

PRESENTATION

Hawaii-DOE Clean Energy Initiative

Strategic Vision and Implementation

Honolulu, Hawaii
June, 2008

This document is confidential and is intended solely for the use and information of the client to whom it is addressed.



Hawaii presents unique opportunities, both immediate and long-term, to fundamentally transform the state's energy sector

- ▶ The state has abundant **local renewable resources**, including sun, wind, geothermal, etc.
- ▶ Hawaii pays the **highest electricity costs** in the nation and among the highest transportation fuel costs
- ▶ Hawaii has large, relatively **unexploited opportunities for efficiency**
- ▶ Oil provides approximately 85% of the state's energy, leaving Hawaii vulnerable to supply disruptions and **energy insecurity**
- ▶ Each island is an **isolated micro-grid** providing an opportunity to focus on whole system solutions

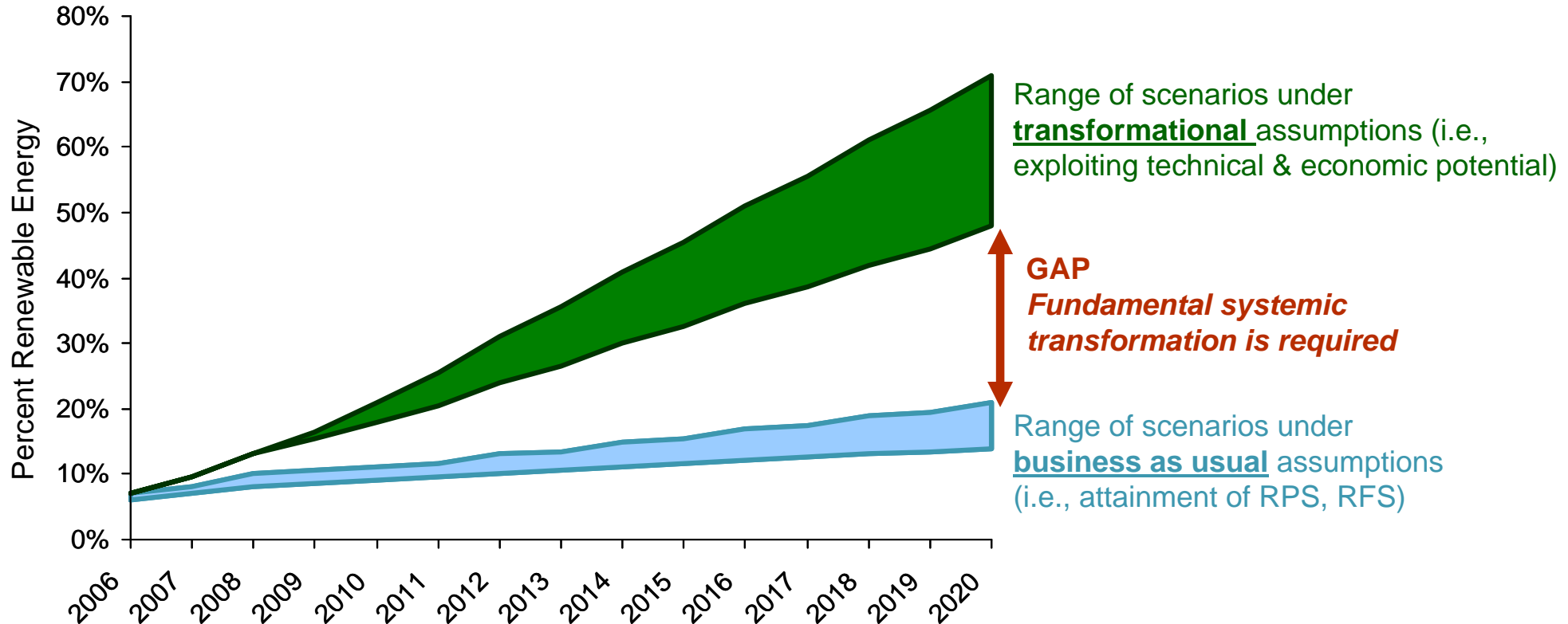
Vision for Hawaii Clean Energy Initiative

To partner with Hawaii and serve as a global model for creating a sustainable, flexible, and economically vibrant path to a carbon-free energy future



Hawaii urgently needs to transition to an economy powered by clean energy, instead of imported oil

In 2004 Hawaii's energy portfolio included 6% renewable energy, a proportion which is set to increase only incrementally under current plans



...but doing so will require a substantive transformation of regulatory, financial, and institutional systems



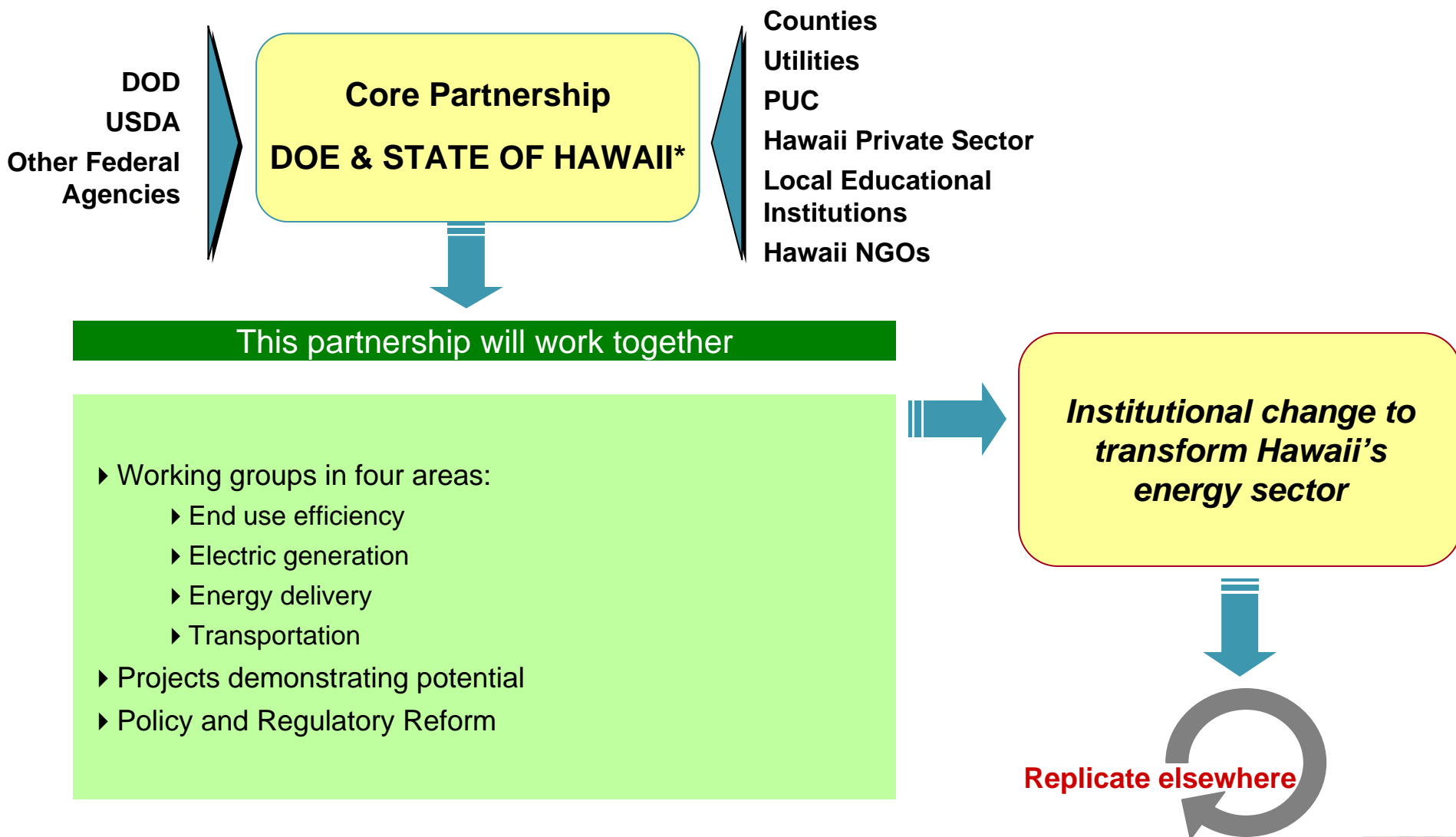
To create this transformative process, Hawaii and U.S. DOE have joined forces to form the Hawaii Clean Energy Initiative

The goals of the initiative are as follows:

- ▶ *Achieve a 70% or greater clean energy basis for Hawaii within a generation*
- ▶ *Increase the security of Hawaii:* Diversify Hawaii's energy supply and increase the security of its energy delivery and defense capabilities
- ▶ *Create economic opportunity at all levels of society:* Develop and diversify Hawaii's economy through innovative, market-based mechanisms that allow every sector to benefit from the transition to clean energy
- ▶ *Foster and demonstrate innovation:* in the technology, financial, organizational and policy models used to achieve a clean energy future
- ▶ *Build the workforce of the future:* help Hawaii create educational and employment opportunities necessary to sustain a clean energy economy
- ▶ *Serve as a "open source" learning opportunity:* Make Hawaii a replicable model for achievement of a clean energy-based economy for the world



DOE and Hawaii will coordinate the Initiative, drawing on the critical input and expertise of local stakeholders and other Federal agencies



* Hawaii's Department of Business, Economic Development and Tourism has the primary lead for the partnership



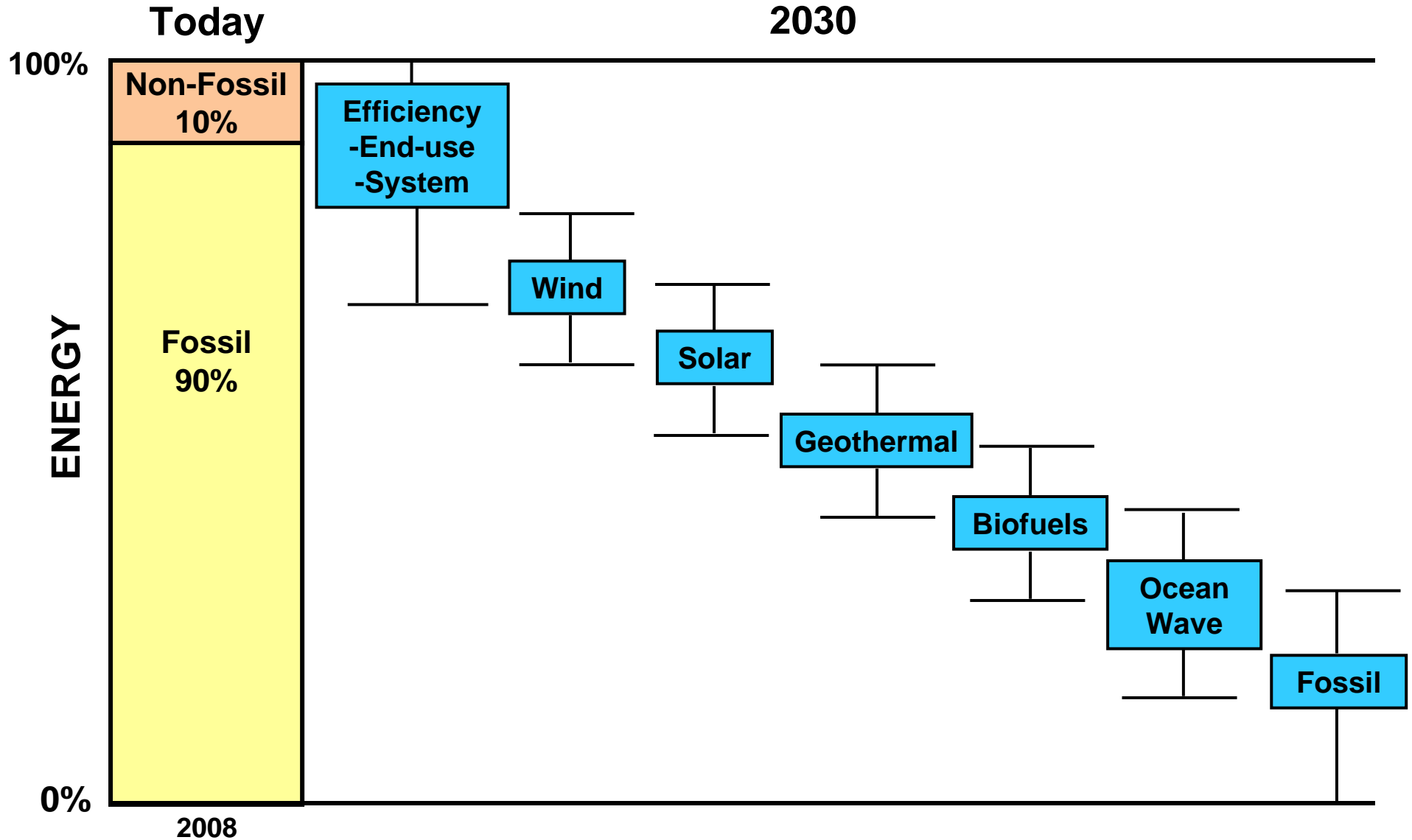
HCEI Projects/Actions

- ▶ Electricity Grid Modeling and Tool Development
- ▶ Maui Smart Grid (controls, storage)
- ▶ Renewable Lanai
- ▶ Sustainable Communities-Forest City Military Housing
- ▶ Plug-in Hybrid Electric Vehicle Demonstrations
- ▶ GHG Impacts-McKinsey
- ▶ Scenario Options- Booz Allan
- ▶ Regulatory Training

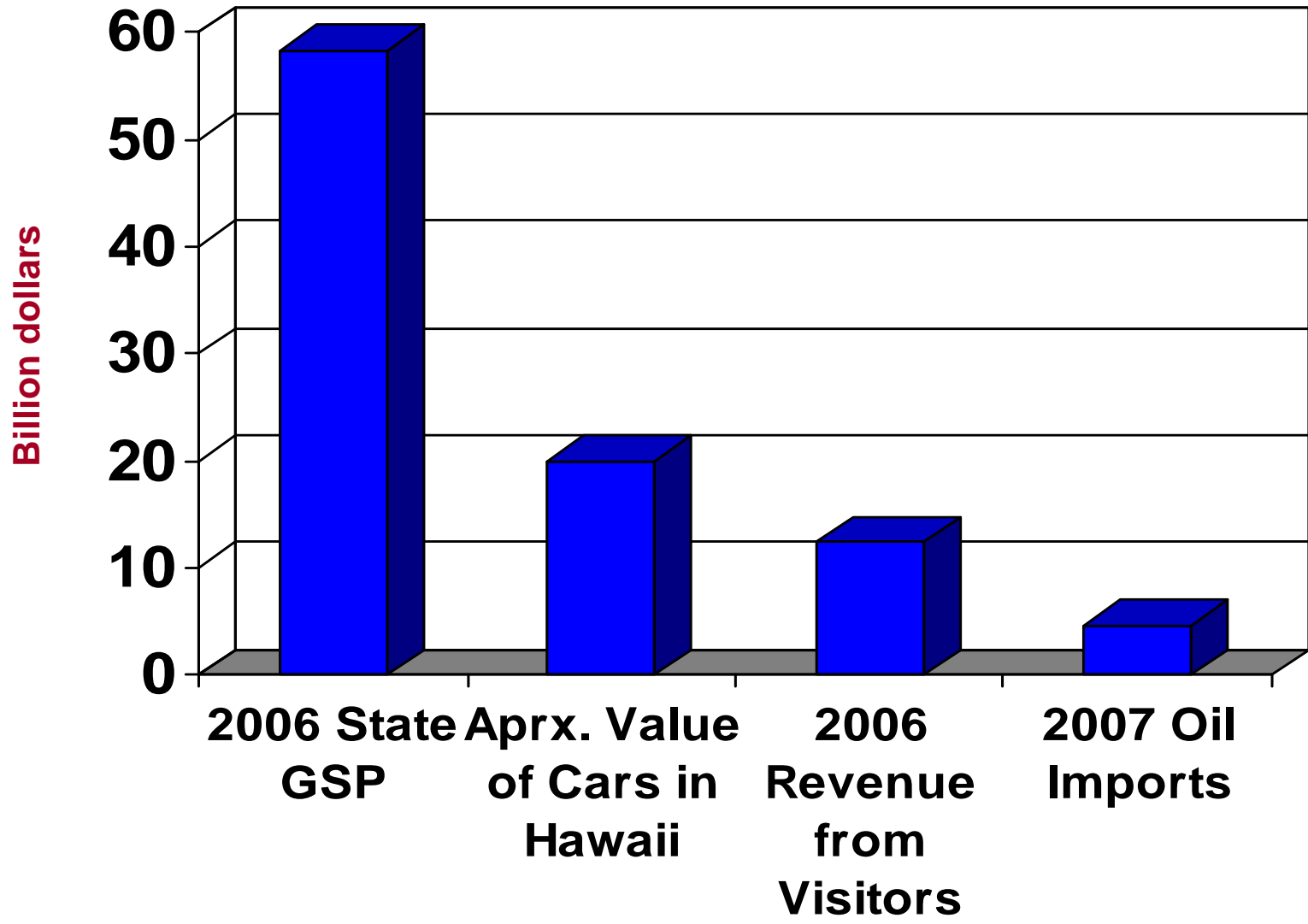


HAWAII CLEAN ENERGY INITIATIVE

Envisioning Energy Options – Requires a Portfolio Approach



Comparative Scale of Funding



Sources: Hawaii Databook, DBEDT, other estimates



Preliminary Estimate of Hawaii's Greenhouse Gas Emissions in 1990 and 2005 Expressed as Global Warming Potential

Tons Carbon Dioxide Equivalent (Tons CO₂E)

	1990	2005	Percentage Change 1990- 2005
ENERGY SECTOR			
Residential Commercial Industrial	1,182,631	2,297,520	94.3%
Electric Utility	7,884,515	9,037,987	14.6%
Stationary Subtotal	9,067,146	11,335,507	25.0%
Domestic Transportation Subtotal	7,776,389	8,709,843	12.0%
International Transportation Subtotal	6,432,255	4,722,044	-26.6%
Military Aviation Fuel	677,100	832,815	23.0%
Transportation Subtotal	14,885,744	14,264,702	-4.2%
Energy TOTAL	23,952,890	25,600,209	6.9%
NON-ENERGY SECTOR	1990	2005	
Industrial Processes: Oil/Gas Transportation, Refining, Storage	4,977	5,157	3.6%
Industrial Processes: Cement Manufacturing	109,274	Ended 1995	
Industrial Processes Subtotal	114,251	5,157	-95.5%
MSW Management	1,161,291	1,701,100	46.5%
Wastewater Treatment	21,563	23,923	10.9%
Domestic Animals	273,879	192,119	-29.9%
Manure Management	129,768	56,774	-56.2%
Sugarcane Burning	31,958	10,797	-66.2%
Fertilizer Use	60,850	62,310	2.4%
Non-Energy TOTAL	1,793,559	2,052,180	14.4%
TOTAL	25,746,449	27,652,389	7.4%

Estimated June 2007



The Hawaii Greenhouse Gas Emissions Reduction Task Force - Objectives

1. Reduce, by January 1, 2020, greenhouse gas emissions in the State to levels at or below the best estimations and updates of the inventory of greenhouse gas emissions estimates for 1990
2. Establish a task force to prepare a work plan and regulatory scheme for implementing the **maximum practically and technically feasible and cost-effective reductions** in greenhouse gas emissions from sources or categories of sources of greenhouse gases to achieve the statewide greenhouse gas emissions limits by 2020.



McKinsey Analysis of Abatement Costs

POTENTIAL ABATEMENT ROADMAP

ILLUSTRATIVE

	Phase 1	Phase 2	Phase 3
Biofuels	<p>Ethanol 1st wave</p> <ul style="list-style-type: none"> Convert existing sugarcane to ethanol production <p>Biomass 1st wave</p> <ul style="list-style-type: none"> Build dedicated co-firing and bagasse plants 	<p>Ethanol 2nd wave</p> <ul style="list-style-type: none"> Expand ethanol production to 1969 sugarcane peak <p>Biomass 2nd wave</p> <ul style="list-style-type: none"> Expand biomass capacity with ethanol production 	<p>Ethanol 3rd wave</p> <ul style="list-style-type: none"> Develop cellulosic production facilities on the Big Island <p>Biomass 3rd wave</p> <ul style="list-style-type: none"> Build cellulosic firing plants
Renewable electricity	<p>Baseload geothermal</p> <ul style="list-style-type: none"> Expand reliable geothermal production on the Big Island <p>Intermittent wind</p> <ul style="list-style-type: none"> Deploy wind capacity on top of existing grid infrastructure 	<p>Solar CSP</p> <ul style="list-style-type: none"> Develop utility scale solar <p>Firm wind</p> <ul style="list-style-type: none"> Connect Maui county and Oahu via cable Develop pumped storage 	<p>Wind and geo for PHEVs</p> <ul style="list-style-type: none"> Deploy PHEV fleet and power with renewable resources <p>Distributed solar</p> <ul style="list-style-type: none"> Encourage residential / commercial adoption of PV
Efficiency	<p>Efficient lighting</p> <ul style="list-style-type: none"> Encourage adoption of high efficiency lighting (e.g., CFLs) 	<p>Sea water AC and CHP</p> <ul style="list-style-type: none"> Create distributed generation and cooling capacity 	<p>Efficient electronics and LEDs</p> <ul style="list-style-type: none"> Expand penetration of LEDs, efficient electronics
Incremental annual impact in 2030*	<p>3.6 MMt CO₂e 7.4 MMB oil</p>	<p>6.4 MMt CO₂e 12.7 MMB</p>	<p>5.4 MMt CO₂e 10.4 MMB</p>

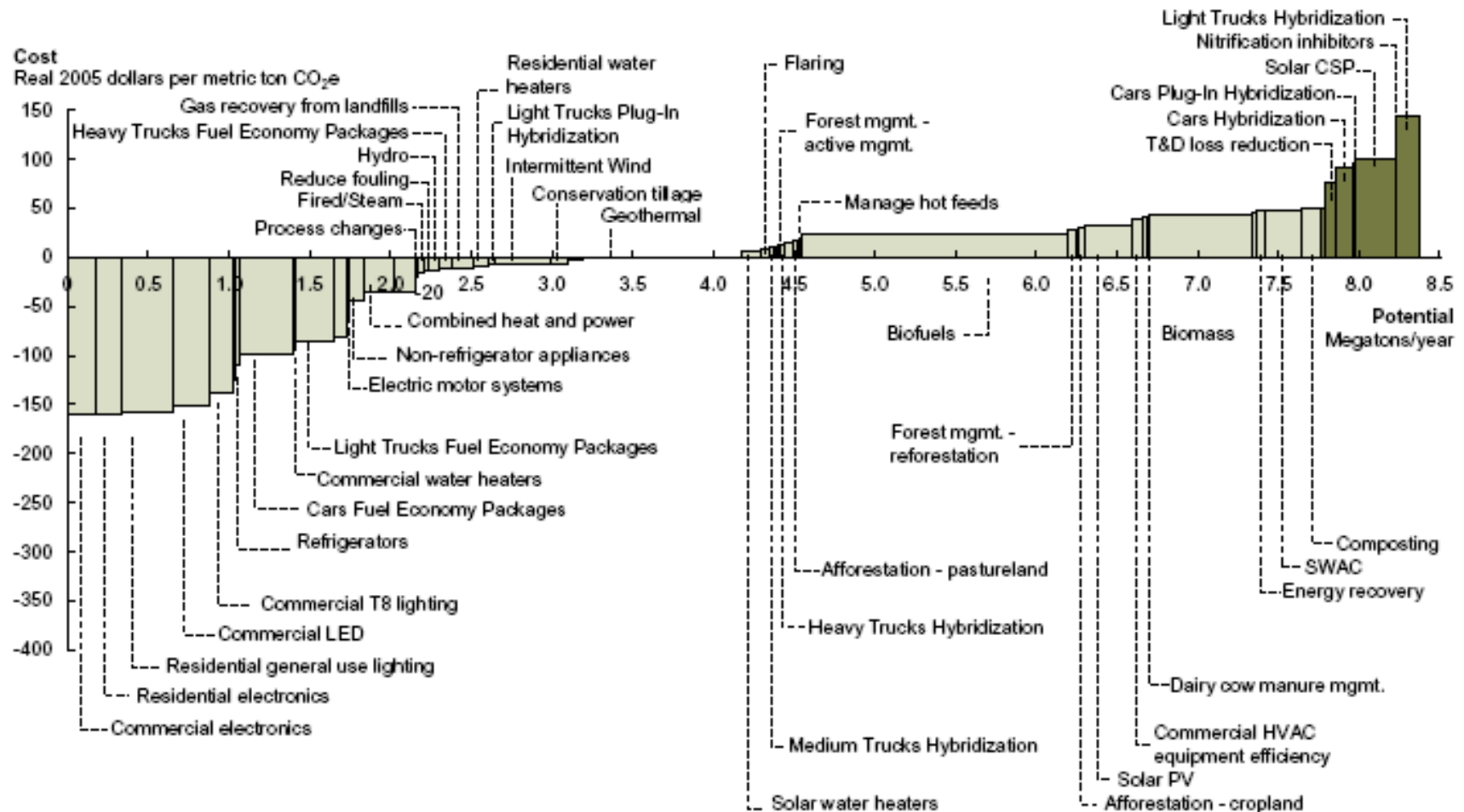
McKinsey Analysis of Abatement – Cost Curve

WE ESTIMATE THE MID-RANGE GHG ABATEMENT OPPORTUNITY AT 7.8 Mt CO₂e LESS THAN \$50/TON

Hawaii GHG Abatement Curve (Abatement Opportunity : 7.8 MtCO₂ and 17.2 MMB)

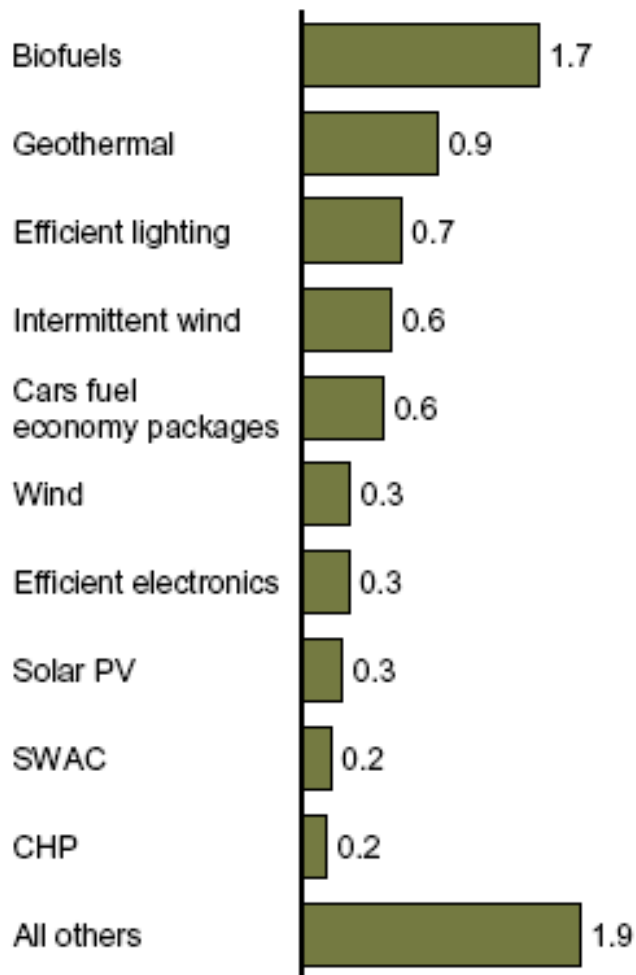
ANALYSIS BASED ON \$60/BBL OIL

Abatement cost <\$50/ton

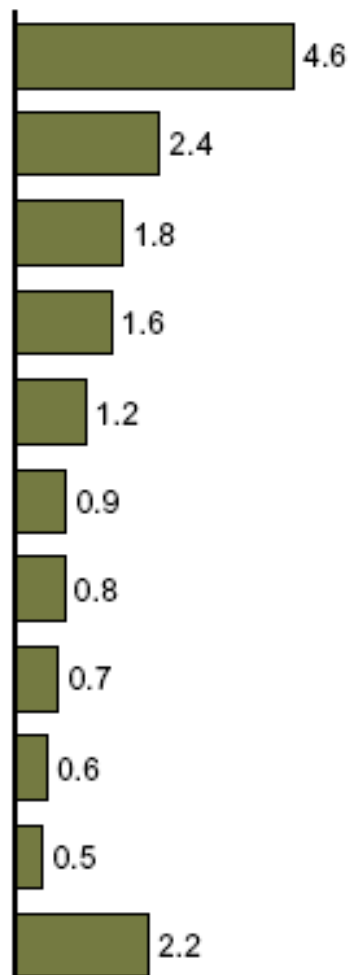


75% OF GHG ABATEMENT POTENTIAL (AND NEARLY 90% OF OIL ABATEMENT) CAN BE ACHIEVED FROM TOP TEN INITIATIVES

Top 10 GHG Abatement Initiatives for Hawaii
MMt CO₂e



Oil abatement
MMB



- Top 10 initiatives account for 5.9 MMt abatement and 15.0 MMB
- Hawaii has benefit of being able to focus on fewer, higher-impact initiatives than the U.S.
- Ensuring progress against these initiatives is critical to capturing full abatement potential