



**EPRI**

ELECTRIC POWER  
RESEARCH INSTITUTE



# **Executive Summary of Australian CCS and Renewable Generation Costing Study**

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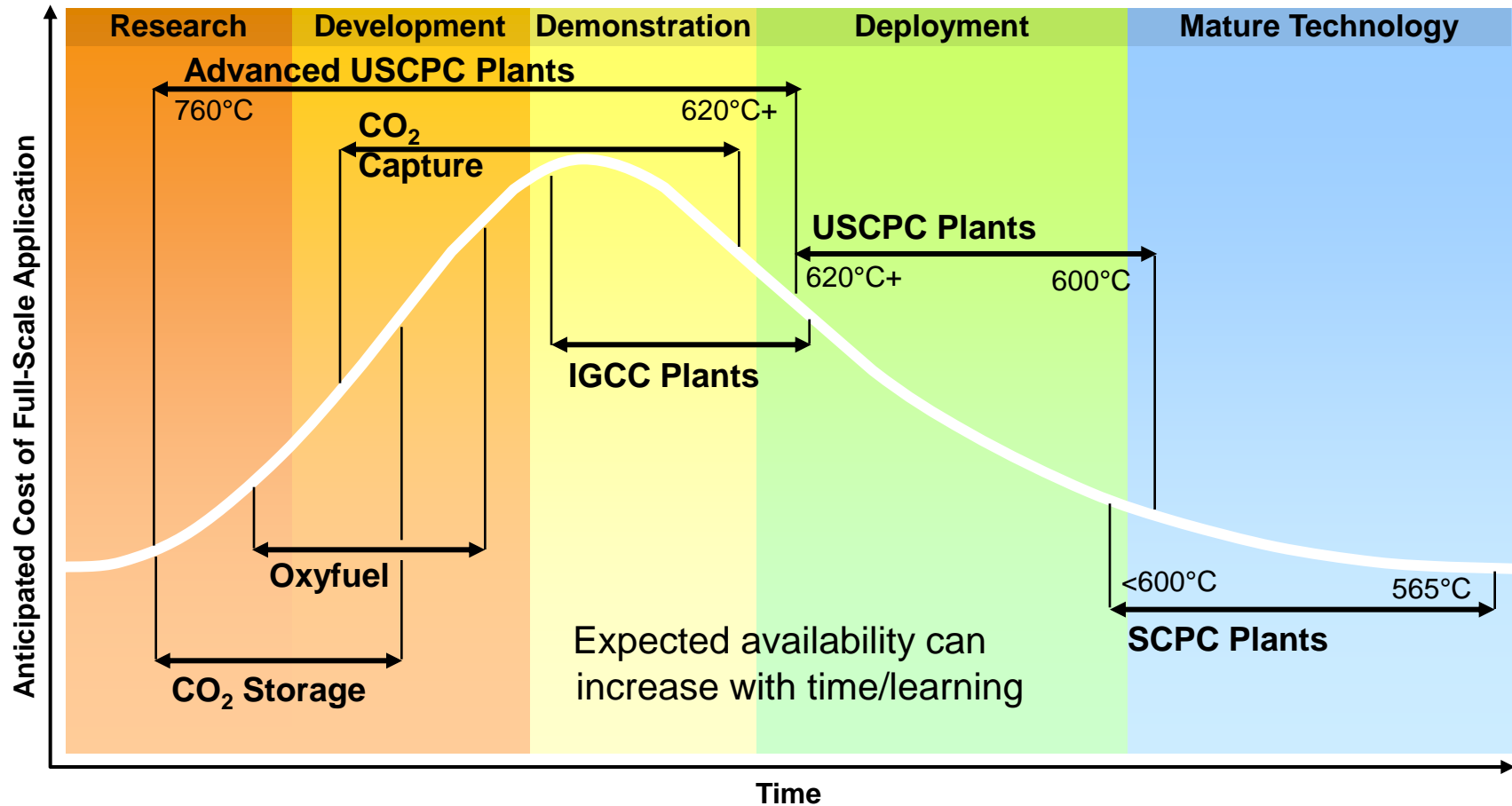
**Asia Pacific Partnership**

**Cleaner Fossil Energy TF**

**1 April, 2009**

**Seoul Korea**

# New Technology Deployment Curve for Coal



**Not All Technologies at the Same Level of Maturity.**

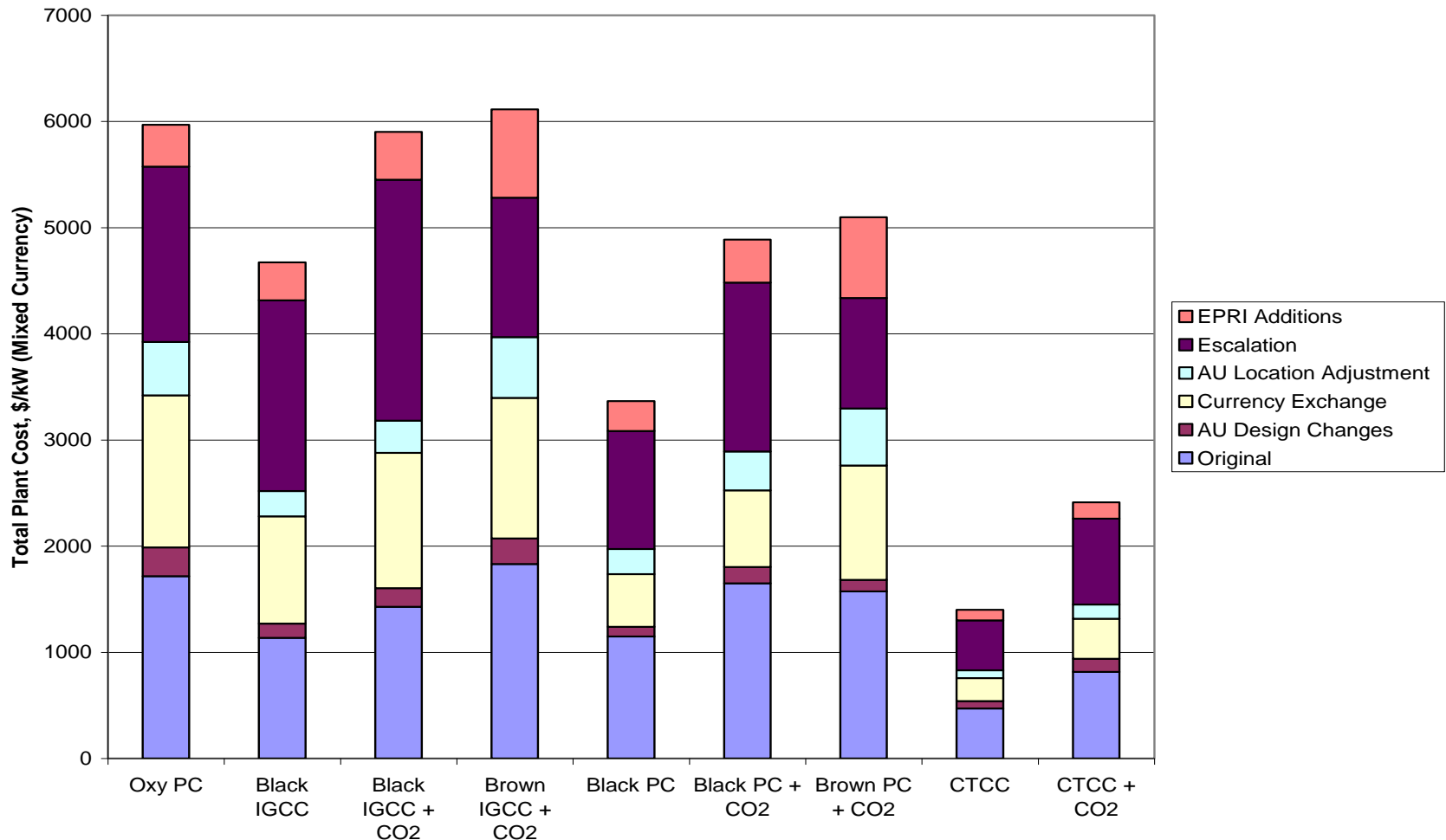
# Technology Maturity

Technology	Technology Development Status (2008)	Cost and Design Estimate	Accuracy Range Estimate (%)
Oxy-combustion PC with CO <sub>2</sub> capture	Pilot	Simplified	-30 to +50
SCPC without CO <sub>2</sub> capture	Mature	Simplified	-15 to +20
SCPC Coal with CO <sub>2</sub> capture	Demonstration	Simplified	-25 to +40
IGCC without CO <sub>2</sub> capture	Commercial	Simplified	-20 to +30
IGCC with CO <sub>2</sub> capture	Demonstration	Simplified	-25 to +40
CTCC without CO <sub>2</sub> capture	Mature	Simplified	-15 to +20
CTCC with CO <sub>2</sub> capture	Demonstration	Simplified	-25 to +40
Wind	Mature	Simplified	-15 to +20
Solar Thermal: Parabolic Trough	Commercial	Simplified	-20 to +30
Solar Thermal: Central Receiver	Demonstration	Simplified	-25 to +40

# Low Emission Technologies Costs and Diffusion Barriers

## Adjustments to Original IEA Estimates

### Effect of Adjustments on Total Plant Cost - Fossil

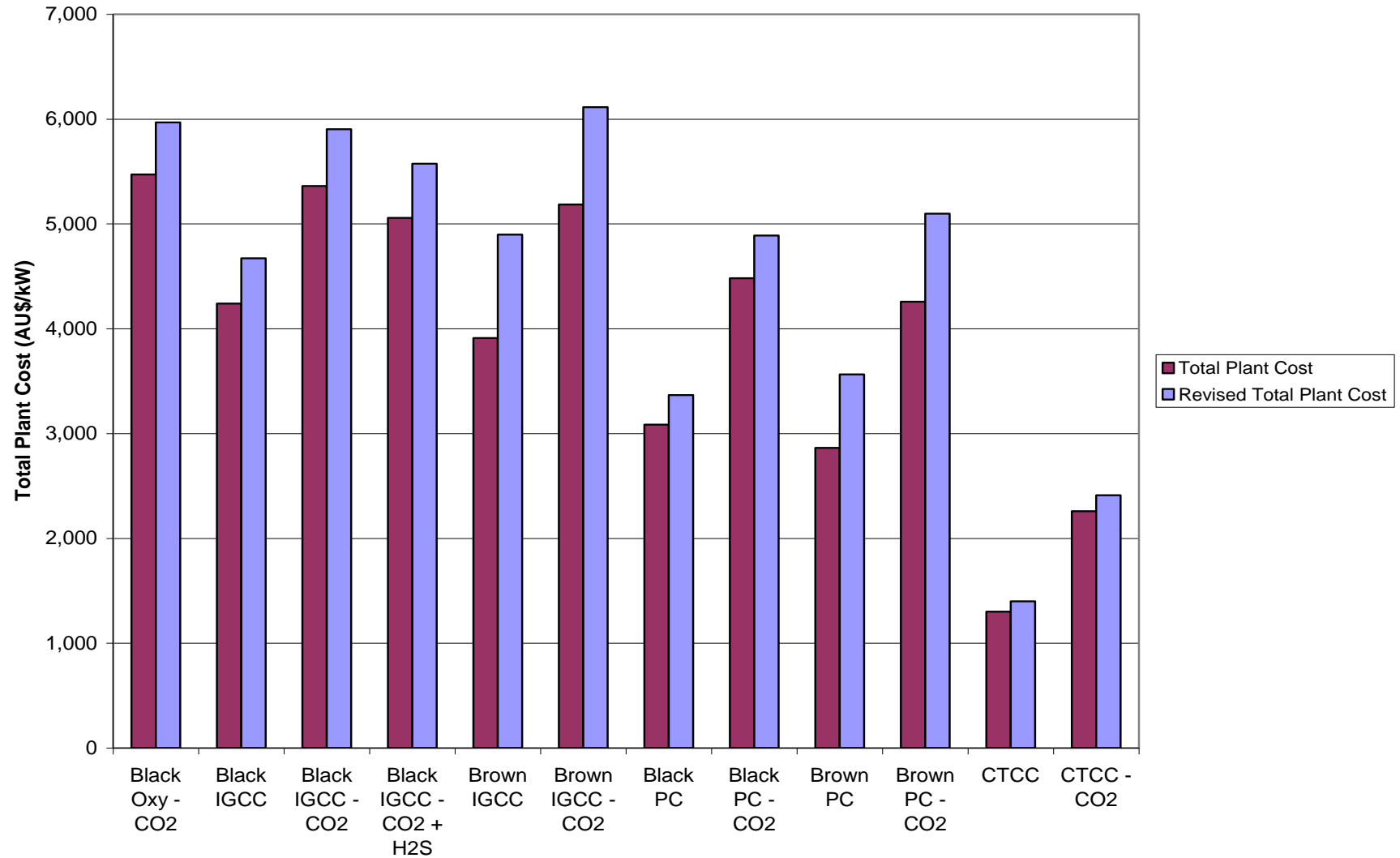


Note: Only studies with original IEA estimates are included in this breakdown

# Adjustments to Total Plant Cost

- Added evaporative coolers to IGCC and CTCC plants
  - Increased overall capital costs
  - Decreased cost on a per kW basis
- Increased drying penalty and cost of drying units for brown coal technologies
- Made contingencies consistent across all technologies at 20% of Total Installed Cost

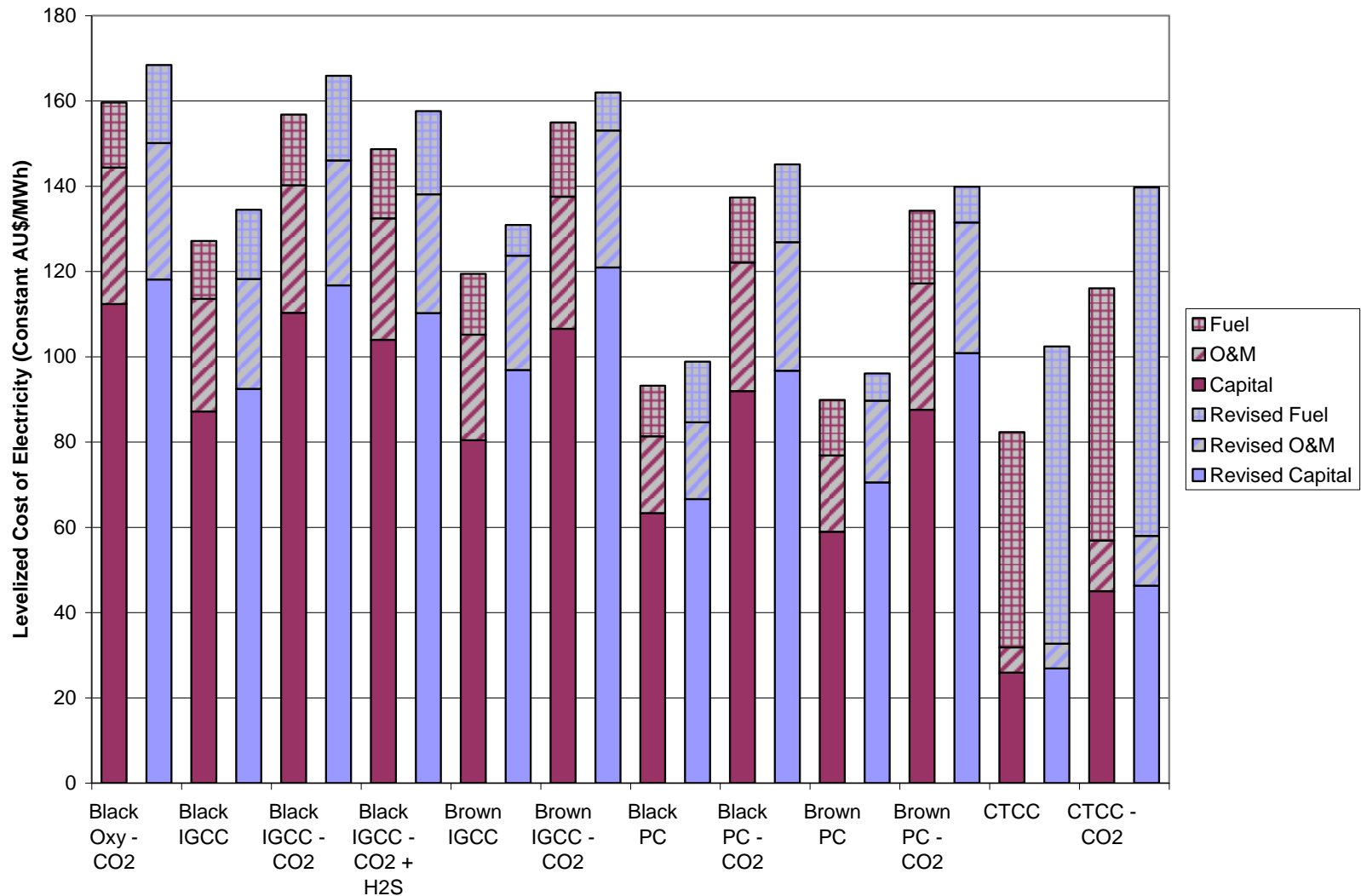
# Adjustments to Total Plant Cost - Fossil



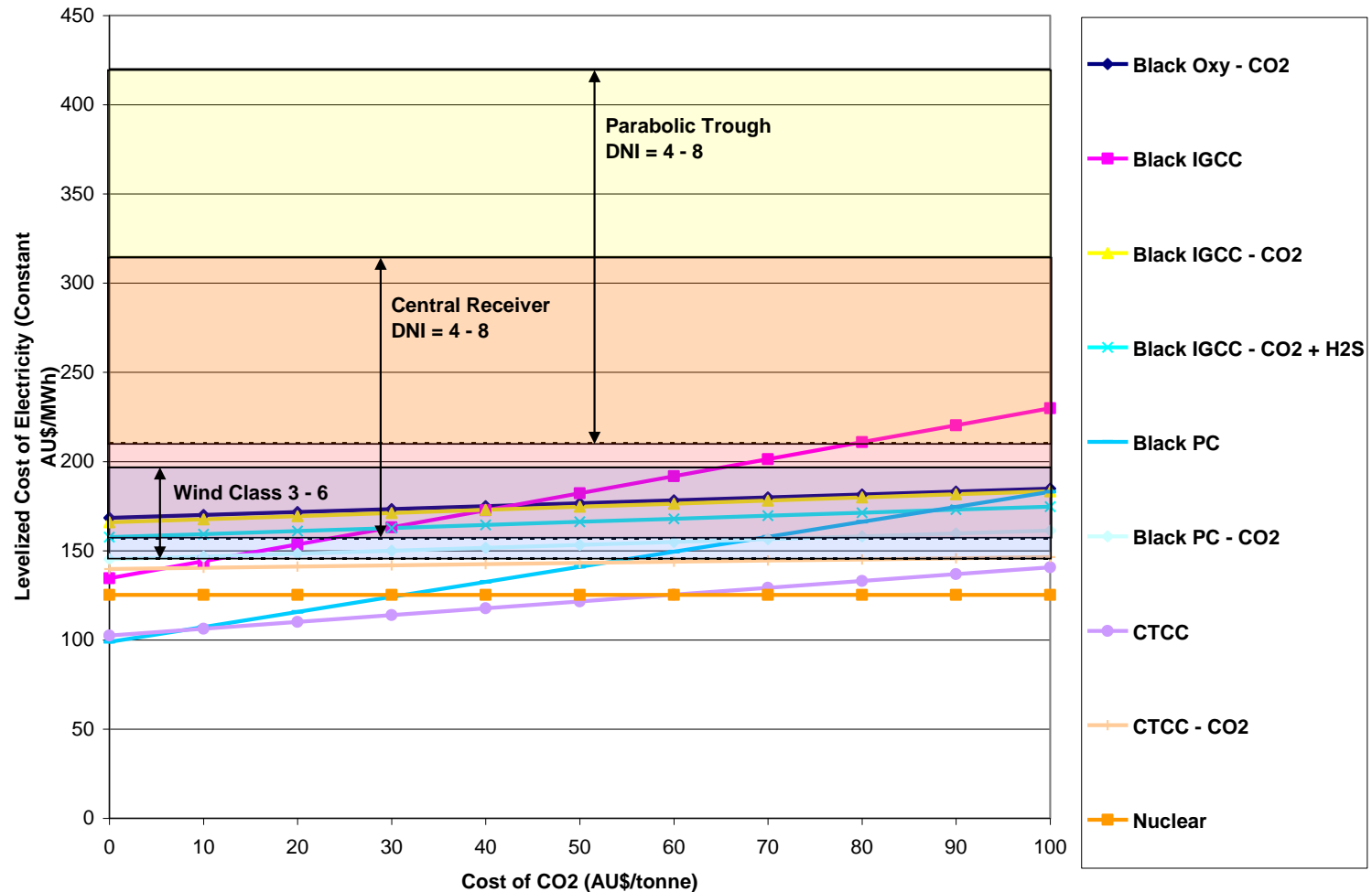
# Adjustments to Fossil Cost of Electricity

- Total Capital Requirement was increased as mentioned previously
- Fuel costs were changed based on feedback from previous webcast
  - Black coal increased from \$1.25/GJ to \$1.5/GJ,
  - Brown coal decreased from \$1.25/GJ to \$0.6/GJ
  - Natural gas increased from \$6/GJ to \$9/GJ
- Fixed O&M was affected by Total Installed Cost changes
- Tax and book life were extended to 30 years for fossil plants based on feedback from previous webcast

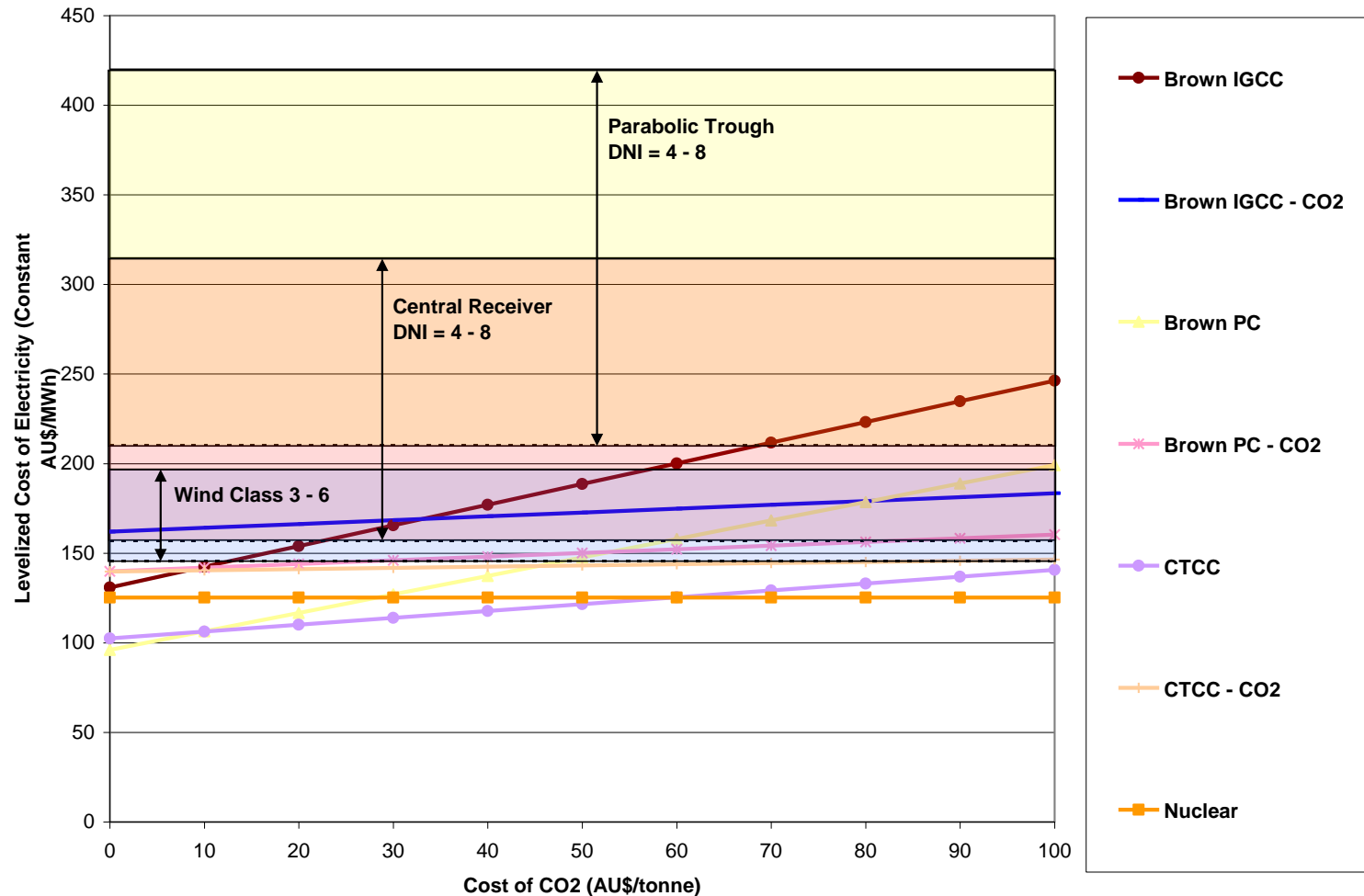
# Adjustments to Fossil Cost of Electricity



# Effect of Carbon Cost on Levelized Cost of Electricity - Black Coal



# Effect of Carbon Cost on Levelized Cost of Electricity - Brown Coal



# Reviewer Comments on Renewables

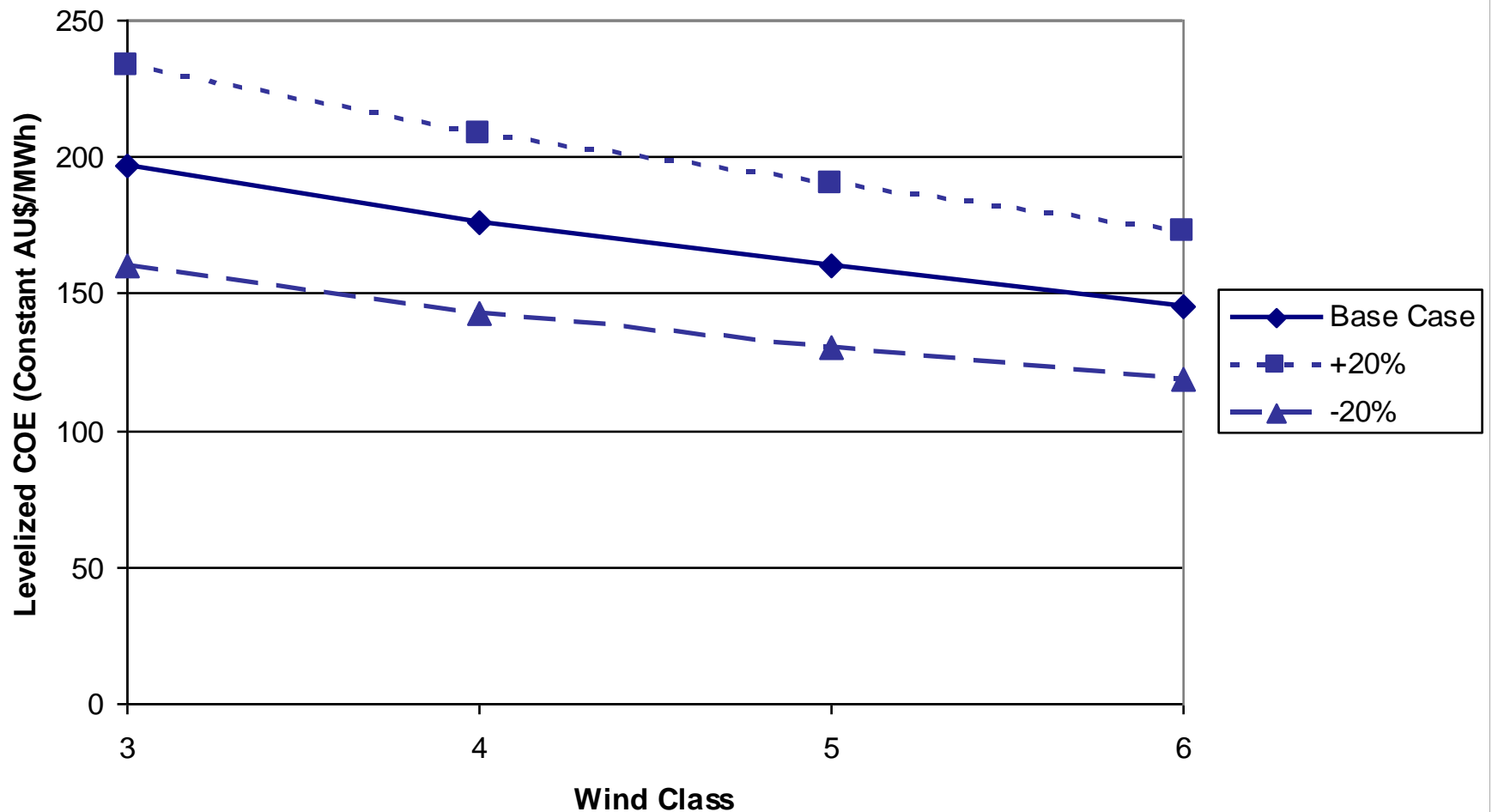
- Do capital cost numbers represent projected 2017 plant costs after several years of deployment and cost reduction?
  - The study did not include cost projections as a result of technology advancement or increased deployment levels.
- Why are costs reported by NREL so much lower than the EPRI cost results?
  - The referenced NREL results include a 30% federal investment tax credit. Without incentives, the NREL/EPRI cost numbers agree within 5%.
- Can EPRI provide a detailed capital cost breakdown?
  - This is not within the scope of the current study.
- What is the source of the solar radiation data?
  - The Australia Representative Meteorological Year (RMY) Climate Files, developed for the Australia Greenhouse Office, are based on weather data collected hourly over the course of many years from both satellite and ground-based measurements. Actual solar radiation may vary between the example cities and the surrounding areas.
- Why are costs based on U.S. costs where the material and labor costs are escalating?
  - The study was limited to publicly available data, and the team chose sources that had sufficient information about the design bases and methodology to convert the data to Australian conditions. U.S. references were selected in the absence of comprehensive public market data for Australia.

# Solar:

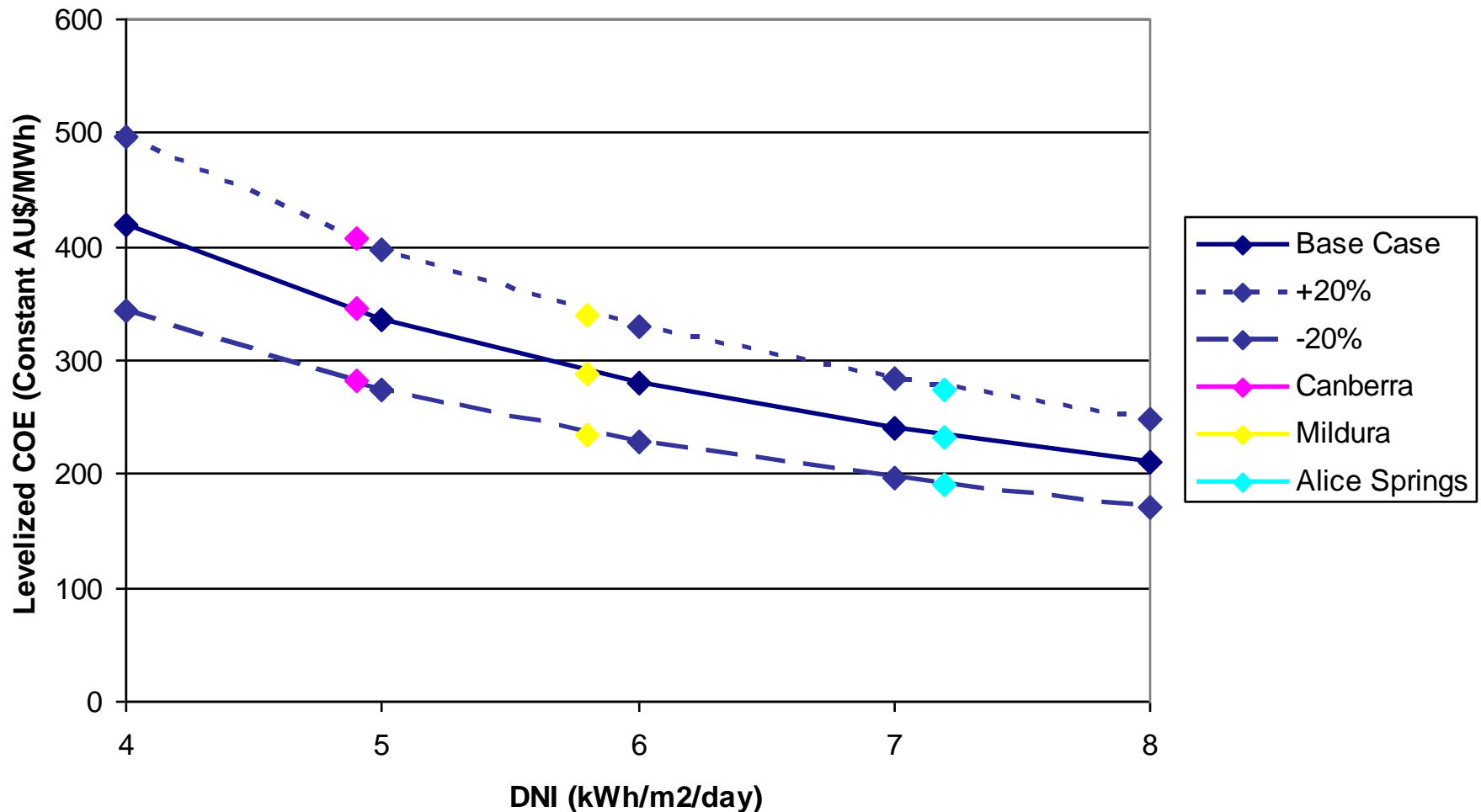
## Sources of Uncertainty

- Enormous growth potential in the next 9 years
- Manufacturing capacity expansion
- Commodity material costs
- Escalation of labor prices
- Technology advancements
- Regional differences in development and installation costs, transportation costs, and requirements for siting and permitting
- Limited experience with solar thermal projects in Australia
- Limited worldwide experience with central receiver

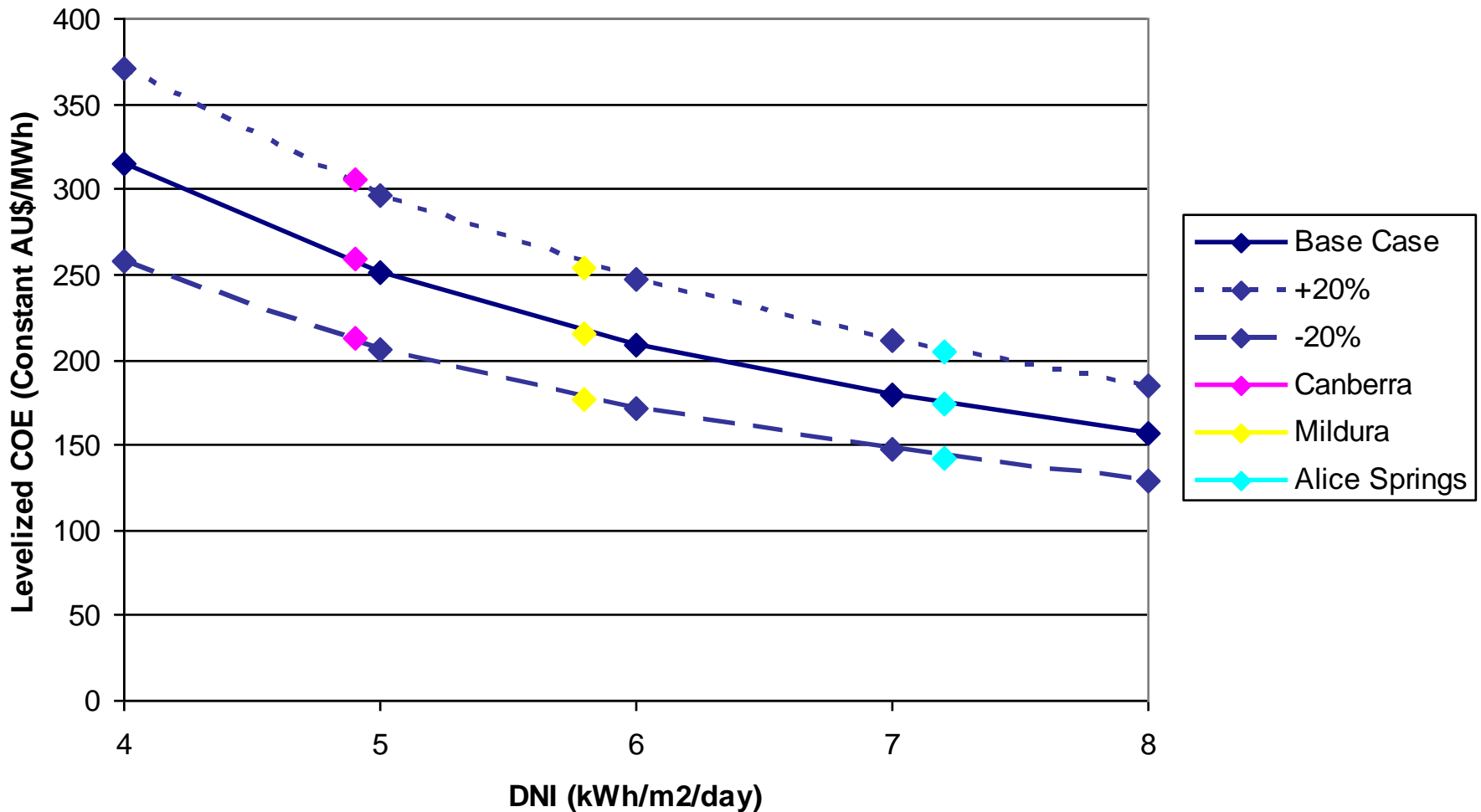
# Wind: Sensitivity to Capital Cost



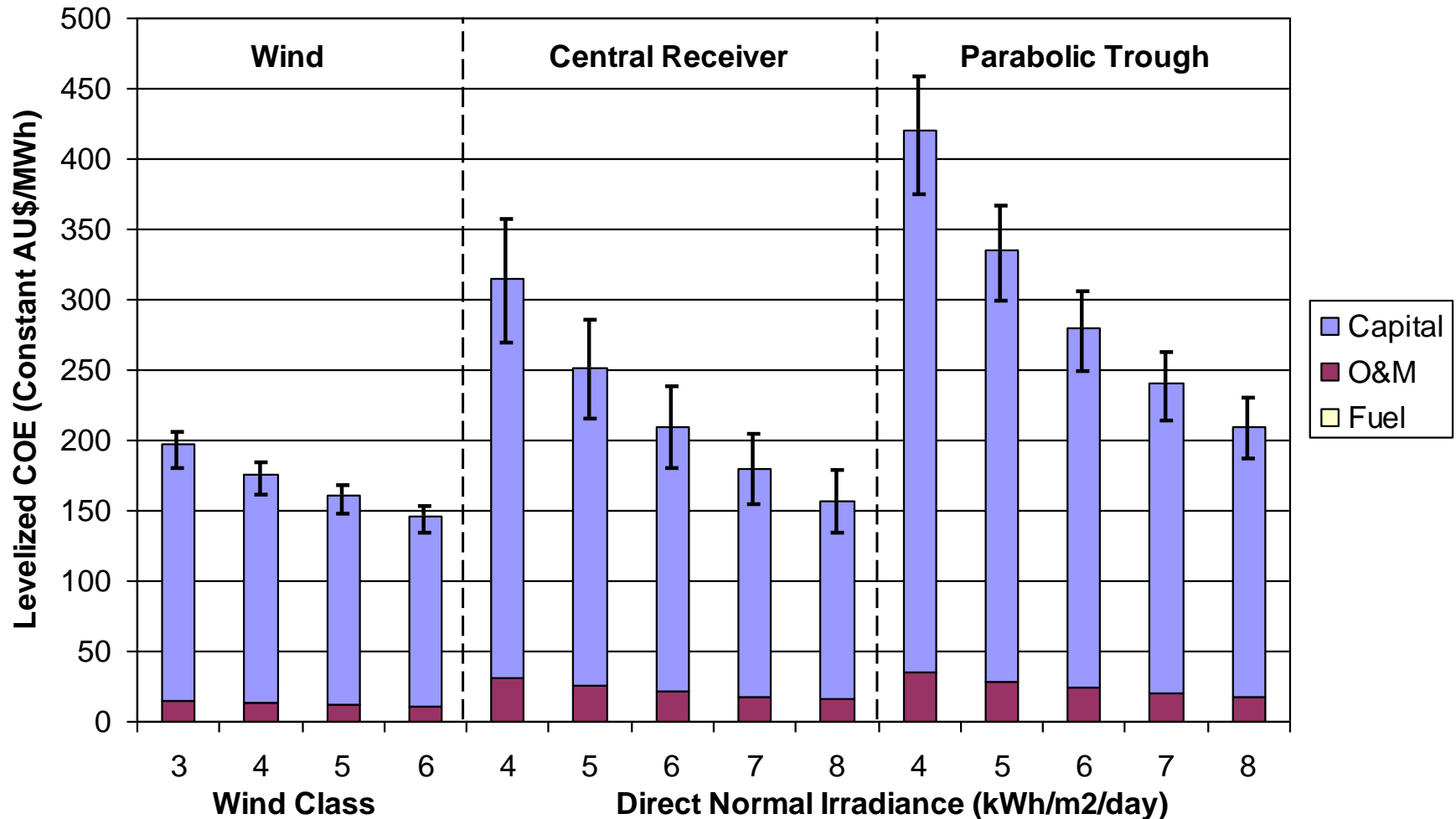
# Solar Parabolic Trough: Sensitivity to Capital Cost



# Solar Central Receiver: Sensitivity to Capital Cost



# Levelized Cost Contributions



Note: I-bars represent variation in capital cost based on uncertainty in the estimate

# Where to from here?

- EPRI believes the process descriptions and performance results from the current study are valuable in informing the stakeholders about the status of low emission power generation technology
- However, the large magnitude of the cost adjustments which were applied in the current analysis suggest the need for additional work
- EPRI recommends that a new study be commissioned which will estimate cost and performance of selected technologies
  - Calculate performance based on new plant designs specifically suited for Australia
  - Have Australia-based engineering firm estimate the cost of construction in Australia based on the new design and current equipment and construction labor costs