# 2009 Integrated Energy Policy Report Staff Workshop

## INTRODUCTION TO THE LEVELIZED COST OF ELECTRICITY GENERATION TECHNOLOGIES PROJECT

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Al Alvarado, Manager
Electricity Analysis Office
California Energy Commission

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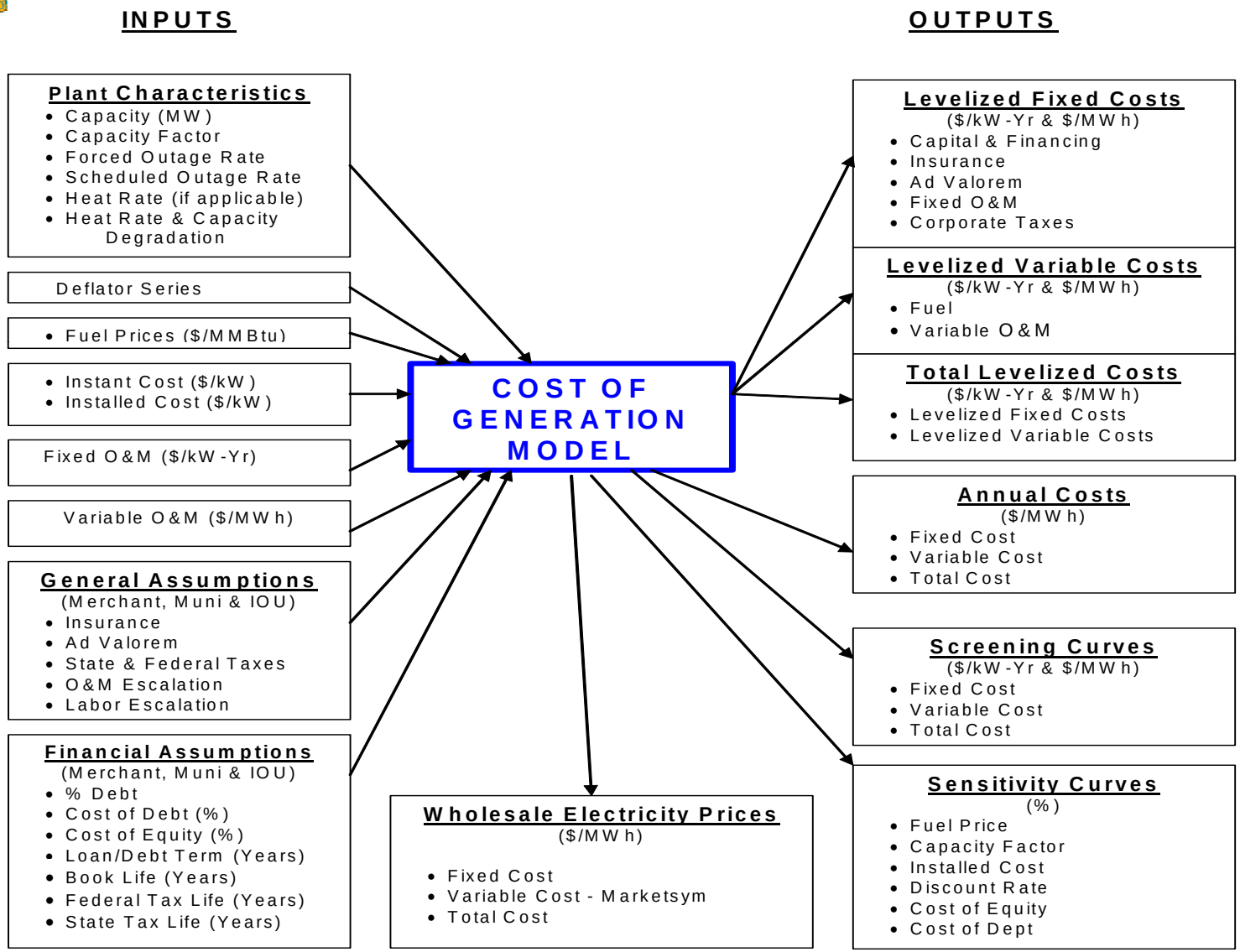
# Context to the Levelized Cost of Generation Project

- Support the development of the 2009 Integrated Energy Policy Report (IEPR)
- Update of the 2003 and 2007 IEPR cost analysis
- Serves as a building block for electricity resource planning studies
- Subject of today's workhop is the first phase of overall project

# Cost of Generation Project Tasks:

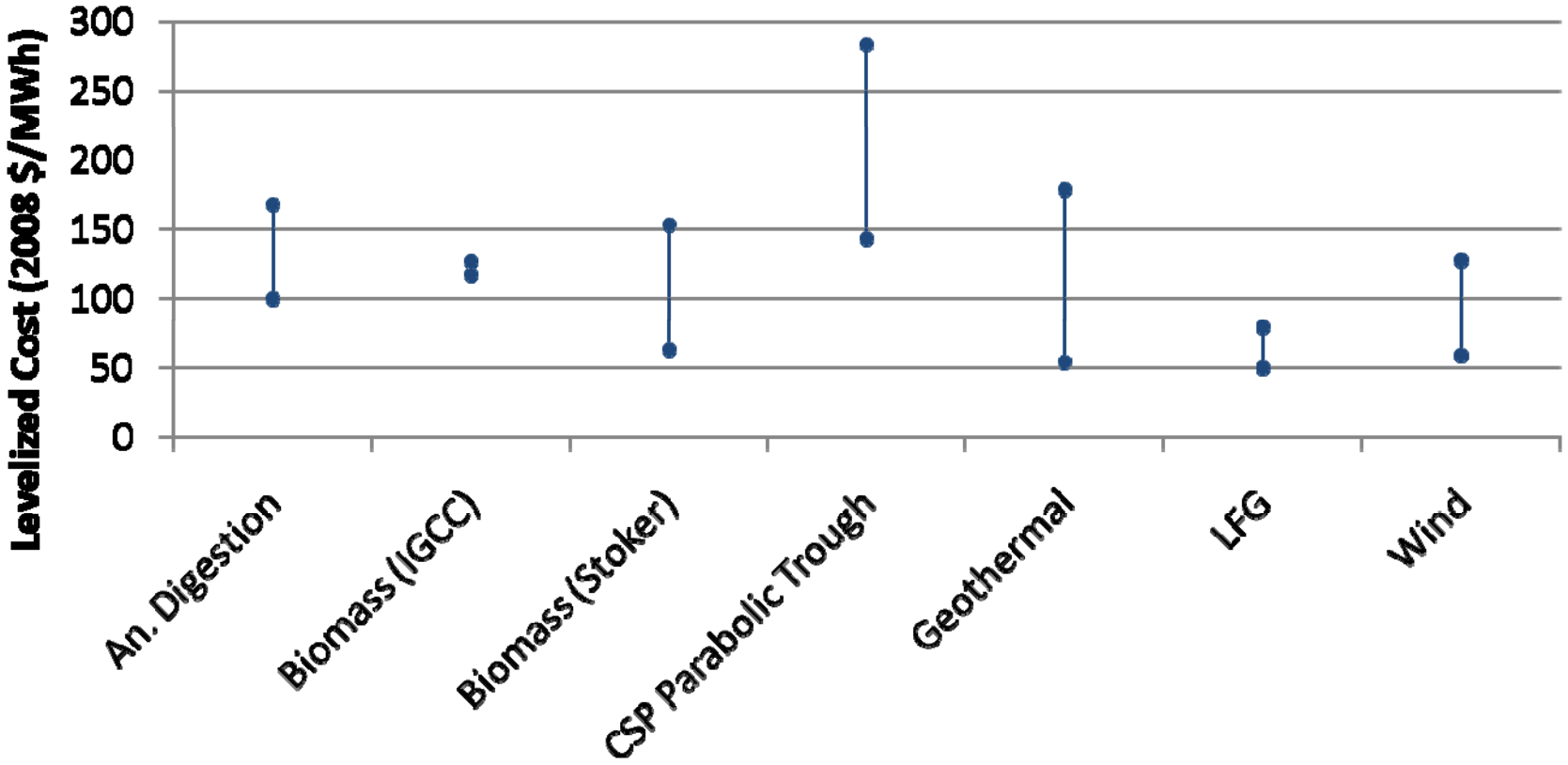
- Modify the Levelized Cost of Generation Model
- Update engineering and financial model inputs
  - Renewable, IGCC and Nuclear generation (today's workshop topic)
  - Natural Gas-fired generation
- Study how individual factors may change in time
- Consider uncertainty variables
- Calculate range of current and future costs
- Compare different levelized cost models.


INPUTS
OUTPUTS
Plant Characteristics
• Capacity (MW)
• Capacity Factor
• Forced Outage Rate
• Scheduled Outage Rate
• Heat Rate (if applicable)
• Heat Rate & Capacity Degradation
Deflator Series
• Fuel Prices ($/MMBtu)
• Instant Cost ($/kW)
• Installed Cost ($/kW)
Fixed O&M ($/kW-Yr)
Variable O&M ($/MWh)
General Assumptions
(Merchant, Muni & IOU)
• Insurance
• Ad Valorem
• State & Federal Taxes
• O&M Escalation
• Labor Escalation
Financial Assumptions
(Merchant, Muni & IOU)
• % Debt
• Cost of Debt (%)
• Cost of Equity (%)
• Loan/Debt Term (Years)
• Book Life (Years)
• Federal Tax Life (Years)
• State Tax Life (Years)
COST OF GENERATION MODEL
Wholesale Electricity Prices
($/MWh)
• Fixed Cost
• Variable Cost - Marketsym
• Total Cost
Levelized Fixed Costs
($/kW-Yr & $/MWh)
• Capital & Financing
• Insurance
• Ad Valorem
• Fixed O&M
• Corporate Taxes
Levelized Variable Costs
($/kW-Yr & $/MWh)
• Fuel
• Variable O&M
Total Levelized Costs
($/kW-Yr & $/MWh)
• Levelized Fixed Costs
• Levelized Variable Costs
Annual Costs
($/MWh)
• Fixed Cost
• Variable Cost
• Total Cost
Screening Curves
($/kW-Yr & $/MWh)
• Fixed Cost
• Variable Cost
• Total Cost
Sensitivity Curves
(%)
• Fuel Price
• Capacity Factor
• Installed Cost
• Discount Rate
• Cost of Equity
• Cost of Dept

# Goals of Project:

- Develop transparent and easy to use analytical features in the Levelized Cost of Generation Model
- Consistent set of financial and operational assumptions that apply to different generation technologies
- Understand the variables and scope of uncertainty that will affect the future costs of different technologies.
- Calculate range of levelized costs

# Comparison of Levelized Costs in Different Studies

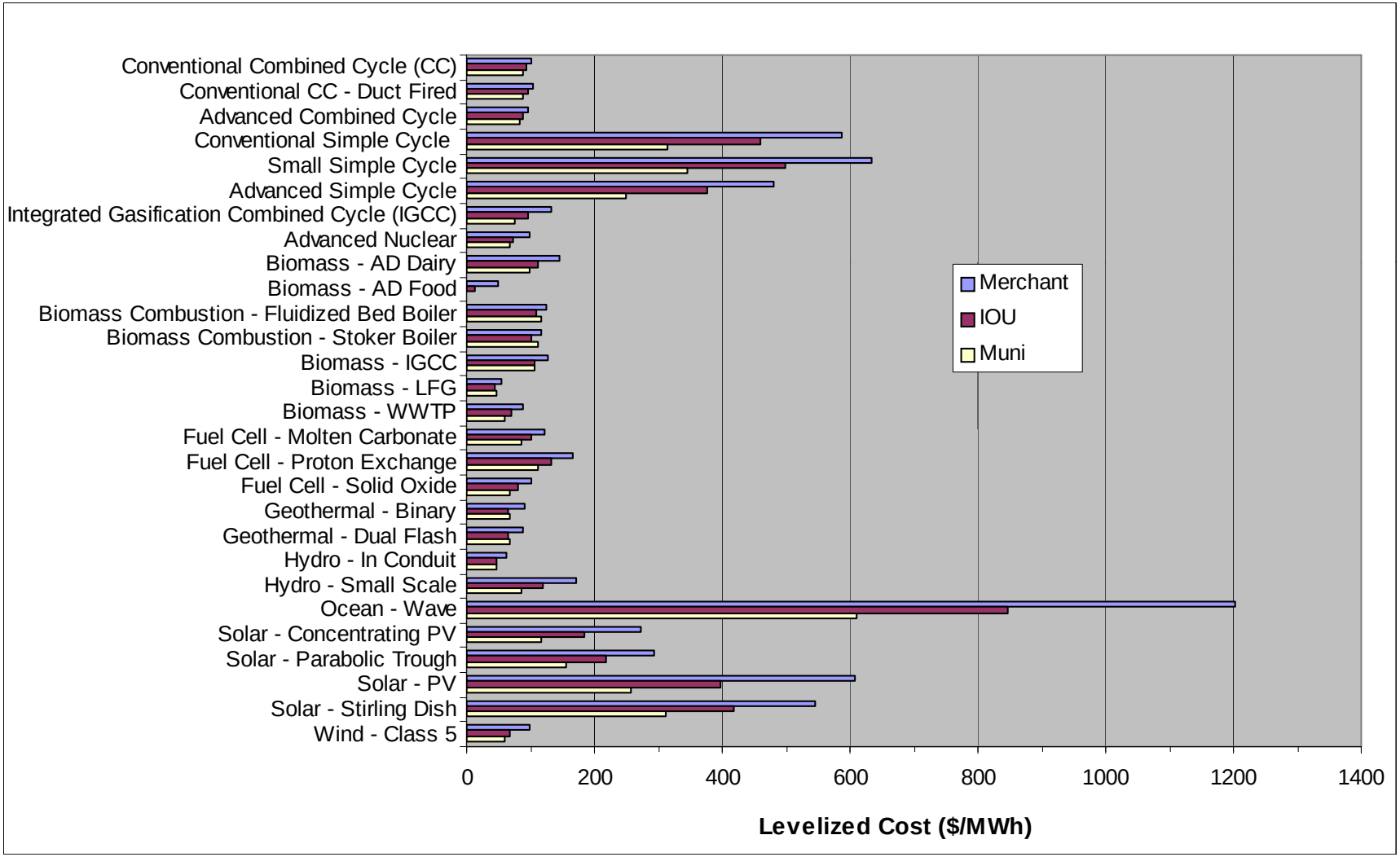



**Data Sources:** [1] California Energy Commission, 2005, *Strategic Value Analysis* [cost data reports]; [2] California Energy Commission, Dec 2007, *Comparative Costs of California Central Station Electricity Generation Technologies*, Final Staff Report; [3] California Energy Commission, 2008 (forthcoming), *Scenario Analyses of California's Electricity System: Final Results for the 2007 Integrated Energy Policy Report*, Final Staff Report; [4] CPUC, Nov 2005, *Achieving a 33% Renewable Energy Target,* by CRS for the CPUC; [5] E3, 2008 (forthcoming), *CPUC GHG Modeling*; [6] RETI Coordinating Committee, March 2008, *Renewable Energy Transmission Initiative Phase 1A Draft Report*; [7] US Department of Energy, EERE, May 2008, *20% Wind Energy by 2030 Increasing Wind Energy's Contribution to U.S. Electricity Supply*.

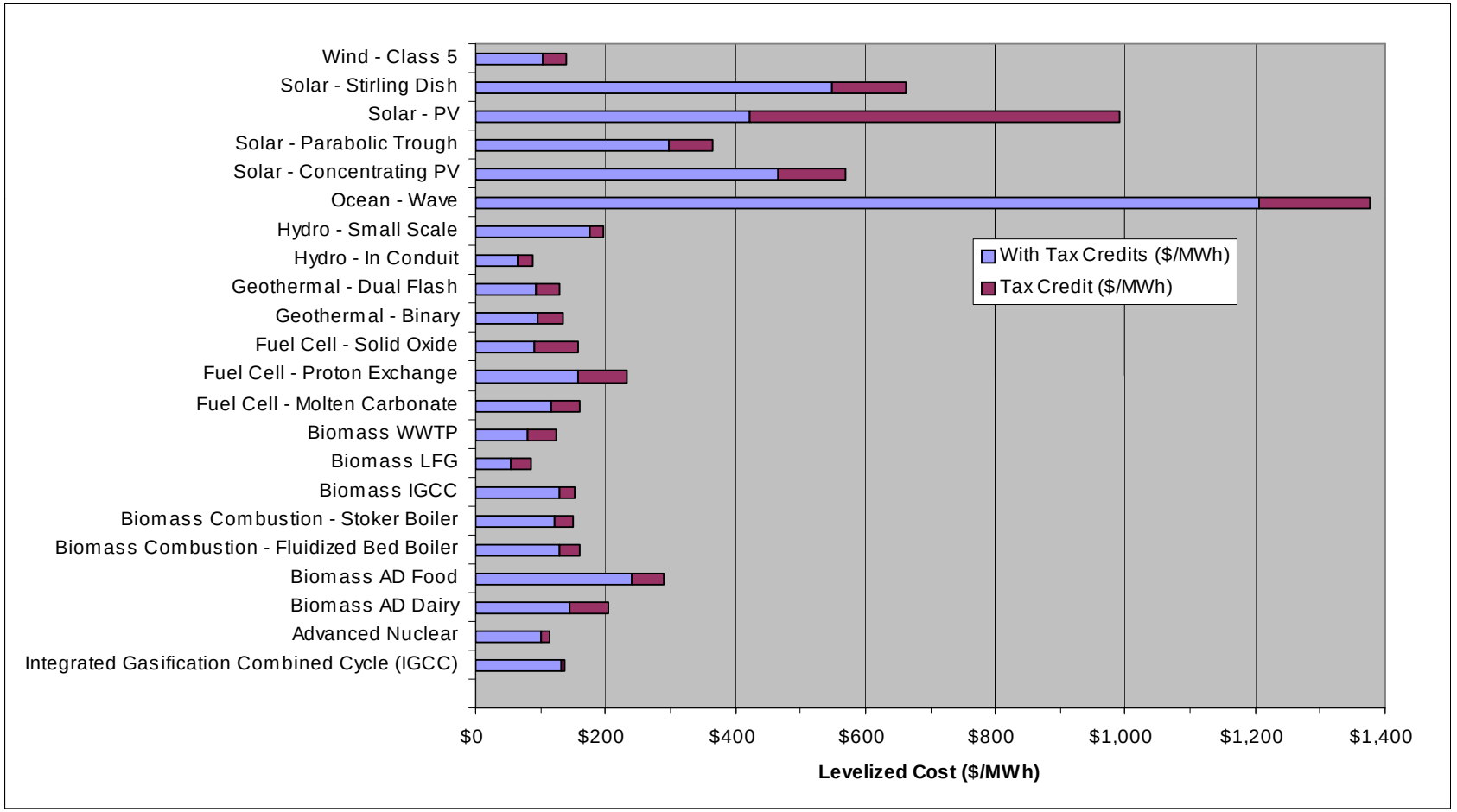
**Note:** Anaerobic Digestion data from [2] and [6]; Biogas data from [2] and [5]; Biomass data from [2], [3], [5], and [6]; Concentrating Solar Power and Geothermal data from [1], [2], [3], [4], [5], [6]; Landfill Gas data from [1], [2], [4], [5], [6]; and Wind data from [1], [2], [3], [4], [5], [6], and [7].

# 2007 Levelized Cost Estimates

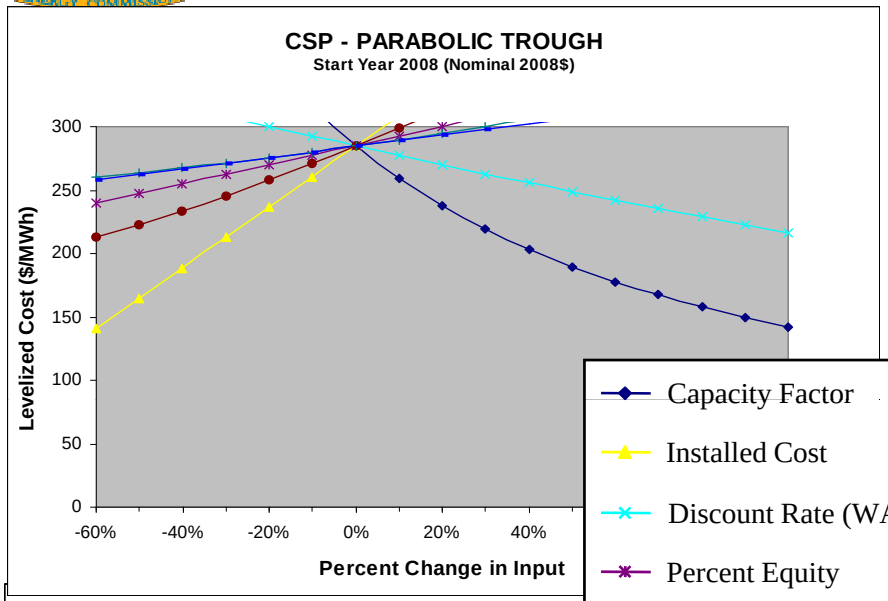
Start Year = 2007 (2007 Nominal$)

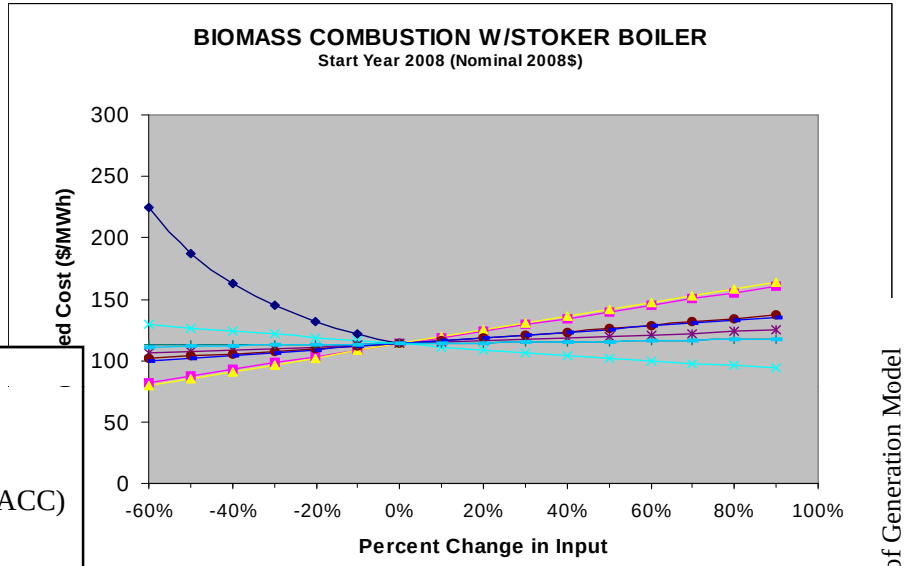


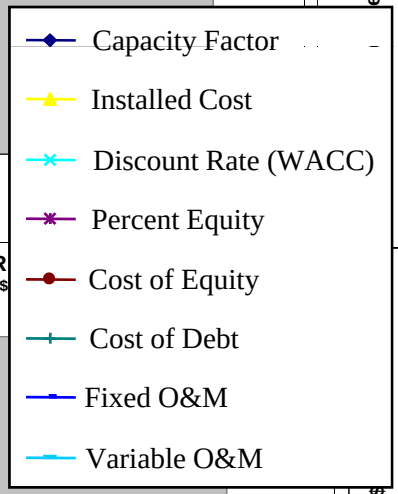
# EFFECT OF TAX CREDITS

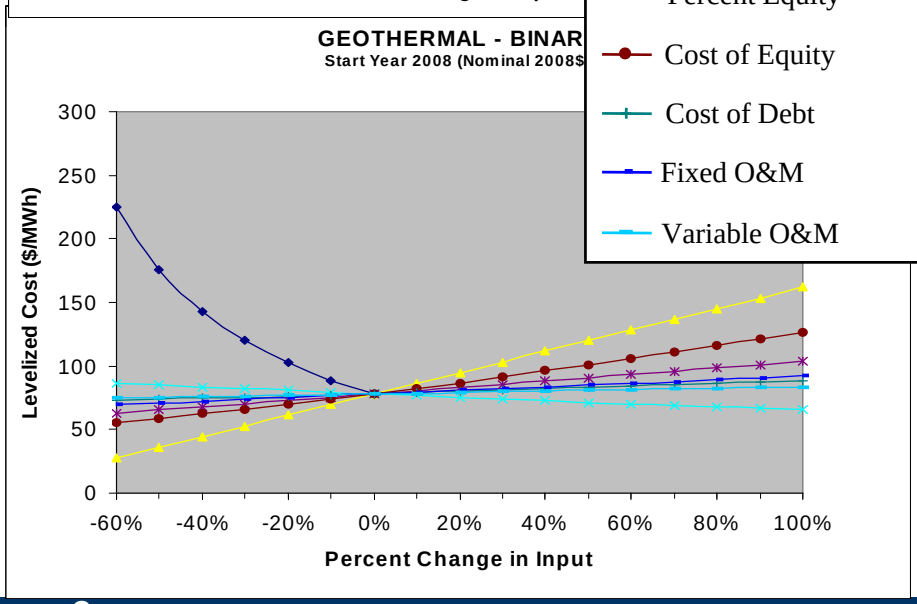


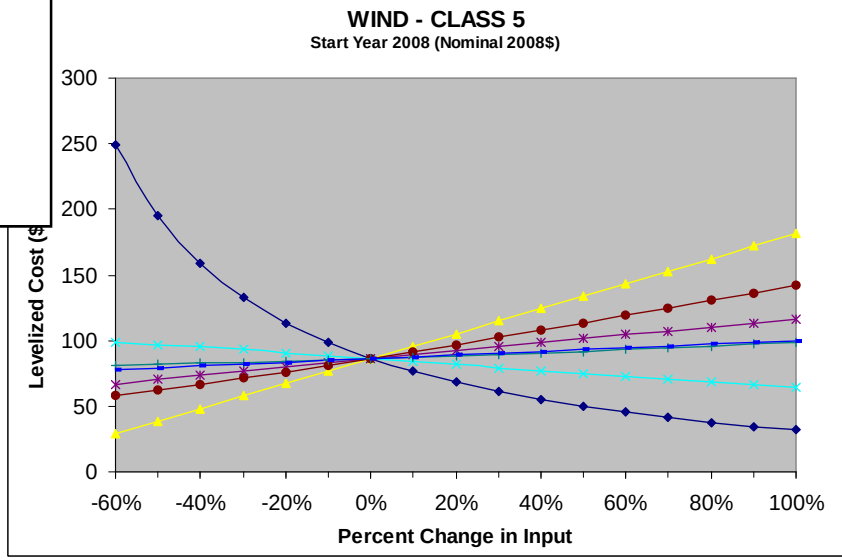
# Levelized Cost Estimates Are Sensitive to Input Assumptions



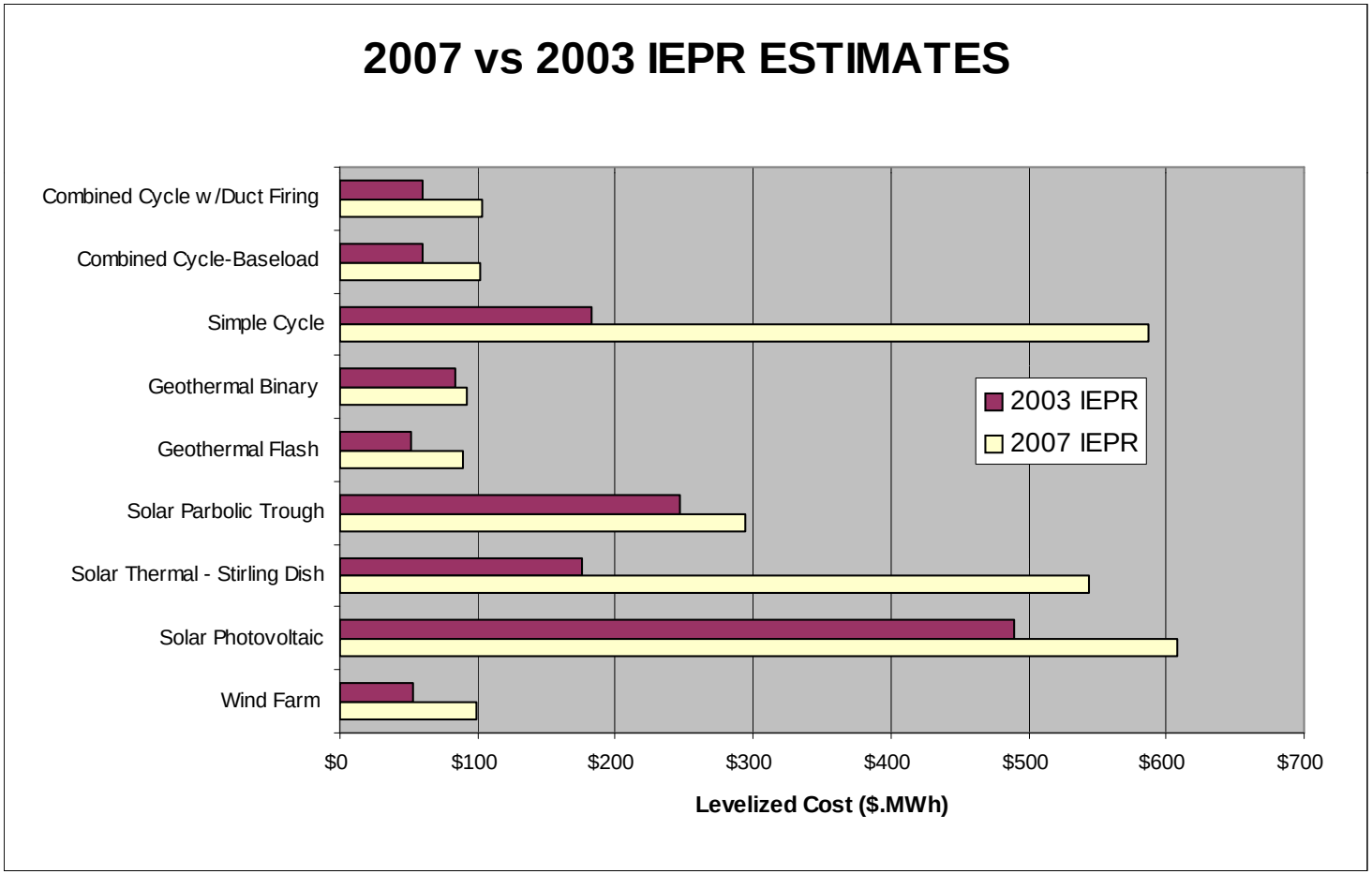




Source: Energy Commission, 2007, Cost of Generation Model

# LEVELIZED COST COMPARISON



# Application of Levelized Cost of Generation Project:

- Evaluate how different factors may affect current and future levelized costs
- Analyze the financial feasibility of generation project proposals
- Screening tool to compare different technologies
- Energy Efficiency program evaluation
- Input to resource planning studies
- Benchmark for wholesale energy costs

# Next Steps

- Modify renewable, IGCC and nuclear generation assumptions based on today's workshop comments, if needed
- Input to Cost of Generation Model to calculate range of levelized costs
- Study results will be subject of July 22, 2009 workshop