



Introduction to EPRI's Technical Assessment Guide for the Web (TAGWeb™)

Clarence Lyons
EPRI, Project Manager

Binh Nguyen
Nexant, Project Engineer

Original EPRI Webcast
October 16, 2014

Slides Revised by Adam Diamant
October 2, 2018

Today's Discussion

- TAGWeb's Capability
- Customization
- Training and Support

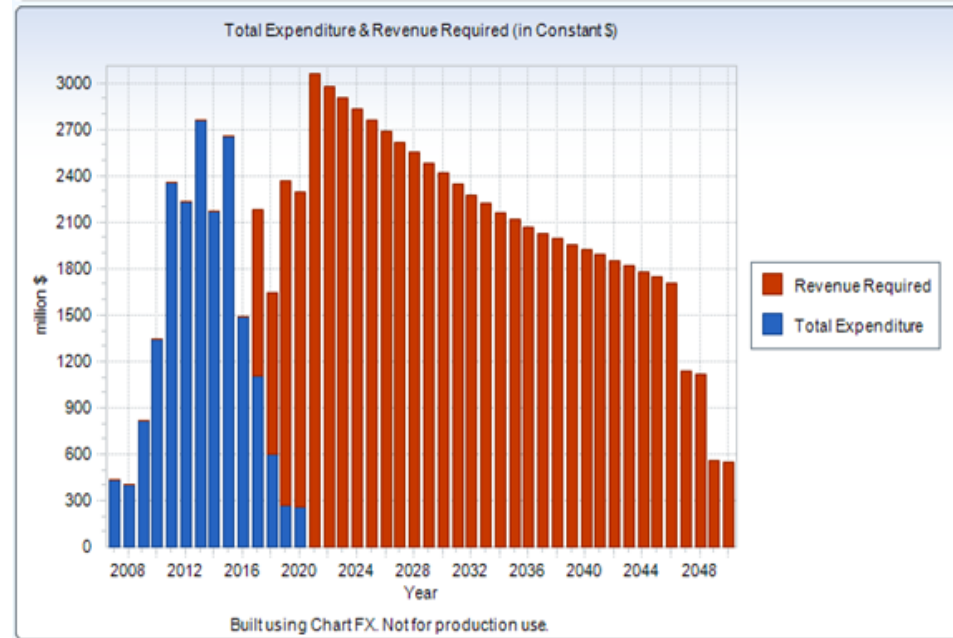
What is TAGWeb™ ?

- TAGWEB™ is a key component of Project Set 178A. It is also available as a supplemental project.
- TAGWEB™ is an internet-based software package for creating customized technology cost & performance estimates. This information provides a sound technology basis for understanding and comparing technology cost estimates and validating results of more detailed, engineering studies.
- TAGWeb™ software provides the necessary information in a concise and credible format to conduct preliminary evaluations of power generation and storage technology options.



Benefits of TAGWeb™ Software

- “One-stop” information source and analytical tool for capital investment planning in the electric power industry.
- It contains a comprehensive database and technology trends
- It facilitates analysis and customization
- TAGWeb® is a planning tool for energy professionals. It can be used for the following purposes:
 - Marketing
 - Energy Evaluation
 - Financial Evaluation
 - Business Planning
 - Investment Analysis
 - Technology Forecasting
 - Integrated Resource Planning (IRP)



Baseline Data for 19 Different Technologies

The screenshot displays the TAGWeb interface. On the left is a navigation menu with categories: STUDY, TECHNOLOGY (with a 'Collapse' button), ALL GROUPS, CENTRAL STATION (listing Pulverized Coal, Fluidized Bed Combustion, IGCC, Nuclear, and Combustion Turbine), SMALL SCALE GENERATION (listing Fuel Cell, Internal Combustion Engine, Small Combustion Turbine, and Micro Turbine), RENEWABLES (listing Wind, Solar Photovoltaic, Solar Thermal, Geothermal, and Renewables Combustible), STORAGE (listing CAES, Pumped Hydro, Flywheel, Batteries, and SMES), TRANSMISSION / DISTRIBUTION (listing Overhead Transmission, Transmission Substation, Overhead Distribution, Underground Distribution, and Distribution Substation), and DISTR GENERATION. Below these are sections for ECONOMICS, FUEL/RESOURCES, and GLOBAL DATA (listing Code of Accounts, Inflation Data, Depreciation Schedules, Season Definitions, and Regionalization). The main content area is titled 'TAGWeb Quick Search' and contains a search form with the following fields: Study (1111.1 cps scenario), Technology Type (ALL), Minimum Size (0 MW), and Maximum Size (2000 MW). Below the search form, the text 'No data available.' is displayed. At the bottom of the search area are buttons for 'Select', 'New', 'Delete', and 'Report'.

EPRI provides a baseline data for several cases for each of 19 different technologies, including, for example, different sizes, locations and types of coal and renewable based generation.

Potential builds out for future versions of TAGWeb.

Technology, Economic and Fuel Parameters

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

SIZE & LOCATION

CT Plant Size (Gross MW)	483.30
HRSG Size (MW)	86.40
Auxiliaries (MW)	5.80
Unit Size (Net MW)	235.85
Unit	2.00
Total Plant Capacity (NET MW)	471.70
Region, State	E/W Central, Michigan

TECH INFO

Save Save As Restore

Cost & Performance Basis

Expand All Collapse All

TECHNOLOGY

- GENERAL
- DESIGN BASIS
 - General**
 - Site
 - Configuration
 - Parameters
- ADJUST DESIGN
- CAPEX
- O&M
- PERFORMANCE
- ENVIRONMENTAL

ECONOMICS

- FINANCING
- O&M UNIT COST
- OWNER'S COST

FUEL

- GENERAL

REPORTS

- REPORTS

NOTE: To make changes to unit or fuel/economic link, please go to Adjust Design -> General

Unit Size, Gross MW	Unit Size, Gross MW	<input type="text" value="155.25"/>
HRSG ST Unit Size, MW	HRSG ST Unit Size, MW	<input type="text" value="86.40"/>
Auxiliaries, MW	Auxiliaries, MW	<input type="text" value="5.80"/>
CT Unit Size, Net MW	CT Unit Size, Net MW	<input type="text" value="235.85"/>
Number of Units	Number of Units	<input type="text" value="2.00"/>
Fuel Type	Fuel Type	<input type="text" value="Natural Gas"/>
Fuel Link	Fuel Link	<input type="text" value="1012.6 2010 Natural Gas EWC"/>
Economics Link	Economics Link	<input type="text" value="1031.3 2010 Econ EWC Natural Gas"/>

The database contains technology, economic, and fuel parameters that can be customized for each company profile and evaluation.

TAGWeb™ Database Structure

Home Admin Log Off

Home > Technology > Tech CAPEX-Capital Costs Help

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

TECH INFO

Save Save As Restore

Expand All Collapse All

TECHNOLOGY

- ☐ GENERAL
- ☐ DESIGN BASIS
- ☐ ADJUST DESIGN
- ☐ CAPEX
 - Capital Costs**
 - Cost Categories
 - AFUDC/Owner
 - Replacement Costs
- ☐ O&M
- ☐ PERFORMANCE
- ☐ ENVIRONMENTAL

ECONOMICS

- ☐ FINANCING
- ☐ O&M UNIT COST
- ☐ OWNER'S COST

Regionalization Data Set: 3.0 2010 Update

Cost Categories

1 Combined Cycle (OEM Scope)	2 Environmental
3 Balance of Plant	4 Electrical
5 Buildings and Structures	6 Foundations

Click a number to see Code of Account

Cost (\$/kW)	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Process Capital	447.66	70.32	151.97	127.29	35.39	36.54
General Facilities	37.6	0	0	0	0	0
Eng. Fee & Constr. Man.	208.7	0	0	0	0	0
Project Contingency	223.2	0	0	0	0	0
Process Contingency	0	0	0	0	0	0

Selected Item

Process Capital	<input type="text" value="447.66"/>	<input type="text" value="70.32"/>	<input type="text" value="151.97"/>	<input type="text" value="127.29"/>	<input type="text" value="35.39"/>	<input type="text" value="36.54"/>
-----------------	-------------------------------------	------------------------------------	-------------------------------------	-------------------------------------	------------------------------------	------------------------------------

The database structure allows input values at various levels. For example, the capital cost can be entered at up to six plant component levels and at code of account levels.

Production Costs and Emissions

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

SIZE & LOCATION

CT Plant Size (Gross MW)	483.30
HRSG Size (MW)	86.40
Auxiliaries (MW)	5.80
Unit Size (Net MW)	235.85
Unit	2.00
Total Plant Capacity (NET MW)	471.70
Region, State	E/W Central, Michigan

TECH INFO

Save Save As Restore

Cost & Performance Basis

Expand All Collapse All

TECHNOLOGY

- ☐ GENERAL
 - General
 - References
 - Financial
 - Timing
 - Time Dependent**
 - Taxes & Credits
- ☐ DESIGN BASIS
- ☐ ADJUST DESIGN
- ☐ CAPEX
- ☐ O&M
- ☐ PERFORMANCE
- ☐ ENVIRONMENTAL
- ECONOMICS**
 - ☐ FINANCING
 - ☐ O&M UNIT COST
 - ☐ OWNER'S COST

Yearly Variations Monthly Variations

Year	Heat Rate(Btu/kWh)	Capacity Factor	Fuel ID
2011	6987	85	1012.6

The software can evaluate production costs and emissions with monthly or annual variations in heat rate, capacity factor, or change in fuel.

Selected Item

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
			Update Delete

Busbar Cost and Capacity Factors

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

SIZE & LOCATION

CT Plant Size (Gross MW)	483.30
HRSG Size (MW)	86.40
Auxiliaries (MW)	5.80
Unit Size (Net MW)	235.85
Unit	2.00
Total Plant Capacity (NET MW)	471.70
Region, State	E/W Central, Michigan

TECH INFO

Cost & Performance Basis

Save Save As Restore

Expand All Collapse All

TECHNOLOGY

- GENERAL
- DESIGN BASIS
- ADJUST DESIGN
- CAPEX
- O&M
- PERFORMANCE

General

- Availability
- Heat Rate
- Liquid Emissions
- Solid Emissions
- Air Emissions

ENVIRONMENTAL

Duty Cycle

Capacity Factor, %

Minimum Load, %

The busbar cost can be evaluated for variations in capacity factor.

Heat Rates and Load Factors

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

SIZE & LOCATION

CT Plant Size (Gross MW)	483.30
HRSG Size (MW)	86.40
Auxiliaries (MW)	5.80
Unit Size (Net MW)	235.85
Unit	2.00
Total Plant Capacity (NET MW)	471.70
Region, State	E/W Central, Michigan

TECH INFO

Save Save As Restore

Cost & Performance Basis

Expand All Collapse All

TECHNOLOGY

- GENERAL
- DESIGN BASIS
- ADJUST DESIGN
- CAPEX
- O&M
- PERFORMANCE

- General
- Availability
- Heat Rate**
- Liquid Emissions
- Solid Emissions
- Air Emissions

ENVIRONMENTAL

Heat Rate, Btu/kWh

Average	<input type="text" value="6987"/>
Full	<input type="text" value="6978"/>
75%	<input type="text" value="7410"/>
50%	<input type="text" value="7220"/>
25%	<input type="text" value="8500"/>

Load level for Heat Rate used in calculations

The variation in heat rates corresponds to variation in load factor.

Operations & Maintenance Costs

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

O&M costs can be entered at various times of the plant operation. For example, the Inspection Service Costs for CTs can be entered at various service hours of operation from plant start-up.

TECH INFO

Save Save As Restore

Expand All Collapse All

TECHNOLOGY

- ⊕ GENERAL
- ⊕ DESIGN BASIS
- ⊕ ADJUST DESIGN
- ⊕ CAPEX
- ⊕ O&M
 - Fixed
 - Variable**
 - Consumables
- ⊕ PERFORMANCE
- ⊕ ENVIRONMENTAL

ECONOMICS

- ⊕ FINANCING
- ⊕ O&M UNIT COST
- ⊕ OWNER'S COST

FUEL

- ⊕ GENERAL

Other

Other Incremental Maintenance, mils/kWh

Other Variable O&M, mils/kWh


Inspection List

No.	Area	Cost (\$)	Period (hrs)
1	Major Maintenance	0	0
2	Major Spare Parts	0	0
3	SCR Catalyst Replace	518800	7446

Selected Item

Note: Changing global COA will NOT affect technology records already imported with the old data. Go to individual technology record to re-import.

Financial Analysis



ELECTRIC POWER RESEARCH INSTITUTE

TAGWEB™ Database & Software

TAGWeb Account: t2010resul
Log Off

Home Admin
Home > Economics > Financing-Financing
Help

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

SIZE & LOCATION

CT Plant Size (Gross MW)	483.30
HRSG Size (MW)	86.40
Auxiliaries (MW)	5.80
Unit Size (Net MW)	235.85
Unit	2.00
Total Plant Capacity (NET MW)	471.70
Region, State	E/W Central, Michigan

TECH INFO

Save Save As Restore

Expand All Collapse All

TECHNOLOGY

- GENERAL
- DESIGN BASIS
- ADJUST DESIGN
- CAPEX
- O&M
- PERFORMANCE
- ENVIRONMENTAL

ECONOMICS

- FINANCING
 - General
 - Financing
 - Inflation
 - Taxes
 - Timing
 - AFUDC
- O&M UNIT COST
- OWNER'S COST

Security	% of total	Current \$ %/yr
Debt	<input type="text" value="46.00"/>	<input type="text" value="7.50"/>
Preferred	<input type="text" value="8.00"/>	<input type="text" value="8.40"/>
Common	<input type="text" value="46.00"/>	<input type="text" value="11.50"/>

Levelize with After Tax Debt Cost?

The economics input data provide enough level of detail for various types of financial analyses for projects.

Fuel Prices

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

SIZE & LOCATION

CT Plant Size (Gross MW)	483.30
HRSNG Size (MW)	86.40
Auxiliaries (MW)	5.80
Unit Size (Net MW)	235.85
Unit	2.00
Total Plant Capacity (NET MW)	471.70
Region, State	E/W Central, Michigan

TECH INFO

Save Save As Restore

Expand All Collapse All

TECHNOLOGY

- GENERAL
- DESIGN BASIS
- ADJUST DESIGN
- CAPEX
- O&M
- PERFORMANCE
- ENVIRONMENTAL

ECONOMICS

- FINANCING
- O&M UNIT COST
- OWNER'S COST

FUEL

- GENERAL
- [General](#)
- [Cost](#)
- [Physical Properties](#)

Year \$ for Input Data

Month \$ for Input Data

- Use Price Escalation
- Use Year-by-Year


Fuel Price Forecast

Append Auto Populate

Year	Fuel Price, \$/MBtu		
<input type="text" value="2010"/>	<input type="text" value="5.77"/>		
<input type="text" value="2011"/>	<input type="text" value="4.58"/>	<input type="button" value="Insert"/>	<input type="button" value="Delete"/>
<input type="text" value="2012"/>	<input type="text" value="4.58"/>	<input type="button" value="Insert"/>	<input type="button" value="Delete"/>
<input type="text" value="2013"/>	<input type="text" value="4.58"/>	<input type="button" value="Insert"/>	<input type="button" value="Delete"/>
<input type="text" value="2014"/>	<input type="text" value="4.58"/>	<input type="button" value="Insert"/>	<input type="button" value="Delete"/>

Fuel prices can be set on an annual basis with half-yearly inflation, and with escalation.

TAGWeb™ Report Generation



ELECTRIC POWER
RESEARCH INSTITUTE

TAGWEB™ Database & Software

TAGWeb Account: t2010resul

Home Admin ▶
Log Off

Home > Technology > Tech Reports-Technology
Help

CURRENT SELECTION

Study 10.0	2010 Tech Cases for 2011
Technology 1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Fuel 1012.6	2010 Natural Gas EWC
Economics 1031.3	2010 Econ EWC Natural Gas

SIZE & LOCATION

CT Plant Size (Gross MW) 483.30
HRSG Size (MW) 86.40
Auxiliaries (MW) 5.80
Unit Size (Net MW) 235.85
Unit 2.00
Total Plant Capacity (NET MW) 471.70
Region, State E/W Central, Michigan

TECH INFO

Save Save As Restore

Expand All Collapse All

TECHNOLOGY

- GENERAL
- DESIGN BASIS
- ADJUST DESIGN
- CAPEX
- O&M
- PERFORMANCE
- ENVIRONMENTAL

ECONOMICS

- FINANCING
- O&M UNIT COST
- OWNER'S COST

FUEL

- GENERAL

REPORTS

- REPORTS

Technology Reports

- Comparison Reports
- Phase Construction

Technology	Financial
<p>Technology Summary Results of current calculations</p> <p>Estimating Worksheet Calculation details and intermediate results</p> <p>Technology Input Data Current technology input data</p> <p>Economics Input Data Current economics input data</p> <p>Fuel/Resource Input Data Current fuel/resource input data</p>	<p>Carrying Charge Summary Carrying Charge Summary</p> <p>Revenue Requirements Revenue Requirements</p> <p>Discounted Cash Flow Discounted Cash Flow Report</p>
Emissions	Sensitivity Study
<p>Emissions Outputs Physical emissions output</p> <p>Emissions Costs Cost of emissions treatment and disposal</p>	<p>Technology Sensitivity Report Technology sensitivity report</p> <p>Fuel Sensitivity Report Fuel sensitivity report</p> <p>Economics Sensitivity Report Economics sensitivity report</p>

Hands on Demonstration Tutorial



Technical Information About Each Power Generation Technology

Technical Information - Combustion Turbine

[Combustion Turbine Update - 2010](#)
[Combustion Turbine Update - 2009](#)
[Combustion Turbine Update - 2008](#)
[Combustion Turbine Update - 2007](#)
[Fixed and Variable O&M Inputs for CTCC](#)

[Introduction - 2010](#)
[Cost and Performance Basis - 2010](#)
[Technology Risks and CTCC Market Impact - 2010](#)
[Generation/Transmission Capacity Impacts - 2010](#)
[Table of Contents/Product Description - 2010](#)
[Carbon Dioxide Capture Technologies - 2008](#)
[Hybrid and Dry Cooling Systems - 2008](#)
[Technology Improvements for 2020+](#)
[Environmental Controls - 2007](#)
[Bulk Percentages and Quantities - 2008](#)
[Method of Escalation - 2008](#)
[MACRS Depreciation Schedule](#)
[Availability - 1993](#)

Technical Description for Each Technology

EPRI Proprietary Licensed Material

6 COMBUSTION TURBINE COMBINED CYCLE

6.1 Introduction and Overview

Section 6 presents updated performance and cost information for combustion turbine combined-cycle systems. Major subsections include 6.2 Aeroderivative Combustion Turbines, 6.3 LM6000 SPRINT™, 6.4 GE LMS100 (updated in this edition), and 6.5 GE “H-Class” combined cycle. Subsection 6.6 describes recent shifts in the combustion turbine market. Subsection 6.7 presents detailed information on air-cooled and hybrid condensers for combined-cycle power plants.

A combustion turbine (CT), also called a gas turbine (GT), includes an air compressor, a combustor, and an expansion turbine. Gaseous or liquid fuels are burned under pressure at about 10 to 15 atm in the combustor, producing hot gases that pass through the expansion turbine, driving the air compressor. The shaft of the CT is coupled to an electric generator such that mechanical energy produced by the CT drives the electric generator.

A simple-cycle CT is one in which the working fluid remains gaseous throughout the cycle, which consists of adiabatic compression, isobaric heating, and isentropic expansion and isobaric

Block Diagram for Each Technology and Plant Configuration

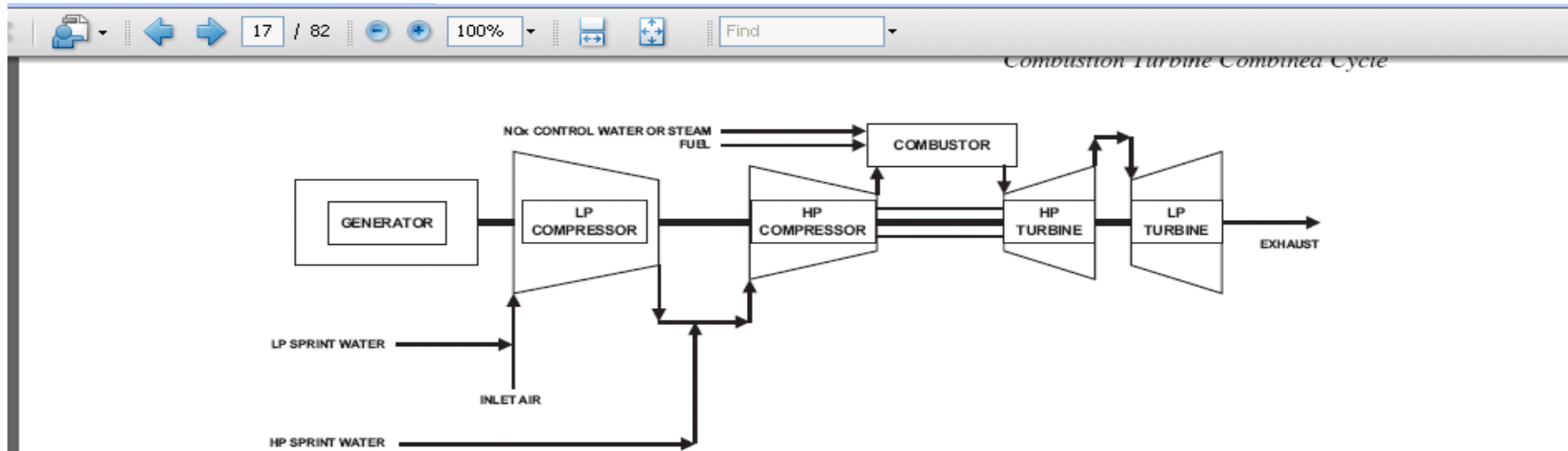


Figure 6-10
SPRINT™ Process Flow Diagram

Intercooling improves turbine output in three ways. First, it reduces the work of compression since the cooler HP compressor inlet temperature reduces the work required for HP compression. Second, it reduces the temperature of air entering the combustor, allowing more fuel to be burned before reaching combustor or turbine temperature limits. Third, a significant quantity of compressor discharge air, in the area of 20%, is used as turbine coolant and must bypass the combustor. An intercooled compressor has a lower air discharge temperature; consequently, less cooling air is required, allowing more fuel to be burned in the larger quantity of combustion air. Demineralized water is required for SPRINT operation to minimize solids deposition on the compressor blades.

SPRINT is available as an option on the water/steam injected LM6000PC and may be employed with natural gas firing or fuel oil firing. SPRINT also is offered on the dry low-NO_x LM6000PD, but at this time it must be switched off when firing fuel oil. Also, at this time

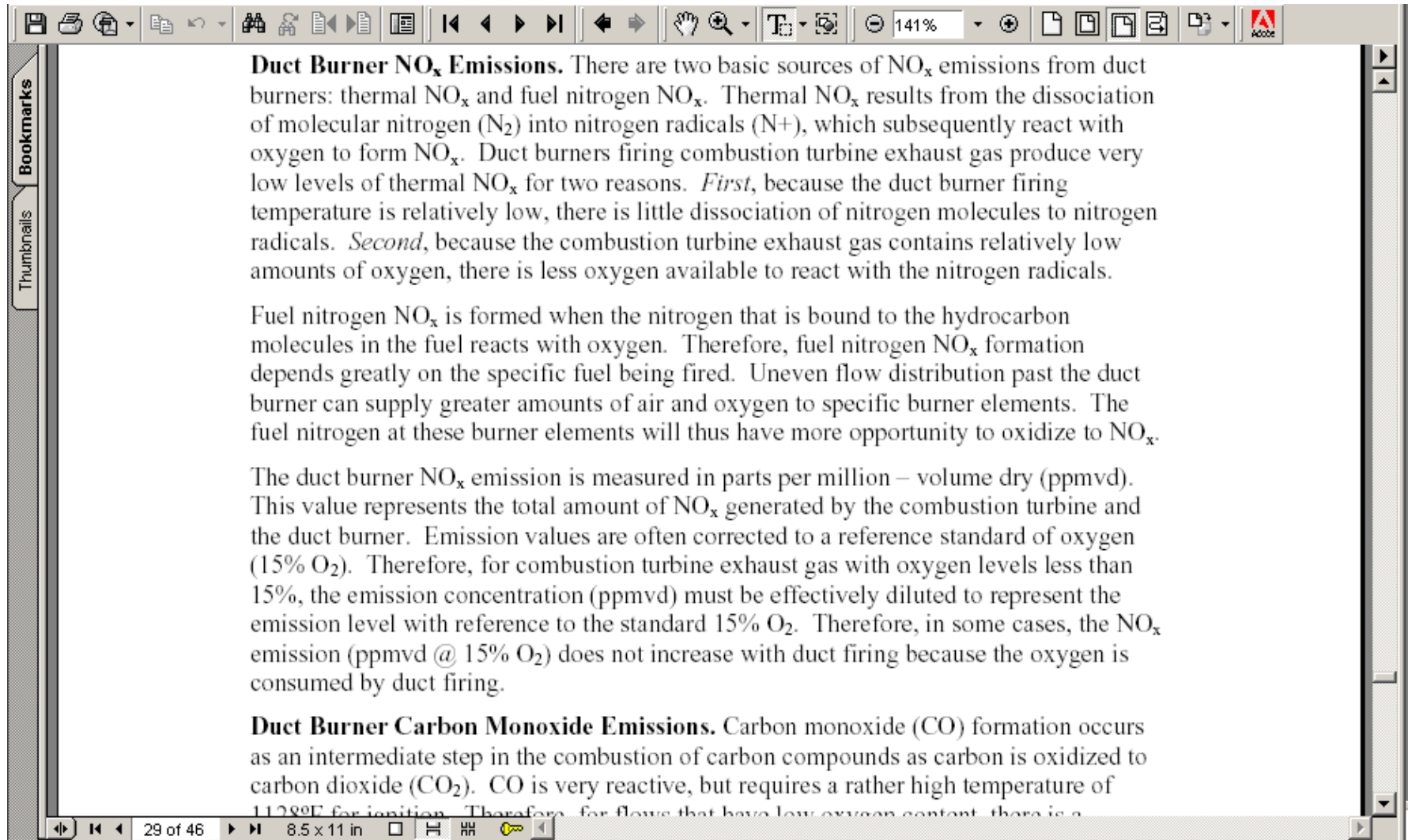
Qualitative Assessment of Technical Aspects for Each Technology

Technologies	R&D Intensity	Leading Developers of the Science or Technology			Major Trends	Changes To Watch For	Unresolved Issues
		Government Organizations	Nonprofit Organizations	Leading Vendors			
Conventional subcritical CFBC	Low		EPRI	Various CFBC boiler and steam turbine vendors	Addition of polishing scrubbers to new units. Existing units: co-firing "opportunity" fuels like biomass	Increasing price of natural gas, improving economics of coal-fired plants over CT plants. Stricter regulations	CO2 emission control systems and associated costs. Impact of CO2 tax.
Conventional supercritical CFBC	Low			Various CFBC boiler and steam turbine vendors	First supercritical unit being built	Increasing price of natural gas, favoring coal-fired plants. If first and subsequent supercritical	Construction of more supercritical units dependent on experience of first
Advanced supercritical CFBC	Limited	DOE/ORNL (much of research in high pressure/ temperature alloys will be applicable to CFBC pressure parts)		Primarily one CFBC vendor steam and turbine vendors	New alloys - higher temperature and pressure. Research at ORNL will be applicable to CFBC	Advanced supercritical possible in the future, but is a number of years away.	Depends on the experience at Lagisza, Poland.

Qualitative Assessment of Business Aspects for Each Technology

	<i>First Generation</i>	<i>Second Generation</i>	<i>Third Generation</i>	<i>Fourth Generation</i>
Process Identification Usual capacity Steam Conditions	Conventional non-reheat and subcritical CFBC 50-150 MW 1200 psig/950°F & 2400 psig 1000°F/1000°F	Conventional subcritical CFBC 150-300 MW 2400 psig 1000°F/1000°F	Subcritical CFBC 300-500 MW 2400 psig 1000°F/1000°F	Supercritical CFBC; 500 MW 3500 psig 1000°F/1000°F
NO_x control	None	SNCR	SNCR	SNCR
Sulfur control	In-bed 70-80% control	In-bed 85-95% control	In-bed 95-98% control. Efficiency greater than 95% may require polishing scrubber	In-bed 95-98% control. Efficiency greater than 95% may require polishing scrubber
Mercury control	None	None	Activated carbon	Enhanced activated carbon
Fly ash control	ESP	Fabric filter	Fabric filter	Fabric filter
Other Characteristics	Initial commercial experience	Maturing operating experience	Commercial operating experience	Needs to be proven
Heat Rate, HHV	10,000-12,000 Btu/kWh	9500-10,000 Btu/kWh	9500-9800 Btu/kWh	Needs to be shown
Major Disadvantages Environmental	Solid waste disposal Fine particulate emission CO ₂ emissions NO _x emissions Mercury emissions	Solid waste disposal Fine particulate emission CO ₂ emissions NO _x emissions Mercury (Hg) emissions	Solid waste disposal in most cases CO ₂ emissions Trace compound emissions (other than Hg)	No supercritical experience yet. Same disadvantages as third generation.
Others	Limited efficiency. High capital cost compared to NGCC.	Improving efficiency. High capital cost compared to NGCC.	Move toward more waste coal and fuel firing.	
Key technology needs	Reducing O&M costs and minimizing tube erosion	Reducing O&M costs and increasing plant size	Proving commercial viability of 500-MW single boilers	Proving commercial viability of 500-MW supercritical boilers
Development Timing				
Research	1960s	1970s	1990s	2001-2003
Development	1970s	1990s	Late 1990s	In progress
Demonstration	1980s	1990s	Early 2000s	2006
Commercialization Date for Large Units	1990-1995	1995-2000	2002-2007	Future
Key Issues	Improving performance	Reducing capital cost Improving performance, availability	Improving performance. Competing with PC & IGCC	Competing with PC & IGCC

Emissions Overview for Each Technology



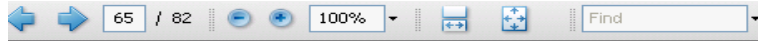
Duct Burner NO_x Emissions. There are two basic sources of NO_x emissions from duct burners: thermal NO_x and fuel nitrogen NO_x. Thermal NO_x results from the dissociation of molecular nitrogen (N₂) into nitrogen radicals (N+), which subsequently react with oxygen to form NO_x. Duct burners firing combustion turbine exhaust gas produce very low levels of thermal NO_x for two reasons. *First*, because the duct burner firing temperature is relatively low, there is little dissociation of nitrogen molecules to nitrogen radicals. *Second*, because the combustion turbine exhaust gas contains relatively low amounts of oxygen, there is less oxygen available to react with the nitrogen radicals.

Fuel nitrogen NO_x is formed when the nitrogen that is bound to the hydrocarbon molecules in the fuel reacts with oxygen. Therefore, fuel nitrogen NO_x formation depends greatly on the specific fuel being fired. Uneven flow distribution past the duct burner can supply greater amounts of air and oxygen to specific burner elements. The fuel nitrogen at these burner elements will thus have more opportunity to oxidize to NO_x.

The duct burner NO_x emission is measured in parts per million – volume dry (ppmvd). This value represents the total amount of NO_x generated by the combustion turbine and the duct burner. Emission values are often corrected to a reference standard of oxygen (15% O₂). Therefore, for combustion turbine exhaust gas with oxygen levels less than 15%, the emission concentration (ppmvd) must be effectively diluted to represent the emission level with reference to the standard 15% O₂. Therefore, in some cases, the NO_x emission (ppmvd @ 15% O₂) does not increase with duct firing because the oxygen is consumed by duct firing.

Duct Burner Carbon Monoxide Emissions. Carbon monoxide (CO) formation occurs as an intermediate step in the combustion of carbon compounds as carbon is oxidized to carbon dioxide (CO₂). CO is very reactive, but requires a rather high temperature of 1128°F for ignition. Therefore, for flows that have low oxygen content, there is a

Overview of Costs and Performance for Each Technology



EPRI Proprietary Licensed Material

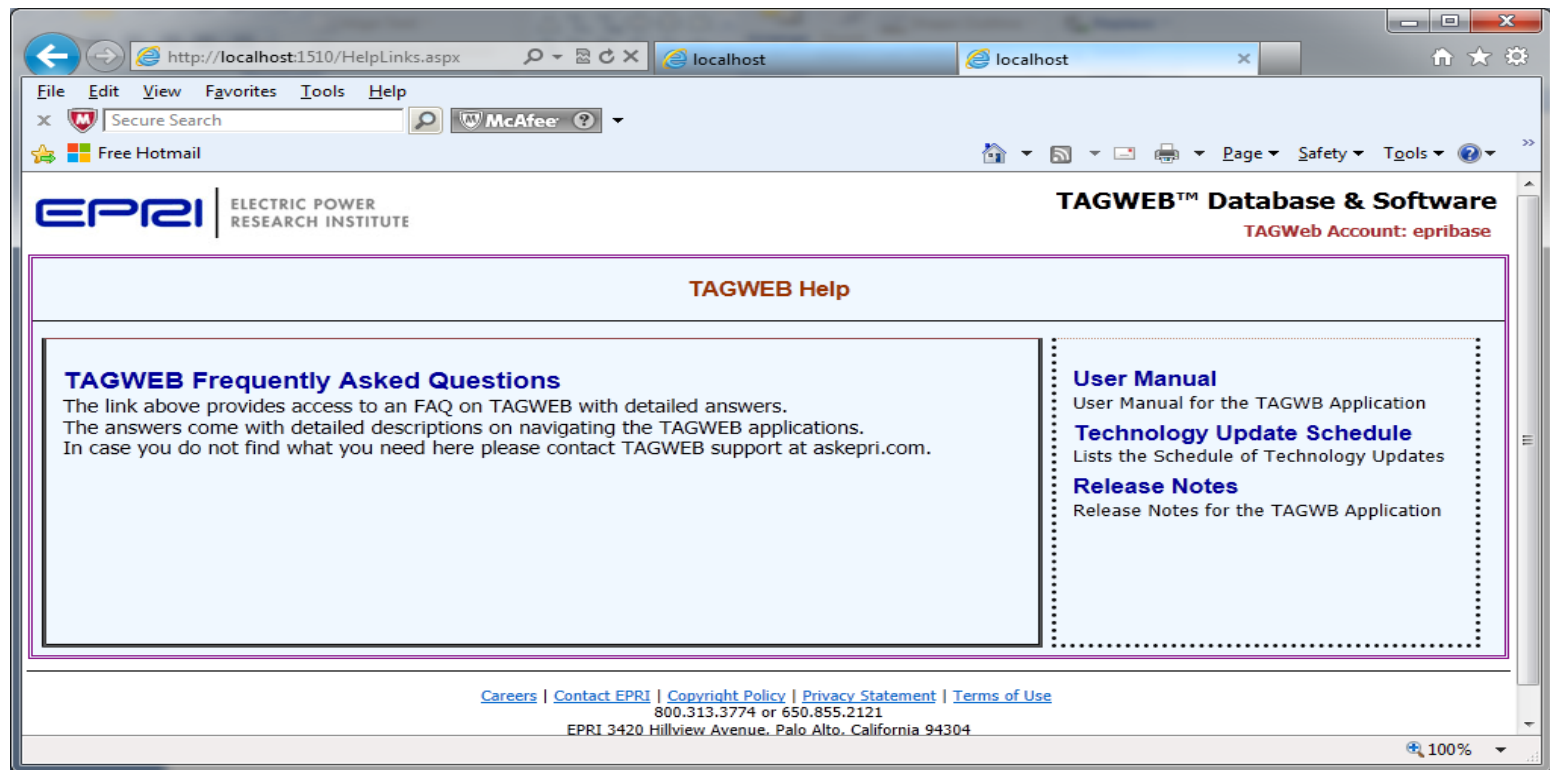
Combustion Turbine Combined Cycle

Exhibits 6-1: Combustion Turbine 45 MW NE NG Aero derivative

Technology ID	0615.7
Technology Description	Combustion Turbine 45 MW NE NG Aero derivative
Region	Northeast
Fuel Type	2005 Natural Gas NE
Plant Size (no. of units x unit size, MW)	1 x 45.30
Available for Commercial Orders, Year	2005
First Commercial Service, Year	2007
Plant Capital Cost, \$/kW	
Month/Year Dollars	Dec, 2006
Combustion Turbine & Aux.	447.0
Balance of Plant	124.0
Buildings	13.0
Environmental	0.0
General Facilities and Engineering Fee	75
Project and Process Contingency	35.0
Total Plant Cost	694.4
Total Cash Expended (mixed year \$)	694.0
AFUDC (Interest during construction)	0.0
Total Plant Investment (Includes AFUDC)	694.0
Total Owner Costs	43.9
Total Capital Requirement, Hypothetical In-Service Year (includes AFUDC)	737.9
Total Capital Replacement (for Unit Life)	-
Costs for Hypothetical In-Service Year	
Fixed, \$/kW-yr	22.00
Incremental, mils/kWh	
Variable (includes consumables)	38.25
Consumables (includes byproducts)	0.03
Byproducts (- indicates credit)	0.00
Net Heat Rate, Btu/kWh	
Full Load	9385
75% Load	10061
50% Load	11459

TAGWeb Help

- The FAQs link will open a list of questions. The user can click on a question to open a PDF file containing the answer/explanation



TAGWeb Frequently Asked Questions

1. How is the TAGWeb database structured?
2. How do I make changes to Technology Design Basis (unit capacity, site, configuration, design parameters)?
3. How do I make changes to Capital Costs data?
4. How do I make changes to O&M data?
5. How do I make changes to Performance data (capacity factor, heat rate, emissions data)?
6. How do I make changes to Economics Financial data (financing structure, inflation, timing)?
7. How do I make changes to Economics O&M unit cost data?

TAGWeb Frequently Asked Questions

8. How do I make changes to Fuel (cost and physical properties)?
9. How do I do Adjust Design?
10. How do I save the changes made to a technology record?
11. How do I generate a Technology Summary report?
12. How do I generate a Comparison report?
13. How do I copy a record from another account?
14. How do I copy a study from another account?

TAGWeb Frequently Asked Questions

15. What is the Reference Year?

16. What is the Technology Input Year?

17. What is the Year Dollars for Input Data?



Questions & Answers

Clarence Lyons

704-595-2788

clyons@epri.com

Binh Nguyen

650-855-8592

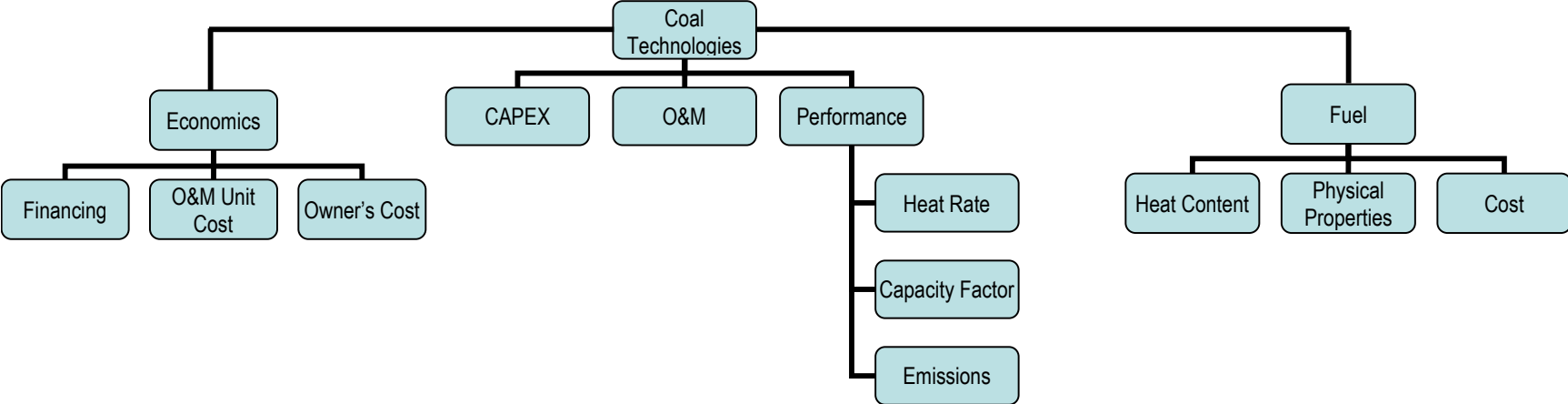
bnguyen@contractor.epri.com

Together...Shaping the Future of Electricity

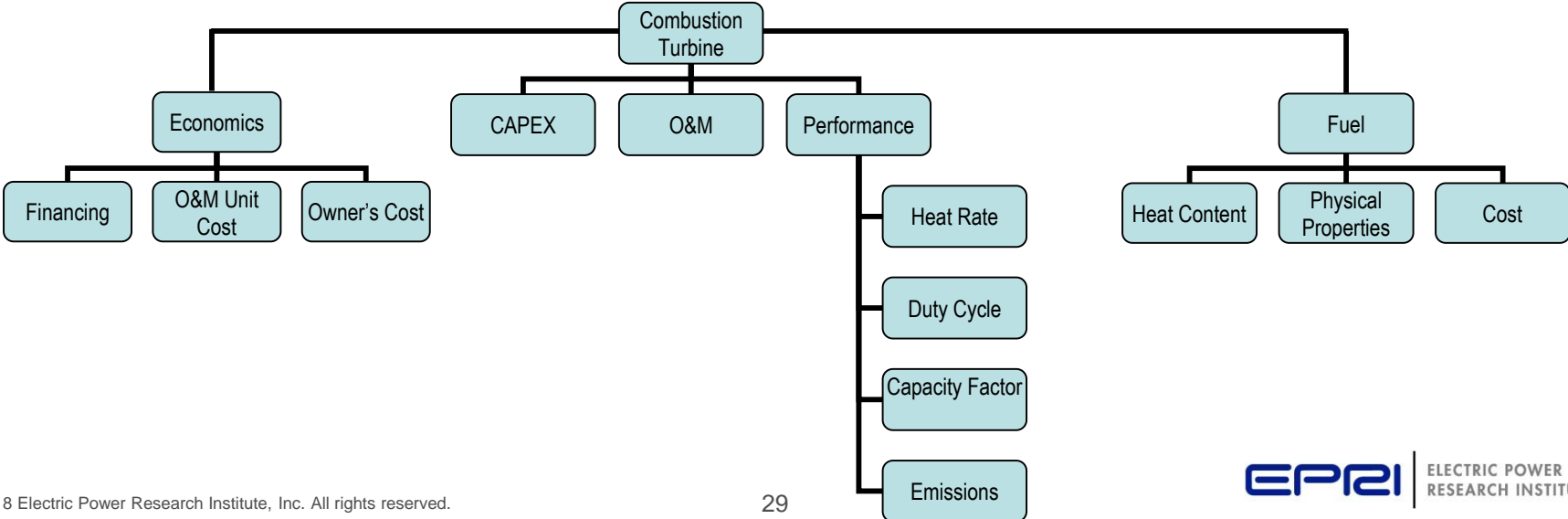
Additional TAGWeb Slides

TAGWeb™ for Coal and CT Generation

TAGWEB Navigation for Coal Technologies

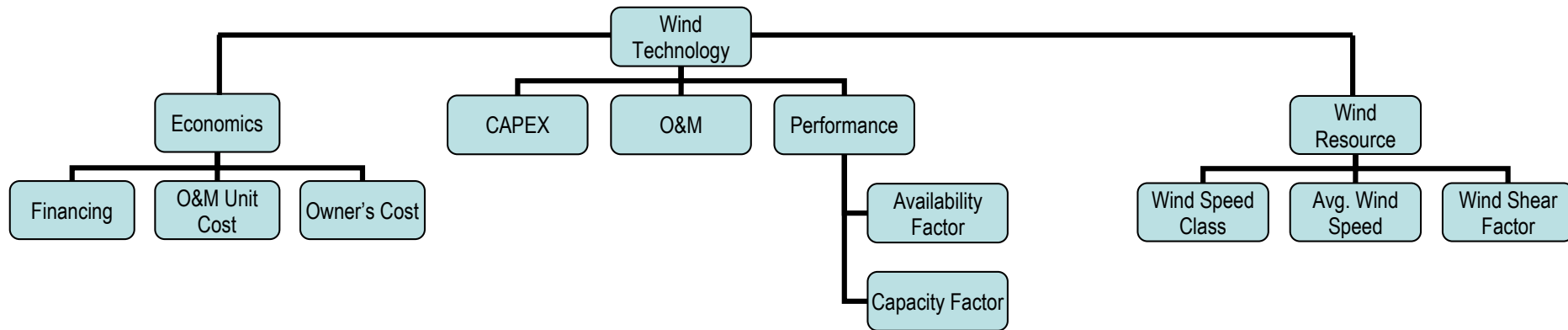


TAGWEB Navigation for Combustion Turbine Technologies

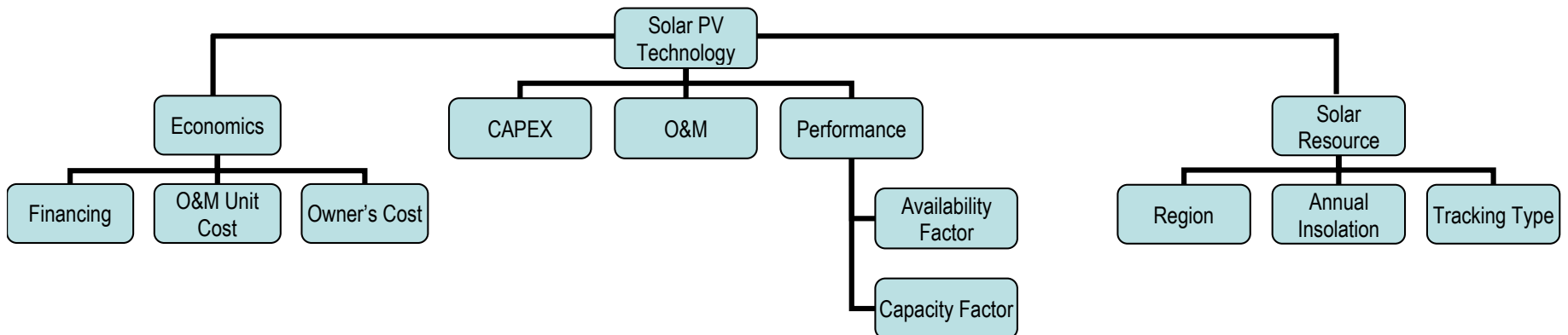


TAGWeb™ for Wind and Solar PV

TAGWEB Navigation for Wind Technologies

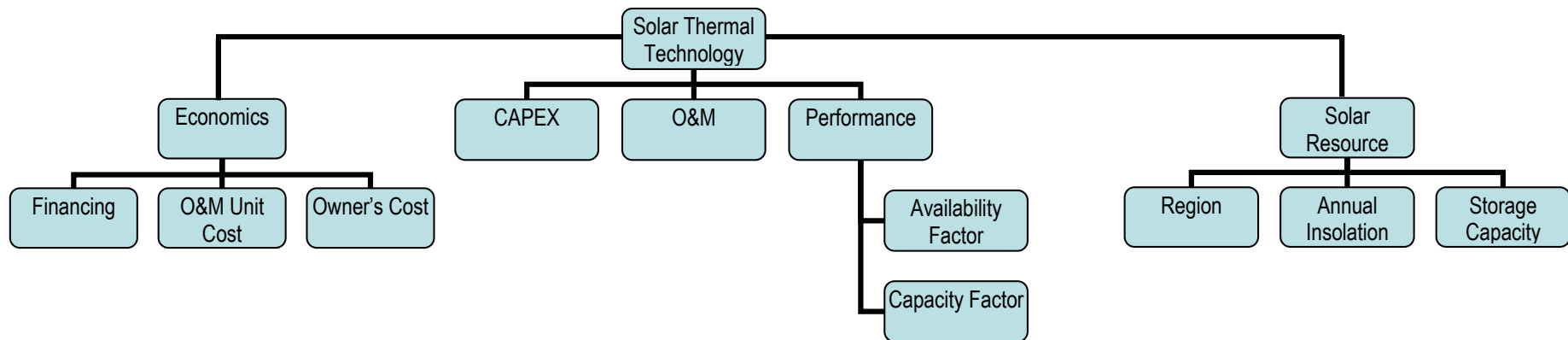


TAGWEB Navigation for Solar PV Technologies



TAGWeb™ for Solar Thermal Generation

TAGWEB Navigation for Solar Thermal Technologies



TAGWeb™ Reporting (1 of 3)

Technology Reports:

- **Technology summary:** Key data, including capital, O&M, and busbar costs
- **TAG exhibit:** Displays data in the format used in the EPRI TAG publication
- **Estimating worksheet:** Displays data, including intermediate calculations made during the TAGWeb run that are not included in other TAGWeb outputs

Emissions

- **Emissions output:** Physical air, liquid, and solid emissions from the plant
- **Emissions cost:** Capital and O&M costs associated with emissions controls for the selected technology

TAGWeb™ Reporting (2 of 3)

Financial

- **CC (Carrying Charge Summary):** Year-by-year listing of the capital costs contributing to the carrying charge requirements for the plant
- **RR (Revenue Requirements):** Year-by-year costs for all items contributing to the revenue requirements for the plant, such as capital carrying charges, O&M expenses, and fuel costs. Intended for Investor-Owned Utilities (IOU).
- **DCF (Discounted Cash Flow):** Includes the year-by-year cash flow requirements for the major plant cost categories such as taxes, capital recovery costs, O&M expenses, and fuel costs. Intended for Non-Utility Generating (NUG) plants;

Sensitivity Analysis

- Performs technology, economics, or fuel sensitivities by varying key input variables

TAGWeb™ Reporting (3 of 3)

Comparison Reports

- **Summary Technologies Comparison:** Key data comparing selected Technologies, including capital, O&M, and busbar costs.
- **Detailed Technologies Comparison:** Detailed data about the selected Technologies, including capital and O&M costs, performance, emissions, and busbar costs.
- **Busbar Chart:** A chart comparing busbar costs over the life of the plant for the Technologies that have been selected

Screening Curves: A graph showing the total levelized plant cost versus capacity factor for selected technologies.

Phase Construction Report: Graphs of expenditure and revenue flows for multiple unit projects built with a sequential approach to project expenditure

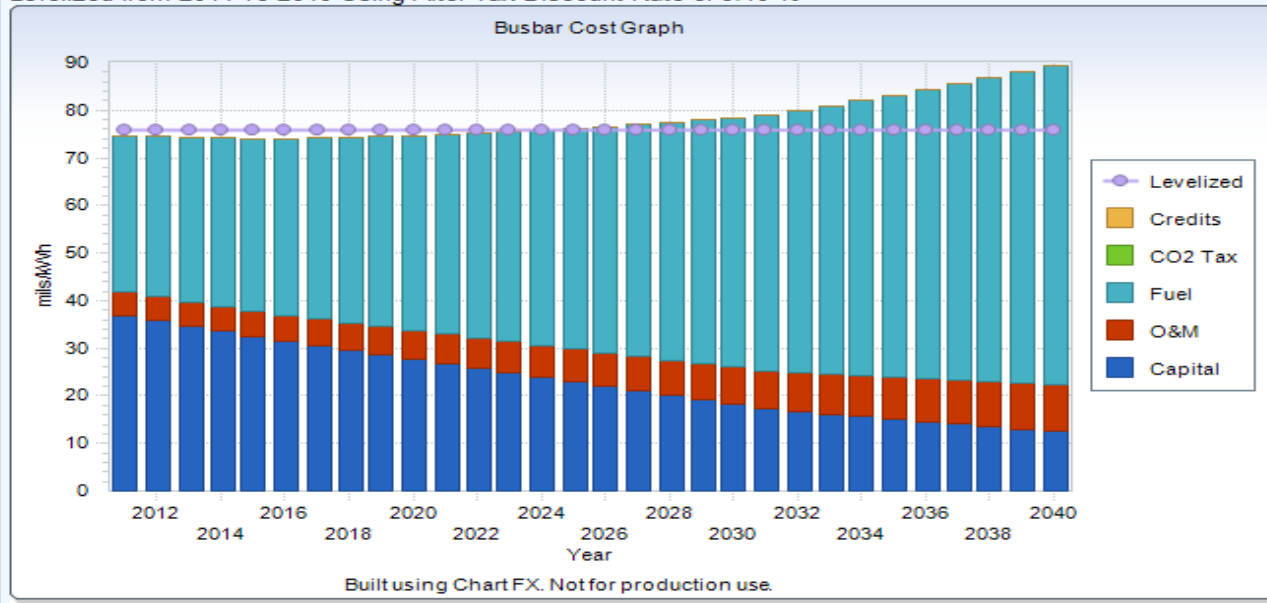
Busbar Costs

Current Dollars Busbar Costs (mils/kWh)

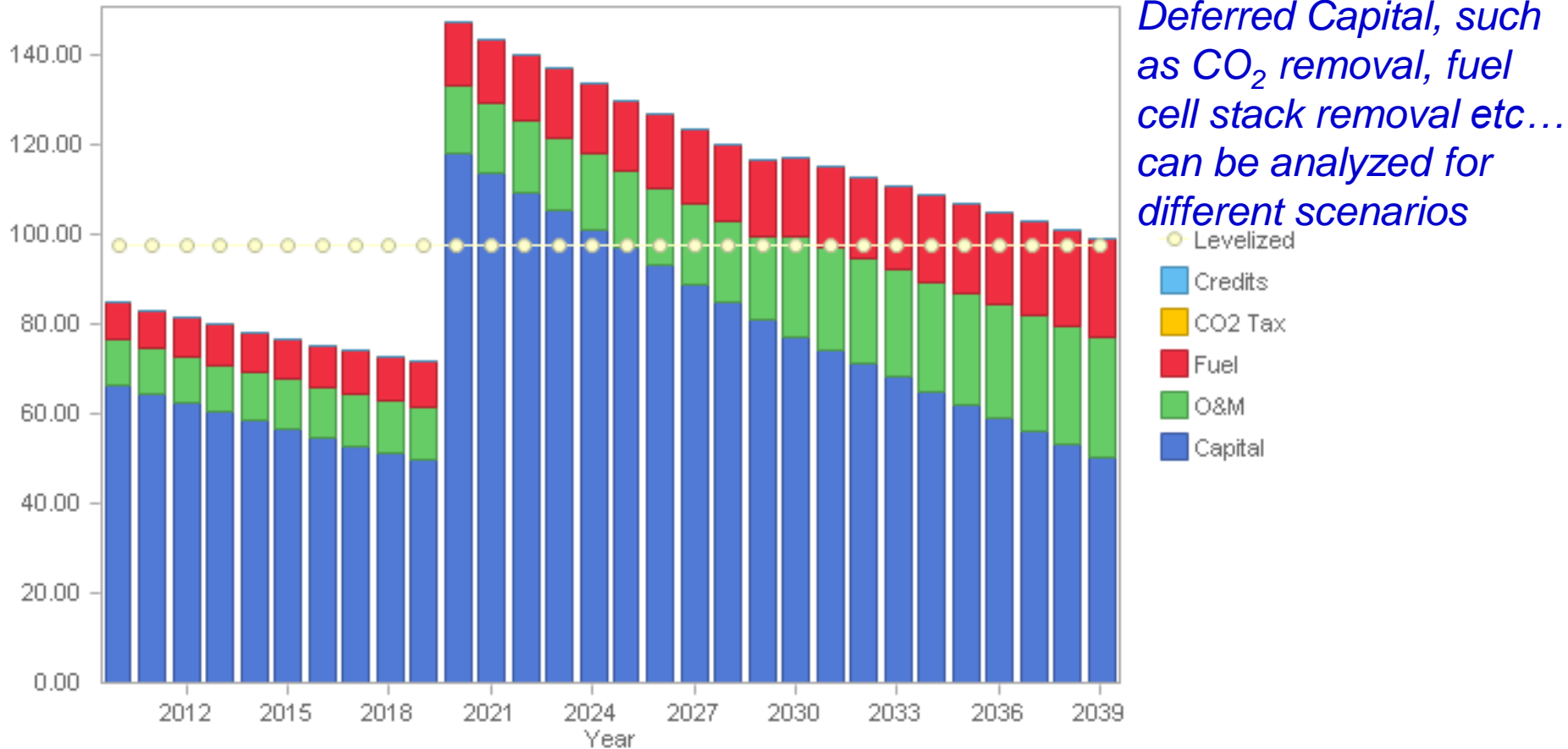
	2011	2012	2013	2014	2015	2020	2030	2040	Levelized
Capital	36.97	35.85	34.68	33.56	32.48	27.61	18.24	12.44	27.88
O&M	4.86	4.98	5.10	5.23	5.36	6.06	7.76	9.94	6.20
Fuel	32.80	33.62	34.46	35.32	36.21	40.96	52.44	67.12	41.87
CO2 Tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Byproduct Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Production Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emission Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROC Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	74.63	74.44	74.24	74.11	74.05	74.64	78.44	89.50	75.95

Busbar costs are presented on an annual basis.

Levelized from 2011 To 2040 Using After Tax Discount Rate of 8.10 %

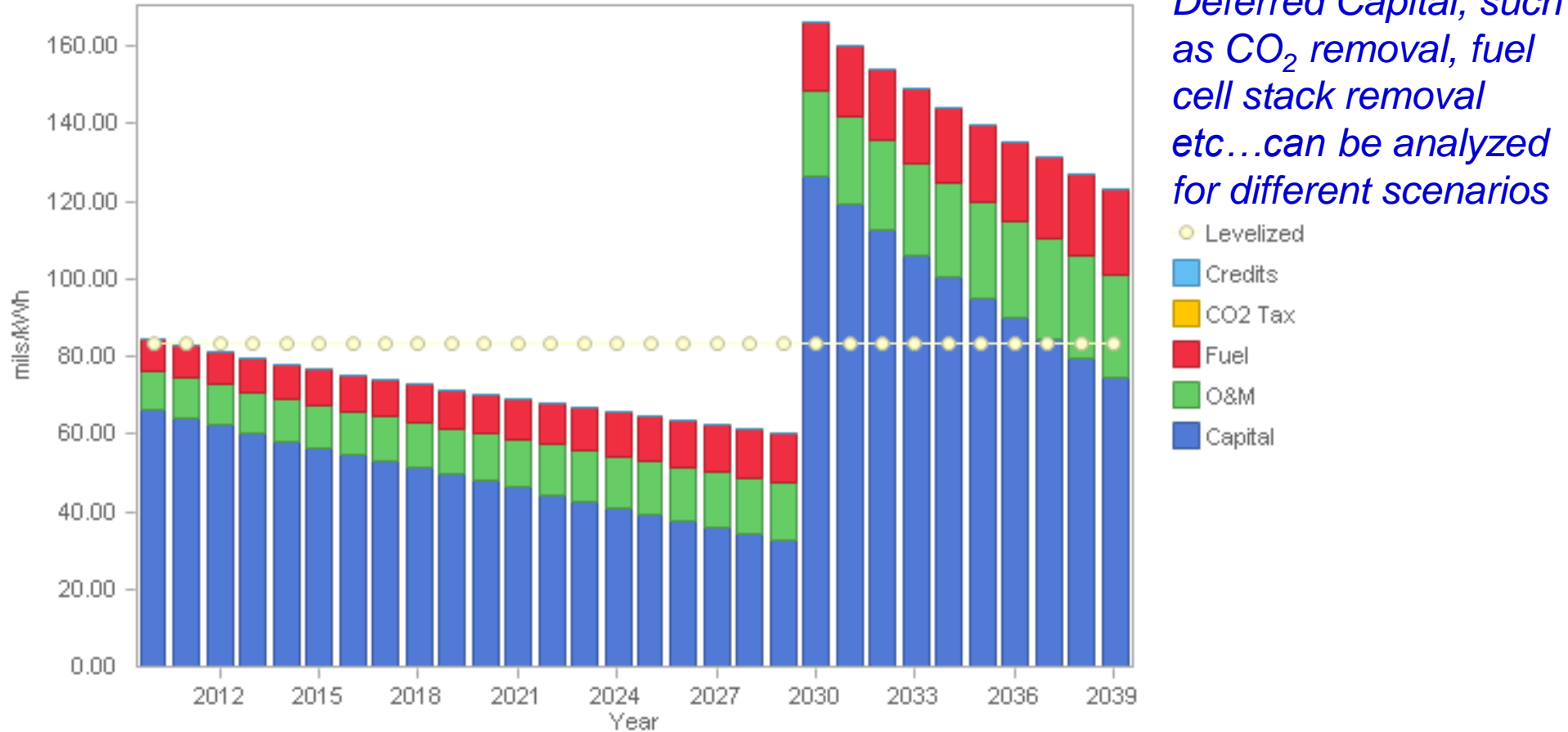


Busbar Cost Graph 1



- 800 MW PC Plant with hybrid cooling (30% wet/70% dry) installed upfront
- PC plant is retrofitted with 90% CO₂ capture after 10 years of operation

Busbar Cost Graph 2



Deferred Capital, such as CO₂ removal, fuel cell stack removal etc...can be analyzed for different scenarios

- Levelized
- Credits
- CO2 Tax
- Fuel
- O&M
- Capital

- 800 MW PC Plant with hybrid cooling (30% wet / 70% dry) installed upfront
- PC plant is retrofitted with 90% CO₂ capture after 20 years of operation

Discounted Cash Flow Analysis for Unregulated Power Projects

DISCOUNTED CASH FLOW REPORT

Study	10.0	2010 Tech Cases for 2011
Technology	1016.3C	Combustion Turbine Combined Cycle, 2x1 7FA.03, EWC, Nat Gas
Economics	1031.3	2010 Econ EWC Natural Gas
Fuel	1012.6	2010 Natural Gas EWC
Region	E/W Central	
State	Michigan	
Unit Size (Net MW)	235.85	
Number of Units	2	
Capacity Factor (%)	85.00	
Dec 2010 \$		

**Revenue Requirements Schedule
For an Investor-Owned Utility
(Thousands of \$)
Current \$ Analysis**

Study Year	Year	Return on Common Equity	Interest on Debt	Income Taxes	Other Taxes and Insurance	Capital Recovery	Fuel Cost	Charging Cost	O&M Cost(%)
1	2011	45903.1	25501.7	20267.7	11903.5	29235.5	115204.4	NA	17054.8
2	2012	44054.0	24380.3	18049.5	11903.5	30320.4	118084.5	NA	17481.2
3	2013	42137.6	23221.4	18155.3	11903.5	29040.0	121036.6	NA	17918.2
4	2014	40300.7	22106.7	18213.8	11903.5	27855.7	124062.5	NA	18366.2
5	2015	38537.3	21032.8	18228.6	11903.5	26760.1	127164.1	NA	18825.3
6	2016	36842.0	19996.8	18202.8	11903.5	25746.8	130343.1	NA	19295.9
7	2017	35209.6	18995.7	18139.7	11903.5	24809.4	133601.7	NA	19778.3
8	2018	33635.4	18026.9	17872.2	11903.5	24112.1	136941.8	NA	20272.8
9	2019	32104.5	17082.3	16933.9	11903.5	24112.1	140365.3	NA	20779.6
10	2020	30573.6	16137.6	15995.6	11903.5	24112.1	143874.4	NA	21299.1

Busbar Costs Based on DCF Analysis

Year-by-Year Revenue Requirements Schedule
For a Non-Utility Company
(Thousands of \$)
(See Note Below)
Current \$ Analysis

Study Year	Year	Sub-total	CO2 Tax	Byproducts Credit	Production Credit	Emission Credit	ROC Credit	Total Revenue Required	mils/kWh Current \$ Analysis	mils/kWh Constant \$
1	2011	265070.7	0.0	0.0	0.0	0.0	0.0	265070.7	75.470	73.629
2	2012	264273.3	0.0	0.0	0.0	0.0	0.0	264273.3	75.243	71.617
3	2013	263412.6	0.0	0.0	0.0	0.0	0.0	263412.6	74.998	69.643
4	2014	262809.0	0.0	0.0	0.0	0.0	0.0	262809.0	74.826	67.788
5	2015	262451.7	0.0	0.0	0.0	0.0	0.0	262451.7	74.724	66.045
6	2016	262331.0	0.0	0.0	0.0	0.0	0.0	262331.0	74.690	64.405
7	2017	262438.0	0.0	0.0	0.0	0.0	0.0	262438.0	74.720	62.859
8	2018	262764.7	0.0	0.0	0.0	0.0	0.0	262764.7	74.813	61.403
9	2019	263281.2	0.0	0.0	0.0	0.0	0.0	263281.2	74.960	60.023
10	2020	263895.9	0.0	0.0	0.0	0.0	0.0	263895.9	75.135	58.696
11	2021	264611.4	0.0	0.0	0.0	0.0	0.0	264611.4	75.339	57.419
12	2022	265430.1	0.0	0.0	0.0	0.0	0.0	265430.1	75.572	56.192
13	2023	266354.6	0.0	0.0	0.0	0.0	0.0	266354.6	75.835	55.012
14	2024	267387.5	0.0	0.0	0.0	0.0	0.0	267387.5	76.129	53.879
15	2025	268531.7	0.0	0.0	0.0	0.0	0.0	268531.7	76.455	52.790
16	2026	269789.8	0.0	0.0	0.0	0.0	0.0	269789.8	76.813	51.743
17	2027	271164.6	0.0	0.0	0.0	0.0	0.0	271164.6	77.205	50.739
18	2028	272659.2	0.0	0.0	0.0	0.0	0.0	272659.2	77.630	49.774
19	2029	274276.5	0.0	0.0	0.0	0.0	0.0	274276.5	78.091	48.848
20	2030	276019.7	0.0	0.0	0.0	0.0	0.0	276019.7	78.587	47.959
21	2031	277891.7	0.0	0.0	0.0	0.0	0.0	277891.7	79.120	47.107

Technology Search Capability

STUDY

TECHNOLOGY Expand

- ALL GROUPS
- CENTRAL STATION
- SMALL SCALE GENERATION
- RENEWABLES
- STORAGE
- TRANSMISSION / DISTRIBUTION
- DISTR GENERATION

ECONOMICS

FUEL/RESOURCES

GLOBAL DATA

- Code of Accounts
- Inflation Data
- Depreciation Schedules
- Season Definitions
- Regionalization

TAGWeb Quick Search

Study: ALL STUDIES

Technology Type: Combustion Turbine

Minimum Size: 100 MW

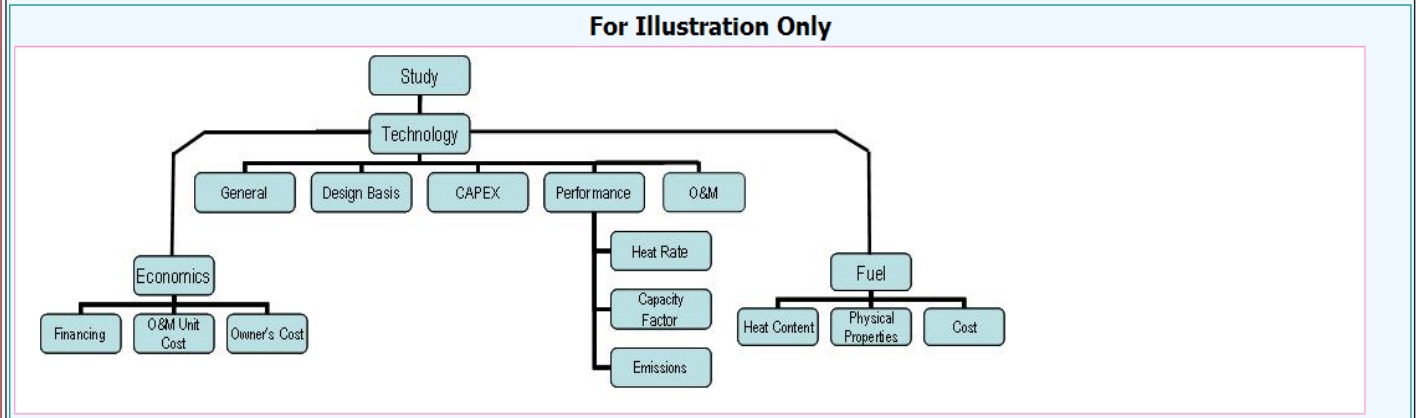
Maximum Size: 500 MW

Fuel/Resource Type: Natural Gas

Region: E/W Central

State: Representative

Search



Instructions:

Users can see the records for any technology in one of the following ways:

- 1) Selecting a technology from the panel on the left.

OR

- 2) By using the search panel on the top of the page. Define the type of technology.

NOTE: When a record is selected, then the details of the record will be displayed.

Technology Search helps choose and run an analysis for a technology very quickly.

Ability to Move Records Between Studies and Copy Records from Other User Accounts

Home Admin Log Off

Home > Technology > Tech-Copy Help

TECHNOLOGY NEW/COPY

Current Study ID: **10.0**

Select TAGWeb account to copy technology data from:

Current Account
 Another User Account (need login info below)

TAGWeb User ID:

Password:

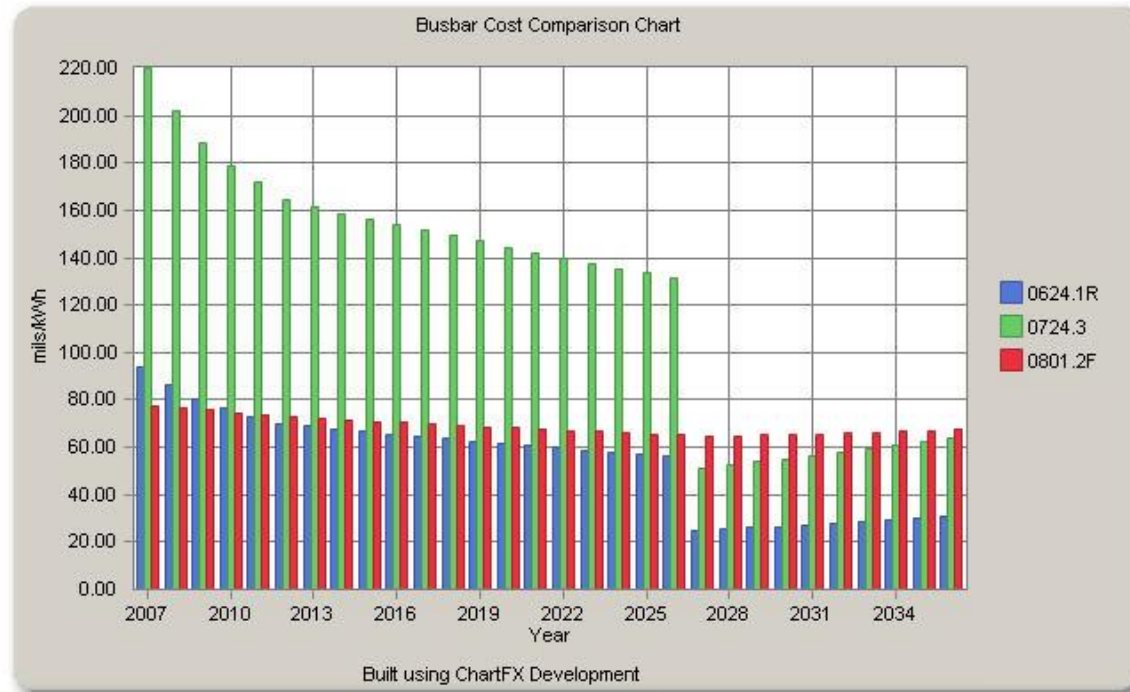
Select study to copy from t2010resul Update Studies

StudyID	Description
SCE1.1B	SCE Test Study Revised
SCE1.1A	SCE Test Study
20.0	Combustion Turbine Study
1000.X	TEST study
10.2	CT ISO Conditions
10.1	2010 Revisions
10.0	2010 Tech Cases for 2011

Select technology records to copy from account t2010resul study (10.0) Update Tech Records

TechID	Description	Region	State
1016.4B	Combustion Turbine Combined Cycle, 2x1 7FA.05, SE, Nat Gas	Southeast	North Carolina
1015.4A	Combustion Turbine, 3x209 MW, SE, Nat Gas, 7FA.05 with DLN	Southeast	North Carolina
1015.2	Combustion Turbine, 4x84 MW, SE, Nat Gas, 7EA with DLN1	Southeast	North Carolina
1016.5B	Combustion Turbine Combined Cycle, 2x1 G-Class, SE, Nat Gas	Southeast	North Carolina
1015.1A	Combustion Turbine, 3x97 MW, SE, Natural Gas, LMS 100PB	Southeast	North Carolina
1015.0A	Combustion Turbine, 4x50 MW, SE, Nat Gas, LM6000PH w/ SPRINT	Southeast	North Carolina
1016.3D	Combustion Turbine Combined Cycle, 2x1 7FA.03, SE, Nat Gas	Southeast	North Carolina
1001.2FA	Pulverized Coal, 800 MW, SC, PRB, Supercritical, LSFO w/o CO2	South Central	Texas
1001.2FB	Pulverized Coal, 800 MW, SC, PRB, Supercritical, LSFO w 90% CO2	South Central	Texas
1022.1A	Thin Film PV, SC, 2 MW	South Central	Texas

Busbar Comparison Chart Compares Cost of Electricity for Different Technologies



Close

[Careers](#) | [Contact Us](#) | [Copyright Policy](#) | [Privacy Statement](#) | [Terms of Use](#)

800.313.3774 or 650.855.2121
EPR 3420 Hillview Avenue, Palo Alto, California 94304
© Electric Power Research Institute, Inc. 2001-2009 All rights reserved

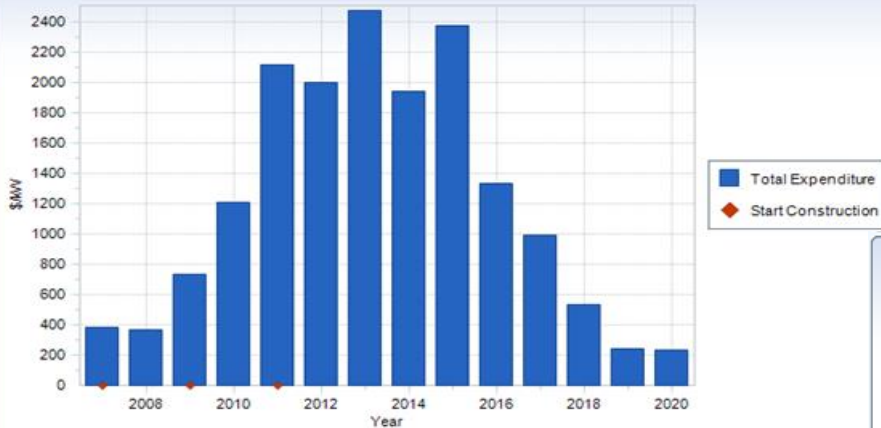
Phase Construction Report

PHASE CONSTRUCTION REPORT

Expense Schedule in Sequence of Construction

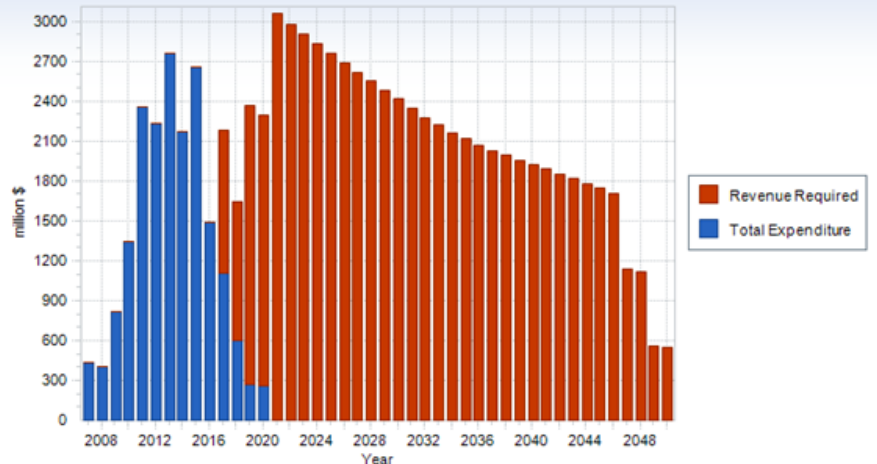
Tech/Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1028.3A	5.0%	5.0%	5.0%	14.0%	25.0%	15.0%	15.0%	6.0%	5.0%	5.0%	Startup				
1028.3B			5.0%	5.0%	5.0%	14.0%	25.0%	15.0%	15.0%	6.0%	5.0%	5.0%	Startup		
1028.3C					5.0%	5.0%	5.0%	14.0%	25.0%	15.0%	15.0%	6.0%	5.0%	Startup	
Total %	5.0%	5.0%	10.0%	19.0%	35.0%	34.0%	45.0%	35.0%	45.0%	26.0%	20.0%	11.0%	5.0%	5.0%	
TCR (\$/kW)	386.8	364.9	731.1	1207.8	2116.8	2003.3	2477.9	1942.1	2378.9	1331.4	993.2	535.9	245.3	232.3	

Total Expenditure (in Constant \$)



Built using Chart FX. Not for production use.

Total Expenditure & Revenue Required (in Constant \$)



Built using Chart FX. Not for production use.

24x7 Data Input with Auto-population

Home Admin Log Off

Home > Technology > Tech General-TimeDependent Help

CURRENT SELECTION

Study **10.0** 2010 Tech Cases for 2011
 Technology **1024.1** Wind, EWC, 1.5 MW x 100
 Resource **1024.3** 2010 EWC Wind
 Economics **1020.3** 2010 Econ EWC Wind

SIZE & LOCATION

Plant Nameplate rating (MW) **150.000**
 Gross Unit Size (MW) **1.500**
 Energy Loss (MW) **0.000**
 Turbine Size (Net MW) **1.500**
 Turbine **100.000**
 Total Plant Capacity (NET MW) **150.000**
 Region, State **E/W Central, Representative**

TECH INFO Cost & Performance Basis

Save Save As Restore

Expand All Collapse All

TECHNOLOGY

- GENERAL
 - General
 - References
 - Financial
 - Timing
 - Time Dependent**
 - Taxes & Credits
- DESIGN BASIS
 - ADJUST DESIGN
 - CAPEX
 - O&M
 - PERFORMANCE
- ECONOMICS
 - FINANCING
 - O&M UNIT COST
 - OWNER'S COST
- WIND RESOURCE
 - GENERAL
- REPORTS
 - REPORTS

Yearly Variations 24x7 Hourly Variations

Capacity Adjustment Factor:

Average wind speed (m/sec)

Season Set Auto Populate

Season 1

Month	In Season	Hour	M-F	Sat	Sun
January	Season 1	1	65	65	65
		2	65	65	65
February	Season 1	3	65	65	65
		4	65	65	65
March	Season 2	5	65	65	65
		6	65	65	65
April	Season 2	7	65	65	65
		8	65	65	65
May	Season 2	9	65	65	65
		10	65	65	65
June	Season 3	11	65	65	65
		12	65	65	65
July	Season 3	13	65	65	65
		14	65	65	65
August	Season 3	15	65	65	65
		16	65	65	65
September	Season 4	17	65	65	65
		18	65	65	65
October	Season 4	19	65	65	65
		20	65	65	65
November	Season 4	21	65	65	65
		22	65	65	65
December	Season 1	23	65	65	65
		24	65	65	65

Selected Item

Season 1 Auto Populate

Month	In Season	Hour	M-F	Sat	Sun
January	Season 1	1	0	0	0
		2	0	0	0
February	Season 1	3	0	0	0
		4	0	0	0
December	Season 1	5	0	0	0
		6	0	0	0
March	Season 2	7	0	0	0
		8	0	0	0
April	Season 2	9	0	0	0
		10	0	0	0
May	Season 2	11	0	0	0
		12	0	0	0
June	Season 3	13	0	0	0
		14	0	0	0
July	Season 3	15	0	0	0
		16	0	0	0
August	Season 3	17	0	0	0
		18	0	0	0
September	Season 4	19	0	0	0
		20	0	0	0
October	Season 4	21	0	0	0
		22	0	0	0
November	Season 4	23	0	0	0
		24	0	0	0

Selected Item

Code of Account Escalation

Home Admin Log Off

Home > Global > COA Escalate Help

STUDY

TECHNOLOGY + Expand

- ALL GROUPS
- CENTRAL STATION
- SMALL SCALE GENERATION
- RENEWABLES
- STORAGE
- TRANSMISSION / DISTRIBUTION
- DISTR GENERATION

ECONOMICS

FUEL/RESOURCES

GLOBAL DATA

- Code of Accounts**
- Inflation Data
- Depreciation Schedules
- Season Definitions
- Regionalization

Code of Account - Escalate

Set ID:

Description:

Enter amount (%) to escalate below. Select one or more technology records from the right to apply the escalation.
**Note that only technology records using the current Code of Account set are shown.*

#	Account	Material (%)	Labor (%)	Indirects (%)	Subcontr (%)
1	CO2 Control	0	0	0	0
2	CO Control	0	0	0	0
3	SO2 Control	0	0	0	0
4	NOx Control	0	0	0	0
5	Particulate	0	0	0	0
6	Thermal (Cooling Water)	0	0	0	0
7	Solid Waste	0	0	0	0
8	Hg Control	0	0	0	0
9	VOC Control	0	0	0	0
10	Other	0	0	0	0

Selected Item

1001.2C - Pulverized Coal, 800 MW, EWC, IL6 Bit, Supercritical, LSFO w/o CO2
 1001.2C1 - Pulverized Coal, 800 MW, EWC, IL6 Bit, Supercritical, LSFO w 90% CO2
 1001.2F - Pulverized Coal, 800 MW, EWC, PRB, Supercritical, LSFO w/o CO2
 1001.2F1 - Pulverized Coal, 800 MW, EWC, PRB, Supercritical, LSFO w 90% CO2
 1001.2FA - Pulverized Coal, 800 MW, SC, PRB, Supercritical, LSFO w/o CO2
 1001.2FB - Pulverized Coal, 800 MW, SC, PRB, Supercritical, LSFO w 90% CO2
 1001.2K - Pulverized Coal, 800 MW, NE, WV Bit, Supercritical, LSFO w/o CO2
 1001.2K1 - Pulverized Coal, 800 MW, NE, WV Bit, Supercritical, LSFO w 90% CO2
 1001.2L - Pulverized Coal, 800 MW, SE, WV Bit, Supercritical, LSFO w/o CO2
 1001.2L1 - Pulverized Coal, 800 MW, SE, WV Bit, Supercritical, LSFO w 90% CO2

Making changes to Technology Design Basis (unit capacity, site)

Gross Unit Capacity can be revised by editing the Technology > Design Basis > General screen. Auxiliary data can also be revised. If any changes are made to the gross unit capacity and/or auxiliaries, then TAGWeb will recalculate the net capacity.

Save Save As Restore

Expand All Collapse All

TECHNOLOGY

- GENERAL
- DESIGN BASIS
 - General**
 - Site
 - Configuration
 - Parameters
- ADJUST DESIGN
- CAPEX
- O&M
- PERFORMANCE
- ENVIRONMENTAL

NOTE: To make changes to unit or fuel/economic link, please go to Adjust Design -> General

CT Unit Size, Gross MW	<input type="text" value="50.700"/>
HRSG ST Unit Size, MW	<input type="text" value="0.000"/>
Auxiliaries, MW	<input type="text" value="0.650"/>
CT/CC Unit Size, Net MW	<input type="text" value="50.050"/>
Number of Units	<input type="text" value="2.000"/>
Fuel Type	<input type="text" value="Natural Gas"/>
Fuel Link	<input type="text" value="1112.4 2011 Natural Gas W"/>
Economics Link	<input type="text" value="1231.5A 2012 Econ W Natural Gas"/>

Please note that if you want to scale the unit capacity up or down, you must use **Adjust Design** function in order to scale the capital costs appropriately.