



Fuel and Power Options

Stuart Dalton

Senior Government Representative - Generation

NATIONAL CONFERENCE of STATE LEGISLATURES

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PLANNING FOR THE FUTURE

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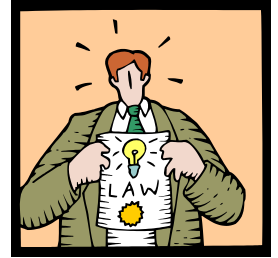
Power - We Need All the Options



- There is no “silver bullet” answer to all the questions for the power industry
- Today’s supply of natural gas looks promising and the industry is responding but where will the price be in a few years?
- Wind and solar are growing rapidly but remain higher cost and both are variable - is the grid up to it?
- Nuclear power provides low dispatched cost of power and is reliable but capital cost? Few new units are planned
- Existing coal is under pressure but it still is a major source of generation and new coal is not on the table now

Policy > Finance > Technology

Gas and Regulations Change the US Fossil Outlook



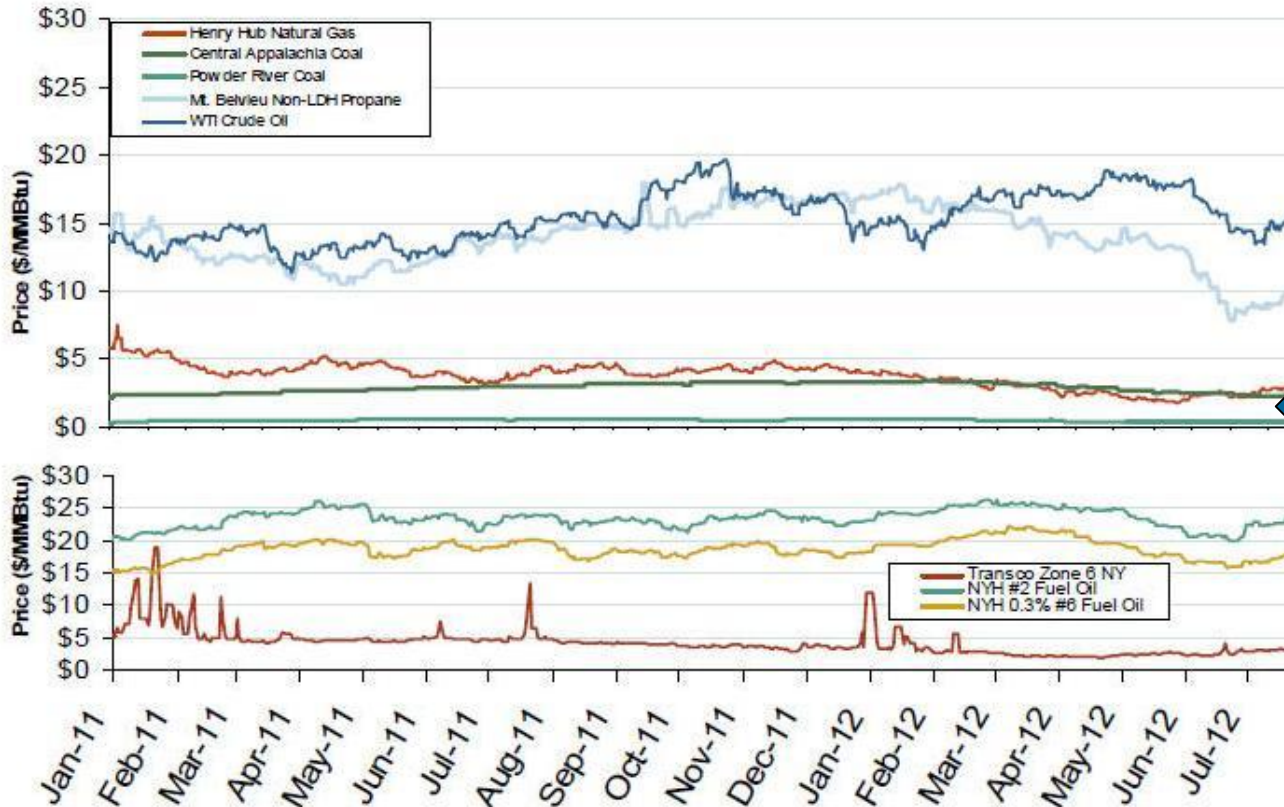
- “Fracking” for gas is changing supply
- A few years ago coal was > 50% of Generation
- In April gas power generation caught up with coal for the first time on record - 32% generation for each fuel
- Gas price now makes natural gas cheaper than some coal for dispatch (e.g., Central Appalachian coal)
- Existing coal is facing many new requirements for primary pollutants, mercury, solids and water use
- New coal is facing a limit for CO₂ requiring expensive carbon capture – new natural gas gets a “pass”

Comparing Fuels (in US \$/MMBtu)

Other Fuels Market: Fossil Fuel Prices

Federal Energy Regulatory Commission • Market Oversight • www.ferc.gov/oversight

Oil, Coal, Natural Gas and Propane Daily Spot Prices



Source: FERC
Market Oversight

Gas was less expensive than
Central App coal

Notes: Coal prices are quoted in \$/ton. Conversion factors to \$/MMBtu are based on contract specifications of 12,000 btus/pound for Central Appalachian coal and 8800 btus/pound for Powder River Basin coal
Source: Derived from IGE and Bloomberg data

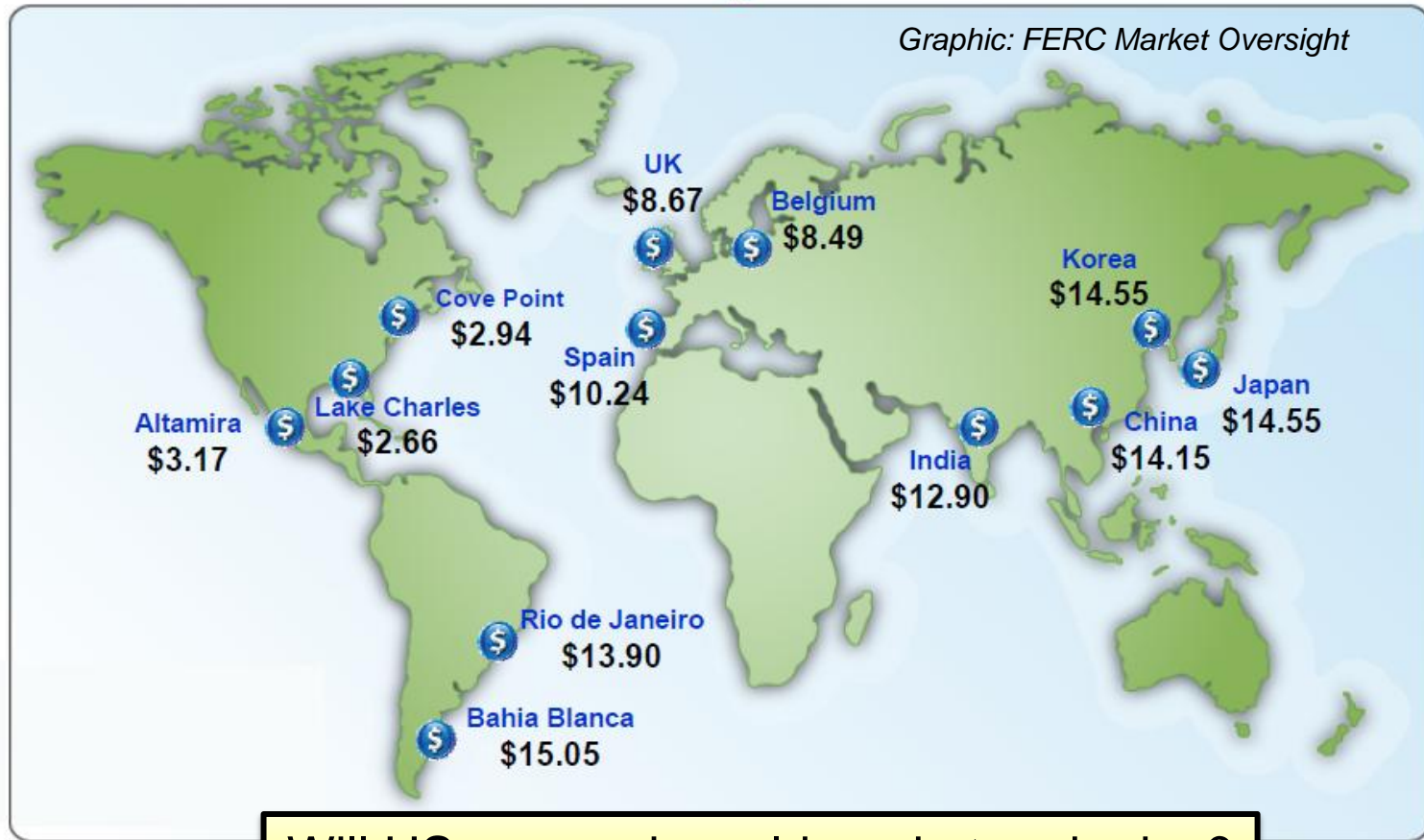
Updated: July 13, 2012

Global LNG “Landed Prices” (in US \$/MMBtu)

Natural Gas Overview: World LNG Prices

Federal Energy Regulatory Commission • Market Oversight • www.ferc.gov/oversight

World LNG Estimated August 2012 Landed Prices



Will US gas seek world market and price?

Source: Waterborne Energy, Inc. Data in \$US/MMBtu

Updated: July 11, 2012

Gas Impacts Renewables and Nuclear in the USA



- It competes with both for new units - - lower capital cost , and now low variable (dispatch) cost
- If no production tax credits are available for renewables, they may not be built at the recent fast pace
- Nuclear capital cost and permit issues make gas look good today
- Gas (particularly peaking) is quick to build and will back up variable renewables like wind and solar, and can provide variable load and grid support for nuclear units which operate base load

Tough Planning Questions Abound



- What will load look like?
 - Growth negative in 2012 first quarter – coal “cycling”
- What price will we see for natural gas in the future (it was lowest in a decade dipping below \$2/MM Btu now > \$3)?
- What environmental limits?
 - Air, water, solids limits for coal (MATs and mercury rule reconsideration, CSAPR, 316b, combustion products), EPA greenhouse gas limits
- Financial incentives?
 - Loan guarantees for nuclear, fossil, renewable
 - Production Tax Credits for renewable
- Cost of alternatives?

Cost Near-Term: 2015

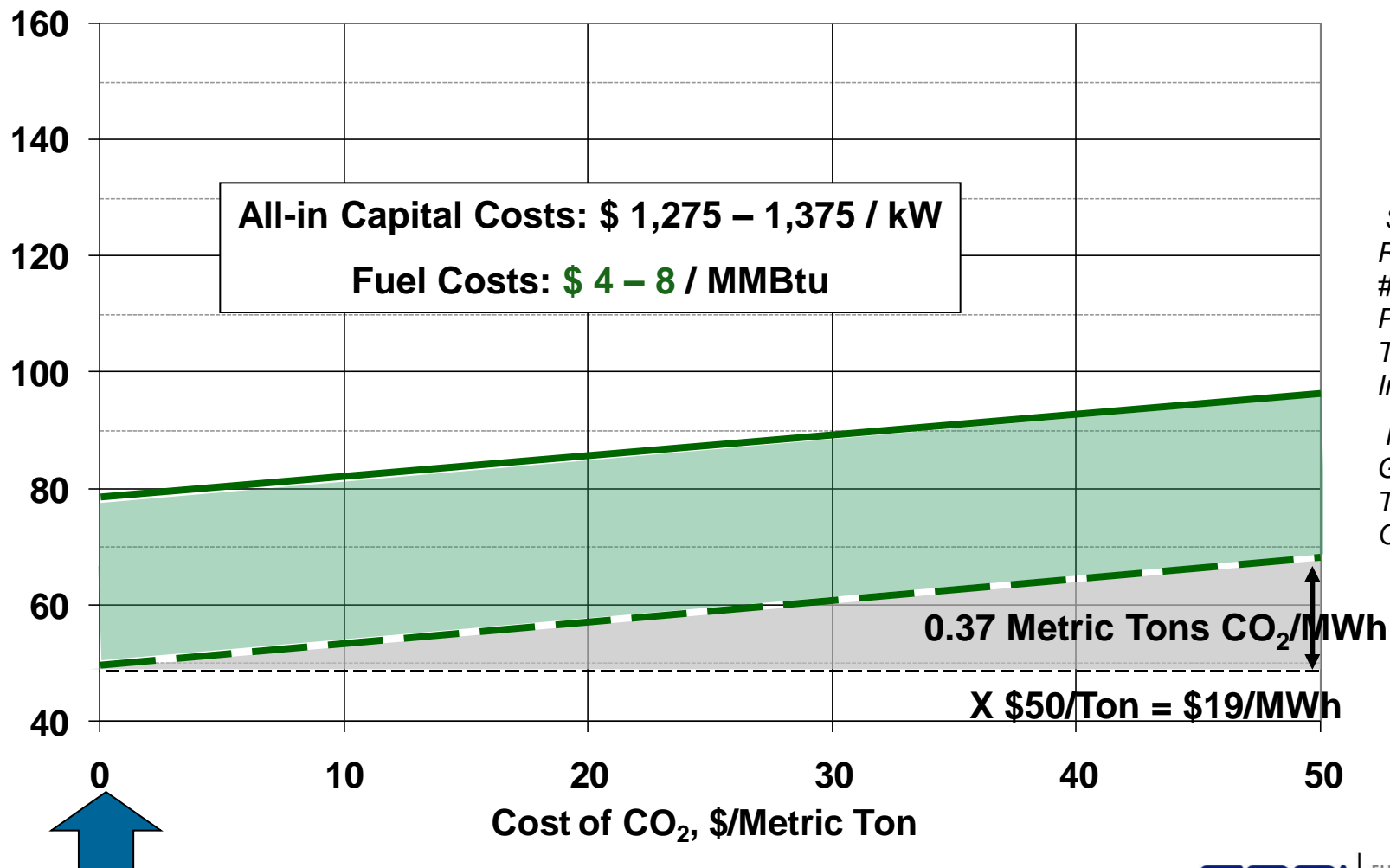
Report available at www.epri.com #1022782
Update later this year (note these are *generic* costs)

Natural Gas Combined-Cycle (NGCC) Fuel Cost Sensitivity Comparison – 2015



Levelized Cost of Electricity, \$/MWh

All costs are in December 2010 \$



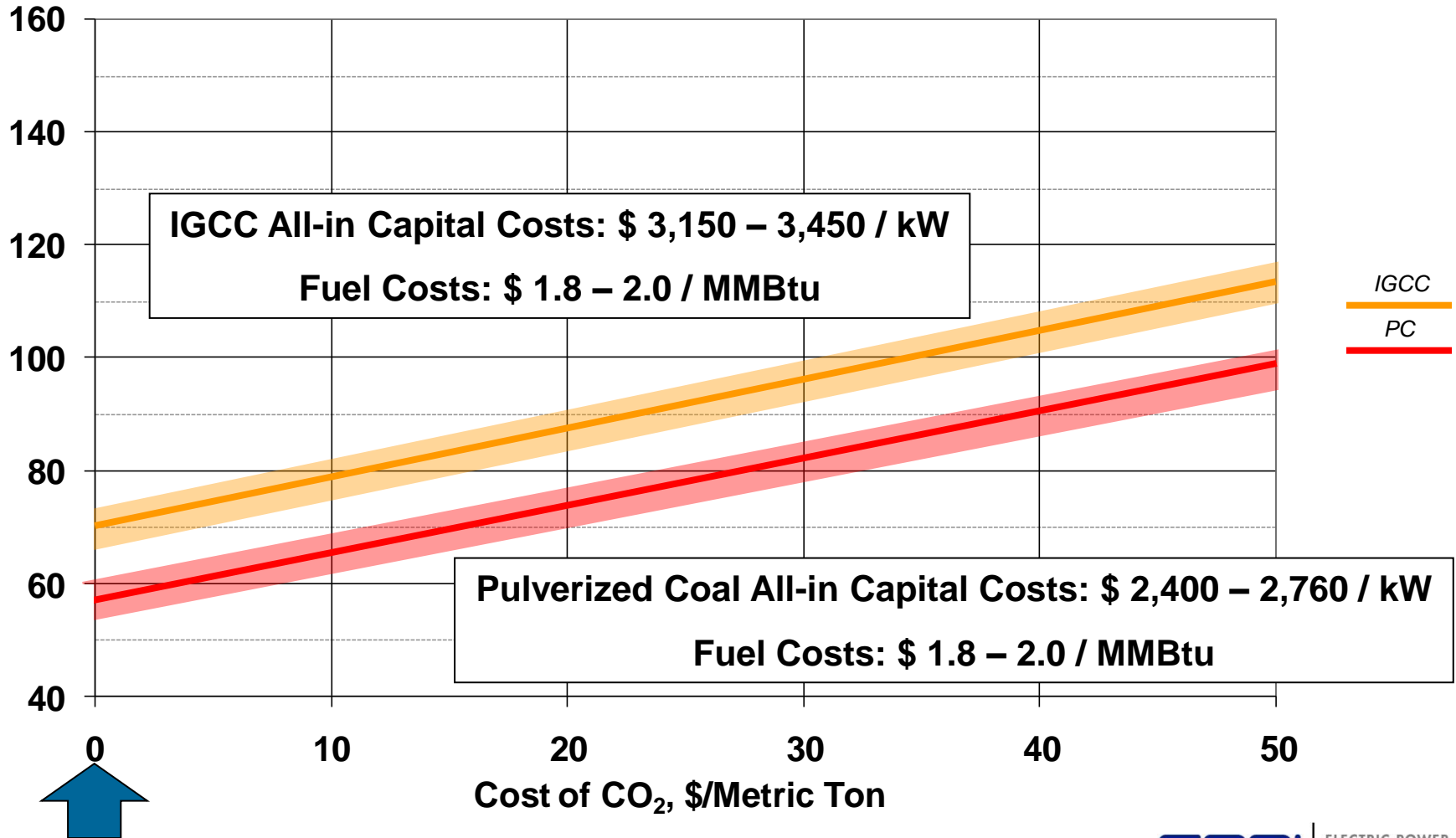
Source Report #1022782 Program on Technology Innovation: Integrated Generation Technology Options –

Coal Combustion and Gasification Comparison – 2015



All costs are in December 2010 \$

Levelized Cost of Electricity, \$/MWh

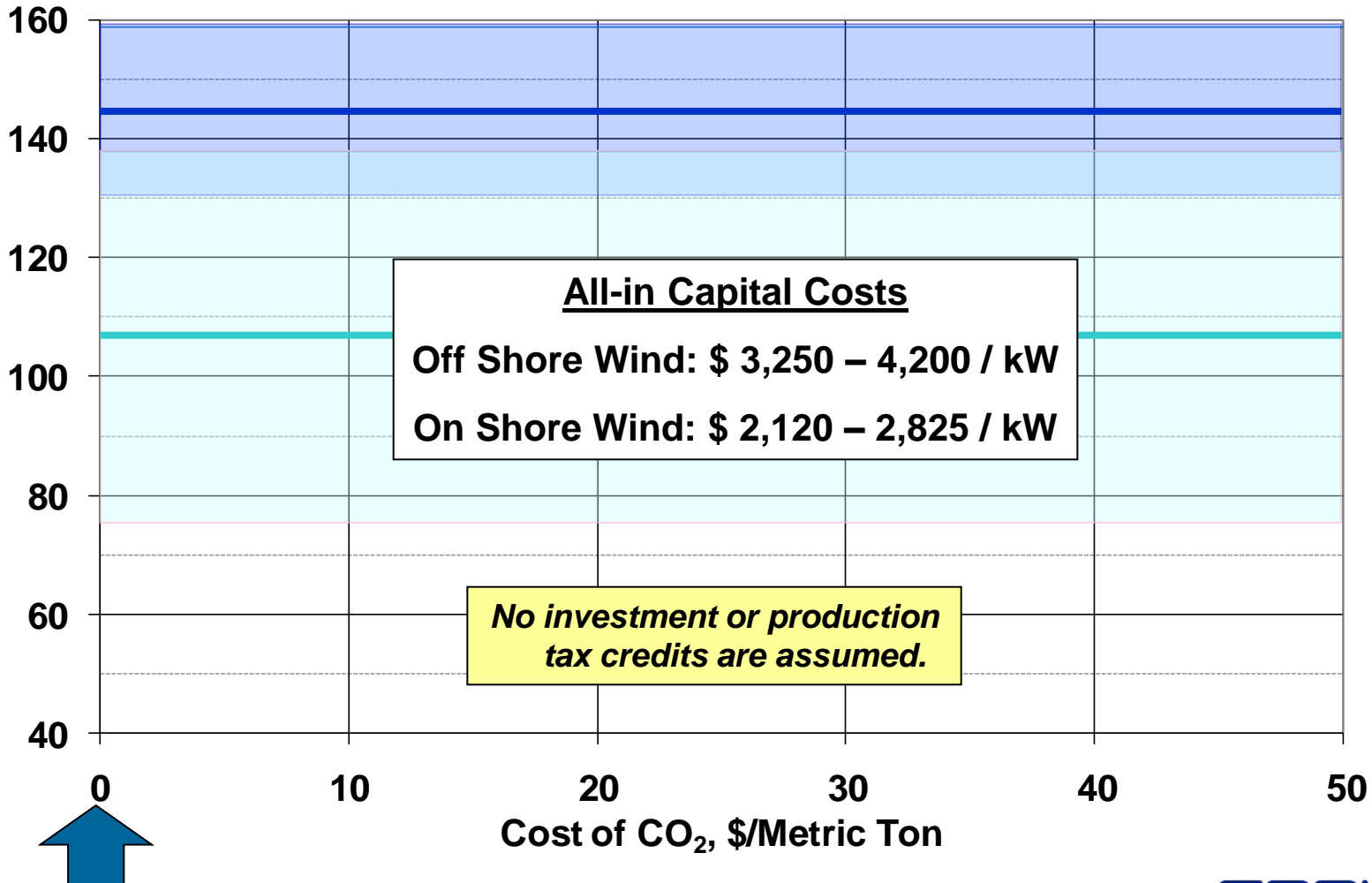


Wind – 2015



*All costs are in
December 2010 \$*

Levelized Cost of Electricity, \$/MWh

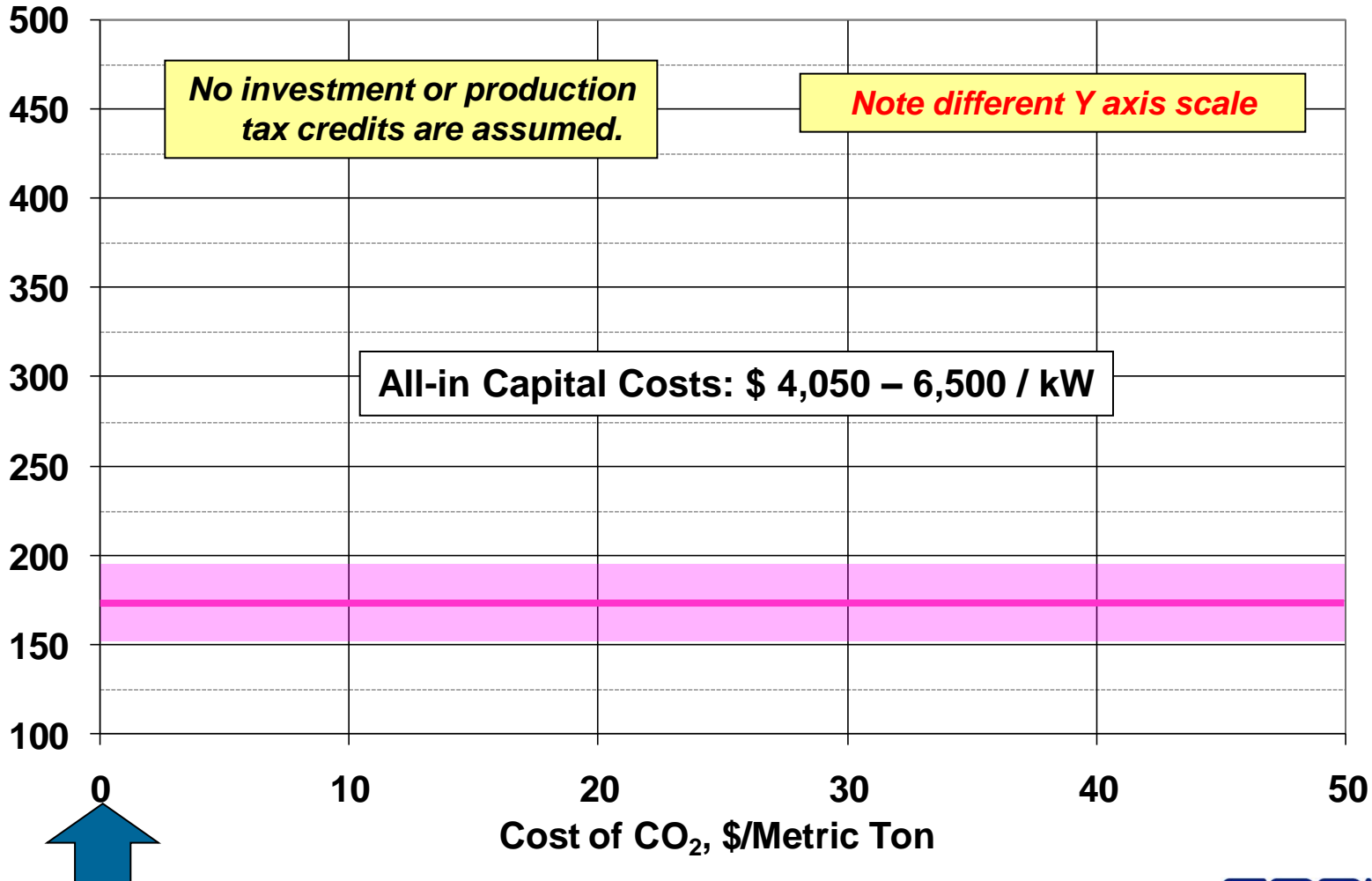


Concentrating Solar Thermal – 2015



All costs are in
December 2010 \$

Levelized Cost of Electricity, \$/MWh

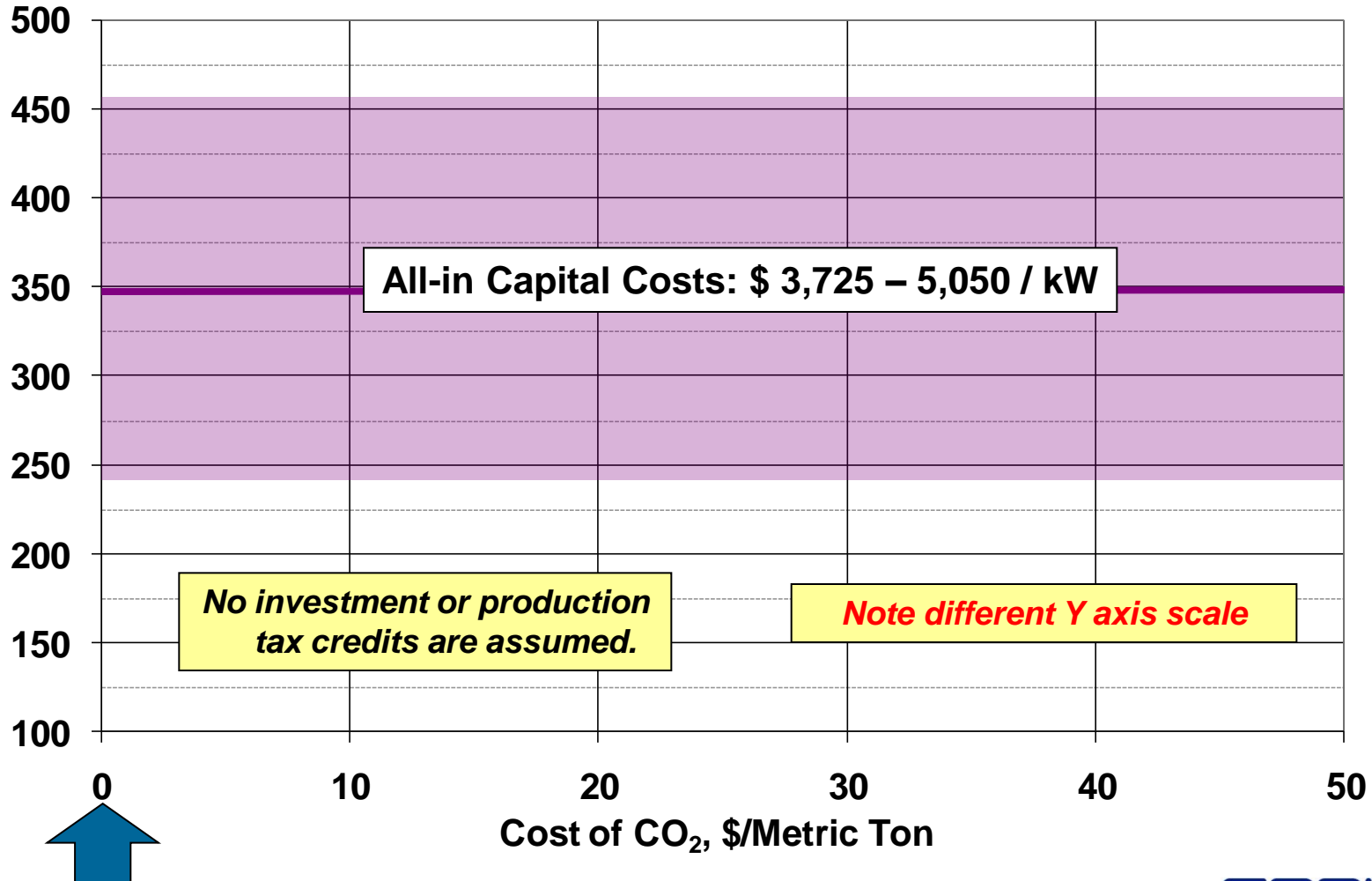


Solar Photovoltaic – 2015



Levelized Cost of Electricity, \$/MWh

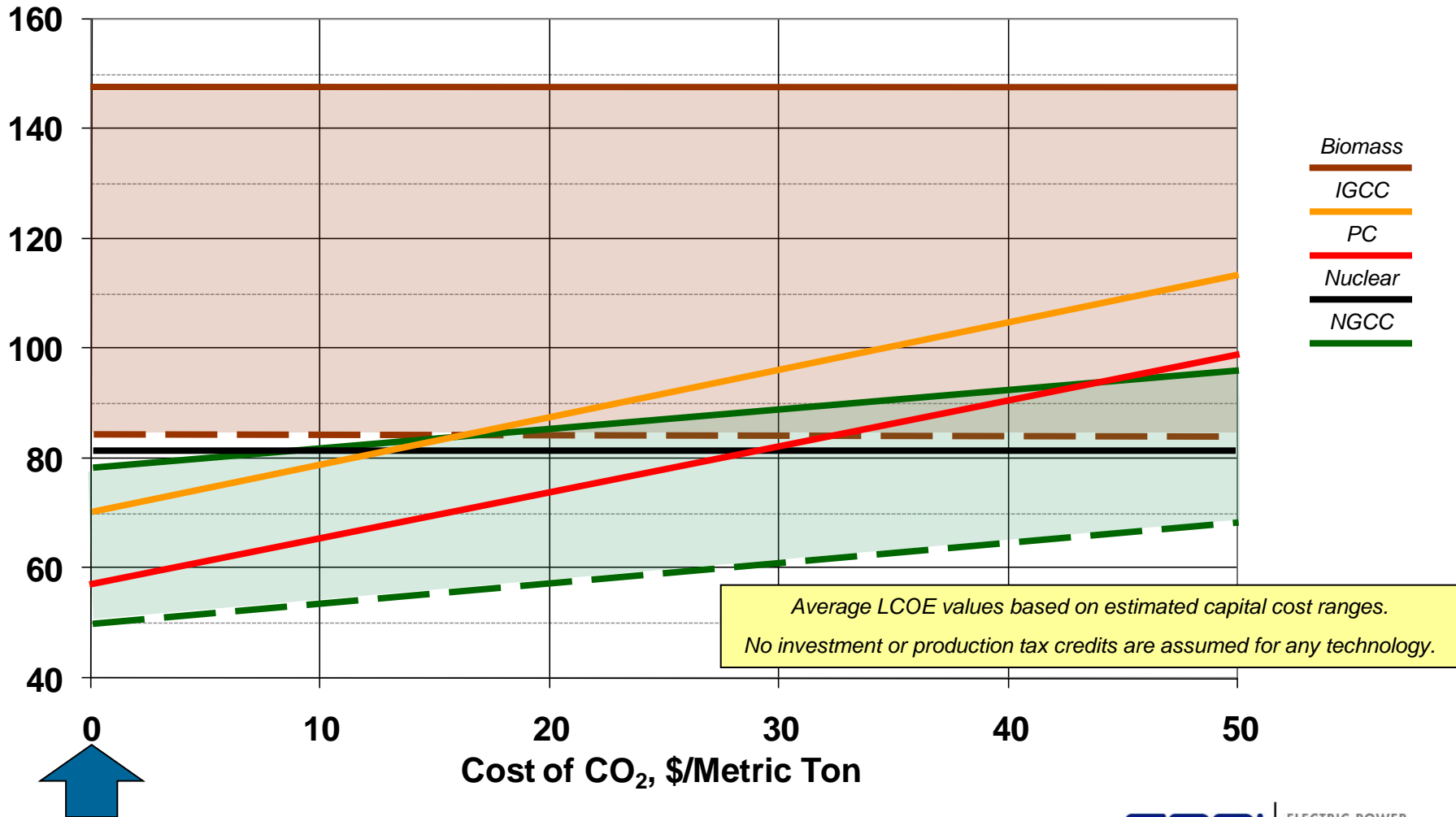
All costs are in December 2010 \$



Comparative Levelized Costs of Electricity – 2015 – Dispatchable Technologies

Levelized Cost of Electricity, \$/MWh

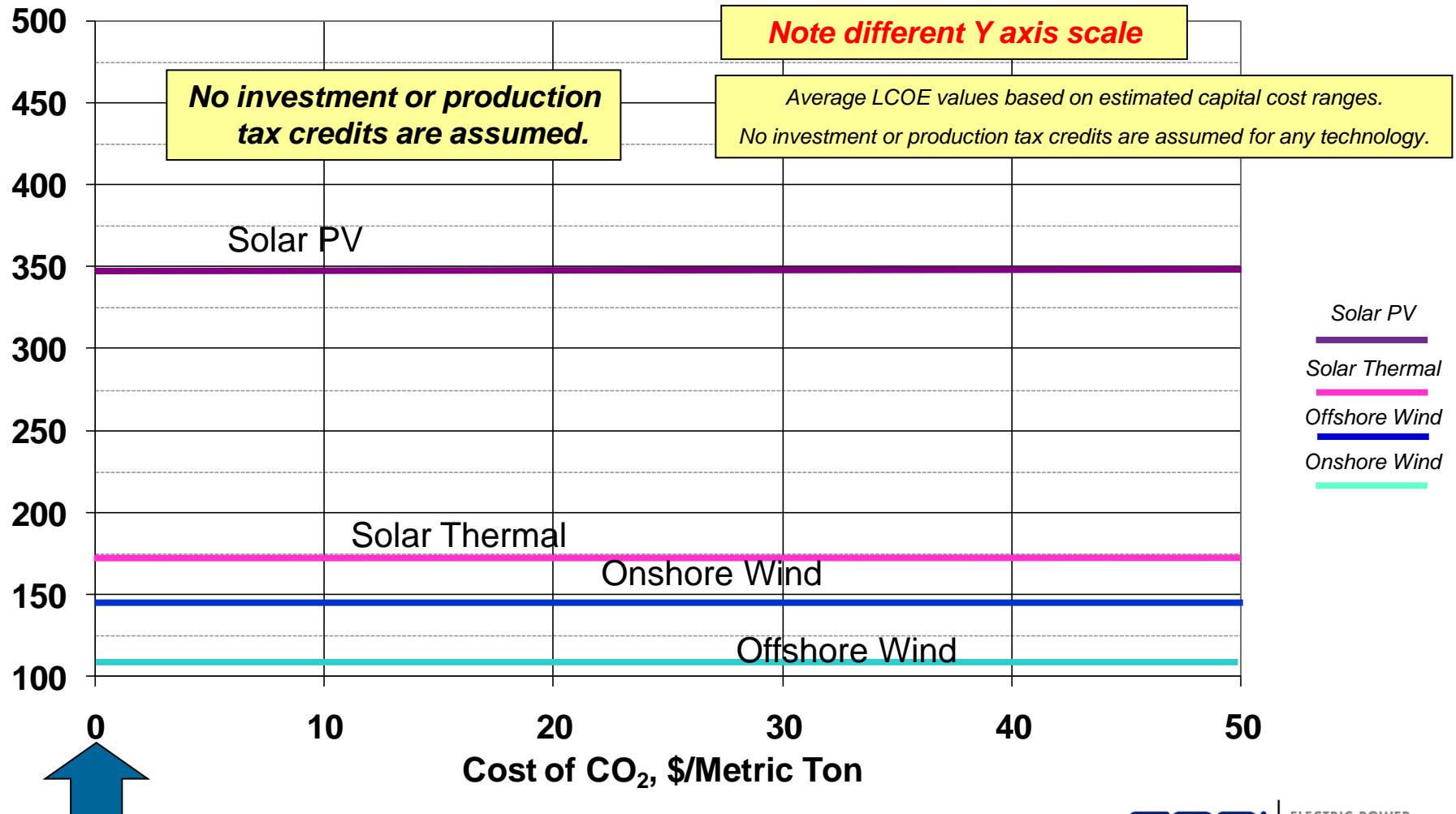
All costs are in December 2010 \$



Comparative Levelized Costs of Electricity – 2015 – Non-Dispatchable Technologies

Levelized Cost of Electricity, \$/MWh

All costs are in December 2010 \$

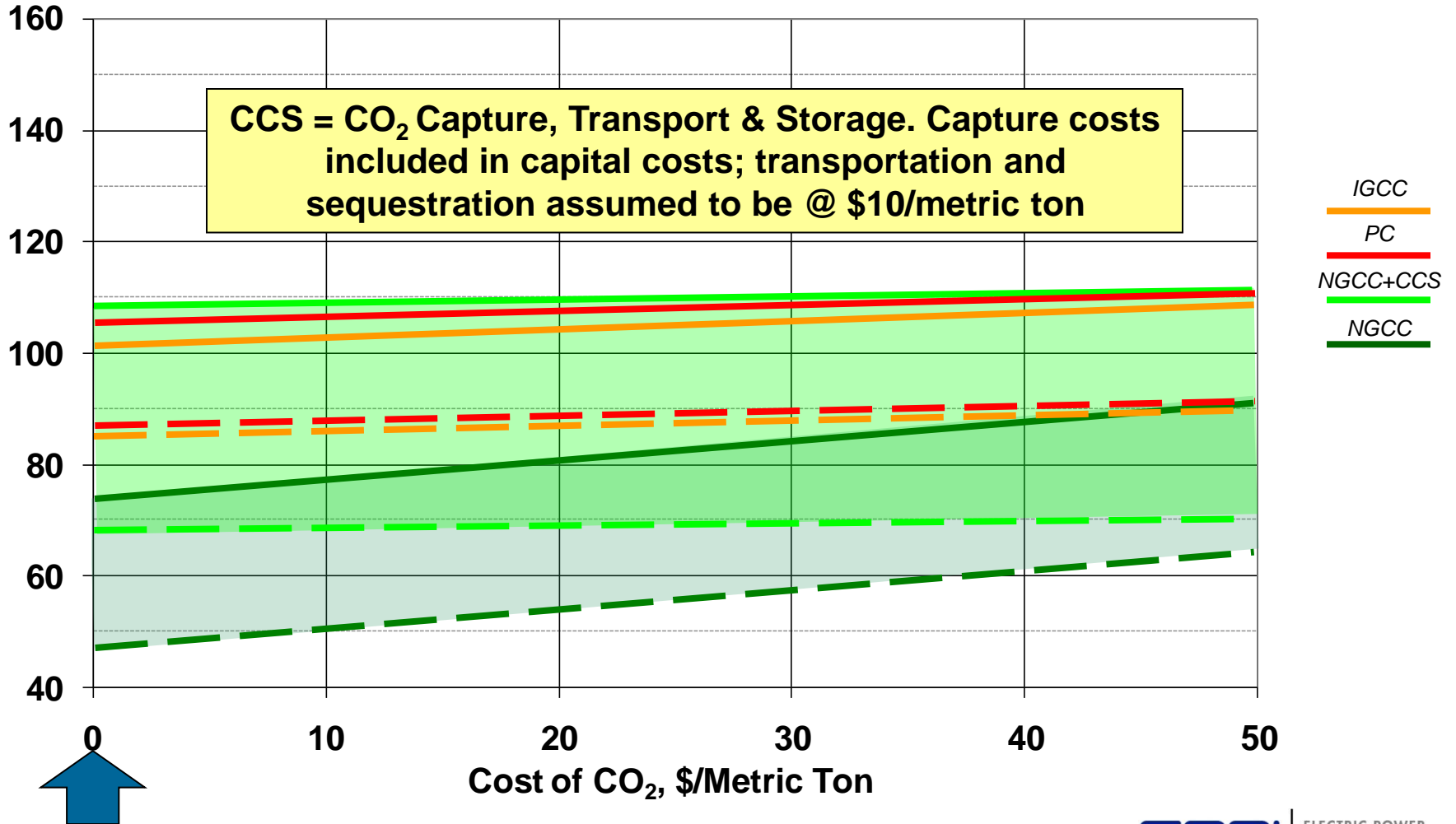


Comparing Low-Carbon Options Longer-Term: 2025

PC, IGCC, NGCC, 2025—Impact of CO₂ Removal, Transport & Storage (CCS) and Cost and Performance Improvements on Levelized Cost of Electricity

Levelized Cost of Electricity, \$/MWh

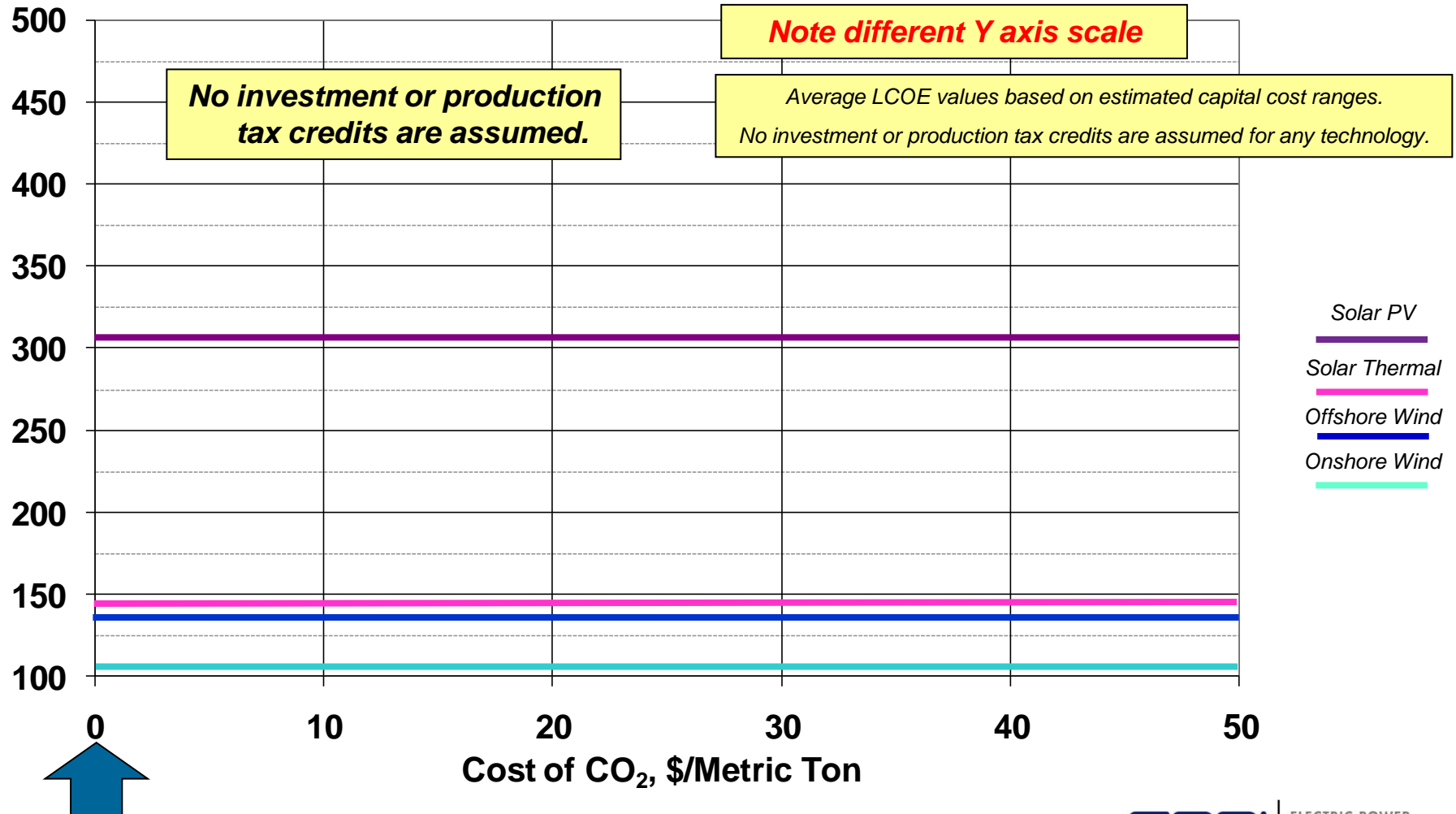
All costs are in December 2010 \$



Comparative Levelized Costs of Electricity – 2025 – Non-Dispatchable Technologies

Levelized Cost of Electricity, \$/MWh

All costs are in December 2010 \$



Conclusions...Options – But No Crystal Ball



- Natural Gas – great prices now – where is it going?
 - Warm winter, fracking, storage, LNG export (2016)
- Coal - MATs, CSAPR – CO₂ GHG - solids?
 - Hard for existing coal – loss of 10-20% of fleet? New?
- Wind – Size improves costs -Production Tax Credit fails
 - Birds, Bats, TV interference, neighbor concerns
 - Variability and “inverse correlation” with load
- Solar – PV /Solar thermal cost coming down but still high
- Nuclear power – new licenses and shared risk
 - Existing sites favored but what will build-out cost?

Policy > Finance > Technology

Together...Shaping the Future of Electricity

Stu Dalton

Senior Government Representative, Generation

sdalton@epri.com

