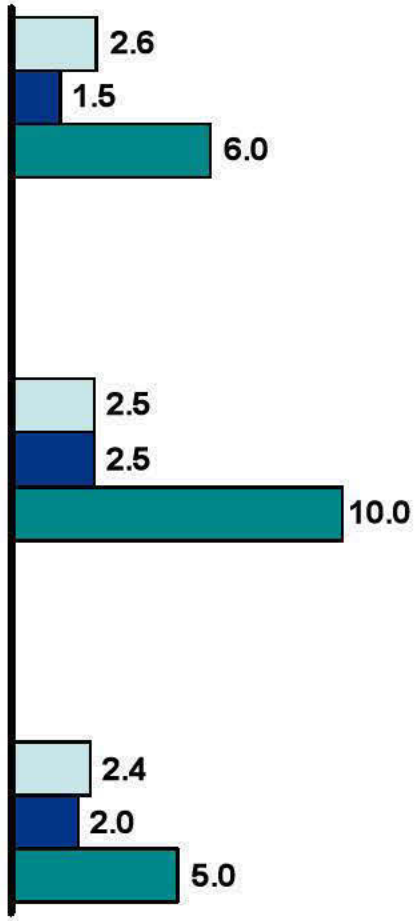
Advanced Biofuels Technologies

Technology	Advantages	Barriers
Cellulosic Biochemical	Cellulose broken down in pretreat, processed into fuels	Can use non-food feedstocks Technology progressing rapidly	Limited scale due to cost of biomass logistics
Biomass Gasification	Biomass convert to syngas Syngas converted into fuels via F-T or similar	Extremely feedstock flexible Syngas may be used to produce variety of products	Extremely high capital costs Mature process limits opportunity for cost reduction
Biomass Pyrolysis	Biomass processed at moderate conditions to produce "pyrolysis oil"	Feedstock flexible Moderate capital Leverages existing refinery infrastructure for processing to fuel	New technology Pyrolysis oil poses significant handling problems

Costs ($/gal)*



* Based on Tesoro's internal estimates

Current production cost
Future production cost
Capital cost (annual capacity)

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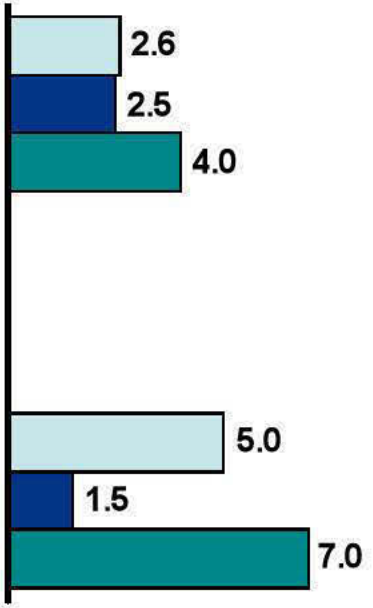
Advanced Biofuels Technologies

	Technology	Advantages	Barriers
Green Diesel	Hydroprocess renewable oils to remove oxygen	Drop-in compatible fuels, including green jet fuel Moderate capital costs when embedded in existing refinery	Limited feedstock flexibility Economics require consideration of alternative uses for land, crops
Algae	Cultivation of algae to produce algal oil (lipids) for processing into fuels	Extremely high land productivity Potential CO2 sink for adjacent industrial facilities Flexible on water quality	Significant technical challenges remain in terms of algae growth, harvesting, and oil recovery

Costs ($/gal)*



Many different technologies are being pursued, many of which will be commercialized
Which technologies "win" remains to be seen
Technology choice largely a function of local availability of biomass

* Based on Tesoro's internal estimates

Current production cost
Future production cost
Capital cost (annual capacity)

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Traditional vs. Drop-in Compatible Biofuels

	Traditional	Drop-in Compatible	Hybrid
Type of fuel	Ethanol, FAME bio-diesel	Bio-butanol Green jet and diesel	Mixed supply and distribution model – Local demand for E10 supplied with locally produced ethanol – Additional supply would come from drop-in fuels
Technology	Cellulosic ethanol Corn.cane ethanol Transestrification	Various, including pyrolysis, gasification, green diesel	
Auto fleet impact	FFV Blend wall issue	No issues with current fleet	
Plant siting	Distributed for proximity to feedstock	May be located near existing refinery, pipeline infrastructure	
Logistics	Dedicated (rail) infrastructure to terminals	Current logistics	
	Requires relaxation of blend wall and/or E85 penetration Significant infrastructure investment required	Significant reduction in infrastructure investment Technology still being commercialized	Hybrid model should provide overall lowest cost of compliance by taking advantage of local biomass resource and existing infrastructure

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Advanced Biofuels Consortiums

- Tesoro is participating in a number of consortiums to develop advanced biofuels competing for ARRA funding
- Envergent Pyrolysis Pilot Plant
  - Tesoro's refinery in Kapolei to host a pilot plant to test pyrolysis technology for converting biomass into "green" crude
  - FOA proposal has cleared the initial screening and has moved on to the oral presentation stage
  - Proposal has received support from HawaiÃ's Congressional delegation
- National Advanced Biofuel Consortium
  - Lead by National Renewable Energy Laboratory
  - Theme: Refinery of the Future
  - Screening and development of technologies to allow biomass processing in existing petroleum refineries
- Tesoro is also participating in several algae consortiums
  - Contributing algal biomass testing and CO2 supply

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Participation in HCEI

- Tesoro has allocated resources to actively participate in the HawaiĀClean Energy Initiative
  - Met with DOE and DBEDT in April to offer support and get input
  - Task Force consisting of local employees and support staff from San Antonio has been chartered
- Participating in Hawaii BioEnergy Master Plan Stakeholders meetings
  - Provided input into development of master plan being developed by Hawaii Natural Energy Institute (HNEI)
- Participating as a member of the HCEI Fuels Working Group
- Tesoro is using our participation in the development of advanced biofuels technologies to help keep the state in the cutting edge of commercialization

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Other: IC Sunshine – Solar Power

- Solar Power project under development in Kapolei
  - Partnership with Axio Power (formerly BQ Energy)
  - 5 MW photovoltaic solar panels on Tesoro's leased land adjacent to refinery (about 1MW net generation)
- Axio is in negotiation with HECO for power sales
- Construction is dependent on two factors
  - HECO power purchasing agreement is needed to get financing
  - Public Utilities Commission approval
- Project completion – approximately 4 months after groundbreaking

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Other: Waste Heat Power Generation

- Tesoro has been working with Raser Technologies in Utah and HawaiĀto develop power generation opportunities
- Raser's geothermal technology can be used to generate electricity from low-level heat that has not been economical to recover in the past
  - Application under study could produce up to 5 MW
- Provides reliable power
  - Nearly availability vs. 20% to 30% for solar and wind

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Key Takeaways

- There is no “silver bullet”
  - HCEI objectives will be met by “All of the Above”
- Land use, productivity, and sustainability are key to a successful in-state biofuel industry
- Proper development of technologies that will be competitive in the long term will take 2 to 5 years
  - There will be small scale plants in the near term, but large scale rollouts will take a while
- A level playing field in terms of government incentives is essential to ensure that the state is supplied with renewable energy at the lowest cost in the long run
- Integration of existing energy assets into the renewable energy world can maximize the capital efficiency of the conversion to renewables

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