GUIDE TO IPM Output FILES

IPM Base Case v.4.10

The following information is meant to provide users with a general explanation of the different IPM output files that are made web ready and posted to EPA's website and/or the Transport Rule Docket. It refers to the v.4.10 EPA Base Case Model that was designed, developed and tested for use in analyzing policy scenarios starting in 2012. It is meant to help users identify and interpret the data available in the model input and output files. The IPM v.4.10 documentation (available at http://www.epa.gov/airmarkets/progsregs/epa-ipm/index.html) provides more comprehensive details regarding the assumptions and methodology used in the model.

Below is a brief overview of the non-unit level IPM inputs and outputs that are made publically available through EPA's website and/or the Docket. Because the System Summary Report is one of the more frequently referenced documents that summarizes many IPM key outputs, it is described in further detail in the remainder of this guide.

Once IPM v.4.10 Files are downloaded and decompressed from EPA's website or the Docket, the unzipped files will contain two folders: "Input and Output Files" & "Parsed Files". Additionally, it will have an Excel spreadsheet that includes "System Summary Report" in the title. The "Input and Output Files" folder will have four files within it: A DAT, CAR, RPE, and TAC file.

Input and Output Files

DAT file: This file will have a "DAT" filename extension, e.g., Base Case.dat. It contains the key input set-up data used to define the model run, including the definitions and specifications for run years, model regions, model plants, financial parameters, available fuels, and power system transmission and operating parameters.

RPE file: This file will have a "RPE" filename extension, e.g., Base Case 2010.rpe. For each model plant, this file shows the projections of fuel consumption, emissions (rates and tonnage), capacity, costs (capital, fixed operations and maintenance, and variable operations and maintenance), and generation. The model plant results are grouped by model plant type within model regions within model run year. Aggregated results are reported (a) for each model region differentiated by plant type, (b) for each plant type differentiated by model region, (c) for model regions without consideration of plant type, and (d) for plant types without consideration of model region.

CAR file: This file will have a "CAR" filename extension, e.g., Base Case 2006.car. This file contains capacity utilization projections for each model plant grouped by model plant type. Included are capacity contributed to reserve margins, capacity dispatch, and summer, winter, and annual generation, capacity factors, and availabilities. The capacity dispatch column in this file indicates the total capacity (in megawatts) that the model plant represents. The average size of a unit that the model plant represents is found in the DAT file and is the size used for cost assignment (e.g., to determine the applicable economies of scale when retrofitting existing units with emission controls).

TAC file: This file will have a "TAC" filename extension, e.g., Base Case 20106.tac. The file contains annual production costs for each model plant grouped by model plant type. For each model plant, total and rate-based capital, fixed operations and maintenance (FOM), variable operation and maintenance (VOM), and fuel costs are shown. The variable costs reported for model plants in this file can provide insights into why the utilization rates reported for some plants in the CAR file are higher than those of other model plants in the same region. The DAT, RPE, CAR, and TAC files can be reviewed using a text viewer or text editor such as WordPad.

System Summary Report

System Summary Report: These outputs are available in either spreadsheet or PDF document format, e.g., Base Case 2010.xls and Base Case 2010.pdf. It contains system-wide power sector results for the lower continental U.S. for each run year. It reports forecasted generation, capacity, capacity additions, capacity factors, production costs, emissions, fuel consumption & cost, and allowance prices by model run year. Disaggregation of system-wide data to plant type data is provided for generation and capacity fields. The plant types are categorized based on fuel used (e.g., coal, oil/gas, nuclear, hydro), combustion technology (e.g., turbine, combined cycle gas), control technology (e.g., scrubber, post-combustion NO_x control), and retrofit structure (e.g., coal plant with existing SNCR retrofit with ACI). In addition to providing the above outputs forecasted for each model run year, it also gives information on the various regulatory and legal requirements that were inputted into the model as constraints. Below is a more detailed explanation of each worksheet in the System Summary Report.

Description of Worksheets and Data within the System Summary Report File

System Summary Report: When the Excel File is opened, it will contain four worksheets

1. "Summary" worksheet
2. "All Constraints" worksheet
3. "Fuel Report" worksheet
4. "Tables 1-16" worksheet

Summary Worksheet: The summary worksheet in the system summary file highlights some of the key data points from the IPM output, and is intended to be an ideal starting point for assessing fundamental environmental and operational projections for the power sector in any given IPM run. For first time users, it is one of the more user friendly documents from which to view output data. See Appendix 1-1 for description of fields included in the "Summary" worksheet.

All Constraints: The "All Constraints" worksheet in the System Summary Report provides information on various legal and policy requirements and how they are captured in the model. Each constraint typically involves a "standard" that is imposed in the form of an emission limit, emission rate limit, or generation limit. The constraint can be applied at the unit, plant, system, state, regional or national level. The constraints also include a time dimension and may vary between model run years. Each constraint in the worksheet provides information on the impact of the "standard" on the effected unit(s). These impacts are modeling outputs given in the form of emissions, emission rates, and/or generation that occur under the given "standard" in a particular model run year. For constraints that represent cap-and-trade programs with banking, the IPM data indicates additions and withdraws from the allowance bank and allowance price by year. There are nearly 1000 constraints in the IPM V.4.10 Base Case, and the total number may extend beyond a thousand for the modeling of certain policy scenarios. An example of a constraint would be "Constraint Name: #1 – Title IV – SO2 Constraint v.4.0" which captures the Emission limits imposed on coal units by the Acid Rain Program. The constraint provides a total "standard" that reflects the Title IV SO2 allowances available to units in a given model run year. Below is a table that illustrates the typical format of a constraint in the "All Constraints" worksheet, along with an explanation of each row. **Appendix table 2-1 provides a comprehensive list of legal and policy requirements that are reflected in the model through the various constraints.**

Description of Constraint Level Data Fields

Row Title	Description
Constraint Name: #1 - Title IV - SO2 Constraint v4.0	Provides information on legal or policy constraint being modeled.

Constraint Type: Rate Cap [MTons]	Provides information on constraint type that is being modeled (e.g., generation, emission, rate, etc.). "Mtons" = thousand tons (emission limit); "GWh" = gigawatt hours (generation limit); "lbs/Mmbtu" = pounds per million btus (rate limit).
Run Year, Seasons Included: 2012 WINTER SUMMER	Shows model run year for the output and indicates if the constraint was applied to summer generation, winter generation, or both. Winter months include October through April. Summer months include May through September.
Run Year, Seasons Included: 2015 WINTER SUMMER	
Run Year, Seasons Included: 2020 WINTER SUMMER	
Run Year, Seasons Included: 2025 WINTER SUMMER	
Run Year, Seasons Included: 2032 WINTER SUMMER	
Time Base: Seasonal/Annual	Shows calendar years mapped to each model run year. Indicates year range to which each constraint limit is applied.
Standard - [MTon]	This row provides the value of the constraint being inputted into the model. It is modeling input and one of key interest in the "All Constraints" worksheet.
-Emissions at Affected Plants [MTons]	Model output of collective emission at plants affected by "standard" as well as summary of allowance trading activity supporting the emission level.
-Less Allowances Purchased [MTons] SO2	
-Plus Allowances Sold [MTons] SO2	
-Plus Allowances Banked [MTons]	
-Less Allowances Withdrawn (1:1) [MTons]	
-Less Allowances Withdrawn (n:1) [MTons]	
Total [MTons]	
TBtu Consumed	Tbtu=trillion btu. Model output of fuel consumption for affected units.
Rate - [lb/MMBtu]	Model output of emission rate for effected units. "lbs/Mmbtu" = pounds per affected unit.
TWh Generated	Electricity generated by units subject to the "standard" limit. TWh = Terawatt hours generated.
TWh Generated Qualifying	
Rate - [lb/MWh]	Rate for affected units. Lb/MWh = pound per Megawatt hour.
Constraint Shadow Price [US$/Ton]	If the "standard" is an emission limit (i.e., cap) in a trading program, the constraint shadow price will reflect the $ per ton value of allowances in that trading program. Commonly called the "allowance price".

Fuel Report: The "Fuel Report" worksheet provides consumption and cost data for major power sector fuel sources for each model run year. These fuels include coal, nuclear, natural gas, biomass, pet.coke (petroleum coke), natural gas, biomass, waste coal, and oil. For each fuel type the total consumption is given in TBtus (trillion Btus). Cost is provided in both MMUS$ (million US dollar units)

and US$/MMBtu (U.S. dollar per million Btus). Appendix 3-1 provides an example of the "fuel report" from the IPM v. 4.10 Base Case.

Tables 1-16: The "Tables 1-16" worksheet in the System Summary Report provides information on controls, generation, capacity, and cost. The information in these tables is often the disaggregated value of the totals reported in the "Summary" worksheet. A user interested in better understanding the details behind the totals given in the "Summary" worksheet may wish to consult "Tables 1-16". For example, the "Summary" worksheet provides the total amount of generation from coal in a given model run year. However, the "Tables 1-16" worksheet goes one step further and provides data on the portion of that generation total coming from coal plants with no pollution control and the portion coming from plants with specific pollution control configurations. In particular, tables 10 through14 provide generation and capacity data at the model plant level. Tables 1–9 provide generation supply and demand data at the U.S. region wide level. The table below describes the data output reported in each table, and Appendix 4-1 provides more information on the acronyms, and nomenclature used in the data fields.

Description Tables in "Tables 1-16" Worksheet

Table #	Title	Description
1	Reserve Margin Capacity Winter (MW)	Shows total electric generating capacity available to the U.S. region during winter period. Available supply of electricity in megawatts (MW).
2	Peak Load Winter (MW)	Shows total electricity demand during winter period by the U.S. region. Capacity reported in megawatts (MW).
3	Reserve Margin Winter (%)	Shows excess winter capacity supply as percentage of demand using total values reported from Tables 1 & 2. (supply - demand)/demand.
1	Reserve Margin Capacity summer (MW)	Shows total electric generating capacity available to U.S. region during summer period. Available supply of electricity in megawatts (MW).
2	Peak Load summer (MW)	Shows total electricity demand during summer period by the U.S. region. Capacity reported in megawatts (MW).
3	Reserve Margin summer (%)	Shows excess summer capacity as percentage of demand using total values reported from Tables 1 & 2.
4	Generation (GWh)	Gigawatt hours (GWh) of annual electricity that is produced domestically, imported, exported, and lost during pumping and storage.
5	Total Supply for Demand (GWh)	Gigawatt hours (GWh) of annual electricity generation supplied to the U.S. region. Summation of values in Table 4.
6	Projected Demand (GWh)	Gigawatt hours (GWh) of annual projected demand and projected net demand.
7	Dumped Energy	Typically not referenced.
8	Total Supply for Demand (GWh)	Gigawatt hours (GWh) of annual electricity supply before taking transmission and distribution losses (T&D losses) into account.
9	Total Sales (GWh)	Gigawatt hours (GWh) of annual electricity supply determined by subtracting projected transmission & demand losses from total supply.

10	Capacity by plant type	Cumulative capacity (MW) of model plant types for each model run year. The model run plants are categorized by the unit's fuel, configuration, and online status (e.g., new, existing, retiring). Each control configuration combination is modeled as a separate plant type. The total capacity, retrofit capacity, new unit capacity, and retiring unit capacity values given in the summary table are disaggregated into model plant types in this table. Key difference between table 10 & 11 is that 10 is cumulative and 11 is incremental. Therefore, table 10 will show model plant capacity by a given year, and table 11 will show model plant capacity added during that run year.
11	Capacity Additions and Changes	Incremental capacity (MW) of model plant types for each model run year. The model run plants are categorized by the unit's fuel, configuration, and online status (e.g., new, existing, retiring). Each control configuration combination is modeled as a separate plant type. The total capacity, retrofit capacity, new unit capacity, and retiring unit capacity values given in the summary table are disaggregated into model plant types in this table.
12	Generation by Plant Type (GWh)	Cumulative generation (GWh) of model plant types for each model run year. The model run plants are categorized by the unit's fuel, configuration, and online status (e.g., new, existing, retiring). Each control configuration combination is modeled as a separate plant type. The total generation by each plant type given in the summary table is disaggregated into model plant type generation in this table.
12a	Generation by Fuel Type (GWh)	Total gigawatt hours (GWh) of generation in each model run year by fuel type. Aggregation of the model plants pertaining to each fuel in table 12.
13	Generation by Plant Type (Tbtu)	Cumulative generation measured in Trillion btus (Tbtu) of model plant types for each model run year. The data corresponds to generation values given in Table 12, but is expressed in TBtus to provide the heat content of the power generated. Conversion factor of approximately 3,412 Btu/KWh is used.
14	Capacity factor by Plant Type (%)	Capacity factor for each model plant type. Capacity factor is the actual generation expressed as a percentage of maximum generation possible if the plant was operated every hour of the year. Therefore, it is the generation / (capacity*8760). Generally, the model does not allow for 100% capacity factors because of maintenance, planned outage, and forced outage times. Intermittent generation sources (i.e., wind) also have their capacity factor limited by the availability of their fuel source.

15	Total Annual Production Cost	Provides total production cost in million U.S. dollar units (MMUS$) for each model run year. The production costs are disaggregated into variable operating and maintenance (variable O&M), fixed O&M, fuel, capital, and CO2 transportation and storage cost.
16	Emissions	Provides total annual U.S. emissions for each model run year for several hazardous, criteria, and green house gas pollutants. Emission totals are expressed in 1000 tons (Mtons); 1,000,000 tons (Mmtons), or regular tons. All tons are short tons (2000 lbs/ton) unless otherwise noted.

APPENDIX

Appendix 1-1: Description of Data Fields in "Summary" Worksheet

Row #	Row Title	Description of Field
1		
2	**EPA IPM Run Results**	
3	***All costs and prices are in 2007-year dollars***	Provides year to which all cost and prices within the summary report are indexed.
4	**NATIONWIDE EMISSIONS**	Provides nationwide total emissions from EGUs for given run years in short tons (2000 lbs/ton) unless otherwise noted.
5	**SO2 (million tons)**	
6	**NOx (million tons)**	
7	**CO2 (million metric tons)**	
8	**Hg (tons)**	
9		
10	**TOTAL COSTS**	Provides the total cost of electricity generation to meet demand in given year under the modeled operational, regulatory, and policy constraints. Values are given in billion dollar units and indexed to 2007 prices.
11	**Total Costs (billion $)**	
12		
13	**PRICES**	Gives the prices for various fuel and emission commodities relevant to the power sector.
14	**National Wholesale Electricity Price (mills/kWh)**	For wholesale electricity prices in "mills/Kwh". 1 mill = 1/10 of a cent. Therefore, 10 mills/kwh is equivalent to $.01/Kwh.
15	**Natural Gas Prices (2007 $/MMBtu)**	"Mmbtu" = million btus.
16	Henry Hub	Price at Henry Hub. Henry Hub is a gas pipeline in Louisiana that serves as a generally accepted reference point for U.S. natural gas trading data due to its central location giving shippers access to pipelines in the southeast, midwest, and northeast regions.
17	Delivered	Delivered price of gas. Reflects seasonal and transportation cost adders.
18	**Minemouth Coal Prices (2007 $/MMBtu)**	Provides endogenously determined minemouth coal prices. "Mmbtu" = million btus. See Appendix 1 for map of coal regions. National price is weighted average of regional coal prices.
19	Appalachia	
20	Imports	
21	Interior	
22	Waste Coal	
23	West	

24	National	
25		
26	**Emission Allowance Prices ($/ton)**	Provides emission allowance price for pollutants under that program. Unless otherwise specified, units are in dollar per short ton (2000 lbs). SO2 region 1 (TR) indicates the group of States under the Transport Rule with a 2014 and beyond budget based on SO2 reductions projected to be cost-effective at $2000/ton. Region 1 States include Georgia, Illinois, Indiana, Iowa, Kentucky, Michigan, Missouri, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and Wisconsin. SO2 Region 2 (TR) States have 2014 and beyond budgets that remain equal to the 2012 budgets. These States include Alabama, Connecticut, Delaware, Florida, Kansas, Louisiana, Maryland, Massachusetts, Nebraska, New Jersey & South Carolina.
27	SO2 Region 1 (TR)	
28	SO2 Region 2 (TR)	
29	SO2 (Title IV)	
30	NOx Annual (TR)	
31	NOx Ozone Season (TR)	
32	CO2 ($/metric ton)	
33		
34	**EMISSION CONSTRAINTS (Mtons)**	Provides total emissions limits for electric generating units (EGUs) affected by the referenced policy. Mtons = 1000 tons. Tons listed are short tons, unless otherwise specified. "TR" = Transport Rule, and provides emission limits related to the collective budget and variability limits laid out in the Policy. Region 1 States include Georgia, Illinois, Indiana, Iowa, Kentucky, Michigan, Missouri, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and Wisconsin. SO2 Region 2 (TR) States have 2014 and beyond budgets that remain equal to the 2012 budgets. These States include Alabama, Connecticut, Delaware, Florida, Kansas, Louisiana, Maryland, Massachusetts, Nebraska, New Jersey & South Carolina.
35	SO2 Region 1 (TR)	
36	SO2 Region 2 (TR)	
37	SO2 (Title IV)	
38	NOx Annual (TR)	
39	NOx Ozone Season (TR)	
40	CO2 (metric ton)	
41		
42	**TOTAL CAPACITY (Cumulative GW)**	Provides the cumulative gigawatts of generating capacity by plant type forecasted to be online for a given run year. It reflects ((existing units + new units) – retiring units) for that generation type. The existing value is obtained from the previous model run year. Total is the aggregate electricity generating capacity available. Abbreviations: PC = pulverized coal; IGCC = integrated gasification combined cycle; IGCC-CCS = integrated gasification combined cycle with carbon capture and storage; CC = combined cycle; CT = combustion turbine.
43	**Hydro**	
44	**Non-Hydro Renewables**	
45	Biomass	
46	Other	
47	Wind	
48	**Coal**	
49	PC	
50	Advanced Coal with CCS	
51	IGCC	
52	**New Future Technology**	

53	**Nuclear**	
54	**Natural Gas**	
55	CC	
56	CT	
57	**Oil/Gas Steam**	
58	**Other**	
59	**Grand Total**	
60		
61	**NEW CAPACITY (Cumulative GW)**	
62	**Non-Hydro Renewables**	
63	Biomass	
64	Other	
65	Wind	
66	**Coal**	
67	PC	Provides the cumulative gigawatts of new capacity by plant type expected to come online by a given run year (i.e., total capacity - existing capacity). New capacity is determined endogenously and constitutes units that are not currently listed in the National Electric Energy Data Source (NEEDs). Abbreviations: PC = pulverized coal; IGCC = integrated gasification combined cycle; IGCC-CCS = integrated gasification combined cycle with carbon capture and storage; CC = combined cycle; CT = combustion turbine.
68	Advanced Coal with CCS	
69	IGCC	
70	**New Future Technology**	
71	**Nuclear**	
72	**Natural Gas**	
73	CC	
74	CT	
75	**Other**	
76	**Grand Total**	
77		
78	**RETIREMENTS (GW)**	Provides the cumulative gigawatts of retirements by plant type that occur after 2011 and by the given run year. Reflects cumulative retirements that have occurred between 2012 and model run year. Abbreviations: PC = pulverized coal; IGCC = integrated gasification combined cycle; IGCC-CCS = integrated gasification combined cycle with carbon capture and storage; CC = combined cycle; CT = combustion turbine; O/G = oil/gas steam. In some cases, retirements may also reflect retirements that are required by enforcement actions (e.g., consent decree).
79	Advanced Coal Retirement	
80	CC Retirements	
81	Coal Retirements	

82	CT Retirements	
83	Nuclear Retirements	
84	O/G Retirements	
85	Grand Total	
86		
87	**GENERATION MIX (thousand GWh)**	Provides the annual generation forecasted for a given model run year by a particular plant type. Generation data is given in units of 1000 gigawatt hours. The total value reflects total electricity demand from the power grid. Abbreviations: PC = pulverized coal; IGCC = integrated gasification combined cycle; IGCC-CCS = integrated gasification combined cycle with carbon capture and storage; CC = combined cycle; CT = combustion turbine; O/G = oil/gas steam.
88	**Hydro**	
89	**Non-Hydro Renewables**	
90	Wind	
91	Biomass Co-firing	
92	**Coal**	
93	PC	
94	Advanced Coal with CCS	
95	Biomass	
96	Other	
97	IGCC	
98	**New Future Technology**	
99	**Nuclear**	
100	**Natural Gas**	
101	CC	
102	CT	
103	**Oil/Gas Steam**	
104	**Other**	
105	**Grand Total**	
106		
107	**TOTAL CONTROLS (Cumulative GW)**	Provides total gigawatts of a particular type of control technology at coal-fired units.
108	**FGD**	Provides total gigawatt of units with Flue Gas Desulfurization technology (FGD) for a given run year. FGD is used for removing SO2 from coal fired power plants. Also referred to as a "scrubber". The total given is a summation of existing scrubbers, retrofit scrubbers, and all new pulverized coal capacity which is assumed to have scrubber technology installed.

109	Existing FGD	Provides total gigawatt of capacity with existing FGD prior to first model run year (e.g. 2012). These are FGDs that are exogenous to the model and in place prior to retrofits and new units that are added in the model. Wet FGD refers to limestone forced oxidation (LSFO) or Magnewsium Enhanced Lime (MEL) technologies. Dry FGD refers to Lime Spray Dryer (LSD) technology.
110	Existing Wet FGD	
111	Existing Dry FGD	
112	Non-Disapatchable FGD	Provides gigawatts of non-dispatchable FGD retrofits for a given model run year. Non-dispatchable FGD refers to a FGD retrofit that is installed at a unit and must be run for compliance with EPA-administered trading programs like the Acid Rain Program or have other continuous mandates to operate (e.g., NSR settlement).
113	Retrofit Wet FGD	
114	Retrofit Dry FGD	
115	Disapatchable FGD	Provides gigawatts of dispatchable FGD retrofits for a given model run year. Dispatchable refers to a FGD that is already installed at a unit, but was potentially bypassed or not fully operated due to lack of economic incentive prior to model run year. "Dispatchable" retrofits are assumed to have no capital cost in the model because they are already installed. The values given here depict existing FGDs being "turned on" at power plants that would otherwise remain "turned off".
116	Retrofit Wet FGD	
117	Retrofit Dry FGD	
118	New FGD	Refers to cumulative GW of new FGDs online by a given model run year. Corresponds to the capacity of cumulative new pulverized coal capacity expected for a given model run year. The model assumes all new pulverized coal has FGD controls.
119	New Wet FGD	
120	New Dry FGD	
121	**SCR**	Provides total gigawatts of Selective Catalytic Reduction (SCR) online by a given model run year (Existing + retrofits + new units). SCRs are primarily used as a post-combustion technology for reducing NOx from emissions at power plants.
122	Existing SCR	Provides total gigawatts of SCR that were online prior to 2012 and included in the modeling input. These SCRs are exogenous to the model.
123	Non-Disapatchable SCR	Refers to cumulative gigawatts of capacity retrofitted with non-dispatchable SCR by a given model run year. Non-dispatchable refers to controls that must be continuously run due to a mandatory enforceable requirement (e.g., NSR settlements or other pre-existing requirements).
124	Disapatchable SCR	Refers to cumulative gigawatts of capacity retrofitted with dispatchable SCR by a given model run year. Dispatchable SCR retrofits refers to those SCRs that are installed at power plants but potentially not run prior to model run year due to lack of economic incentive. They are assumed to have no capital cost in the IPM model. The values given here depict existing SCRs being "turned on" at power plants that would otherwise remain "turned off".
125	New SCR	Refers to the cumulative gigawatts of new SCRs (non-retrofits) that have come online by a given model run year. Corresponds to capacity of new coal units that is forecasted, as all new coal is assumed to have SCR.
126	**SNCR**	Provides total cumulative gigawatts of Selective Non-Catalytic Reduction (SNCR) technology that is online by a given model run year. Summation of existing, retrofit, and new SNCR. SNCR is post-combustion technology for reducing NOx from power plant emissions.
127	Existing SNCR	Provides total gigawatts of SNCR that was online prior to 2012 and included in NEEDs inventory as a modeling input. These SNCRs are exogenous to the model.
128	Retrofit SNCR	Refers to cumulative gigawatts of capacity that is retrofitted with SNCR by a given run year. This is the total capacity of units that are retrofitted with SNCR post 2011. These are model projects and therefore endogenous to the model.

129	New SNCR	Provides cumulative GW of capacity of new units that are coming online with a SNCR
130	**ACI**	Provides cumulative GW of generating capacity that has Activated Carbon Injection (ACI). Is a summation of existing, retrofits, and new ACI. ACI is technology for reducing Mercury (Hg) emissions at power plants.
131	Existing ACI	Provides total gigawatts of ACI that is online prior to 2012 and included in the modeling input. This existing capacity is exogenous to the model.
132	Retrofit ACI	Provides cumulative gigawatts of generating capacity that is retrofitted with ACI post 2011 and by the given model run year. These are model projections, and therefore endogenous to the model.
133	New ACI	Provides cumulative gigawatts of new units that are coming online with ACI technology post 2011. These are endogenous to the model.
134	**CCS**	Provides cumulative gigawatts of generating capacity that has Carbon Capture and Storage Technology installed by a given model run year. Is a summation of existing, retrofit, and new CCS.
135	Hardwired CCS	Provides total gigawatts of existing CCS that is online prior to 2012 and included in the modeling input in the NEEDs inventory. This is exogenous to the model.
136	Retrofit CCS	Provides total cumulative gigawatts of capacity that is retrofitted with CCS post 2011 and by the given model run year. Is endogenous to the model.
137	New CCS	Provides cumulative gigawatts of new units that are coming online with CCS technology post 2011 and by the given model run year.
138		
139	**NON-DISPATCHABLE RETROFITS (Cumulative GW)**	Provides total cumulative gigawatts of capacity that is retrofitted with a given technology post 2011 and by given model run year. These are non-dispatchable retrofits which means their capital cost are included in the model and they are installed at the power plant post 2011.
140	**FGD**	Cumulative gigawatts of non-dispatchable Flue Gas Desulfurization.
141	**SCR**	Cumulative gigawatts of non-dispatchable Selective Catalytic Reduction retrofits.
142	**SNCR**	Cumulative gigawatts of non-dispatchable Selective Non-Catalytic Reduction retrofits
143	**ACI**	Cumulative gigawatts of non-dispatchable Activated Carbon Injection retrofits.
144	**CCS**	Cumulative gigawatts of non-dispatchable Carbon Capture & Storage retrofits.
145		
146	**DISPATCHABLE RETROFITS (Cumulative GW)**	Provides total cumulative gigawatts of capacity that is retrofitted with a given technology post 2011 and by given model run year. These are dispatchable retrofits, which implies they were installed at the unit prior to 2011, but previously lacked economic incentive to operate. Their capital costs are not included in the model.
147	**DFGD**	Cumulative gigawatts of Dispatchable Flue Gas Desulfurization retrofits.
148	**DSCR**	Cumulative gigawatts of Dispatchable Selective Catalytic Reduction retrofits.
149		
150	**TOTAL CONTROLS IN NEEDS**	Reflects cumulative gigatwatts of capacity that has control installed by a given model run year. Value is

151	**FGD**	reflective of controls at all fossil-fired units.
152	**SCR**	
153	**SNCR**	
154		
155	**FUEL SUPPLY AND CONSUMPTION**	Provides Coal and Gas supply and consumption for given model run years.
156	**Coal Use by Region (million tons)**	Provides total coal use in million tons by power and non-power sector for given model run year.
157	Power Sector	Provides total coal use in million tons by power sector for given model run year.
158	Appalachia	Provides total coal supply for power sector that comes from Appalachia coal region.
159	Imports	Provided total coal supply for power sector that comes from Imports.
160	Interior	Provides total coal supply for power sector that comes from Interior Region.
161	Waste Coal	Provides total coal supply for power sector that comes from Waste Coal.
162	West	Provides total coal supply for power sector that comes from the West Region.
163	Non-Power Sector	Provides total coal use in million tons for the non-power sector.
164	Appalachia	Provides total coal use for non-power sector that comes for Appalachia region.
165	Interior	Provides total coal use for non-power sector that comes from Interior Region.
166	West	Provides total coal use for non-power sector that comes from West Region.
167	**Power Sector Coal Use by Rank (TBtu)**	Provides total coal supply to power sector in trillion Btus (Tbtu).
168	Bituminous	Provides total bituminous coal supply to power sector in trillion Btus (Tbtu).
169	Subbituminous	Provides total subbituminou coal supply to power sector in trillion Btus (Tbtu).
170	Lignite	Provides total lignite coal supply to power sector in trillion Btus (Tbtu).
171		
172	**Natural Gas Use (Tcf)**	Total natural gas use by power and non-power sectors in trillion cubic feet (Tcf).

Appendix 2-1: Summary of legal and regulatory requirements considered in the IPM v.4.10 Base Case

NSR Settlements	State Settlements	Citizen Suits	State Rules	Regional/National Programs	International
Alabama Power	AES	SWEPCO	Alabama	Title IV Acid Rain Program	Canada
Minnkota Power	Niagra Mohawk Power	Allegheny Energy	Arizona	Regional Green House Gas Initiative (RGGI)	Manitoba
SIGECO	Public Service Co of New Mexico	Wisconsin Public Service Corp.	California	Pacific Northwest	Ontario
PSEG Fossil	Public Service Co of Colorado	University of Wisconsin	Colorado	Nox SIP Call	Quebec
TECO	TVA	Tucson Electric Power	Delaware	Western Regional Air Partnership (WRAP)	New Brunswick
WEPCO	Rochester Gas & Electric		Georgia		Novia Scotia
VEPCO	Mirant-New York		Illinois		Labrador and Newfoundland
Santee Cooper			Louisiana		
Ohio Edison			Maine		
Mirant			Maryland		
Illinois Power			Massachusetts		
Kentucky Utilities Company			Michigan		
Salt River Project			Minnesota		
American Electric Power (AEP)			Missouri		
Eastern Kentucky Power Cooperative			Montana		
Nevada Power			New Hampshire		
Dayton Power and Light			New Jersey		
Puerto Rico Power			New York		
Westar Energy			North Carolina		
Duke Energy			Oregon		
			Pennsylvania		
			Tennessee		
			Texas		
			Utah		
			Washington		
			West Virginia		
			Wisconsin		

APPENDIX 3

Appendix 3-1: Example of “Fuel Report” worksheet in System Summary Report File

Fuel Consumption by Fueland FuelType [TBtu]					
Fuel	**2012**	**2015**	**2020**	**2025**	**2032**
Coal	22523.2	24259.8	26175.3	27009.4	29400.3
Nuclear	8322.9	8138.5	8203.2	8258.5	8515.4
Natural Gas	5666.2	4792.6	4316.2	4915.4	5065.2
Biomass	501.5	765.1	1193.5	1364.3	1416.9
Pet. Coke	193.6	190.3	190.9	188.8	188.8
Waste Coal	163.9	157.5	158.4	158.7	158.8
Oil	253	162.5	150.4	83.1	50.2

Fuel Costs by Fuel and Fuel Type[MMUS$]					
Fuel	**2012**	**2015**	**2020**	**2025**	**2032**
Coal	35871.9	37904.9	40446.9	41834.7	47769.9
Nuclear	5791.9	5663.6	6086.8	6325.2	6400.2
Natural Gas	37254.2	29201.6	26979.3	28874.4	31609.6
Biomass	1014.7	1614.7	2714.5	3236.2	3414.3
Pet. Coke	258.6	254.2	255	252.1	252.2
Waste Coal	220.3	206.2	206.3	207.2	216.3
Oil	1404.1	811.6	784.4	465.4	284.9
Fuel Costs by Fuel and Fuel Type[US$/MMBtu]					
Fuel	**2012**	**2015**	**2020**	**2025**	**2032**
Coal	1.59	1.56	1.55	1.55	1.62
Nuclear	0.7	0.7	0.74	0.77	0.75
Natural Gas	6.57	6.09	6.25	5.87	6.24
Biomass	2.02	2.11	2.27	2.37	2.41
Pet. Coke	1.34	1.34	1.34	1.34	1.34
Waste Coal	1.34	1.31	1.3	1.31	1.36
Oil	5.55	4.99	5.22	5.6	5.68

APPENDIX 4

Appendix 4-1: Explanation of Model Plant Nomenclature

The field headers given in each row of Tables 10-14 represent model plants. The model plant types are differentiated by fuel used (e.g., coal, oil/gas, nuclear, hydro), combustion technology (e.g., turbine, combined cycle gas), control technology (e.g., scrubber, post-combustion NOx control), online status (e.g., new, existing, or retiring) and retrofit structure (e.g., coal plant with existing SNCR retrofit with ACI). It is helpful in understanding the nomenclature of model plants to recognize the significance of the "ret.", "exist" and "&" usage in the title. "Ret." suggests that the model plant is receiving a retrofit in or by the given run year. If there is no "exist" label that immediately follows the "ret." designation, then every control listed is a retrofit on a unit without any previously existing emission controls. The indicated controls come online post 2011 and are endogenous to the model.

If there is an "exist" that follows "ret." then each control listed after the "exist" and before the first ampersand (&) is an existing control (online prior to 2012 and exogenous to the model) and everything after the "&" is a retrofit that is added to that model plant by the model run year given. To illustrate the difference, let's look at plant types with the same controls shown but with the word "Exist" absent and when the word "Exist" is present, there will be variants in the placement of the first ampersand (&):

Plant Type	**ID #**	**Description**
Ret.ACI & SCR & WetFGD & CCS	64	Retrofit ACI, SCR, CCS and Wet FGD on Existing Coal Steam
Ret.ExistACI & SCR & WetFGD & CCS	77	Retrofit SCR, CCS and Wet FGD on Existing Coal Steam with ACI
Ret.ExistSCR_ACI & WetFGD & CCS	108	Retrofit CCS and Wet FGD on Existing Coal Steam with SCR and ACI
Ret.ExistSCR_WFGD_ACI & CCS	112	Retrofit CCS on Existing Coal Steam with SCR, ACI and Wet FGD
Ret.ExistWetFGD & ACI & SCR & CCS	130	Retrofit ACI, SCR and CCS on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD_ACI & SCR & CCS	138	Retrofit SCR and CCS on Existing Coal Steam with ACI and Wet FGD
Ret.ExistWetFGD_SCR & ACI & CCS	139	Retrofit ACI and CCS on Existing Coal Steam with SCR and Wet FGD

Appendix 4-2: Comprehensive list of Model Plant Types

Key to EPA Base Case v.4.10 Plant Types

Plant Type	ID #	Description	Notes
New Biomass	1	New Biomass	
New Advanced Coal with CCS	2	New IGCC with Carbon Capture and Sequestration (CCS)	
New Combined Cycle	3	New Combined Cycle	
New Combined Cycle - Uncontrolled	4	New Combined Cycle - Uncontrolled	Canada only
New Combustion Turbine	5	New Combustion Turbine	
New Fuel Cell	6	New Fuel Cell	
New Future Technology	7	New Future Technology	
New Geothermal	8	New Geothermal	
New Hydro	9	New Hydro	Canada only
New IGCC	10	New IGCC	
New Landfill Gas	11	New Landfill Gas	
New Nuclear	12	New Nuclear	
New Offshore Wind	13	New Offshore Wind	
New Onshore Wind	14	New Onshore Wind	
New Solar PV	15	New Solar Photovoltaic	
New Solar Thermal	16	New Solar Thermal	
New SPC - Uncontrolled	17	New Supercritical Coal Uncontrolled	Canada only
New SPC-DryFGD_SCR_ACI	18	New Supercritical Coal with SCR, ACI and Dry FGD	
New SPC-WetFGD_SCR	19	New Supercritical Coal with SCR and Wet FGD	
Exist Biomass	20	Existing Biomass	
Exist Coal Steam_ACI	21	Existing Coal Steam with ACI	
Exist Coal Steam_DryFGD	22	Existing Coal Steam with Dry FGD	
Exist Coal Steam_DryFGD_ACI	23	Existing Coal Steam with ACI and Dry FGD	
Exist Coal Steam_DryFGD_SCR	24	Existing Coal Steam with SCR and Dry FGD	
Exist Coal Steam_DryFGD_SCR_ACI	25	Existing Coal Steam with SCR, ACI and Dry FGD	
Exist Coal Steam_DryFGD_SNCR	26	Existing Coal Steam with SNCR and Dry FGD	
Exist Coal Steam_DryFGD_SNCR_ACI	27	Existing Coal Steam with ACI, SNCR and Dry FGD	
Exist Coal Steam_SCR	28	Existing Coal Steam with SCR	
Exist Coal Steam_SCR_ACI	29	Existing Coal Steam with SCR and ACI	
Exist Coal Steam_SNCR	30	Existing Coal Steam with SNCR	
Exist Coal Steam_SNCR_ACI	31	Existing Coal Steam with SNCR and ACI	
Exist Coal Steam_Uncontrolled	32	Existing Coal Steam Uncontrolled	
Exist Coal Steam_WetFGD	33	Existing Coal Steam with Wet FGD	
Exist Coal Steam_WetFGD_ACI	34	Existing Coal Steam with ACI and Wet FGD	
Exist Coal Steam_WetFGD_SCR	35	Existing Coal Steam with SCR and Wet FGD	

Exist Coal Steam_WetFGD_SCR_ACI	36	Existing Coal Steam with SCR, ACI and Wet FGD	
Exist Coal Steam_WetFGD_SNCR	37	Existing Coal Steam with SNCR and Wet FGD	
Exist Combined Cycle	38	Existing Combined Cycle	
Exist Combustion Turbine	39	Existing Combustion Turbine	
Exist FBC_DryFGD	40	Existing Fluidized Bed Combustion with Dry FGD	
Exist FBC_DryFGD_SNCR	41	Existing Fluidized Bed Combustion with SNCR and Dry FGD	
Exist FBC_SNCR	42	Existing Fluidized Bed Combustion with SNCR	
Exist FBC_Uncontrolled	43	Existing Fluidized Bed Combustion Uncontrolled	
Exist Fossil_Other	44	Existing Fossil Other	
Exist Fuel Cell	45	Existing Fuel Cell	
Exist Geothermal	46	Existing Geothermal	
Exist Hydro	47	Existing Hydro	
Exist IGCC	48	Existing IGCC	
Exist Landfill Gas	49	Existing Landfill Gas	
Exist Non Fossil_Other	50	Existing Non Fossil Other	
Exist Nuclear	51	Existing Nuclear	
Exist Oil/Gas Steam	52	Existing Oil/Gas Steam	
Exist Oil/Gas Steam_SCR	53	Existing Oil/Gas Steam with SCR	
Exist Oil/Gas Steam_SNCR	54	Existing Oil/Gas Steam with SNCR	
Exist Pump Storage	55	Existing Pump Storage	
Exist Solar PV	56	Existing Solar Photovoltaic	
Exist Solar Thermal	57	Existing Solar Thermal	
Exist Wind	58	Existing Wind	
International Imports	59	International Imports	Imports from Mexico
Ret.ACI	60	Retrofit ACI on Existing Coal Steam	
Ret.ACI & DryFGD	61	Retrofit ACI and Dry FGD on Existing Coal Steam	
Ret.ACI & SCR	62	Retrofit ACI and SCR on Existing Coal Steam	
Ret.ACI & SCR & DryFGD & CCS	63	Retrofit ACI, SCR, CCS and Dry FGD on Existing Coal Steam	
Ret.ACI & SCR & WetFGD & CCS	64	Retrofit ACI, SCR, CCS and Wet FGD on Existing Coal Steam	
Ret.ACI & SNCR	65	Retrofit ACI and SNCR on Existing Coal Steam	
Ret.ACI & WetFGD	66	Retrofit ACI and Wet FGD on Existing Coal Steam	
Ret.CCS	67	Retrofit CCS on Existing Coal Steam	
Ret.DryFGD	68	Retrofit Dry FGD on Existing Coal Steam	
Ret.DryFGD & ACI & CCS	69	Retrofit ACI, CCS and Dry FGD on Existing Coal Steam	
Ret.DryFGD & CCS	70	Retrofit CCS and Dry FGD on Existing Coal Steam	
Ret.ExistACI & DryFGD	71	Retrofit Dry FGD on Existing Coal Steam with ACI	

Ret.ExistACI & DryFGD & CCS	72	Retrofit CCS and Dry FGD on Existing Coal Steam with ACI
Ret.ExistACI & SCR	73	Retrofit SCR on Existing Coal Steam with ACI
Ret.ExistACI & SCR & DryFGD	74	Retrofit SCR and Dry FGD on Existing Coal Steam with ACI
Ret.ExistACI & SCR & DryFGD & CCS	75	Retrofit SCR, CCS and Dry FGD on Existing Coal Steam with ACI
Ret.ExistACI & SCR & WetFGD	76	Retrofit SCR and Wet FGD on Existing Coal Steam with ACI
Ret.ExistACI & SCR & WetFGD & CCS	77	Retrofit SCR, CCS and Wet FGD on Existing Coal Steam with ACI
Ret.ExistACI & SNCR	78	Retrofit SNCR on Existing Coal Steam with ACI
Ret.ExistACI & SNCR & DryFGD	79	Retrofit SNCR and Dry FGD on Existing Coal Steam with ACI
Ret.ExistACI & SNCR & WetFGD	80	Retrofit SNCR and Wet FGD on Existing Coal Steam with ACI
Ret.ExistACI & WetFGD	81	Retrofit Wet FGD on Existing Coal Steam with ACI
Ret.ExistACI & WetFGD & CCS	82	Retrofit CCS and Wet FGD on Existing Coal Steam with ACI
Ret.ExistDryFGD & ACI	83	Retrofit ACI on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD & ACI & CCS	84	Retrofit ACI and CCS on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD & ACI & SCR	85	Retrofit ACI and SCR on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD & ACI & SCR & CCS	86	Retrofit ACI, SCR and CCS on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD & ACI & SNCR	87	Retrofit ACI and SNCR on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD & CCS	88	Retrofit CCS on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD & SCR	89	Retrofit SCR on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD & SCR & CCS	90	Retrofit SCR and CCS on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD & SNCR	91	Retrofit SNCR on Existing Coal Steam with Dry FGD
Ret.ExistDryFGD_ACI & CCS	92	Retrofit CCS on Existing Coal Steam with ACI and Dry FGD
Ret.ExistDryFGD_ACI & SCR	93	Retrofit SCR on Existing Coal Steam with ACI and Dry FGD
Ret.ExistDryFGD_ACI & SCR & CCS	94	Retrofit SCR and CCS on Existing Coal Steam with ACI and Dry FGD
Ret.ExistDryFGD_SCR & ACI & CCS	95	Retrofit ACI and CCS on Existing Coal Steam with SCR and Dry FGD
Ret.ExistDryFGD_SCR & CCS	96	Retrofit CCS on Existing Coal Steam with SCR and Dry FGD
Ret.ExistSCR & ACI	97	Retrofit ACI on Existing Coal Steam with SCR
Ret.ExistSCR & ACI & DryFGD	98	Retrofit ACI and Dry FGD on Existing Coal Steam with SCR
Ret.ExistSCR & ACI & WetFGD	99	Retrofit ACI and Wet FGD on Existing Coal Steam with SCR
Ret.ExistSCR & DryFGD	100	Retrofit Dry FGD on Existing Coal Steam with SCR
Ret.ExistSCR & DryFGD & ACI & CCS	101	Retrofit ACI, CCS and Dry FGD on Existing Coal Steam with SCR
Ret.ExistSCR & DryFGD & CCS	102	Retrofit CCS and Dry FGD on Existing Coal Steam with SCR
Ret.ExistSCR & WetFGD	103	Retrofit Wet FGD on Existing Coal Steam with SCR
Ret.ExistSCR & WetFGD & ACI & CCS	104	Retrofit ACI, CCS and Wet FGD on Existing Coal Steam with SCR
Ret.ExistSCR & WetFGD & CCS	105	Retrofit CCS and Wet FGD on Existing Coal Steam with SCR
Ret.ExistSCR_ACI & DryFGD	106	Retrofit Dry FGD on Existing Coal Steam with SCR and ACI
Ret.ExistSCR_ACI & WetFGD	107	Retrofit Wet FGD on Existing Coal Steam with SCR and ACI

Ret.ExistSCR_ACI & WetFGD & CCS	108	Retrofit CCS and Wet FGD on Existing Coal Steam with SCR and ACI
Ret.ExistSCR_DFGD & ACI	109	Retrofit ACI on Existing Coal Steam with SCR and Dry FGD
Ret.ExistSCR_DFGD_ACI & CCS	110	Retrofit CCS on Existing Coal Steam with SCR, ACI and Dry FGD
Ret.ExistSCR_WFGD & ACI	111	Retrofit ACI on Existing Coal Steam with SCR and Wet FGD
Ret.ExistSCR_WFGD_ACI & CCS	112	Retrofit CCS on Existing Coal Steam with SCR, ACI and Wet FGD
Ret.ExistSNCR & ACI	113	Retrofit ACI on Existing Coal Steam with SNCR
Ret.ExistSNCR & ACI & DryFGD	114	Retrofit ACI and Dry FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR & ACI & WetFGD	115	Retrofit ACI and Wet FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR & DryFGD	116	Retrofit Dry FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR & DryFGD & ACI & CCS	117	Retrofit ACI, CCS and Dry FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR & DryFGD & CCS	118	Retrofit CCS and Dry FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR & WetFGD	119	Retrofit Wet FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR & WetFGD & ACI & CCS	120	Retrofit ACI, CCS and Wet FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR & WetFGD & CCS	121	Retrofit CCS and Wet FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR_ACI & DryFGD	122	Retrofit Dry FGD on Existing Coal Steam with SNCR and ACI
Ret.ExistSNCR_ACI & DryFGD & CCS	123	Retrofit CCS and Dry FGD on Existing Coal Steam with SNCR and ACI
Ret.ExistSNCR_ACI & WetFGD	124	Retrofit Wet FGD on Existing Coal Steam with SNCR and ACI
Ret.ExistSNCR_DFGD & ACI	125	Retrofit ACI on Existing Coal Steam with SNCR and Dry FGD
Ret.ExistSNCR_WFGD & ACI	126	Retrofit ACI on Existing Coal Steam with SNCR and Wet FGD
Ret.ExistWetFGD & ACI	127	Retrofit ACI on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & ACI & CCS	128	Retrofit ACI and CCS on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & ACI & SCR	129	Retrofit ACI and SCR on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & ACI & SCR & CCS	130	Retrofit ACI, SCR and CCS on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & ACI & SNCR	131	Retrofit ACI and SNCR on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & CCS	132	Retrofit CCS on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & SCR	133	Retrofit SCR on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & SCR & CCS	134	Retrofit SCR and CCS on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & SNCR	135	Retrofit SNCR on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD_ACI & CCS	136	Retrofit CCS on Existing Coal Steam with ACI and Wet FGD
Ret.ExistWetFGD_ACI & SCR	137	Retrofit SCR on Existing Coal Steam with ACI and Wet FGD
Ret.ExistWetFGD_ACI & SCR & CCS	138	Retrofit SCR and CCS on Existing Coal Steam with ACI and Wet FGD
Ret.ExistWetFGD_SCR & ACI & CCS	139	Retrofit ACI and CCS on Existing Coal Steam with SCR and Wet FGD
Ret.ExistWetFGD_SCR & CCS	140	Retrofit CCS on Existing Coal Steam with SCR and Wet FGD
Ret.ExistWetFGD_SNCR & ACI & CCS	141	Retrofit ACI and CCS on Existing Coal Steam with SNCR and Wet FGD
Ret.ExistWetFGD_SNCR & CCS	142	Retrofit CCS on Existing Coal Steam with SNCR and Wet FGD
Ret.FB-ACI & SNCR	143	Retrofit SNCR and ACI on Existing Coal Steam with Fluidized Bed

Ret.FB-ExistDryFGD & SNCR	144	Retrofit SNCR on Existing Coal Steam with Fluidized Bed and Dry FGD	
Ret.FB-ExistDryFGD_ACI & SNCR	145	Retrofit SNCR on Existing Coal Steam with Fluidized Bed, ACI and Dry FGD	
Ret.FB-SNCR	146	Retrofit SNCR on Existing Coal Steam with Fluidized Bed	
Ret.Oil/Gas Steam SCR	147	Retrofit SCR on Existing Oil/Gas Steam	
Ret.SCR	148	Retrofit SCR on Existing Coal Steam	
Ret.SCR & DryFGD	149	Retrofit SCR and Dry FGD on Existing Coal Steam	
Ret.SCR & DryFGD & ACI	150	Retrofit SCR, ACI and Dry FGD on Existing Coal Steam	
Ret.SCR & DryFGD & CCS	151	Retrofit SCR, CCS and Dry FGD on Existing Coal Steam	
Ret.SCR & WetFGD	152	Retrofit SCR and Wet FGD on Existing Coal Steam	
Ret.SCR & WetFGD & ACI	153	Retrofit SCR, ACI and Wet FGD on Existing Coal Steam	
Ret.SCR & WetFGD & CCS	154	Retrofit SCR, CCS and Wet FGD on Existing Coal Steam	
Ret.SNCR	155	Retrofit SNCR on Existing Coal Steam	
Ret.SNCR & DryFGD	156	Retrofit SNCR and Dry FGD on Existing Coal Steam	
Ret.SNCR & WetFGD	157	Retrofit SNCR and Wet FGD on Existing Coal Steam	
Ret.WetFGD	158	Retrofit Wet FGD on Existing Coal Steam	
Ret.WetFGD & ACI & CCS	159	Retrofit ACI, CCS and Wet FGD on Existing Coal Steam	
Ret.WetFGD & CCS	160	Retrofit CCS and Wet FGD on Existing Coal Steam	
Ret.MPT1	161	Retrofit Multi-Pollutant Technology (MPT1) on Existing Coal Steam	The pollutants controlled are NO_x, SO_2, and Hg.
Ret.ExistSCR & MPT1	162	Retrofit MPT1 on Existing Coal Steam with SCR	
Ret.ExistSNCR & MPT1	163	Retrofit MPT1 on Existing Coal Steam with SNCR	
Ret.ExistWetFGD & MPT1	164	Retrofit MPT1 on Existing Coal Steam with Wet FGD	
Ret.ExistWetFGD_SNCR & MPT1	165	Retrofit MPT1 on Existing Coal Steam with SNCR and Wet FGD	
Ret.ExistDryFGD_SCR & MPT1	166	Retrofit MPT1 on Existing Coal Steam with SCR and Dry FGD	
Ret.ExistDryFGD_SNCR & MPT1	167	Retrofit MPT1 on Existing Coal Steam with SNCR and Dry FGD	
Ret.ExistDryFGD & MPT1	168	Retrofit MPT1 on Existing Coal Steam with Dry FGD	
Ret.ExistSNCR_ACI & MPT1	169	Retrofit MPT1 on Existing Coal Steam with SNCR and ACI	
Ret.ExistACI & MPT1	170	Retrofit MPT1 on Existing Coal Steam with ACI	
Nuke Early Retirement	171	Nuke Early Retirement	
O/G Early Retirement	172	O/G Early Retirement	
CT Early Retirement	173	CT Early Retirement	
Coal Early Retirement	174	Coal Early Retirement	
CC Early Retirement	175	CC Early Retirement	
IGCC Early Retirement	176	IGCC Early Retirement	
Ret.ACI & DDryFGD	177	Retrofit ACI and Dispatchable Dry FGD on Existing Coal Steam	
Ret.ACI & DSCR	178	Retrofit ACI and Dispatchable SCR on Existing Coal Steam	
Ret.ACI & DSCR & DryFGD & CCS	179	Retrofit ACI, CCS, Dry FGD and Dispatchable SCR on Existing Coal Steam	

Ret.ACI & DSCR & DWetFGD & CCS	180	Retrofit ACI, CCS, Dispatchable SCR and Dispatchable Wet FGD on Existing Coal Steam
Ret.ACI & DSCR & WetFGD & CCS	181	Retrofit ACI, CCS, Wet FGD and Dispatchable SCR on Existing Coal Steam
Ret.ACI & DWetFGD	182	Retrofit ACI and Dispatchable Wet FGD on Existing Coal Steam
Ret.ACI & SCR & DWetFGD & CCS	183	Retrofit ACI, SCR, CCS and Dispatchable Wet FGD on Existing Coal Steam
Ret.DDryFGD	184	Retrofit Dispatchable Dry FGD on Existing Coal Steam
Ret.DSCR	185	Retrofit Dispatchable SCR on Existing Coal Steam
Ret.DSCR & DryFGD	186	Retrofit Dry FGD and Dispatchable SCR on Existing Coal Steam
Ret.DSCR & DryFGD & ACI	187	Retrofit ACI, Dry FGD and Dispatchable SCR on Existing Coal Steam
Ret.DSCR & DryFGD & CCS	188	Retrofit CCS, Dry FGD and Dispatchable SCR on Existing Coal Steam
Ret.DSCR & DWetFGD	189	Retrofit Dispatchable SCR and Dispatchable Wet FGD on Existing Coal Steam
Ret.DSCR & DWetFGD & ACI	190	Retrofit ACI, Dispatchable SCR and Dispatchable Wet FGD on Existing Coal Steam
Ret.DSCR & DWetFGD & CCS	191	Retrofit CCS, Dispatchable SCR, Dispatchable Wet FGD on Existing Coal Steam
Ret.DSCR & WetFGD	192	Retrofit Wet FGD and Dispatchable SCR on Existing Coal Steam
Ret.DSCR & WetFGD & ACI	193	Retrofit ACI, Wet FGD and Dispatchable SCR on Existing Coal Steam
Ret.DSCR & WetFGD & CCS	194	Retrofit CCS, Wet FGD and Dispatchable SCR on Existing Coal Steam
Ret.DWetFGD	195	Retrofit Dispatchable Wet FGD on Existing Coal Steam
Ret.DWetFGD & ACI & CCS	196	Retrofit ACI, CCS and Dispatchable Wet FGD on Existing Coal Steam
Ret.DWetFGD & CCS	197	Retrofit CCS and Dispatchable Wet FGD on Existing Coal Steam
Ret.ExistACI & DDryFGD	198	Retrofit Dispatchable Dry FGD on Existing Coal Steam with ACI
Ret.ExistACI & DWetFGD	199	Retrofit Dispatchable Wet FGD on Existing Coal Steam with ACI
Ret.ExistACI & SCR & DDryFGD	200	Retrofit SCR and Dispatchable Dry FGD on Existing Coal Steam with ACI
Ret.ExistACI & SCR & DWetFGD	201	Retrofit SCR and Dispatchable Wet FGD on Existing Coal Steam with ACI
Ret.ExistSCR & ACI & DWetFGD	202	Retrofit ACI and Dispatchable Wet FGD on Existing Coal Steam with SCR
Ret.ExistSCR & DWetFGD	203	Retrofit Dispatchable Wet FGD on Existing Coal Steam with SCR
Ret.ExistSCR_ACI & DDryFGD	204	Retrofit Dispatchable Dry FGD on Existing Coal Steam with SCR and ACI
Ret.ExistSCR_ACI & DWetFGD	205	Retrofit Dispatchable Wet FGD on Existing Coal Steam with SCR and ACI
Ret.ExistSCR_ACI & DWetFGD & CCS	206	Retrofit CCS and Dispatchable Wet FGD on Existing Coal Steam with SCR and ACI
Ret.ExistSNCR & ACI & DWetFGD	207	Retrofit ACI and Dispatchable Wet FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR & DWetFGD	208	Retrofit Dispatchable Wet FGD on Existing Coal Steam with SNCR
Ret.ExistSNCR_ACI & DWetFGD	209	Retrofit Dispatchable Wet FGD on Existing Coal Steam with SNCR and ACI
Ret.ExistWetFGD & ACI & DSCR	210	Retrofit ACI and Dispatchable SCR on Existing Coal Steam with Wet FGD
Ret.ExistWetFGD & DSCR	211	Retrofit Dispatchable SCR on Existing Coal Steam with Wet FGD
Ret.SCR & DDryFGD	212	Retrofit SCR and Dispatchable Dry FGD on Existing Coal Steam
Ret.SCR & DDryFGD & ACI	213	Retrofit SCR, ACI and Dispatchable Dry FGD on Existing Coal Steam
Ret.SCR & DWetFGD	214	Retrofit SCR and Dispatchable Wet FGD on Existing Coal Steam
Ret.SCR & DWetFGD & ACI	215	Retrofit SCR, ACI and Dispatchable Wet FGD on Existing Coal Steam

Ret.SCR & DWetFGD & CCS	216	Retrofit SCR, CCS and Dispatchable Wet FGD on Existing Coal Steam	
Ret.SNCR & DDryFGD	217	Retrofit SNCR and Dispatchable Dry FGD on Existing Coal Steam	
Ret.SNCR & DWetFGD	218	Retrofit SNCR and Dispatchable Wet FGD on Existing Coal Steam	
Ret.ExistSCR & DWetFGD & ACI & CCS	219	Retrofit ACI, CCS and Dispatchable Wet FGD on Existing Coal Steam with SCR	
Ret.ExistSCR & DWetFGD & CCS	220	Retrofit CCS and Dispatchable Wet FGD on Existing Coal Steam with SCR	
Ret.ExistSNCR & DWetFGD & ACI & CCS	221	Retrofit ACI, CCS and Dispatchable Wet FGD on Existing Coal Steam with SNCR	
Ret.ExistSNCR & DWetFGD & CCS	222	Retrofit CCS and Dispatchable Wet FGD on Existing Coal Steam with SNCR	
Ret.ExistWetFGD & ACI & DSCR & CCS	223	Retrofit ACI, CCS and Dispatchable SCR on Existing Coal Steam with Wet FGD	
Ret.ExistWetFGD & DSCR & CCS	224	Retrofit CCS and Dispatchable SCR on Existing Coal Steam with Wet FGD	

Appendix 4-2: Abbreviations Appearing in Model Plant Naming

Abbreviation	**Definition**
IGCC	Integrated Gasification Combined Cycle
PV	Photovoltaic
ACI	Activated Carbon Injection
FGD	Flue gas desulfurization
SCR	Selective Catalytic Reduction
SNCR	Selective Non Catalytic Reduction
DSCR, DSNCR, DFGD,	The "D" before any of the listed control technologies indicates "dispatchable". Dispatchable indicates that no capital cost are associated with the retrofit due to it already being installed at the plant
CC	Combined Cycle
CT	Combustion Turbine
CCS	Carbon Capture & Storage
Ret	Retrofit
Exist	Existing