ENTERGY NEW ORLEANS 2015 IRP
RENEWABLES TECHNICAL CONFERENCE

Technology, Cost and Regulation of CO_2

SEPTEMBER 22, 2014

Note: All IRP materials presented here are marked "preliminary" subject to change prior to Entergy New Orleans' final IRP report due in October 2015.

Entergy®

BACKGROUND AND OBJECTIVES

- The information contained in this presentation summarizes the process used by Entergy's System Planning & Operations ("SPO") group to determine the utility-scale supply-side resource technologies proposed for more detailed modeling in the Entergy New Orleans, Inc. ("ENO") 2015 Integrated Resource Plan ("IRP")
- The assessment is preliminary, and is being provided prior to the October 2014 Milestone 2 Technical Conference to allow participants in the Renewables Technical Conference an opportunity to review ENO's current planning assumptions with respect to renewable technologies
- ENO invites all those who have information relevant to utility-scale renewable resource technologies (i.e., excluding behind-the-meter distributed generation) and their potential to meet the needs of ENO's customers in New Orleans, including the integration of those technologies into long-term integrated resource planning, to register and participate in the Renewables Technical Conference
- ENO expects to file its 2015 IRP Technology Assessment with the City Council in October 2014
- Input received at the Renewables Technical Conference will be taken into consideration prior to making the October 2014 filing
- The Renewables Technical Conference will be hosted by ENO from 9 am to 12 noon (CST) on September 22, 2014 at the Lindy C. Boggs International Conference Center located in the University of New Orleans' Research and Technology Park (Adjacent to the University of New Orleans' Lakefront Campus) 2045 Lakeshore Dr., New Orleans, Louisiana
- All those interested are encouraged to pre-register their attendance using the contact information below:
  - Email: scurein@entergy.com
  - Phone: (504) 670 – 3602
- *Participants interested in presenting information at the Renewables Technical Conference must pre-register indicating their presentation subject, estimated presentation time, and must provide their presentation materials, all no later than close of business September 16, 2014*
  - Time allowed for each presentation will depend on the number of requests received
  - ENO will communicate the agenda to pre-registered participants prior to the meeting
- All those interested in participating in the Renewables Technical Conference are encouraged to visit ENO's 2015 IRP website to review the information previously provided at the Milestone 1 Public Technical Conference:
  - www.entergy-neworleans.com/irp/

ENTERGY NEW ORLEANS 2015 IRP

The Renewables Technical Conference provides an interim step for ENO to seek broad input on utility-scale renewable resources for evaluation in the 2015 IRP

- On June 5th, 2014 the Council established the process for development of ENO's 2015 IRP
- The process reflects lessons learned from the 2012 IRP and provides for public input during development of the IRP
- The following are key milestones in the Council's process[1]
  - June 27 Milestone 1 – Inputs to DSM Potential Study
  - Sept 22 Renewables Technical Conference[2]
  - Oct 2014 Milestone 2 – DSM Potential Study Results / IRP Inputs
  - Feb 2015 Milestone 3 – IRP Modeling Results
  - Jun 2015 Milestone 4 – Draft IRP Report
  - Oct 2015 Final ENO 2015 IRP
- ENO will seek input at each of the milestones above

[1] Additional Information can be found on ENO's IRP website: www.entergy-neworleans.com/irp/
[2] The renewables technical conference was added as a key milestone in the Council's process on August 27th, 2014.

TECHNOLOGY ASSESSMENT PROCESS & OVERVIEW

- An understanding of generation technology capital cost, operating cost, feasibility, commercial availability, and performance is a necessary input to planning and decision support activities. SPO Planning Analysis monitors and assesses generation alternatives on an on-going basis. This analysis uses a generic long-term capital structure of 11.0% Return on Equity (ROE) and 7.0% cost of long-term debt and assumes 50% equity and 50% debt.

- The process has two main steps. First, a screening level analysis is performed. Second, a detailed analysis is performed.

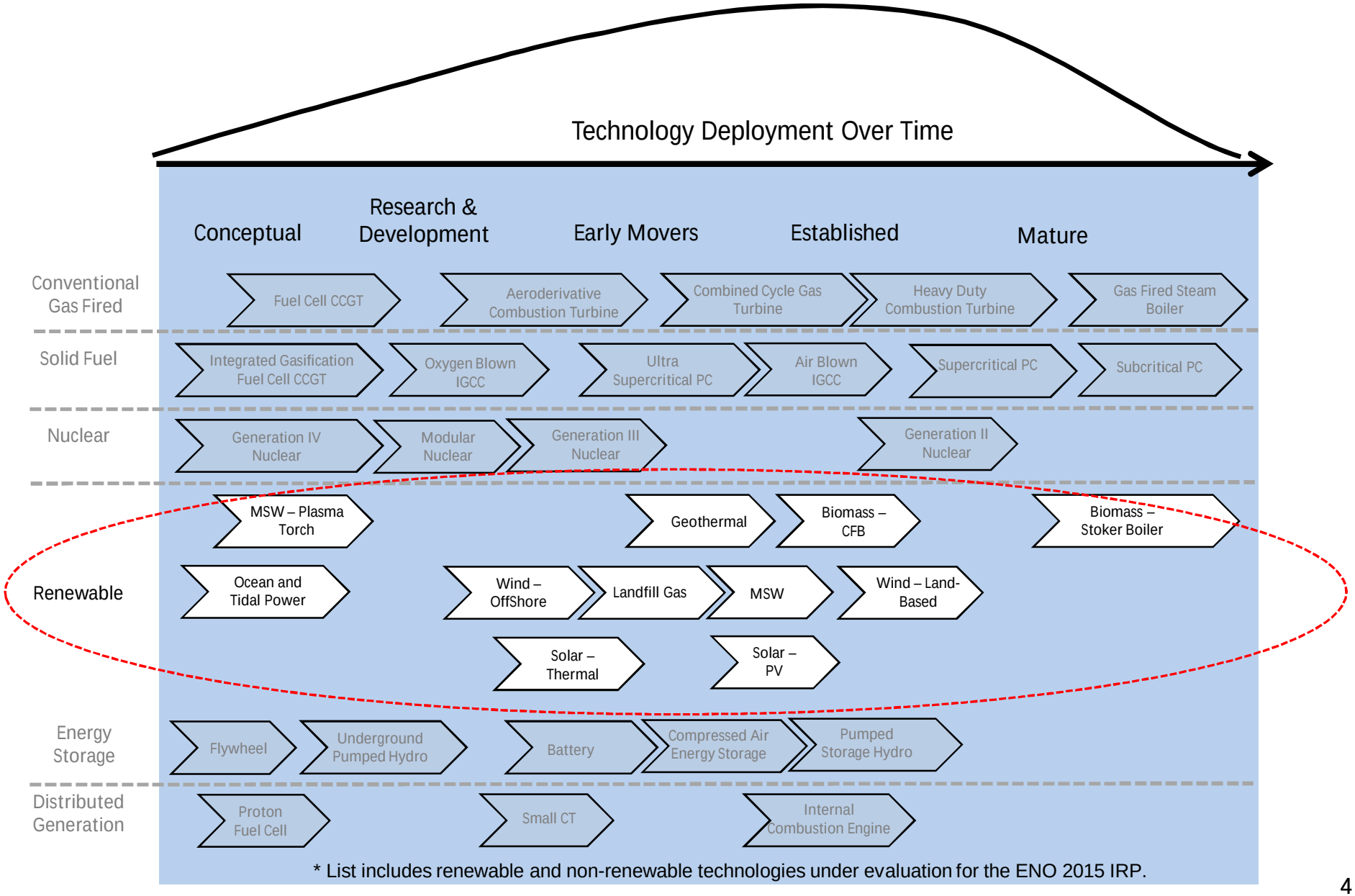
- The 2014 Generation Technology Assessment began by surveying available utility-scale electricity generation technologies, generally those that are two (2) megawatts or greater. The objective is to identify a reasonably wide range of generation technologies for further modeling. The initial list was subject to a screening analysis to identify generation technologies that are technologically mature and could reasonably be expected to be operational in or around the Entergy utility service areas within the IRP planning horizon.

- ENO along with the other Entergy Operating Companies ("EOCs") prefer technologies that are proven viable on a commercial scale. Some technologies identified in this document lack the commercial track record to demonstrate their technical and operational feasibility on a utility-scale basis. A cautious approach to technology development and deployment is therefore reasonable and appropriate in order to maintain reliability and to protect ENO's customers from unnecessary risks and higher costs. It should also be noted that ENO and the other EOCs do not plan to be "first movers" for emerging, unproven technologies.

- Through this first level technology screen, SPO has selected certain conventional and renewable generation technologies, which may reasonably be expected to meet ENO's primary objectives of minimizing cost, risk mitigation, and maintaining reliability. For each selected technology, SPO will develop the necessary cost and performance parameter inputs for the detailed IRP modeling.

- SPO and ENO will also monitor the technologies eliminated at this initial screening stage and incorporate changes into future assessments as appropriate.

A VARIETY OF SUPPLY SIDE RENEWABLE RESOURCES WERE EVALUATED*



* List includes renewable and non-renewable technologies under evaluation for the ENO 2015 IRP.

RENEWABLE TECHNOLOGIES SCREENED*

- Renewable Technologies
  - Biomass
  - Solar Photovoltaic (Fixed Tilt and Tracking)
  - Solar Thermal
  - Wind Power (Land-based and Offshore)
  - Municipal Solid Waste
  - Landfill Gas
  - Geothermal
  - Ocean & Tidal
- Pulverized Coal
  - Subcritical Pulverized Coal
  - Supercritical Pulverized Coal
  - Ultra Supercritical Pulverized Coal
- Fluidized Bed
  - Atmospheric Fluidized Bed
  - Pressurized Fluidized Bed
- Integrated Gasification ("IGCC")
  - Oxygen-Blown IGCC
  - Air-Blown IGCC
  - Integrated Gasification Fuel Cell Combined Cycle
- Combustion Turbine / Combined Cycle / Other Natural Gas
  - Combustion Turbine
  - Combined Cycle
  - Large & Small Scale Aeroderivative
  - Steam Boiler
- Fuel Cells
  - Molten Carbonate
  - Solid Oxide
  - Phosphoric Acid
  - Proton Exchange Membrane
  - Fuel Cell Combined Cycle
- Nuclear
  - Advanced Boiling Water Reactor
  - Generation IV
  - Modular Reactors
- Energy Storage
  - Pumped Hydro
  - Underground Pumped Hydro
  - Battery
  - Flywheel
  - Compressed Air Energy Storage

* List includes renewable and non-renewable technologies under evaluation for the ENO 2015 IRP.

RENEWABLE TECHNOLOGIES SELECTED FOR DETAILED ANALYSIS*

The following renewable technologies are being carried forward for development of detailed planning assumptions

- Renewable Technologies
  - Biomass
  - Wind Power (Land-based)
  - Solar PV (Fixed Tilt and Tracking)
- Pulverized Coal
  - Supercritical Pulverized Coal with carbon capture and storage*
- Natural Gas Fired
  - Combustion Turbine ("CT")
  - Combined Cycle Gas Turbine ("CCGT")
  - Large Scale Aeroderivative CT
  - Small Scale Aeroderivative CT
  - Internal Combustion Engine
- Nuclear
  - Advanced Boiling Water Reactor
- Battery Storage

**Proposed EPA regulations on CO_2 have basically eliminated new coal-fired plants without carbon capture and storage capabilities*

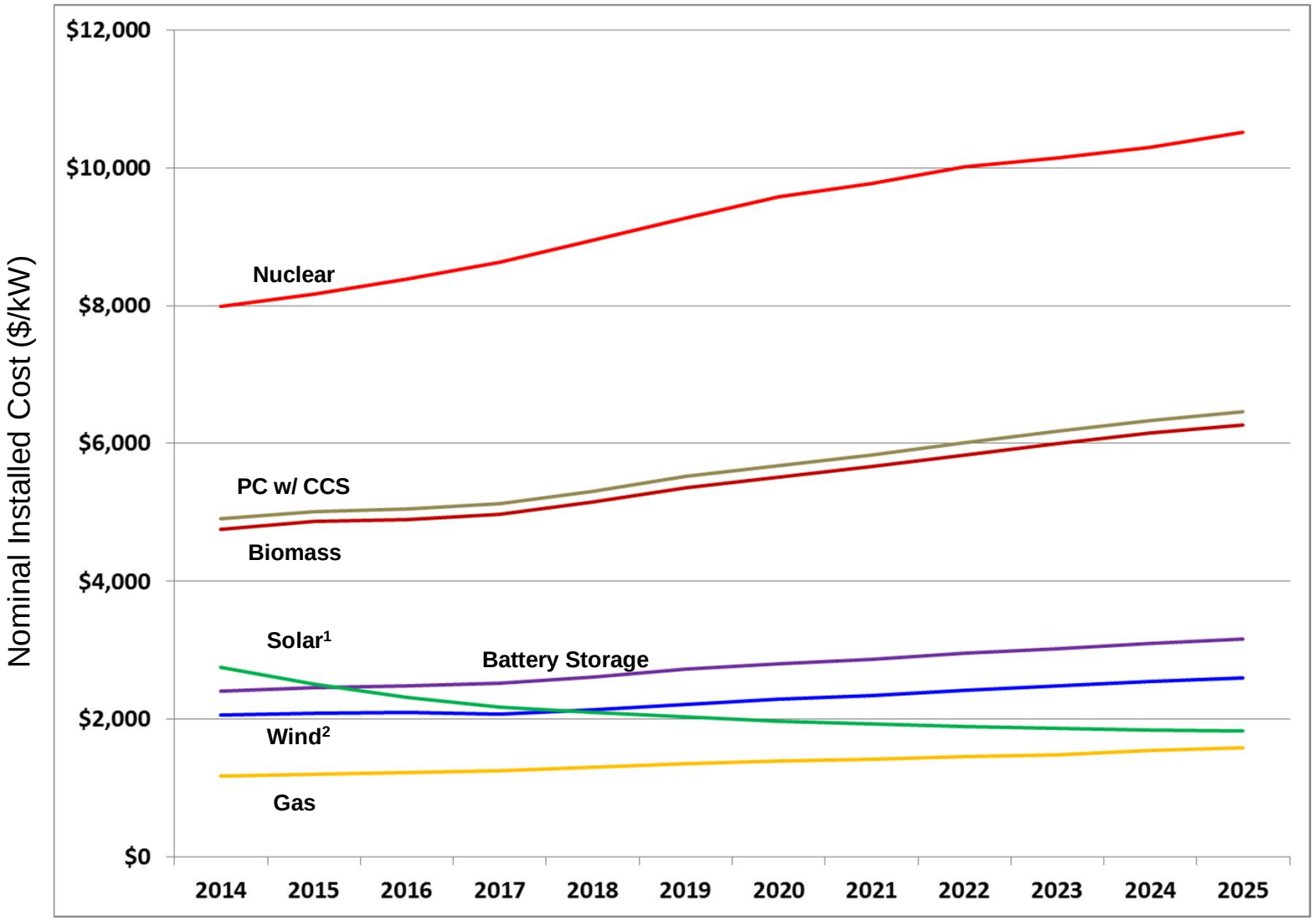
* List includes renewable and non-renewable technologies proposed to be carried forward in the ENO 2015 IRP.

TECHNOLOGY ASSUMPTIONS FOR RENEWABLE RESOURCES

		Biomass	Wind	Solar PV (fixed tilt)	Solar PV (tracking)
Net Max Capacity	(MW)[1]	100	200	100	100
Installed Cost (2014)	($/kW)	$4,760	$2,050	$2,600	$2,900
Full Load Heat Rate – Summer	(Btu/kWh)	12,900	-	-	-
Levelized Fuel Cost	($/mmbtu)	$3.04	-	-	-
Typical Capacity Factor	(%)	85%	34%	18%	21%
O&M	($/kW-yr)[2]	$104.60	$22.10	$19.00	$23.00
Charging Cost	($/MWh)	n/a	n/a	n/a	n/a
Expected Useful Life		30	25	25	25

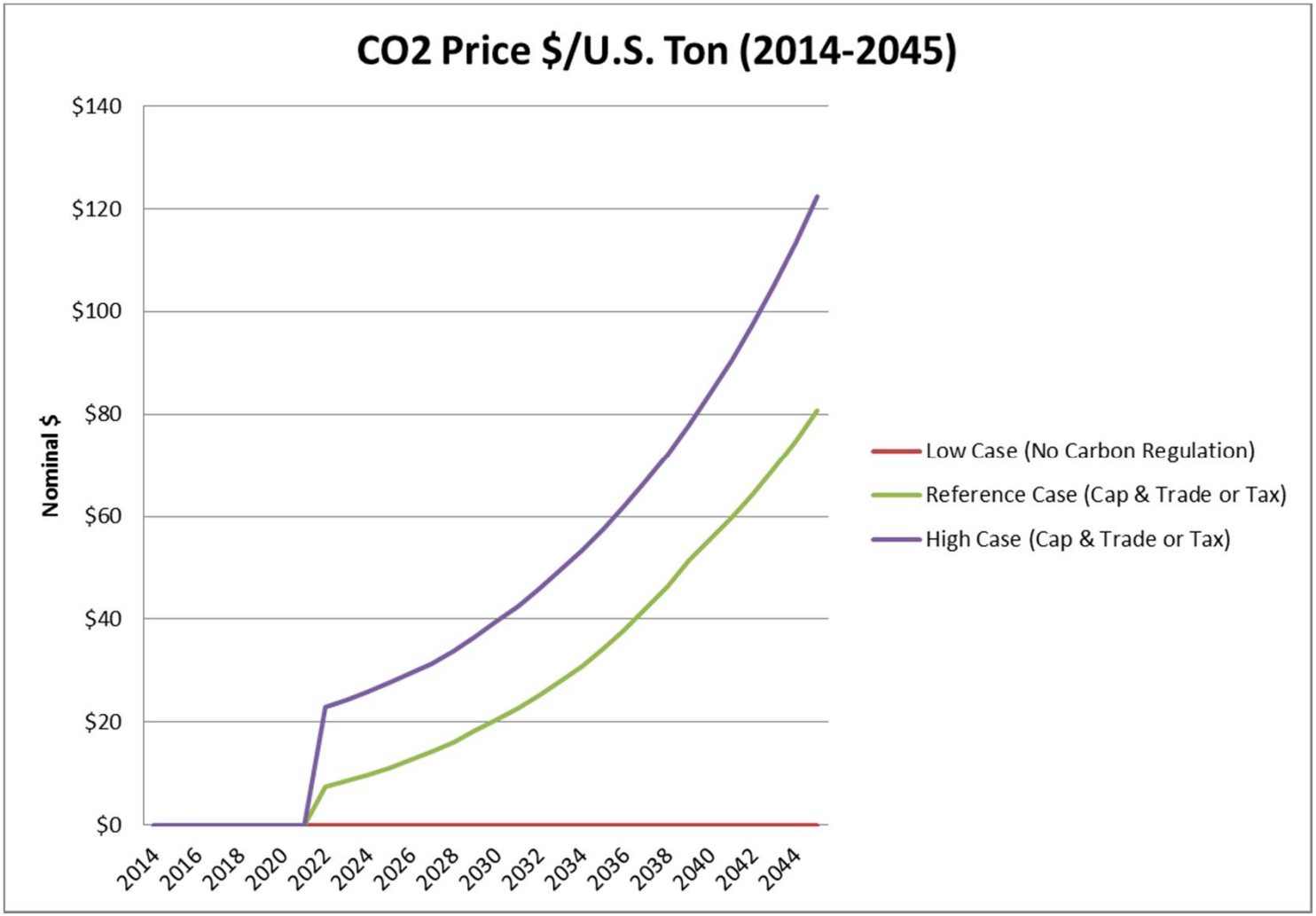
[1] Capacity for these technologies is not significantly affected by ambient air temperature.
[2] All O&M is considered fixed.

TRENDS IN INSTALLED COST PROJECTIONS



1. Solar PV Technologies includes Investment Tax Credit of 30%.
2. Wind does not include any Production Tax Credits.

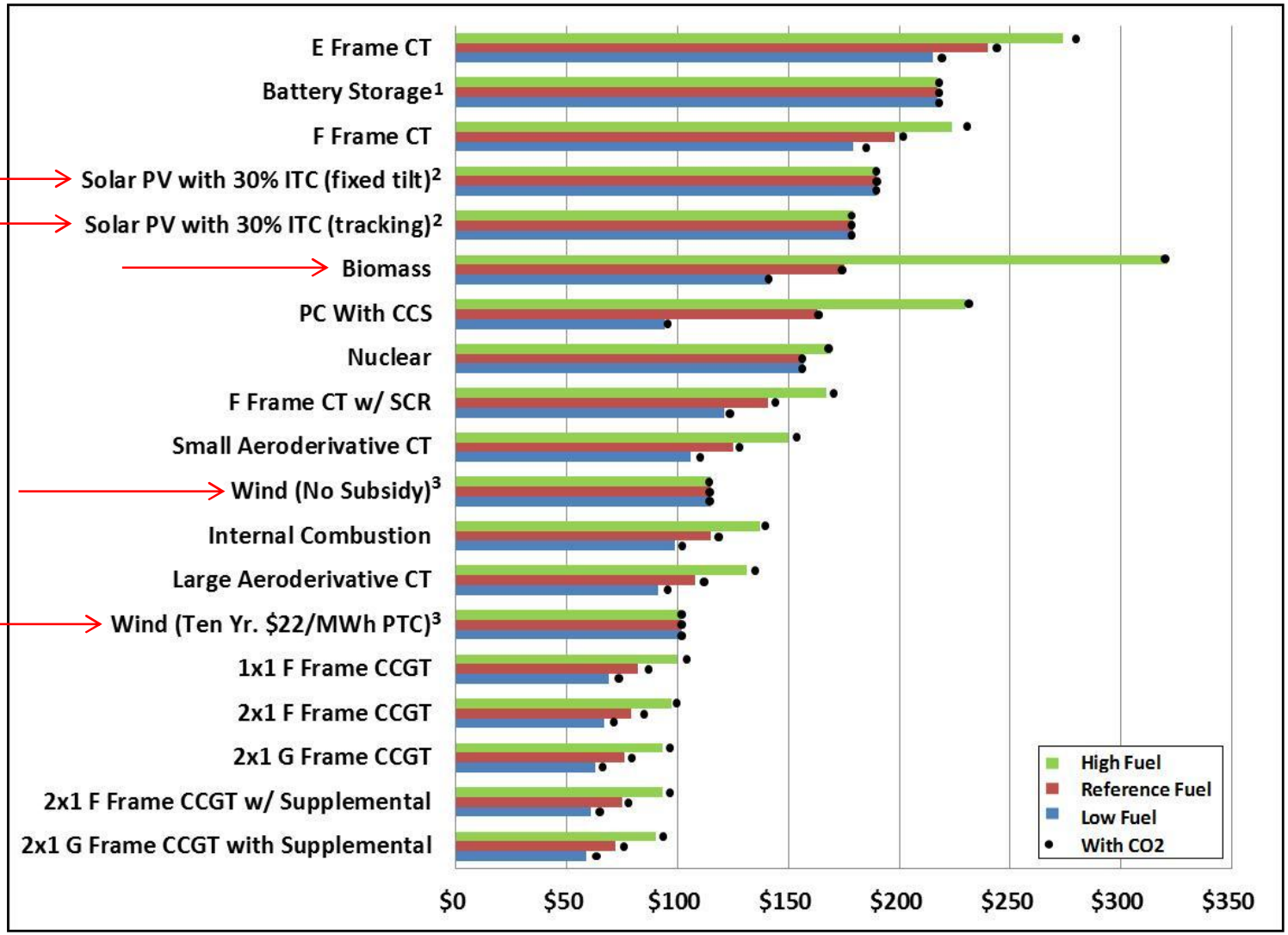
ASSUMPTIONS FOR REGULATION OF CO_2



- Forecast prepared 2013 and reaffirmed January 2014.
- The Reference Case is the ICF 1Q 2013 Integrated Energy Outlook Reference Case.
- The High Case is the ICF 1Q 2013 100% probability case.
- To the extent that there is a cap and trade program or a carbon tax it is assumed to affect both new and existing resources equally.

LEVELIZED LIFECYCLE RESOURCE COST (2015 RESOURCES)

Impact of CO_2 Regulation is accounted for in the assessment of lifecycle cost



Note: Includes capacity Levelized Nominal Lifecycle Cost of resources deployed in 2015 ($/MWh). CO_2 Beginning 2023 $7.54/U.S. Ton ($Nominal), Reaches $66.44/ton in 2043.

1. Includes cost of $25/MWh required to charge batteries.
2. Includes capacity match-up cost of $23.57/MWh assuming a 25.0% capacity value in MISO (see slide 11 for additional details).
3. Includes capacity match-up cost $47.88/MWh due to wind's 14.1% capacity value in MISO (see slide 11 for additional details).

CAPACITY MATCH-UP ASSUMPTIONS

- Intermittent renewable technologies, such as wind and solar, are not able to provide the same level of control that dispatchable resources provide
- As a member of the Midcontinent Independent System Operator ("MISO"), and in recognition of this intermittency, ENO has adopted the MISO estimate of the reliable output of wind as a percentage of the installed capacity (described in Appendix A of the Resource Adequacy Business Practice Manual)
  - MISO performs this analysis each year to determine the capacity credit attributed to all wind resources for the next Planning Year
  - For the Planning Year 2014/15, MISO has determined that the capacity credit for wind resources will be 14.1%
- MISO does not have an established process to assess capacity credit for solar technologies
  - Capacity credit of 25% is the assumption used for solar technologies based on internal assessments
- Importantly, ENO must meet MISO's Resource Adequacy Requirements each year, which do not grant 100% capacity credit to intermittent resources
- Therefore, to compare intermittent and dispatchable resources on a fair and consistent basis, the cost to provide additional capacity must be added to intermittent resources such that the total amount of capacity provided is the same as that provided by dispatchable resources – capacity match-up
- CT capacity is the lowest cost dispatchable resource based on the Technology Assessment and is used for the cost assumption to provide the needed capacity match-up
- For example, consider a 100 MW wind resource:
  - Installed capacity rating of 100 MW
  - MISO applies 14.1% to arrive at 14.1 MW of capacity credit
  - Requires 85.9 MW of CT capacity to provide the same total capacity as that provided by 100 MW of dispatchable resources
  - Resulting MISO capacity credit is 100 MW for both the intermittent resource (with CT capacity match-up) and the dispatchable resource
  - Capacity amount in MISO of each of these alternatives are the same in terms of MW and dollar value
- Because ENO must arrange capacity resources sufficient to meet MISO's Resource Adequacy Requirements each year, it is reasonable to assess a cost to intermittent renewable resources to reflect that 1 MW of intermittent renewable will not contribute 1 MW toward Resource Adequacy Requirements

ADDITIONAL SUPPLY CONSIDERATIONS

Schedule and location can influence which technology is preferred for a given application

Technology	Time to Market	Environmental	Gas Supply	Flexibility
CCGT	◐	●	◐	◐
Frame CT w/ SCR	◕	●	◐	◐
Small Aeroderivative	●	●	○	◕
Large Aeroderivative	◕	●	○	◕
Internal Combustion Engine	●	◐	●	●
Nuclear	○	◕		○
Coal	◔	○		●
Wind	●	●		○
Solar	●	●		○
Biomass	◐	●		◐
Considerations included in category	• Permitting Requirements • Lead time of major components • Engineering Required • Installation Time	• Impact of Non-Attainment Zone • NOx Emissions • SOx Emissions • COx Emissions • By products	• Gas pressure required	• Ramp rate • Turndown ratio • Start time • Performance at part load

Considerations are scored relative to each other.