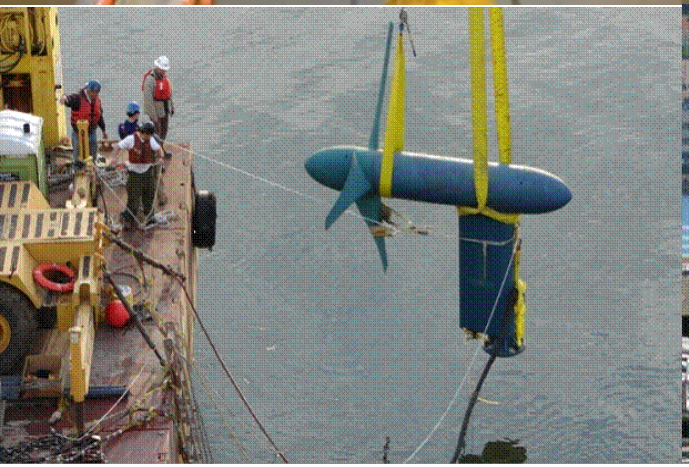
DOE Water Power Activities

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



National Hydropower Association

April 27, 2010

DOE Water Power Mission

- **Assess the potential extractable energy from domestic rivers, estuaries and marine waters**
- **Help industry harness this renewable, emissions-free resource through environmentally sustainable and cost-effective electric generation**

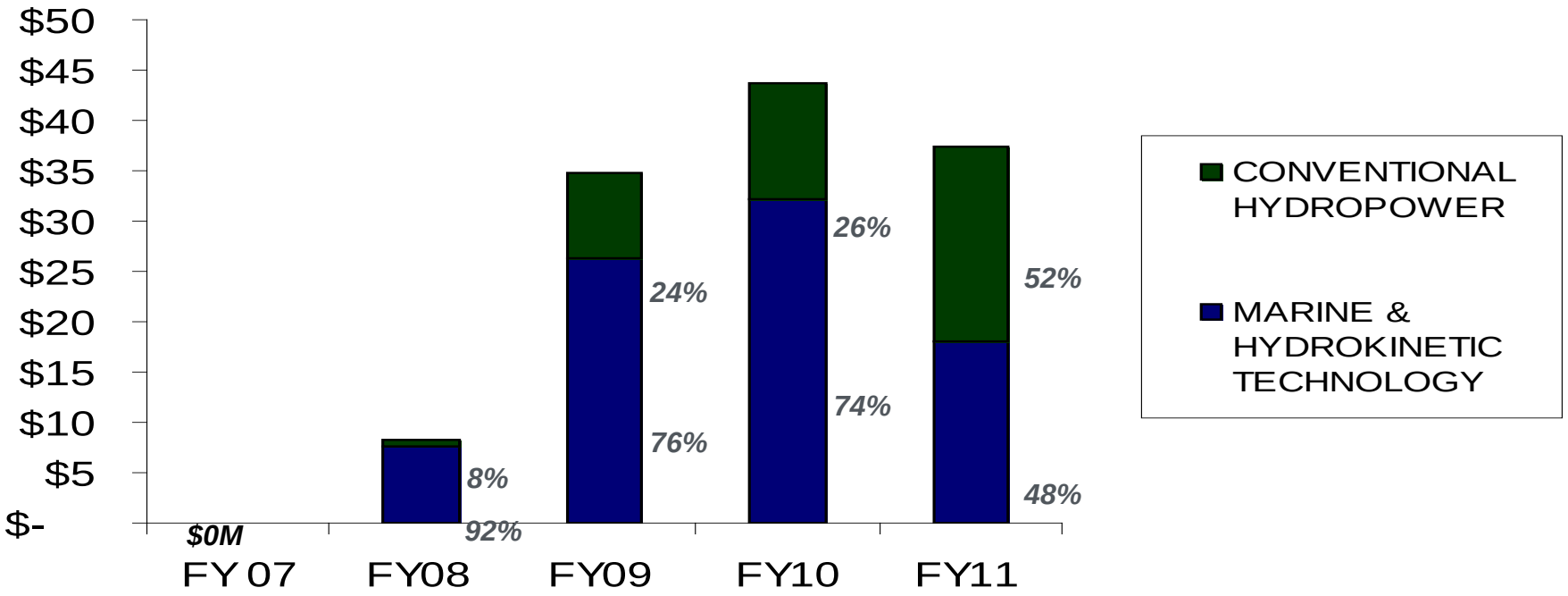
EERE focuses on applied research, development, and deployment

- *Most fundamental R&D undertaken by DOE Office of Science*
- *Policy role limited to advice and recommendations*

Rapid Program Growth

Program Funding ($M)	FY07	FY08	FY09	FY10
Total	**$0.0**	**$8.3**	**$40**	**$50**

Program Funding Breakdown by Technology



Conventional Hydropower.

Hydropower Resource Classes

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Optimization and Process Improvements

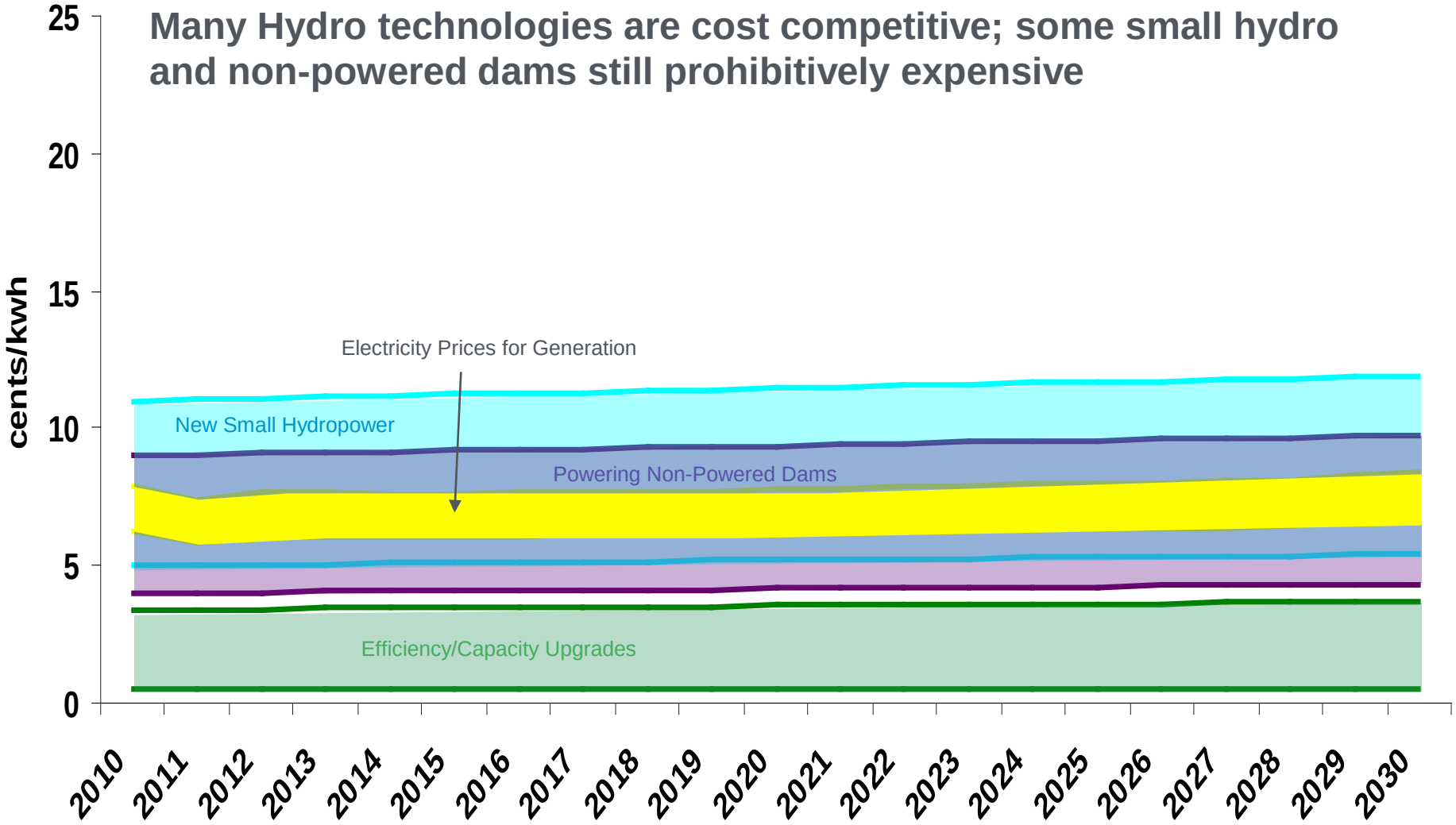
Hardware and Capacity Upgrades

Non-Powered Dams:

Small Hydro Developments:

CH: Cost of Energy

Many Hydro technologies are cost competitive; some small hydro and non-powered dams still prohibitively expensive



Barriers to Development: Hydropower

- High capital cost and long payback period limits financing
- Long and costly licensing process deters construction
- Lack of market for ancillary services reduces value and promotes inefficient operation
- Lack of comprehensive data keeps hydro out of deployment models
- Environmental impacts (real and perceived) lead to fewer legislative incentives and increased regulatory uncertainty
- Technology costs remain high in certain sectors

CH Deployment Support

Step 1. Support immediately-available, low-cost upgrades and feasibility studies to identify additional opportunities

- Deployment support for immediate, lowest-cost opportunities
- Feasibility studies to identify and publicize additional low-cost, advanced-technology opportunities; targeted deployment support to catalyze private sector investment
- Develop operational tools to maximize generation at existing and new facilities

Step 2. Address technology and policy needs to maximize medium-long term opportunities

- Identify critical COE drivers for small hydropower, environmental mitigation technologies and pumped storage; fund targeted R&D to reduce COE
- Market analysis to accurately quantify and monetize hydropower ancillary services

Step 3. Engage regulators and environmental stakeholders to reduce license time and cost

- Align energy generation and environmental priorities across river basins to facilitate development
- Generate data to more accurately correlate generation and water use with environmental impacts

Primary DOE Research Areas

Technology Development and Deployment

Technology Deployment and Feasibility Studies

- Support immediately available low-cost upgrades and feasibility studies to identify additional opportunities

Advanced Technology Development

- Targeted R&D to reduce key cost drivers to small hydro and PSH technologies

Hydropower Optimization

- Develop operational tools to maximize generation at existing and new facilities

Market Acceleration

Resource Assessments

- Quantify resource availability and integrate with technology data to produce cost curves

Regulatory and Environment

- Engage regulators and environmental stakeholders to reduce license time and cost

Economic Analysis and Education

- Quantify full market value of hydropower services; integrate into energy benefit/deployment model; stimulate private R&D efforts

DOE-DOI-DOA MOU

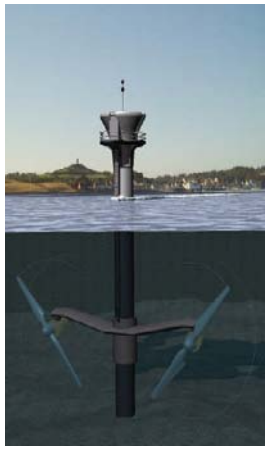
On March 24, DOE, the Corps and the Bureau signed an MOU to increase the generation of renewable energy from hydropower and reduce the environmental impacts associated with historic hydropower development.

The approach of the MOU is to advance hydropower projects that are superior in terms of environmental sensitivity to many other types of energy production and development.

The MOU lays out 7 broad areas of coordination, described to the right:

- Federal Facility Energy Resource Assessment
- Integrated Basin Scale Opportunity Assessments
- Green Hydropower Certification
- Creation of a Federal Inland Hydropower Working Group
- Technology Development and Deployment
- Renewable Energy Integration and Storage
- Regulatory Process

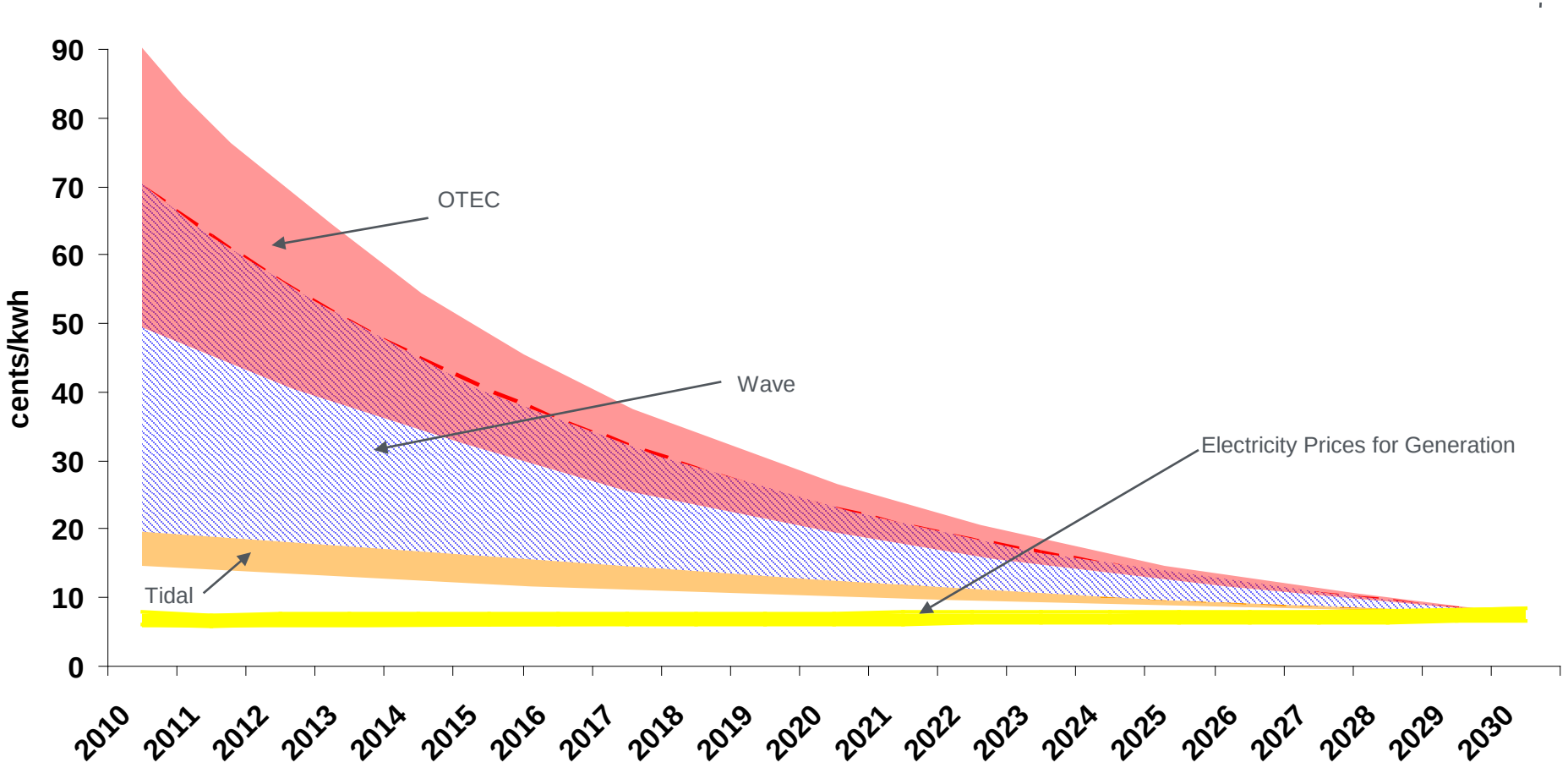
Marine and Hydrokinetics

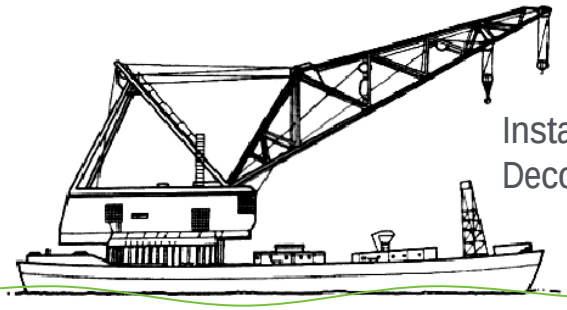




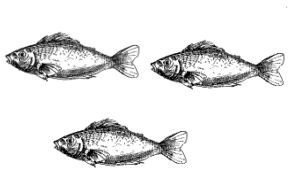

Key Barrier: Technologies not yet cost competitive



Reference Site Models--Estimated Components of Project Cost

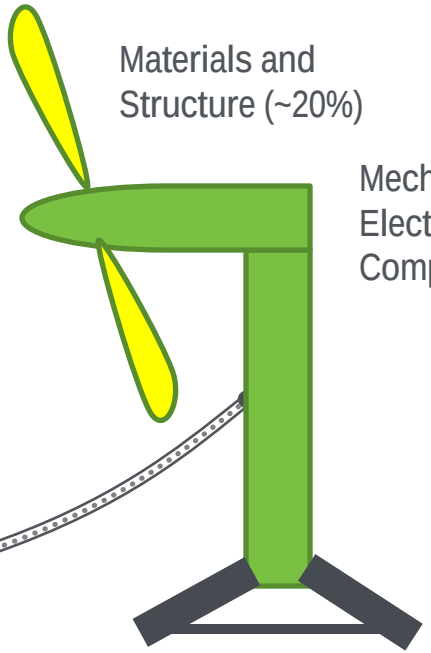


Installation, O+M, and Decommissioning (~10%)



Siting, Environmental Monitoring and Permitting (~20%)

Transmission and Grid Interconnection (~5%)



Materials and Structure (~20%)

Mechanical and Electrical Components (~30%)

Moorings and Foundation (~15%)

MHK Cost Reduction

Step 1. Demonstrate functionality and establish baseline cost and performance data

- Initiate targeted R&D necessary to advance components and systems to demonstration phase
- Support comprehensive testing at progressive technology stages to quantify cost and performance drivers
- Develop tools, models, and materials to ensure system survivability
- Identify and minimize key environmental impacts to allow for demonstration permits

Step 2. Quantify key COE drivers

- Integrate resource assessments, technology cost and performance data, advanced cost/performance models to identify critical drivers to reduce overall COE across MHK technologies

Step 3. Refine R&D priorities and set resource specific COE milestones

- Adjust RD&D focus as necessary to reflect critical components, energy capture designs, and siting needs for least cost MHK systems

MHK Project Portfolio

Primary DOE Research Areas

Technology Development

System Development, Deployment and Verification

- Prove device functionality and generate cost, performance and reliability data

Research Tools and Models

- Develop design codes, models necessary for system development and testing

Test Centers and Facilities

- Ensure necessary facilities exist to generate and collect system data

Technology Characterization and Evaluation

- Develop standards and models to analyze and evaluate test data

Market Acceleration

Resource Assessments

- Quantify resource availability and integrate with technology data to produce cost curves

Environment and Siting

- Evaluate and minimize key environmental risks to permitting and deployment of demonstration projects

Economic Analysis and Market Development

- Disseminate technology and resource data and integrate into energy benefit/deployment models

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CH Project Portfolio

Primary DOE Research Areas

Technology Development and Deployment

Technology Deployment and Feasibility Studies

- Support immediately available low-cost upgrades and feasibility studies to identify additional opportunities

Advanced Technology Development

- Targeted R&D to reduce key cost drivers to small hydro and PSH technologies

Hydropower Optimization

- Develop operational tools to maximize generation at existing and new facilities

Market Acceleration

Resource Assessments

- Quantify resource availability and integrate with technology data to produce cost curves

Regulatory and Environment

- Engage regulators and environmental stakeholders to reduce license time and cost

Economic Analysis and Education

- Quantify full market value of hydropower services; integrate into energy benefit/deployment model; stimulate private R&D efforts