VOLUME 6:

INTEGRATED RESOURCE ANALYSIS

KCP&L GREATER MISSOURI OPERATIONS COMPANY (GMO)

INTEGRATED RESOURCE PLAN

CASE NO. EE-2009-0237

4 CSR 240-22.060

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

INDEX OF RULES COMPLIANCE

VOLUME 6: INTEGRATED RESOURCE ANALYSIS

PURPOSE: This rule requires the utility to design alternative resource plans to meet the planning objectives identified in 4 CSR 240-22.010(2) and sets minimum standards for the scope and level of detail required in resource plan analysis, and for the logically consistent and economically equivalent analysis of alternative resource plans.

SECTION 1: RESOURCE PLANNING OBJECTIVES

(1) Resource Planning Objectives. The utility shall design alternative resource plans to satisfy at least the objectives and priorities identified in 4 CSR 240-22.010(2). The utility may identify additional planning objectives that alternative resource plans will be designed to serve.

Twenty-four alternative resource plans were devised to analyze several levels of supply-side resources that included base load generation and renewable resource inclusion, peak-load generation, varying levels of demand-side resources, and retirement scenarios. As required by Rule 22.010(2), demand-side resources were analyzed on an equivalent basis with supply-side resources, and the net present value of each plan was used as the criteria for determination of the preferred plan.

SECTION 2: PERFORMANCE MEASURES

(2) Specification of Performance Measures. The utility shall specify a set of quantitative measures for assessing the performance of alternative resource plans with respect to identified planning objectives. These measures shall include at least the following: present worth of utility revenue requirements, present worth of probable environmental costs, present worth of out-of-pocket costs to participants in demand-side programs, levelized annual average rates and maximum single-year increase in annual average rates. All present worth and levelization calculations shall use the utility discount rate and all costs and benefits shall be expressed in nominal dollars. Utility decision-makers may also specify other measures that they believe are appropriate for assessing the performance of resource plans relative to the planning objectives identified in 4 CSR 240-22.010(2)

GMO has calculated a 20-year net present value of the revenue requirement estimate of the individual plans.

The present worth of probable environmental costs are calculated by taking an individual plan and running it through the decision tree detailed in Volume 7, Risk Analysis and Strategy Selection, Section 4. The same plan then has each of its supply components adjusted for the cost of additional environmental compliance and run through the same decision tree. The outcomes of each branch of the tree are compared.

The present worth of out-of-pocket costs to participants in DSM programs can be viewed in Volume 5, Demand-Side Analysis, Section 11. A table entitled "Participation Costs" for each of the fifteen DSM programs are shown in this section.

SECTION 3: ALTERNATIVE RESOURCE PLANS

(3) Development of Alternative Resource Plans. The utility shall use appropriate combinations of candidate demand-side and supply-side resources to develop a set of alternative resource plans, each of which is designed to achieve one (1) or more of the planning objectives identified in 4 CSR 240-22.010(2). The alternative resource plans developed at this stage of the analysis shall not include load-building programs, which shall be analyzed as required by section (5) of this rule.

Alternative resource plans were developed using a combination of various capacities of supply-side resources, demand-side resources, biomass retrofit and differing the timing of resource additions Note that Plans 7 through 11 include retiring Sibley Units 1&2 by 2015. In total, twenty-four alternative resource plans were developed for the integrated resource analysis and are shown in Table 1 through Table 24 below:

Table 1: Alternative Resource Plan 1

	Plan 1: Install Prop C Wind and Solar, CT's, and All DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0				31.8
2011	0	1.79			64.1
2012	0	0.03			89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	0	0.05			127.3
2016	0	0.11	100		131.7
2017	0	0.08			134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	154	0.24			144.4
2023	0	0.24	100		144.2
2024	0	0.32			143.8
2025	0	0.26			141.1
2026	0	0.32			138.3
2027	154	0.32			135.3
2028	0	0.35			131.2
2029	0	0.25			126.7

Table 2: Alternative Resource Plan 2

	Plan 2: Install Prop C Wind and Solar, CT's, and No DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				0
2010	0				0
2011	0	1.79			0
2012	0	0.03			0
2013	0	0.02			0
2014	154	2.80			0
2015	0	0.05			0
2016	0	0.11	100		0
2017	0	0.08			0
2018	0	5.02	100		0
2019	0	0.15			0
2020	0	0.20			0
2021	0	5.33	100		0
2022	154	0.24			0
2023	0	0.24	100		0
2024	0	0.32			0
2025	0	0.26			0
2026	0	0.32			0
2027	154	0.32			0
2028	0	0.35			0
2029	0	0.25			0

Table 3: Alternative Resource Plan 3

	Plan 3: Install Prop C Wind and Solar, CT's, Additional 200 MW Wind Above Prop C beginning in 2017, and All DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0				31.8
2011	0	1.79			64.1
2012	0	0.03			89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	0	0.05			127.3
2016	0	0.11	100		131.7
2017	0	0.08		100	134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	154	0.24			144.4
2023	0	0.24	100		144.2
2024	0	0.32		100	143.8
2025	0	0.26			141.1
2026	0	0.32			138.3
2027	154	0.32			135.3
2028	0	0.35			131.2
2029	0	0.25			126.7

Table 4: Alternative Resource Plan 4

	Plan 4: Install Prop C Wind and Solar, CT's, Additional 100 MW Wind Above Prop C beginning in 2014, and No DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				0.0
2010	0				0.0
2011	0	1.79			0.0
2012	0	0.03			0.0
2013	0	0.02			0.0
2014	0	2.80		100	0.0
2015	154	0.05			0.0
2016	0	0.11	100		0.0
2017	0	0.08			0.0
2018	0	5.02	100		0.0
2019	0	0.15			0.0
2020	0	0.20			0.0
2021	0	5.33	100		0.0
2022	0	0.24			0.0
2023	154	0.24	100		0.0
2024	0	0.32			0.0
2025	0	0.26			0.0
2026	0	0.32			0.0
2027	154	0.32			0.0
2028	0	0.35			0.0
2029	0	0.25			0.0

Table 5: Alternative Resource Plan 5

	Plan 5: Install Prop C Wind and Solar, CT's, All DSM, 100% Biomass CFB (less Prop C Wind Needed Due to 100% Biomass CFB)					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	100% Biomass	All DSM
2009	0					5.9
2010	0					31.8
2011	0	1.79				64.1
2012	0	0.03				89.4
2013	0	0.02				109.4
2014	0	2.80				122.9
2015	0	0.05				127.3
2016	0	0.11			50	131.7
2017	0	0.08				134.9
2018	0	5.02	100			138.6
2019	0	0.15				142.0
2020	0	0.20				143.4
2021	0	5.33	100			144.3
2022	0	0.24				144.4
2023	154	0.24	100			144.2
2024	0	0.32				143.8
2025	0	0.26				141.1
2026	0	0.32				138.3
2027	154	0.32				135.3
2028	0	0.35				131.2
2029	0	0.25				126.7

Table 6: Alternative Resource Plan 6

	Plan 6: Install Prop C Wind and Solar, CT's, All DSM, and Sibley 1&2 converted to using 10% biomass				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0				31.8
2011	0	1.79			64.1
2012	0	0.03			89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	0	0.05			127.3
2016	0	0.11	100		131.7
2017	0	0.08			134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	154	0.24			144.4
2023	0	0.24	100		144.2
2024	0	0.32			143.8
2025	0	0.26			141.1
2026	0	0.32			138.3
2027	154	0.32			135.3
2028	0	0.35			131.2
2029	0	0.25			126.7

Table 7: Alternative Resource Plan 7

	Plan 7: Retire Sibley 1&2, Install Prop C Wind and Solar, CT's, and All DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0				31.8
2011	0	1.79			64.1
2012	0	0.03			89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	154	0.05			127.3
2016	0	0.11	100		131.7
2017	0	0.08			134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	0	0.24			144.4
2023	0	0.24	100		144.2
2024	154	0.32			143.8
2025	0	0.26			141.1
2026	0	0.32			138.3
2027	0	0.32			135.3
2028	154	0.35			131.2
2029	0	0.25			126.7

Table 8: Alternative Resource Plan 8

	Plan 8: Retire 108 MW Coal, Install Prop C Wind and Solar, CT's, and No DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				0
2010	0				0
2011	0	1.79			0
2012	0	0.03			0
2013	0	0.02			0
2014	154	2.80			0
2015	0	0.05			0
2016	0	0.11	100		0
2017	154	0.08			0
2018	0	5.02	100		0
2019	0	0.15			0
2020	0	0.20			0
2021	0	5.33	100		0
2022	0	0.24			0
2023	0	0.24	100		0
2024	154	0.32			0
2025	0	0.26			0
2026	0	0.32			0
2027	0	0.32			0
2028	154	0.35			0
2029	0	0.25			0

Table 9: Alternative Resource Plan 9

Plan 9: Retire 108 MW Coal, Install Prop C Wind and Solar, CT's, Additional 200 MW Wind Above Prop C beginning in 2017, and All DSM					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0				31.8
2011	0	1.79			64.1
2012	0	0.03			89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	154	0.05			127.3
2016	0	0.11	100		131.7
2017	0	0.08		100	134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	0	0.24			144.4
2023	0	0.24	100		144.2
2024	0	0.32		100	143.8
2025	154	0.26			141.1
2026	0	0.32			138.3
2027	0	0.32			135.3
2028	154	0.35			131.2
2029	0	0.25			126.7

Table 10: Alternative Resource Plan 10

Plan 10: Retire 108 MW Coal, Install Prop C Wind and Solar, CT's, Additional 100 MW Wind Above Prop C beginning in 2014, and No DSM					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				0
2010	0				0
2011	0	1.79			0
2012	0	0.03			0
2013	0	0.02			0
2014	0	2.80		100	0
2015	154	0.05			0
2016	0	0.11	100		0
2017	154	0.08			0
2018	0	5.02	100		0
2019	0	0.15			0
2020	0	0.20			0
2021	0	5.33	100		0
2022	0	0.24			0
2023	0	0.24	100		0
2024	0	0.32			0
2025	154	0.26			0
2026	0	0.32			0
2027	0	0.32			0
2028	0	0.35			0
2029	154	0.25			0

Table 11: Alternative Resource Plan 11

	Plan 11: Retire 108 MW Coal, Install Prop C Wind and Solar, CT's, All DSM, 100% Biomass					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	100% Biomass	All DSM
2009	0					5.9
2010	0					31.8
2011	0	1.79				64.1
2012	0	0.03				89.4
2013	0	0.02				109.4
2014	0	2.80				122.9
2015	0	0.05			50	127.3
2016	0	0.11				131.7
2017	154	0.08				134.9
2018	0	5.02	100			138.6
2019	0	0.15				142.0
2020	0	0.20				143.4
2021	0	5.33	100			144.3
2022	0	0.24				144.4
2023	0	0.24	100			144.2
2024	0	0.32				143.8
2025	154	0.26				141.1
2026	0	0.32				138.3
2027	0	0.32				135.3
2028	0	0.35				131.2
2029	154	0.25				126.7

Table 12: Alternative Resource Plan 12

	Plan 12: Install Prop C Wind and Solar, CT's, Additional 400 MW Wind Above Prop C beginning in 2017, and All DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0.0				5.9
2010	0.0				31.8
2011	0.0	1.8			64.1
2012	0.0	0.0			89.4
2013	0.0	0.0			109.4
2014	0.0	2.8			122.9
2015	0.0	0.0			127.3
2016	0.0	0.1	100		131.7
2017	0.0	0.1		100	134.9
2018	0.0	5.0	100		138.6
2019	0.0	0.2		100	142.0
2020	0.0	0.2		100	143.4
2021	0.0	5.3	100		144.3
2022	0.0	0.2			144.4
2023	0.0	0.2	100		144.2
2024	154.0	0.3		100	143.8
2025	0.0	0.3			141.1
2026	0.0	0.3			138.3
2027	0.0	0.3			135.3
2028	154.0	0.3			131.2
2029	0.0	0.2			126.7

Table 13: Alternative Resource Plan 13

Plan 13: Install Prop C Wind and Solar, CT's, Coal w/CCS, and All DSM						
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	Coal with CCS	All DSM
2009	0					5.9
2010	0					31.8
2011	0	1.79				64.1
2012	0	0.03				89.4
2013	0	0.02				109.4
2014	0	2.80				122.9
2015	0	0.05				127.3
2016	0	0.11	100			131.7
2017	0	0.08				134.9
2018	0	5.02	100			138.6
2019	0	0.15				142.0
2020	0	0.20			150	143.4
2021	0	5.33	100			144.3
2022	0	0.24				144.4
2023	0	0.24	100			144.2
2024	0	0.32				143.8
2025	0	0.26				141.1
2026	0	0.32				138.3
2027	154	0.32				135.3
2028	0	0.35				131.2
2029	0	0.25				126.7

Table 14: Alternative Resource Plan 14

	Plan 14: Install Prop C Wind and Solar, CT's, Additional 400 MW Wind Above Prop C beginning in 2016, and All DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0				31.8
2011	0	1.79			64.1
2012	0	0.03			89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	0	0.05			127.3
2016	0	0.11	100	100	131.7
2017	0	0.08		200	134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	0	0.24			144.4
2023	0	0.24	100		144.2
2024	154	0.32		100	143.8
2025	0	0.26			141.1
2026	0	0.32			138.3
2027	0	0.32			135.3
2028	154	0.35			131.2
2029	0	0.25			126.7

Table 15: Alternative Resource Plan 15

	Plan 15: Install Prop C Wind and Solar, CT's, Additional 400 MW Wind Above Prop C beginning in 2017, and DSM only comprised of Existing DSM				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	Existing DSM
2009	0				1.3
2010	0				3.0
2011	0	1.79			4.7
2012	0	0.03			6.2
2013	0	0.02			6.2
2014	0	2.80			6.2
2015	154	0.05			6.2
2016	0	0.11	100		6.2
2017	0	0.08		100	6.2
2018	0	5.02	100		6.2
2019	0	0.15		100	6.2
2020	0	0.20		100	6.2
2021	0	5.33	100		6.2
2022	0	0.24			6.2
2023	0	0.24	100		6.2
2024	0	0.32		100	6.2
2025	154	0.26			6.2
2026	0	0.32			6.2
2027	0	0.32			6.2
2028	0	0.35			6.2
2029	154	0.25			6.2

Table 16: Alternative Resource Plan 16

	Plan 16: Install Prop C Wind and Solar, CT's, Additional 400 MW Wind Above Prop C beginning in 2017, and DSM at 1% of retail energy level				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	1% DSM
2009	0				
2010	0				45
2011	0	1.79			90
2012	0	0.03			127
2013	0	0.02			160
2014	0	2.80			188
2015	0	0.05			214
2016	0	0.11	100		241
2017	0	0.08		100	268
2018	0	5.02	100		296
2019	0	0.15		100	324
2020	0	0.20		100	330
2021	0	5.33	100		336
2022	0	0.24			342
2023	0	0.24	100		348
2024	0	0.32		100	354
2025	0	0.26			361
2026	0	0.32			367
2027	0	0.32			374
2028	0	0.35			381
2029	0	0.25			388

Table 17: Alternative Resource Plan 17

Plan 17: Install Prop C Wind and Solar, CT's, Additional 400 MW Wind Above Prop C beginning in 2012, and All DSM					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0				31.8
2011	0	1.79			64.1
2012	0	0.03		100	89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	0	0.05			127.3
2016	0	0.11	100	100	131.7
2017	0	0.08		200	134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	0	0.24			144.4
2023	0	0.24	100		144.2
2024	0	0.32		100	143.8
2025	154	0.26			141.1
2026	0	0.32			138.3
2027	0	0.32			135.3
2028	154	0.35			131.2
2029	0	0.25			126.7

Table 18: Alternative Resource Plan 18

Plan 18: Install Prop C Wind and Solar, CT's, Additional 500 MW Wind Above Prop C beginning in 2010, and All DSM					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0			100	31.8
2011	0	1.79			64.1
2012	0	0.03			89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	0	0.05			127.3
2016	0	0.11	100	100	131.7
2017	0	0.08		200	134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	0	0.24			144.4
2023	0	0.24	100		144.2
2024	0	0.32		100	143.8
2025	154	0.26			141.1
2026	0	0.32			138.3
2027	0	0.32			135.3
2028	154	0.35			131.2
2029	0	0.25			126.7

Table 19: Alternative Resource Plan 19

Plan 19: Install Prop C Wind and Solar, CT's, Additional 500 MW Wind Above Prop C beginning in 2010, All DSM, and Sibley 1&2 converted to using 10% biomass usage					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0			100	31.8
2011	0	1.79			64.1
2012	0	0.03			89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	0	0.05			127.3
2016	0	0.11	100	100	131.7
2017	0	0.08		200	134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	0	0.24			144.4
2023	0	0.24	100		144.2
2024	0	0.32		100	143.8
2025	154	0.26			141.1
2026	0	0.32			138.3
2027	0	0.32			135.3
2028	154	0.35			131.2
2029	0	0.25			126.7

Table 20: Alternative Resource Plan 20

Plan 20: Install Prop C Wind and Solar, CT's, Additional 500 MW Wind Above Prop C beginning in 2010, All DSM, and Coal w/CCS						
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	Coal with CCS	All DSM
2009	0					5.9
2010	0			100		31.8
2011	0	1.79				64.1
2012	0	0.03				89.4
2013	0	0.02				109.4
2014	0	2.80				122.9
2015	0	0.05				127.3
2016	0	0.11	100	100		131.7
2017	0	0.08		200		134.9
2018	0	5.02	100			138.6
2019	0	0.15				142.0
2020	0	0.20			150	143.4
2021	0	5.33	100			144.3
2022	0	0.24				144.4
2023	0	0.24	100			144.2
2024	0	0.32		100		143.8
2025	0	0.26				141.1
2026	0	0.32				138.3
2027	0	0.32				135.3
2028	154	0.35				131.2
2029	0	0.25				126.7

Table 21: Alternative Resource Plan 21

Plan 21: Install Prop C Wind and Solar, CT's, Additional 500 MW Wind Above Prop C beginning in 2010, All DSM, Coal w/CCS, and Sibley 1&2 converted to 10% biomass usage						
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	Coal with CCS	All DSM
2009	0					5.9
2010	0			100		31.8
2011	0	1.79				64.1
2012	0	0.03				89.4
2013	0	0.02				109.4
2014	0	2.80				122.9
2015	0	0.05				127.3
2016	0	0.11	100	100		131.7
2017	0	0.08		200		134.9
2018	0	5.02	100			138.6
2019	0	0.15				142.0
2020	0	0.20			150	143.4
2021	0	5.33	100			144.3
2022	0	0.24				144.4
2023	0	0.24	100			144.2
2024	0	0.32		100		143.8
2025	0	0.26				141.1
2026	0	0.32				138.3
2027	0	0.32				135.3
2028	154	0.35				131.2
2029	0	0.25				126.7

Table 22: Alternative Resource Plan 22

	Plan 22: Install Prop C Wind and Solar, CT's, Additional 500 MW Wind Above Prop C beginning in 2012, All DSM, and Sibley 1&2 converted to 10% biomass usage				
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	All DSM
2009	0				5.9
2010	0				31.8
2011	0	1.79			64.1
2012	0	0.03		100	89.4
2013	0	0.02			109.4
2014	0	2.80			122.9
2015	0	0.05			127.3
2016	0	0.11	100	100	131.7
2017	0	0.08		200	134.9
2018	0	5.02	100		138.6
2019	0	0.15			142.0
2020	0	0.20			143.4
2021	0	5.33	100		144.3
2022	0	0.24			144.4
2023	0	0.24	100		144.2
2024	0	0.32		100	143.8
2025	154	0.26			141.1
2026	0	0.32			138.3
2027	0	0.32			135.3
2028	154	0.35			131.2
2029	0	0.25			126.7

Table 23: Alternative Resource Plan 23

	Plan 23: Install Prop C Wind and Solar, CT's, Additional 500 MW Wind Above Prop C beginning in 2012, All DSM, and Coal w/CCS					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	Coal with CCS	All DSM
2009	0					5.9
2010	0					31.8
2011	0	1.79				64.1
2012	0	0.03		100		89.4
2013	0	0.02				109.4
2014	0	2.80				122.9
2015	0	0.05				127.3
2016	0	0.11	100	100		131.7
2017	0	0.08		200		134.9
2018	0	5.02	100			138.6
2019	0	0.15				142.0
2020	0	0.20			150	143.4
2021	0	5.33	100			144.3
2022	0	0.24				144.4
2023	0	0.24	100			144.2
2024	0	0.32		100		143.8
2025	0	0.26				141.1
2026	0	0.32				138.3
2027	0	0.32				135.3
2028	154	0.35				131.2
2029	0	0.25				126.7

Table 24: Alternative Resource Plan 24

	Plan 24: Install Prop C Wind and Solar, CT's, Additional 500 MW Wind Above Prop C beginning in 2012, All DSM, Coal w/CCS, and Sibley 1&2 converted to 10% biomass usage					
Date	Install CT's	Install Solar	Install Prop C Wind	Install Other Wind	Coal with CCS	All DSM
2009	0					5.9
2010	0					31.8
2011	0	1.79				64.1
2012	0	0.03		100		89.4
2013	0	0.02				109.4
2014	0	2.80				122.9
2015	0	0.05				127.3
2016	0	0.11	100	100		131.7
2017	0	0.08		200		134.9
2018	0	5.02	100			138.6
2019	0	0.15				142.0
2020	0	0.20			150	143.4
2021	0	5.33	100			144.3
2022	0	0.24				144.4
2023	0	0.24	100			144.2
2024	0	0.32		100		143.8
2025	0	0.26				141.1
2026	0	0.32				138.3
2027	0	0.32				135.3
2028	154	0.35				131.2
2029	0	0.25				126.7

SECTION 4: ANALYSIS OF RESOURCE PLANS

(4) Analysis of Alternative Resource Plans. The utility shall assess the relative performance of the alternative resource plans by calculating for each plan the value of each performance measure specified pursuant to section (2). This calculation shall assume values for uncertain factors that are judged by utility decision-makers to be most likely. The analysis shall cover a planning horizon of at least twenty (20) years and shall be carried out with computer models that are capable of simulating the total operation of the system on a year-by-year basis in order to assess the cumulative impacts of alternative resource plans. These models shall be sufficiently detailed to accomplish the following tasks and objectives:

GMO has analyzed the Alternative Resource Plans incorporating critical uncertain factors identified from our preliminary risk analysis detailed in Volume 7, Section 2. All analysis covered at least twenty years and was conducted using a compute model that simulated year-by-year impacts.

4.1 FINANCIAL IMPACT

(A) The financial impact of alternative resource plans shall be modeled in sufficient detail to provide comparative estimates of at least the following measures of the utility's financial condition for each year of the planning horizon: pretax interest coverage, ratio of total debt to total capital and ratio of net cash flow to capital expenditures;

GMO analyzed the financial impact of the Alternative Resource Plans and comparatively estimated pretax interest coverage, ratio of total debt to total capital and ratio of cash flows to capital expenditures. The results of these analyses are plotted in Figure 66 through Figure 68 in the Reporting Requirements, Section 6 of this Volume.

4.2 ANNUALLY ADJUSTED RATES

(B) The modeling procedure shall be based on the assumption that rates will be adjusted annually, in a manner that is consistent with Missouri law. This provision does not imply any requirement for the utility to file actual rate cases or for the commission to accord any particular ratemaking treatment to actual costs incurred by the utility;

GMO utilized the MIDAS Software from Ventyx which simulates utility financial operation with the assumption of perfect annual rate making.

4.3 RATE ELASTICITY

(C) The modeling procedure shall include a method to ensure that the impact of changes in electric rates on future levels of demand for electric service is accounted for in the analysis; and

The methods by which electric rates impact future levels of demand is detailed in Volume 3.

4.4 DSM EQUIVALENCY

(D) The modeling procedure shall treat supply-side and demand-side resources on a logically consistent and economically equivalent basis. This means that the same types or categories of costs, benefits and risks shall be considered, and that these factors shall be quantified at a similar level of detail and precision for all resource types.

GMO utilized a method by which DSM costs are treated in a logically consistent manner with traditional supply-side resource costs. Both DSM and supply options were analyzed under identical risk assumptions.

SECTION 5: LOAD BUILDING PROGRAMS

(5) Analysis of Load-Building Programs. If the utility intends to continue existing load-building programs or implement new ones, it shall analyze these programs in the context of one (1) or more of the alternative plans developed pursuant to section (3) of this rule, including the preferred resource plan selected pursuant to 4 CSR 240-22.070(6). This analysis shall use the same modeling procedure and assumptions described in section (4) and shall include the following elements:

5.1 DEMAND IMPACT

(A) Estimation of the impact of load-building programs on the electric utility's summer and winter peak demands and energy usage;

GMO does not have any existing or proposed load-building programs.

5.2 RATE IMPACT

(B) A comparison of annual average rates in each year of the planning horizon for the resource plan with and without the load-building program;

GMO does not have any existing or proposed load-building programs.

5.3 PROBABLE ENVIRONMENTAL COST IMPACT

(C) A comparison of the probable environmental costs of the resource plan in each year of the planning horizon with and without the proposed load-building program; and

GMO does not have any existing or proposed load-building programs.

5.4 OTHER IMPACTS

(D) An assessment of any other aspects of the proposed load-building programs that affect the public interest.

GMO does not have any existing or proposed load-building programs.

SECTION 6: REPORTING REQUIREMENTS

(6) Reporting Requirements. To demonstrate compliance with the provisions of this rule, and pursuant to the requirements of 4 CSR 240-22.080, the utility shall prepare a report that contains at least the following information:

6.1 ALTERNATIVE PLANS

(A) A description of each alternative resource plan including the type and size of each resource addition and a listing of the sequence and schedule for retiring existing resources and acquiring each new resource addition;

Alternative resource plans were developed using a combination of various capacities of supply-side sources, demand-side resources and differing the timing of resource additions. In total, twenty-four alternative resource plans were developed for integrated resource analysis. Table 25 represent an overview of each plan over the 2009 through 2029 planning period.

Table 25: Overview of Alternative Resource Plans 1 - 24

	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6
DSM	All	None	All	None	All	All
Solar Begin: 2011	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C
Wind	400 MW Begin: 2016	400 MW Begin: 2016	600 MW Begin: 2016	500 MW Begin: 2014	300 MW Begin: 2018	400 MW Begin: 2016
Combustion Turbines	308 MW	462 MW	308 MW	462 MW	308 MW	308 MW
Combustion Fluidized Bed (100% Biomass)					50 MW	
Coal w/Carbon Capture and Sequestration						
10% Biomass Utilization in Existing Units						108 MW
Coal Retirement						
	Plan 7	**Plan 8**	**Plan 9**	**Plan 10**	**Plan 11**	**Plan 12**
DSM	All	None	All	None	All	All
Solar Begin: 2011	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C
Wind	400 MW Begin: 2016	400 MW Begin: 2016	600 MW Begin: 2016	500 MW Begin: 2014	300 MW Begin: 2018	800 MW Begin: 2016
Combustion Turbines	462 MW	616 MW	462 MW	616 MW	462 MW	308 MW
Combustion Fluidized Bed (100% Biomass)					50 MW	
Coal w/Carbon Capture and Sequestration						
10% Biomass Utilization in Existing Units						
Coal Retirement	108 MW	108 MW	108 MW	108 MW	108 MW	
	Plan 13	**Plan 14**	**Plan 15**	**Plan 16**	**Plan 17**	**Plan 18**
DSM	All	All	Existing	1%	All	All
Solar Begin: 2011	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C
Wind	400 MW Begin: 2016	800 MW Begin: 2016	800 MW Begin: 2016	800 MW Begin: 2016	900 MW Begin: 2012	900 MW Begin: 2010
Combustion Turbines	154 MW	308 MW	462 MW	0	308 MW	308 MW
Combustion Fluidized Bed (100% Biomass)						
Coal w/Carbon Capture and Sequestration	150 MW					
10% Biomass Utilization in Existing Units						
Coal Retirement						
	Plan 19	**Plan 20**	**Plan 21**	**Plan 22**	**Plan 23**	**Plan 24**
DSM	All	All	All	All	All	All
Solar Begin: 2011	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C	Mo. Prop C
Wind	900 MW Begin: 2010	900 MW Begin: 2010	900 MW Begin: 2010	900 MW Begin: 2012	900 MW Begin: 2012	900 MW Begin: 2012
Combustion Turbines	308 MW	154 MW	154 MW	308 MW	154 MW	154 MW
Combustion Fluidized Bed (100% Biomass)						
Coal w/Carbon Capture and Sequestration		150 MW	150 MW		150 MW	150 MW
10% Biomass Utilization in Existing Units	108 MW		108 MW	108 MW		108 MW
Coal Retirement						
Note: Combustion Turbines Not Needed Until 2022 Unless No DSM or Sibley 1&2 Retired						

Charts that describe each alternative resource plan including the amounts and timing of resource additions are shown in Table 1 through Table 24 in Section 3: above.

6.2 PERFORMANCE SUMMARY

(B) A summary tabulation that shows the performance of each alternative resource plan as measured by each of the measures specified in section (2) of this rule;

6.3 ALTERNATIVE PLAN PLOTS

(C) For each alternative resource plan, a plot of each of the following over the planning horizon:

6.3.1 DSM IMPACT

1. The combined impact of all demand-side resources on the base-case forecast of summer and winter peak demands;

Existing and proposed demand-side resources are comprised of demand response programs, residential energy efficiency programs, and commercial and industrial programs. The estimated impacts of these programs on the base-case forecast of winter and summer demand for Alternative Resource Plans 1, 3, 5, 6, 7, 9, 11, 12, 13, 14, 17 through 24 are provided in Figure 1 and Figure 2 below:

Figure 1: Winter Demand Impact From All Existing and Proposed DSM Programs

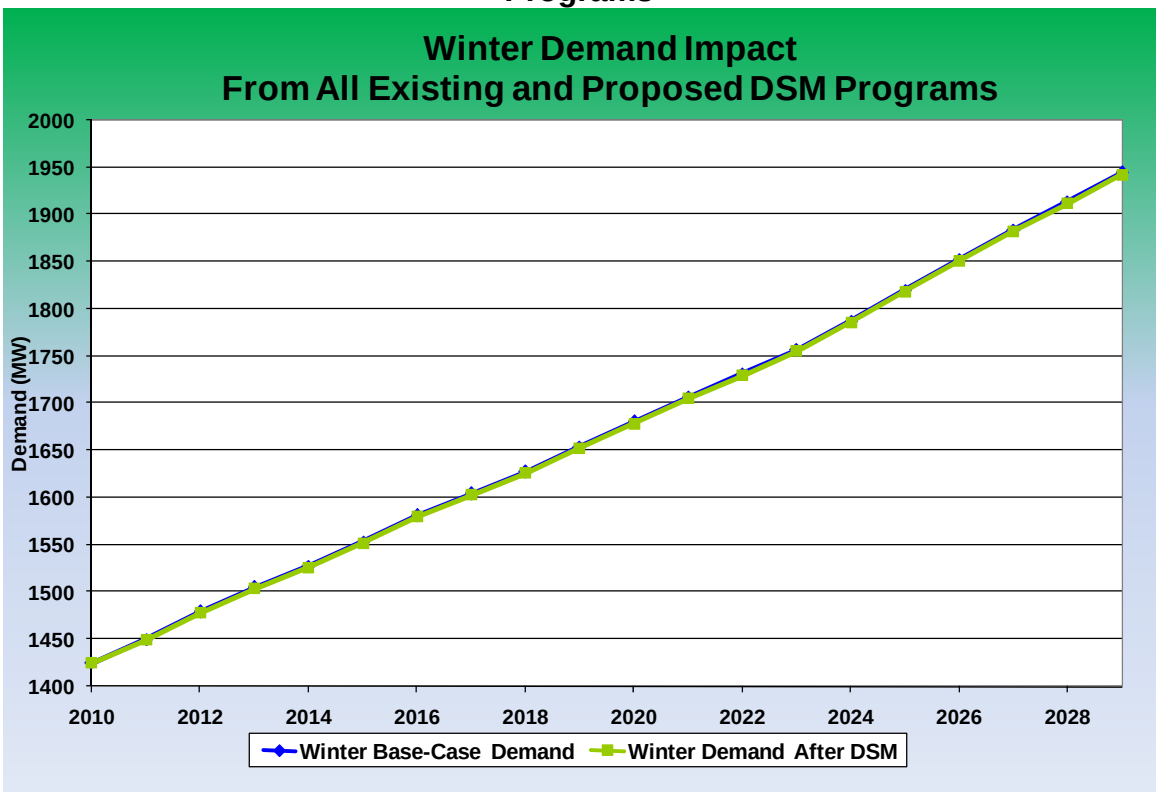
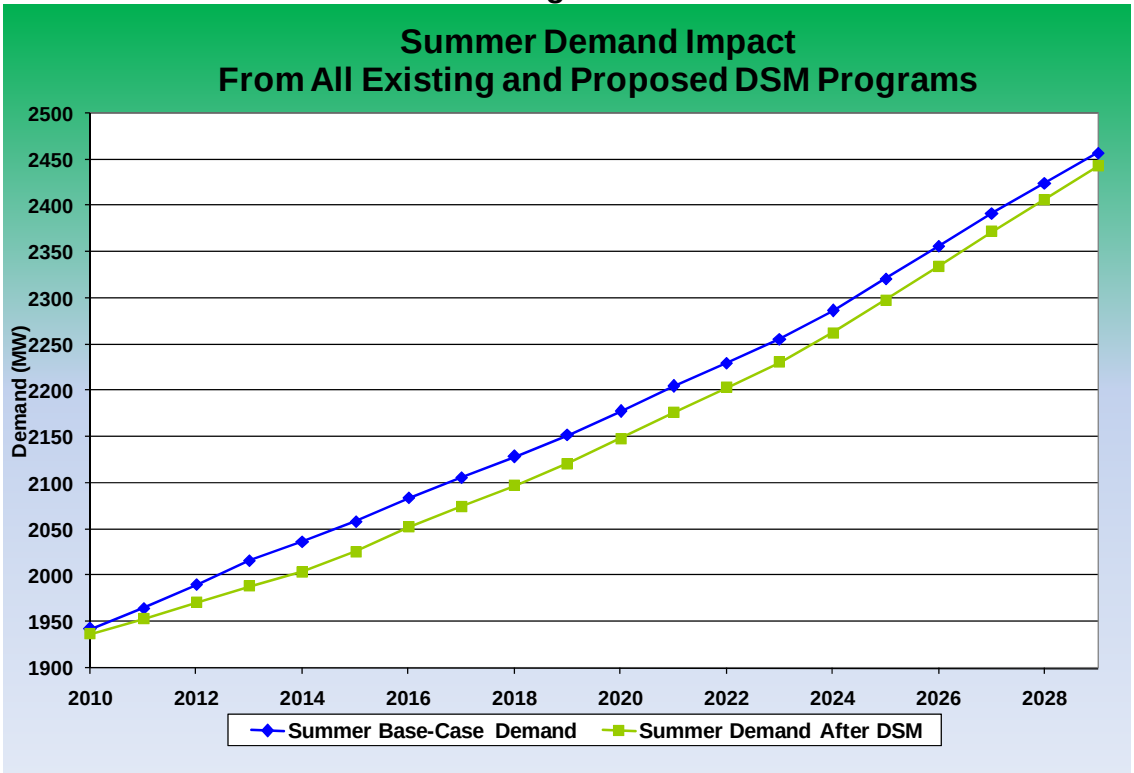


Figure 2: Summer Demand Impact From All Existing and Proposed DSM Programs



Alternative Resource Plan 15 is comprised of existing DSM programs only. The estimated impacts of the existing programs on the base-case forecast of winter and summer demand for Alternative Resource Plan 15 is provided in Figure 3 and Figure 4 below:

Figure 3: Winter Demand Impact From Existing DSM Programs

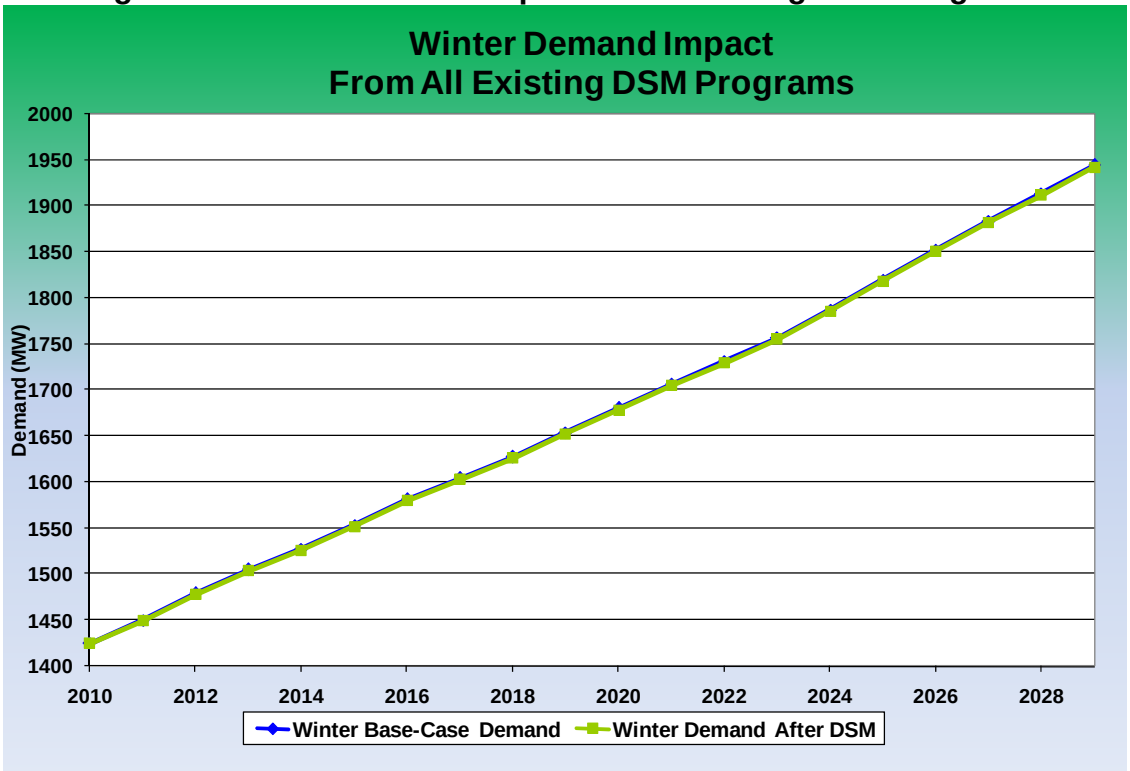
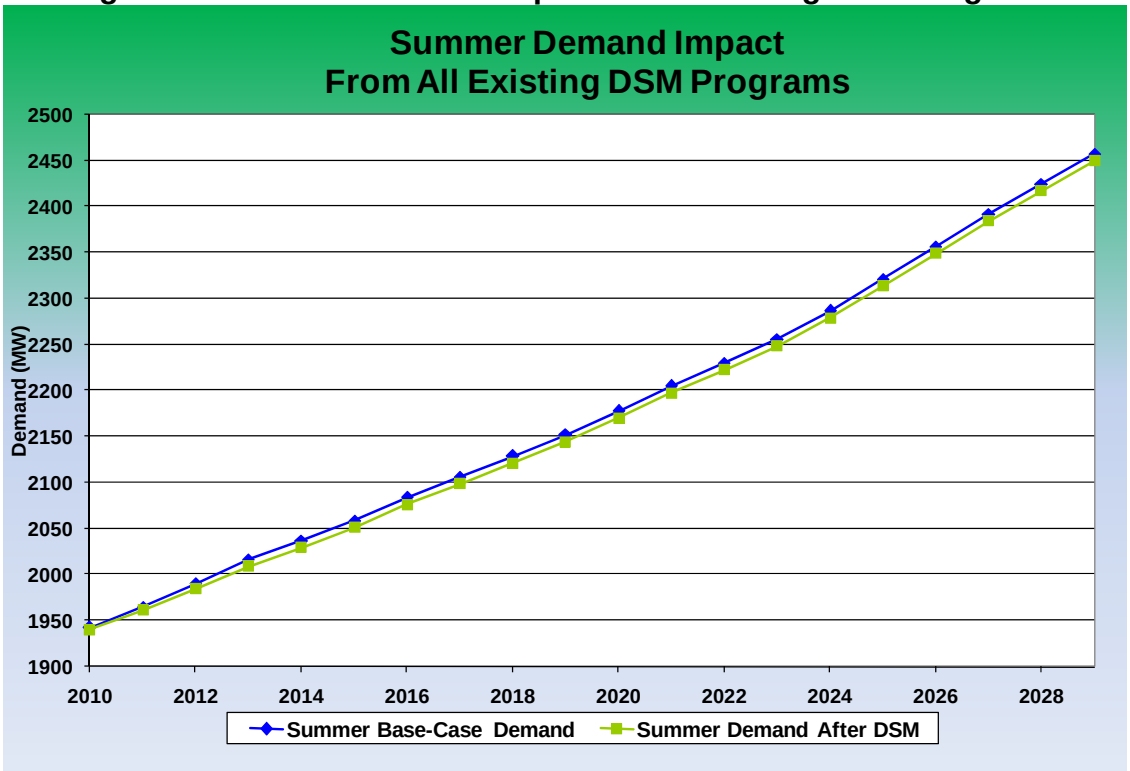


Figure 4: Summer Demand Impact From Existing DSM Programs



Alternative Resource Plan 16 was a hypothetical case of estimating DSM programs to correspond to 1% of retail energy sales. The estimated impact of this level of hypothetical demand response and energy efficiency programs on the base-case forecast of winter and summer demand is provided in below:

Figure 5: Winter Demand Impact From Hypothetical 1% Case

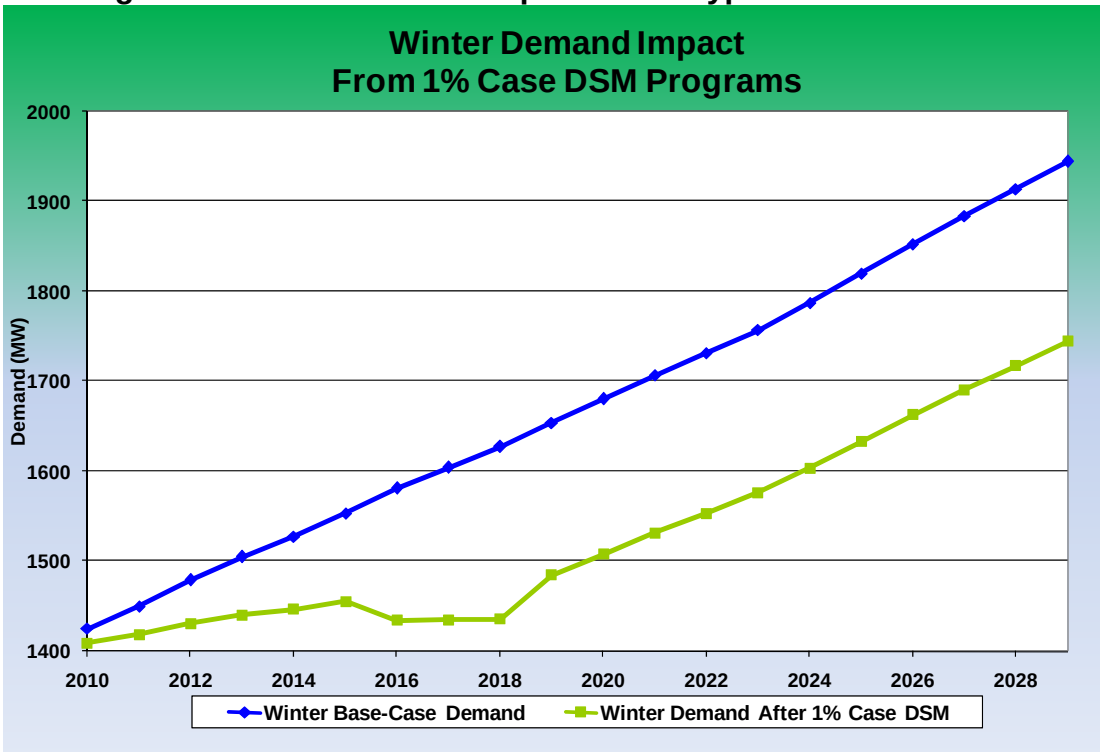
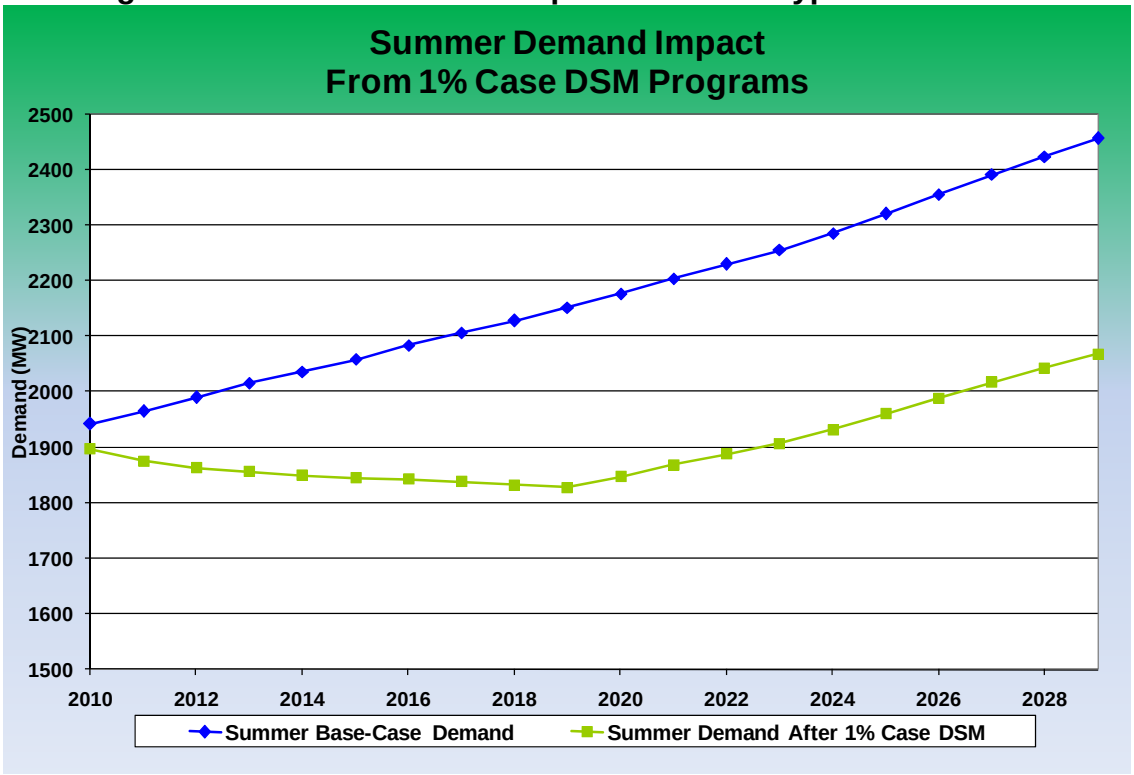


Figure 6: Summer Demand Impact From 1% Hypothetical Case



It should be noted that Alternative Resource Plans 2, 4, 8, and 10 did not include DSM programs and therefore no figures representing demand-side resources were provided for these four Plans.

Note that the tabular data that created Figure 1 through Figure 6 above are provided on the work paper disc in an Excel file entitled “Rule 060 6(C)1 Winter Summer Peak and Energy Impacts.xls”

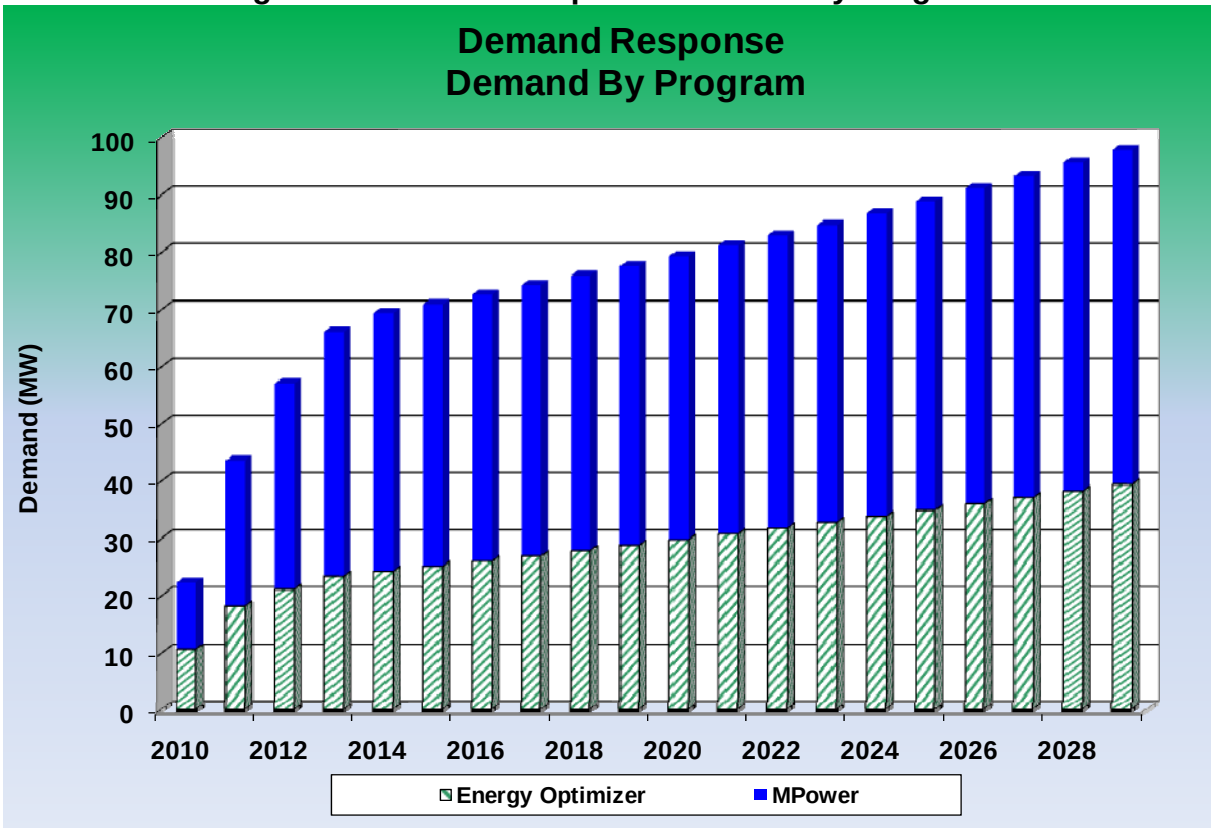
6.3.2 DSM PROGRAMS

2. The composition, by program, of the capacity provided by demand-side resources;

Each demand-side management (DSM) program is categorized as one of four types: Demand Response, Existing Residential Energy Efficiency, Proposed Residential Energy Efficiency, and Proposed Commercial and Industrial Energy Efficiency. The

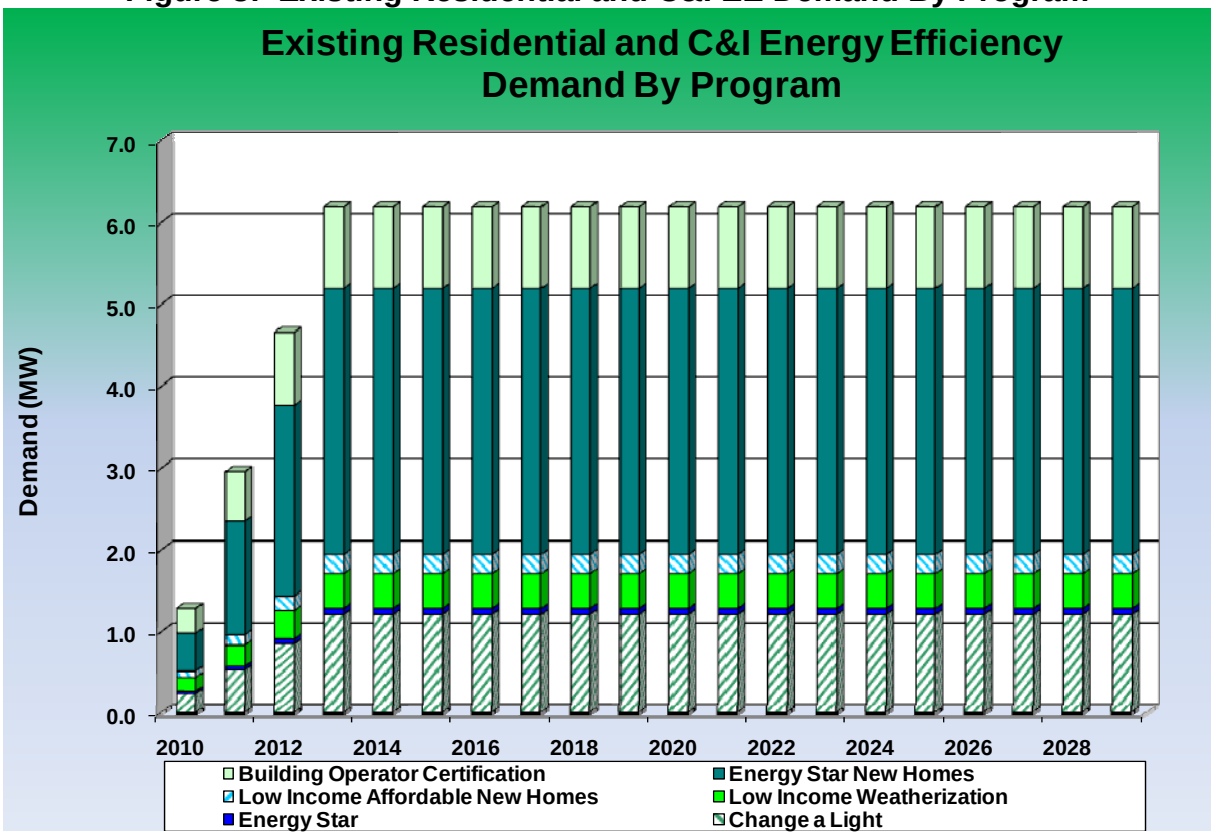
estimated capacity provided by each program is shown in Figure 7 through Figure 10 below:

Figure 7: Demand Response Demand By Program



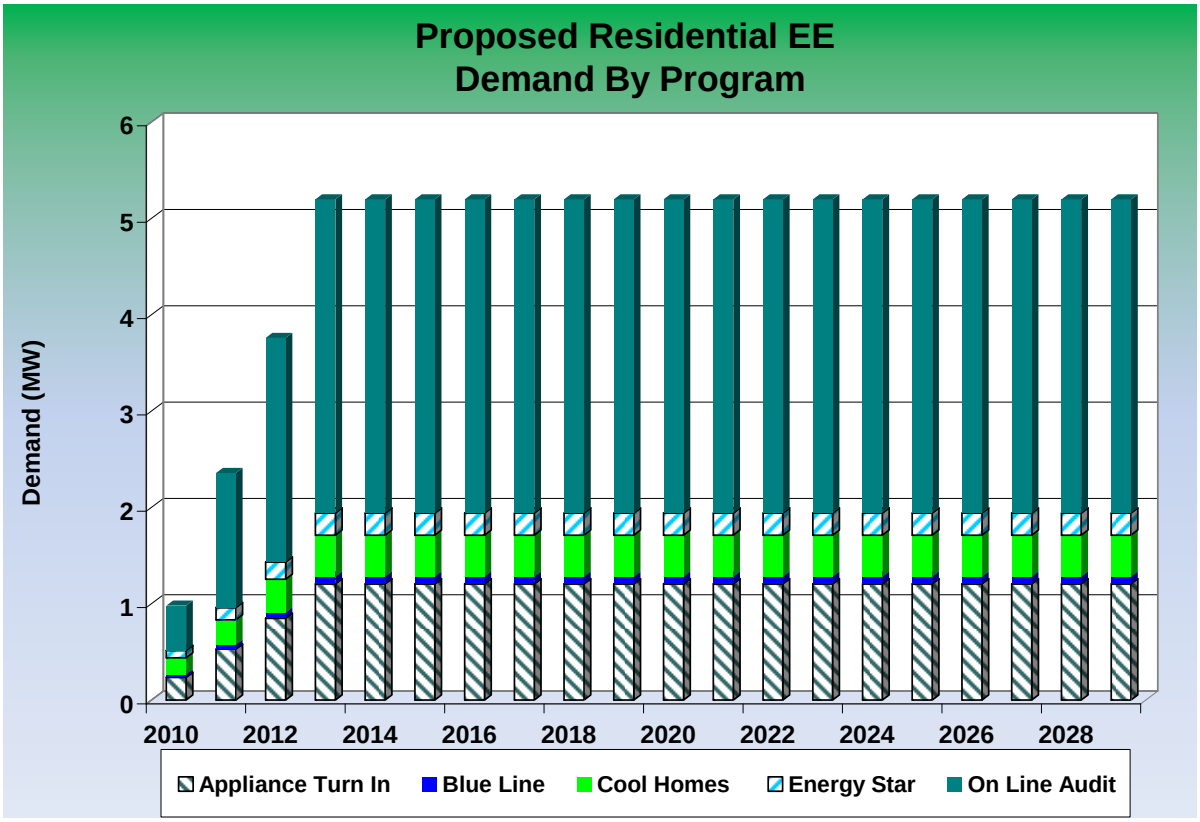
Note that the tabular data that created the above Figure 7 is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)5 Demand Response Capacity And Energy By Program.xls”

Figure 8: Existing Residential and C&I EE Demand By Program



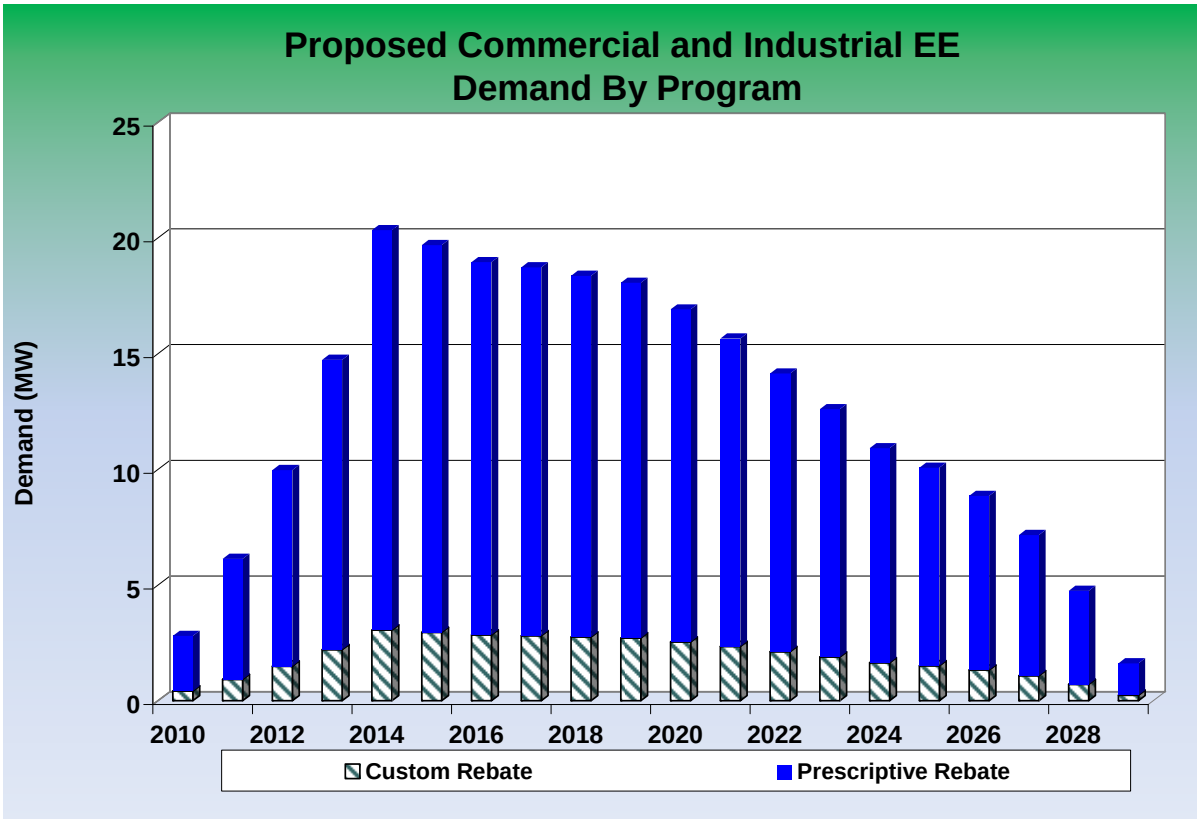
Note that the tabular data that created the above Figure 8 is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)5 Existing Residential and C and I EE Capacity And Energy By Program.xls”

Figure 9: Proposed Residential EE Demand By Program



Note that the tabular data that created the above Figure 9 is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)5 Proposed Residential EE Capacity And Energy By Program.xls”

Figure 10: Proposed Commercial and Industrial EE Demand By Program



Note that the tabular data that created the above Figure 10 is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)5 Proposed C and I EE Capacity And Energy By Program.xls”

6.3.3 SUPPLY RESOURCES

3. The composition, by supply resource, of the capacity (including reserve margin) provided by supply resources. Existing supply-side resources may be shown as a single resource;

The supply-side composition for each of the twenty-four alternative resource plans are shown in Figure 11 through Figure 28 below:

Figure 11: Alternative Resource Plan 1: Supply-Side Capacity

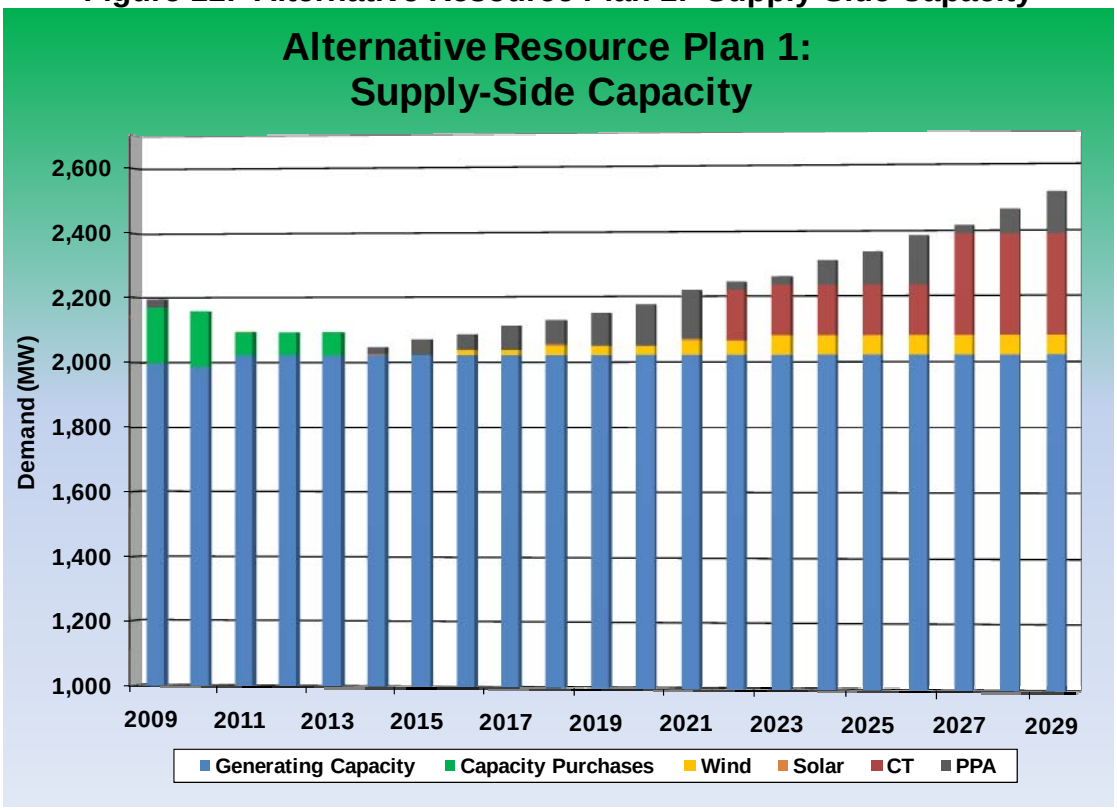


Figure 12: Alternative Resource Plan 2: Supply-Side Capacity

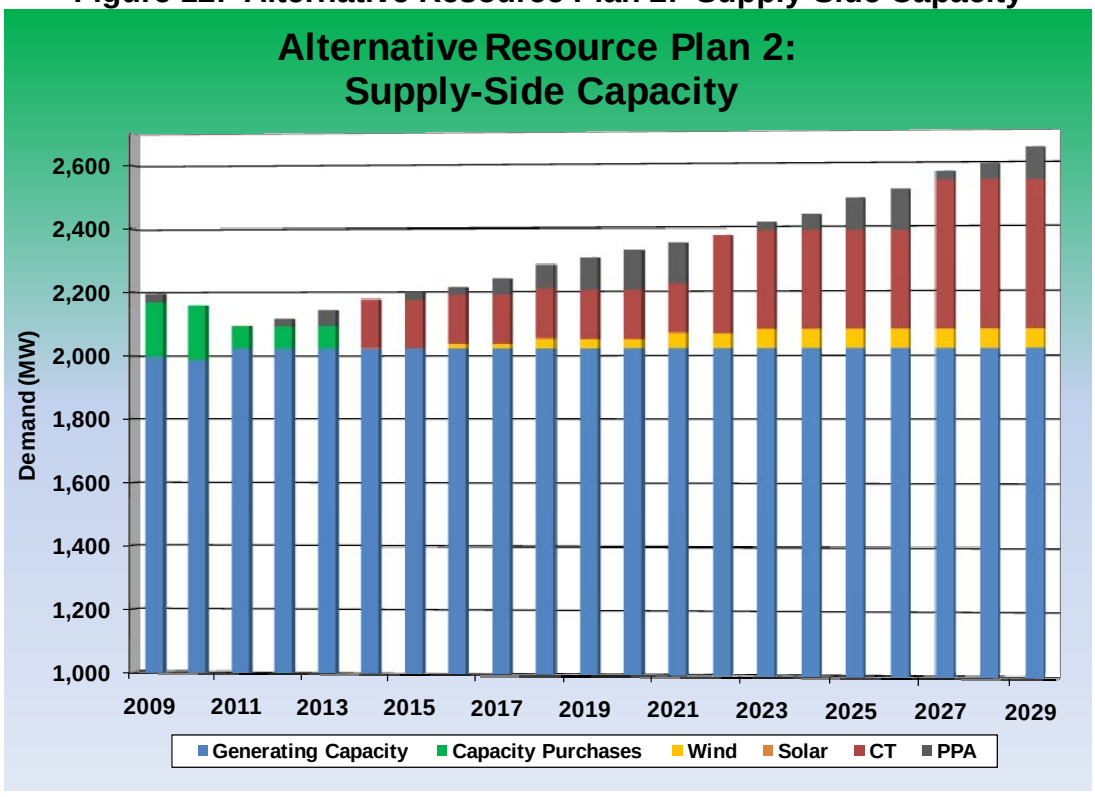


Figure 13: Alternative Resource Plan 3: Supply-Side Capacity

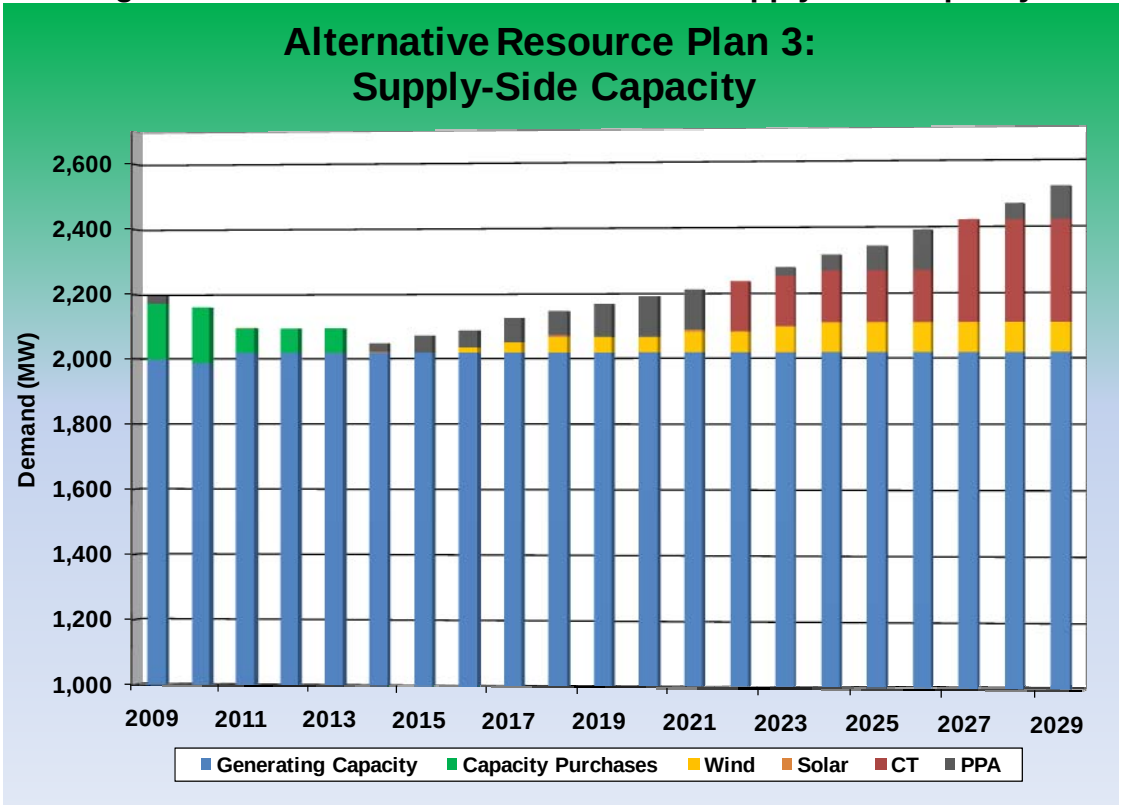


Figure 14: Alternative Resource Plan 4: Supply-Side Capacity

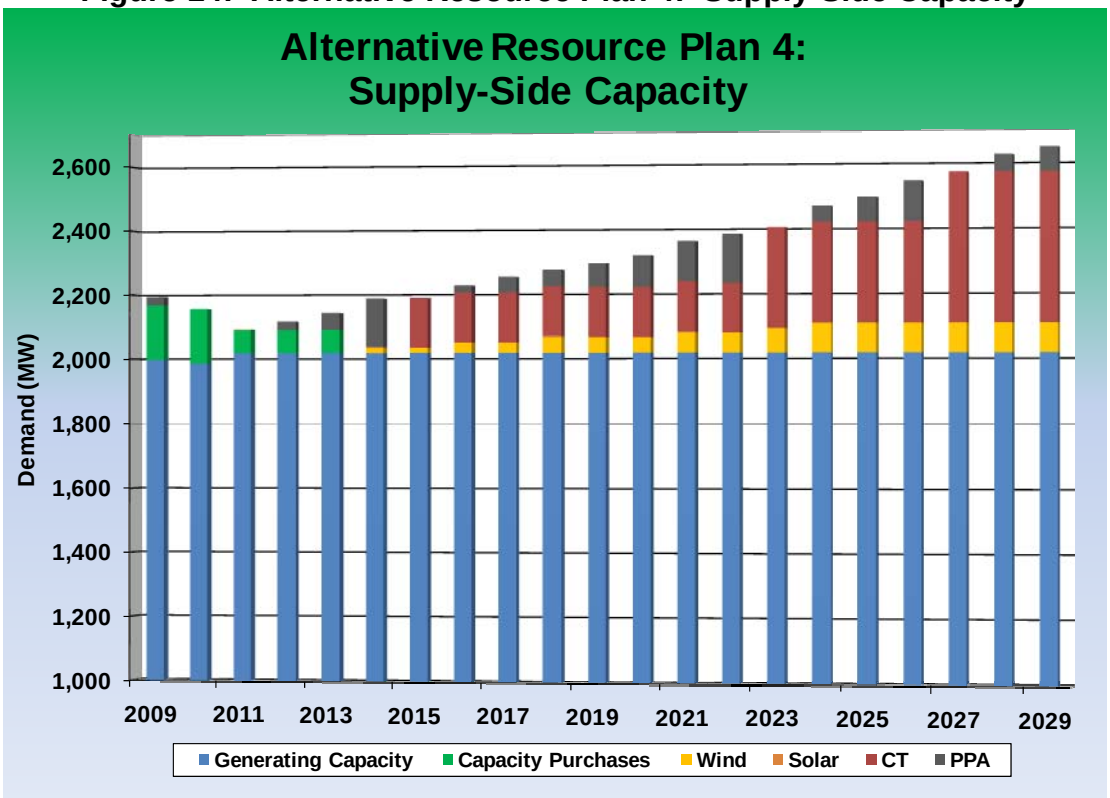


Figure 15: Alternative Resource Plan 5: Supply-Side Capacity

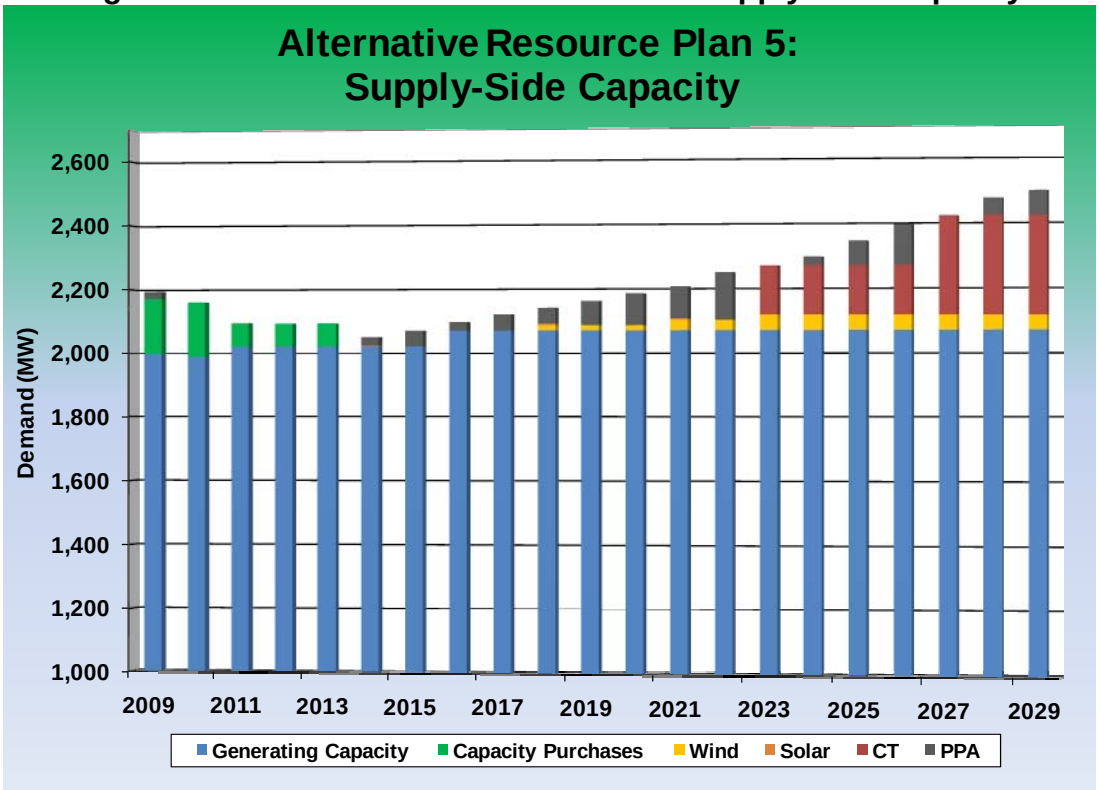


Figure 16: Alternative Resource Plan 6: Supply-Side Capacity

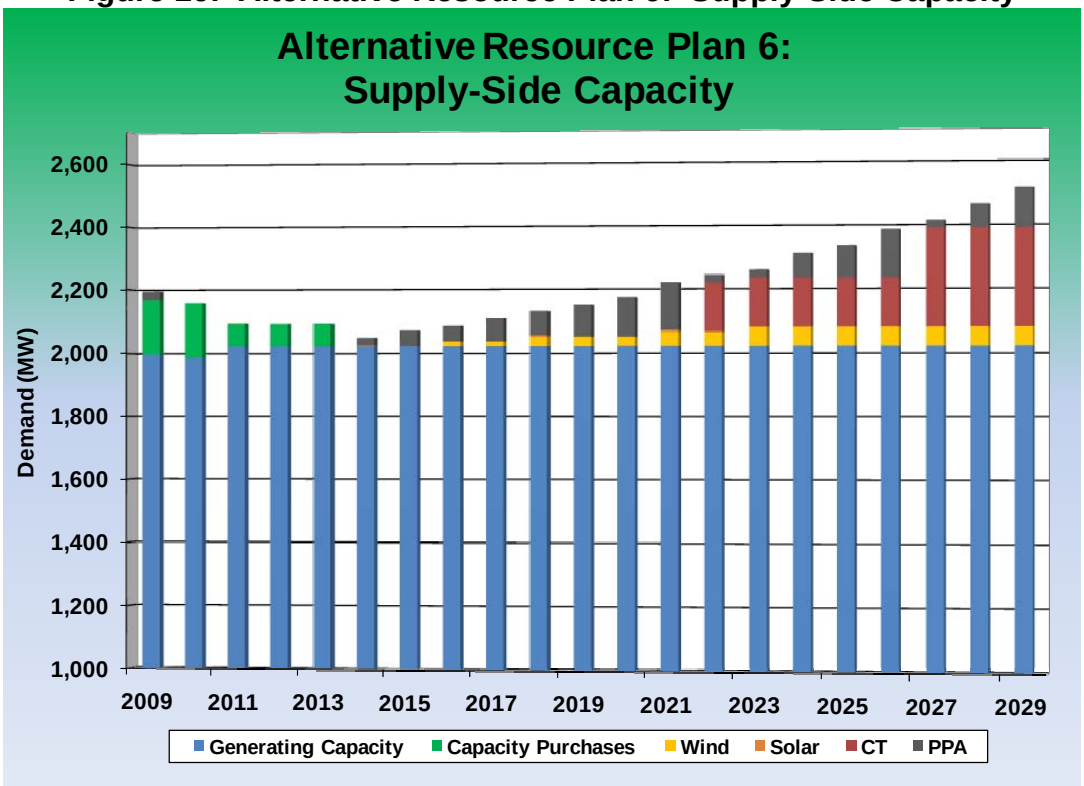


Figure 17: Alternative Resource Plan 7: Supply-Side Capacity

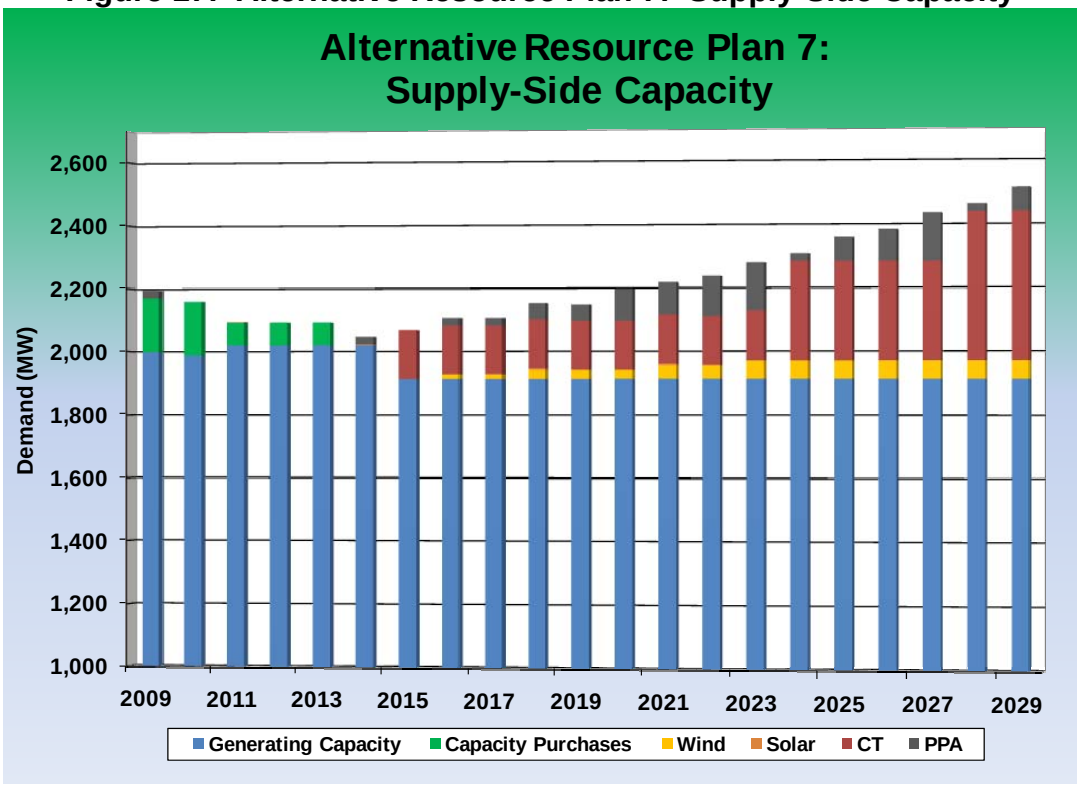


Figure 18: Alternative Resource Plan 8: Supply-Side Capacity

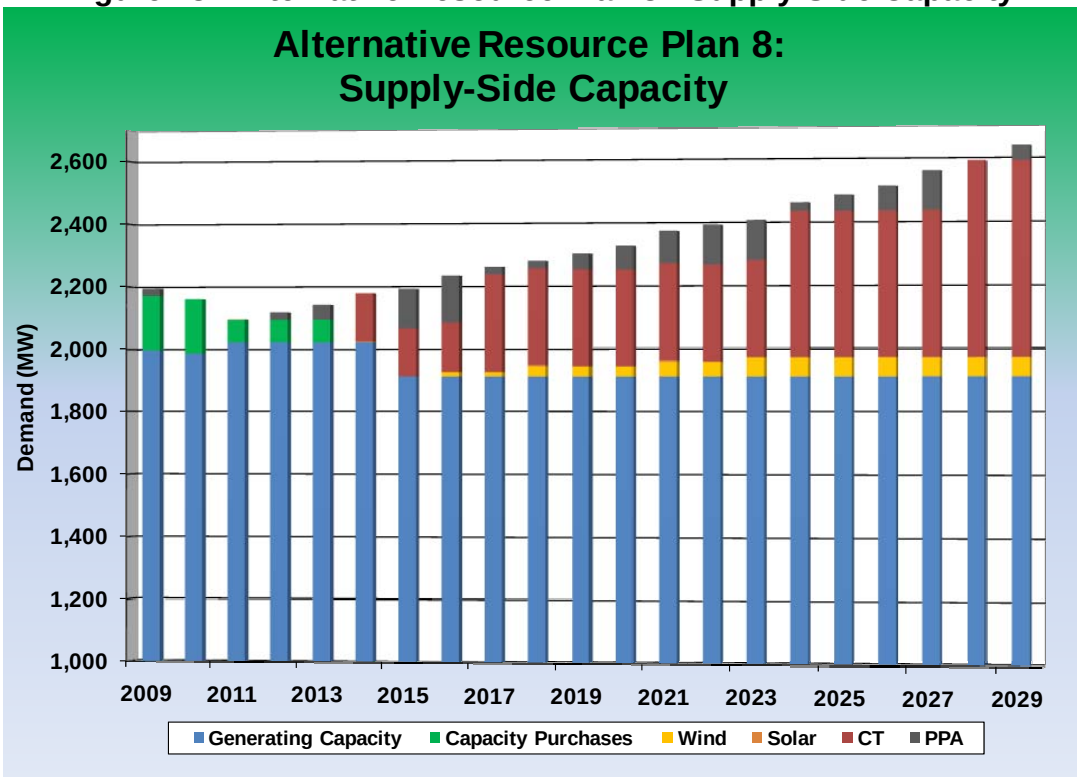


Figure 19: Alternative Resource Plan 9: Supply-Side Capacity

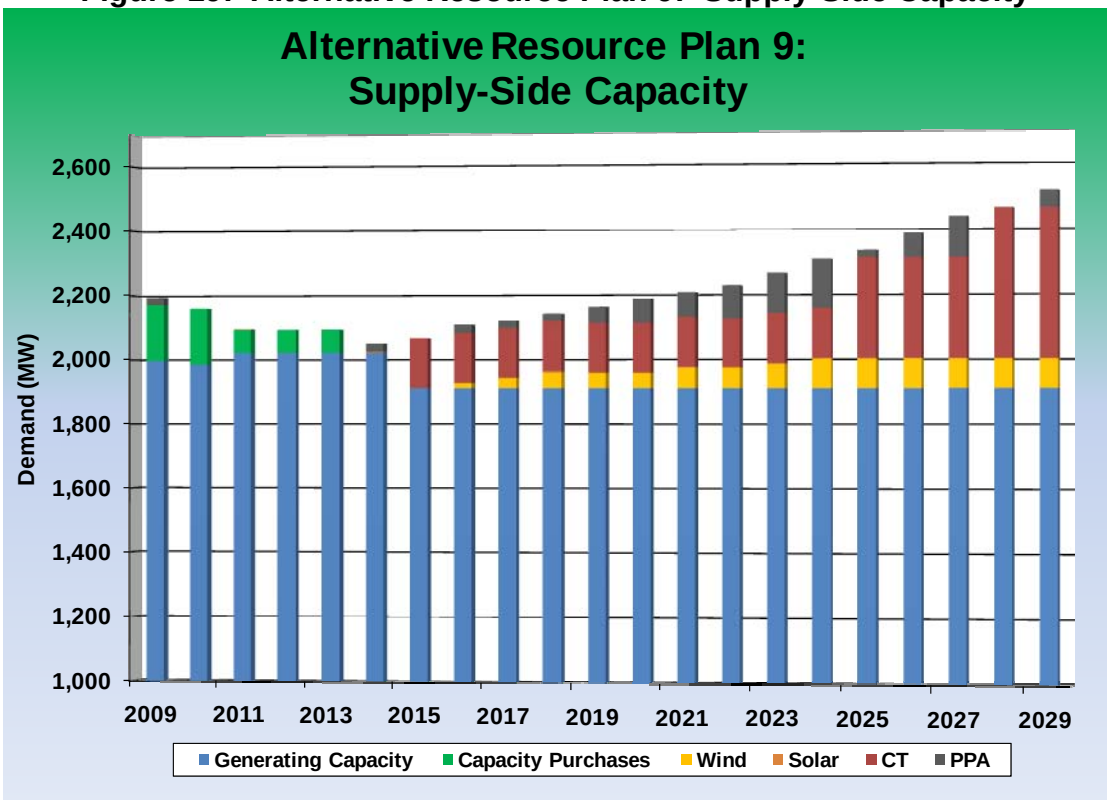


Figure 20: Alternative Resource Plan 10: Supply-Side Capacity

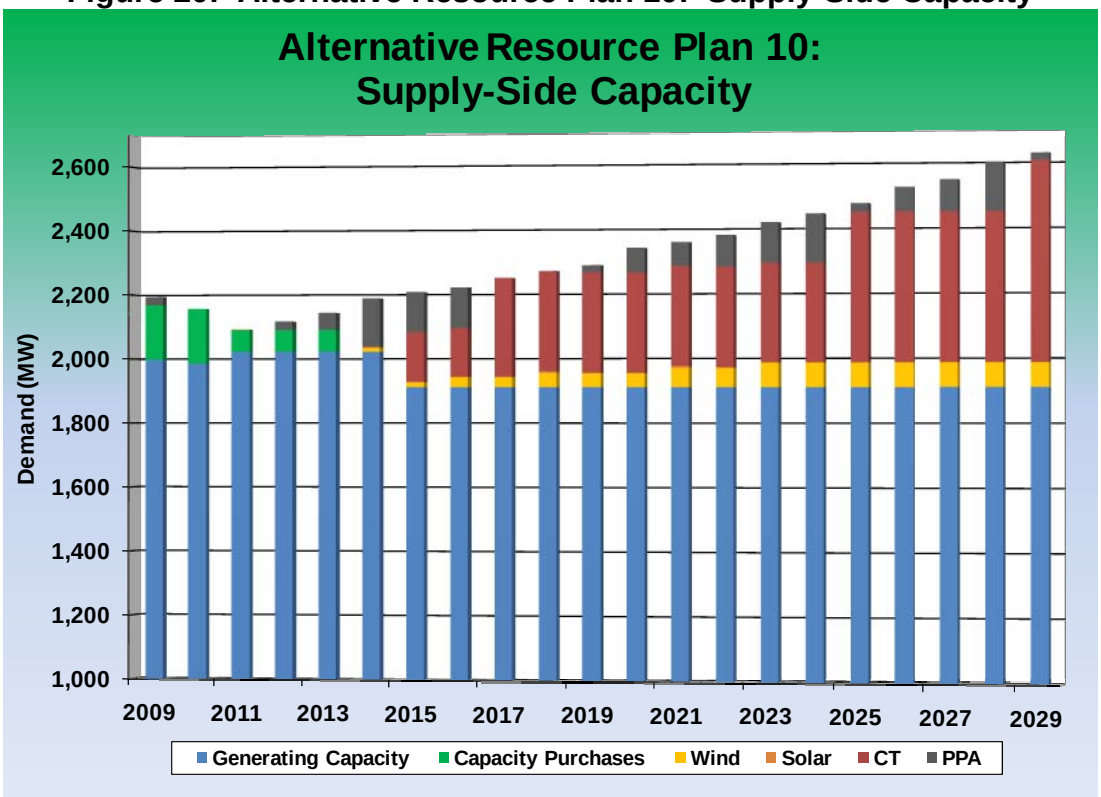


Figure 21: Alternative Resource Plan 11: Supply-Side Capacity

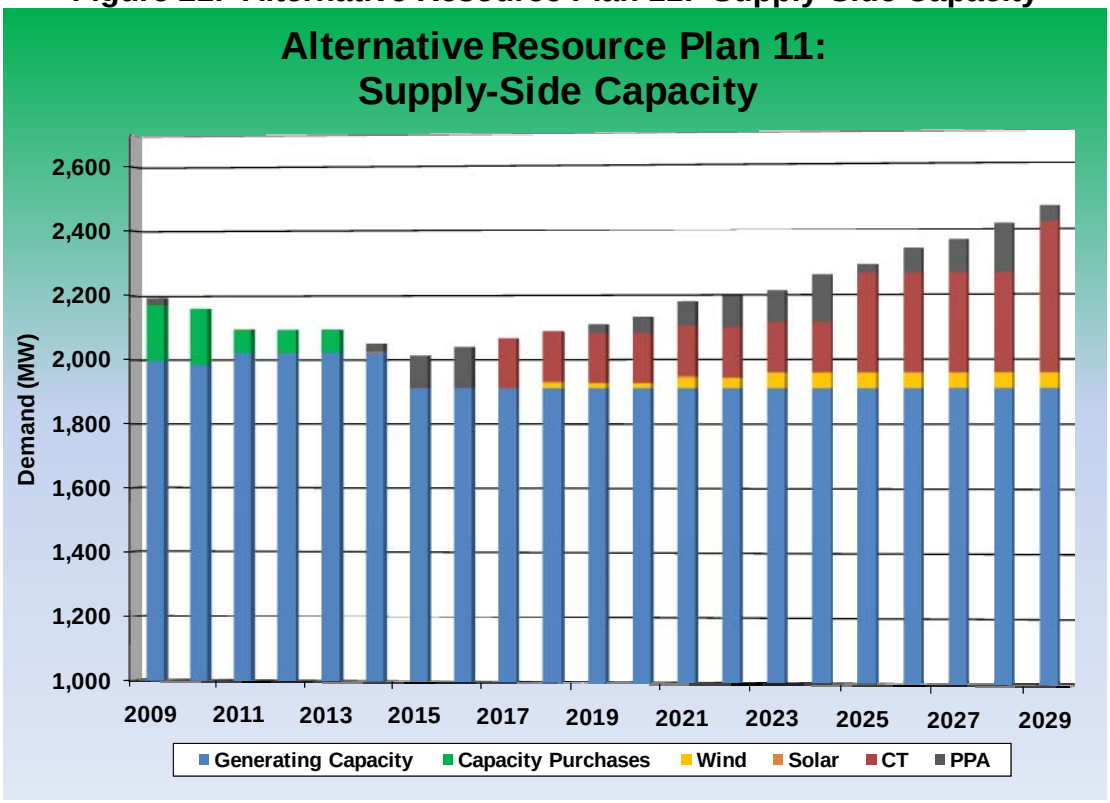


Figure 22: Alternative Resource Plan 12: Supply-Side Capacity

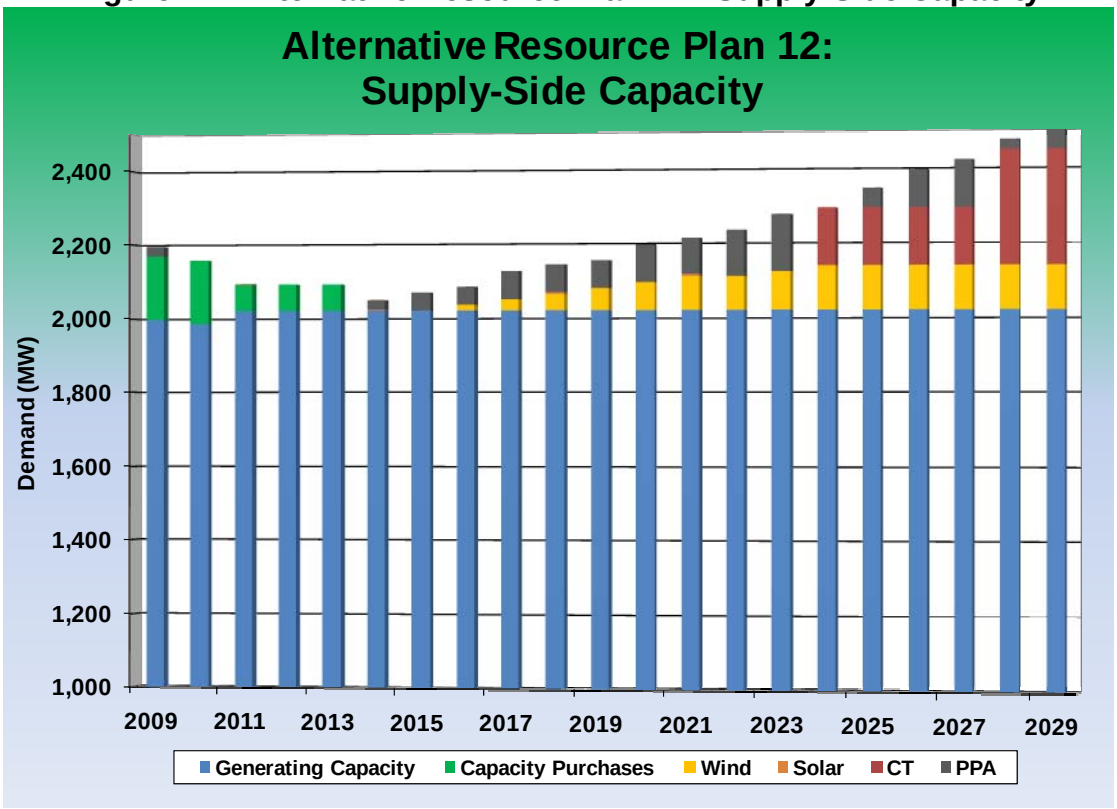


Figure 23: Alternative Resource Plan 13: Supply-Side Capacity

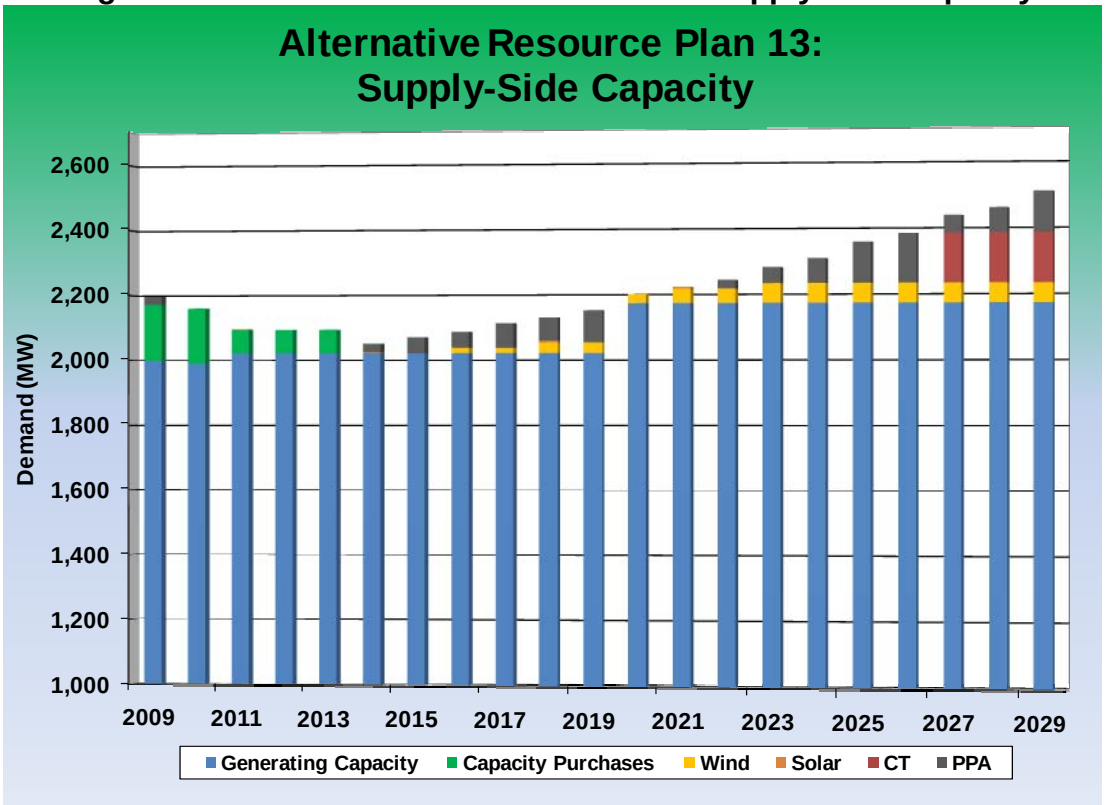


Figure 24: Alternative Resource Plan 14: Supply-Side Capacity

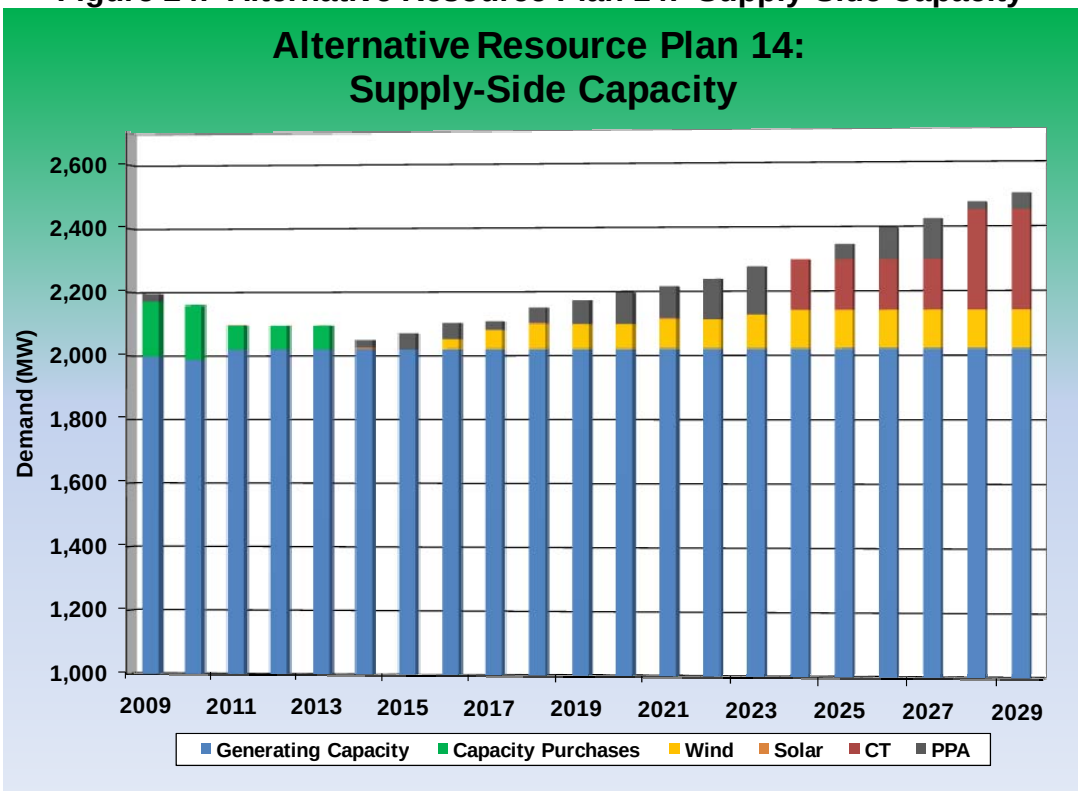


Figure 25: Alternative Resource Plan 15: Supply-Side Capacity

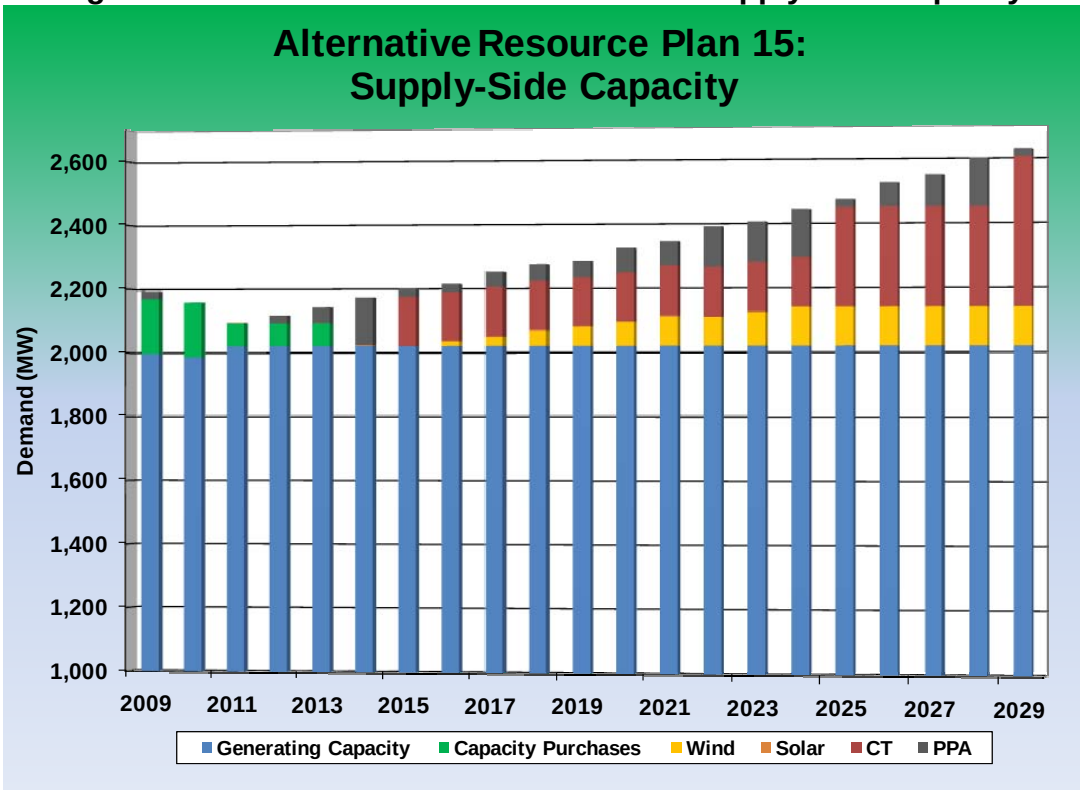


Figure 26: Alternative Resource Plan 16: Supply-Side Capacity

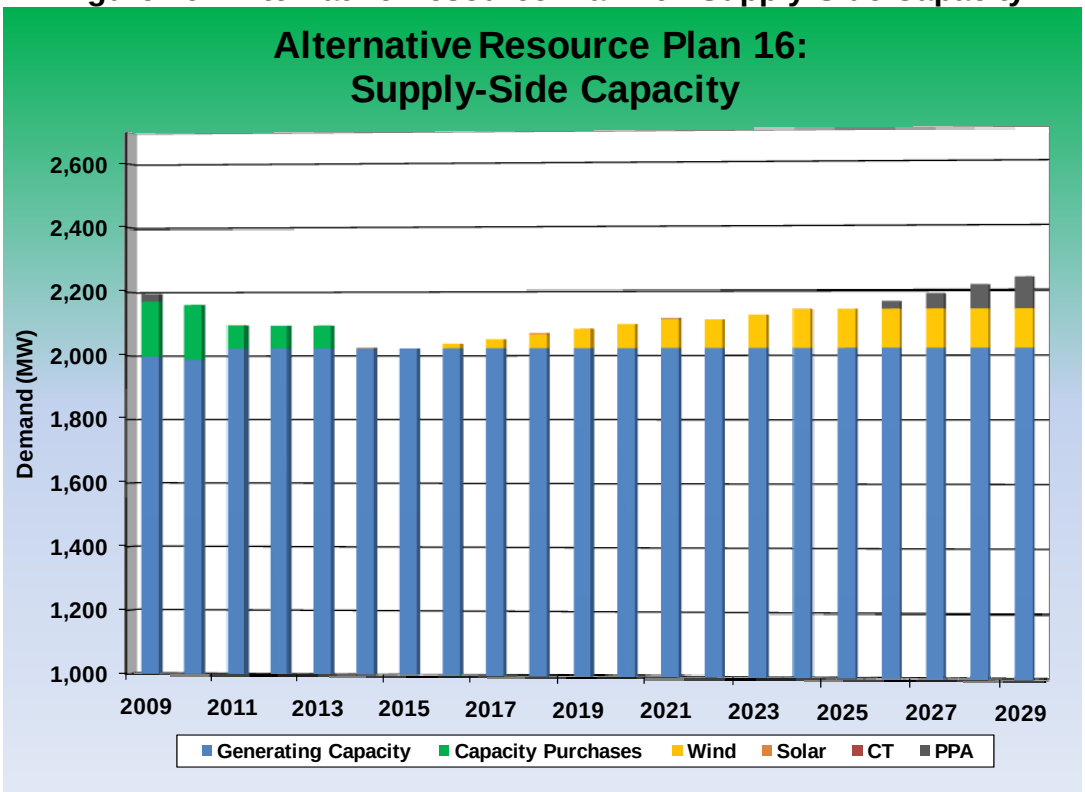


Figure 27: Alternative Resource Plan 17: Supply-Side Capacity

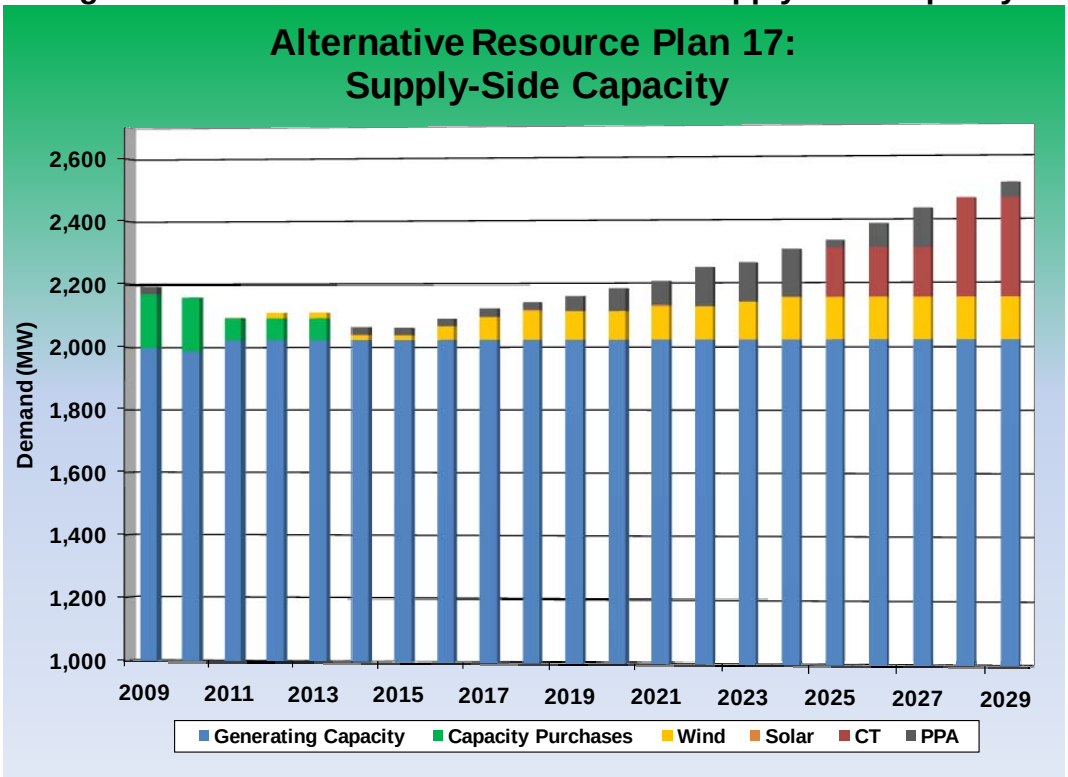


Figure 28: Alternative Resource Plan 18: Supply-Side Capacity

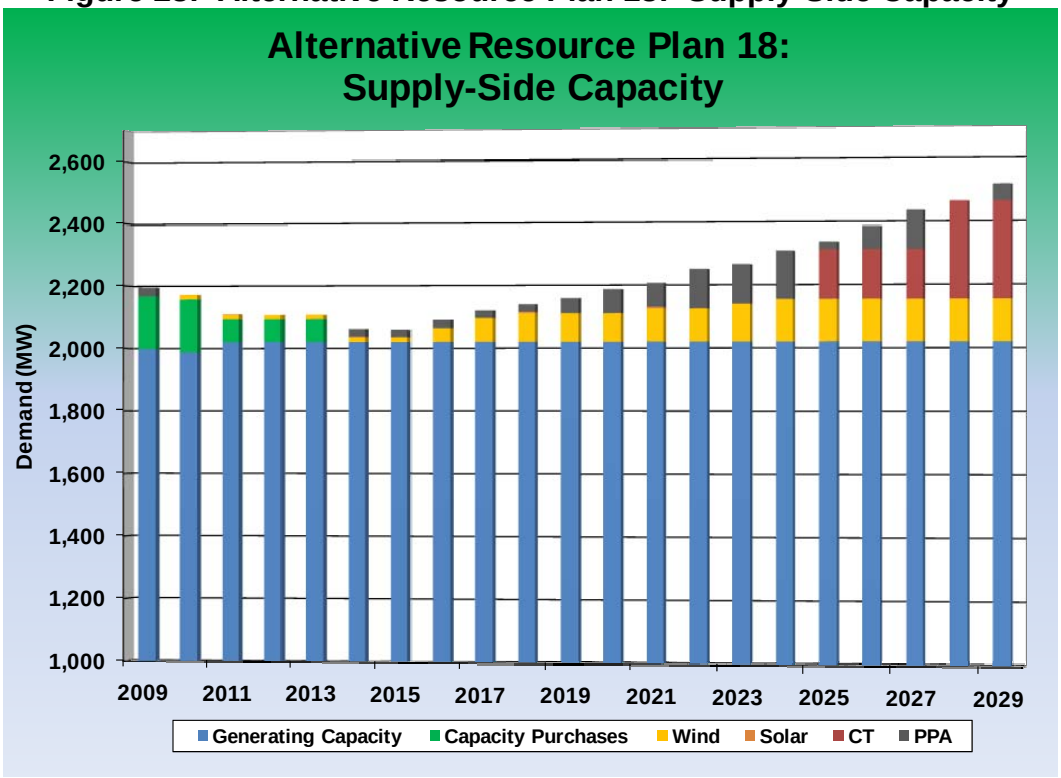


Figure 29: Alternative Resource Plan 19: Supply-Side Capacity

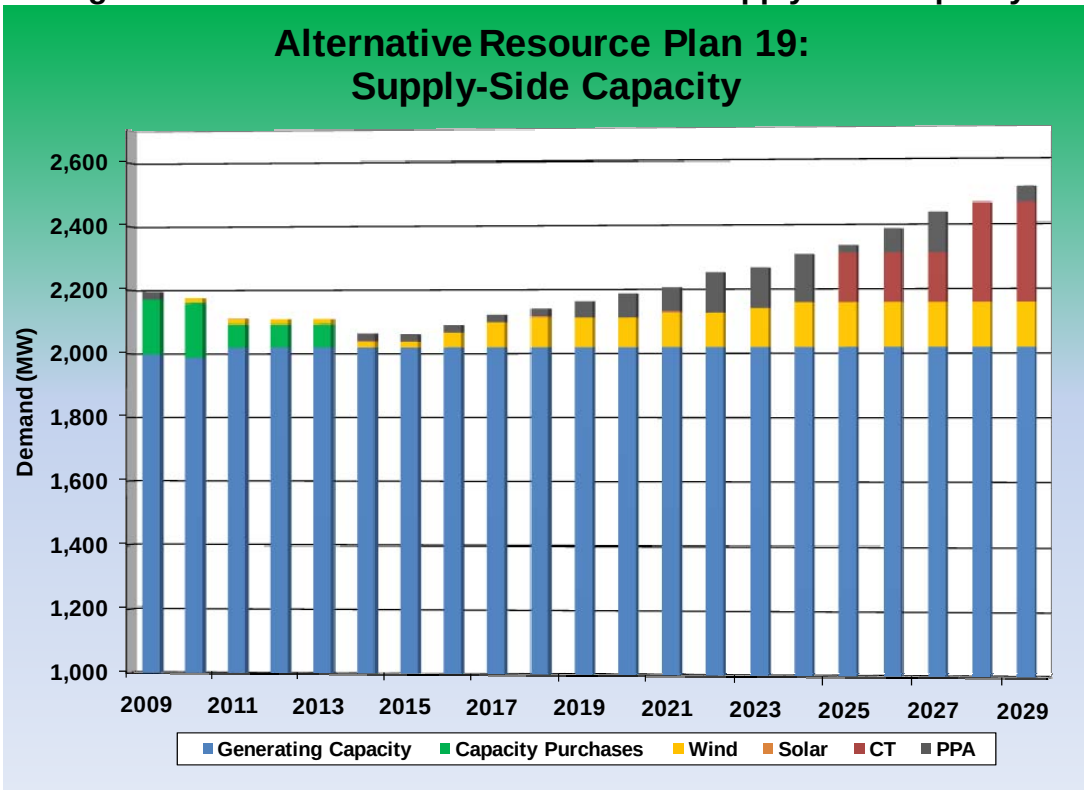


Figure 30: Alternative Resource Plan 20: Supply-Side Capacity

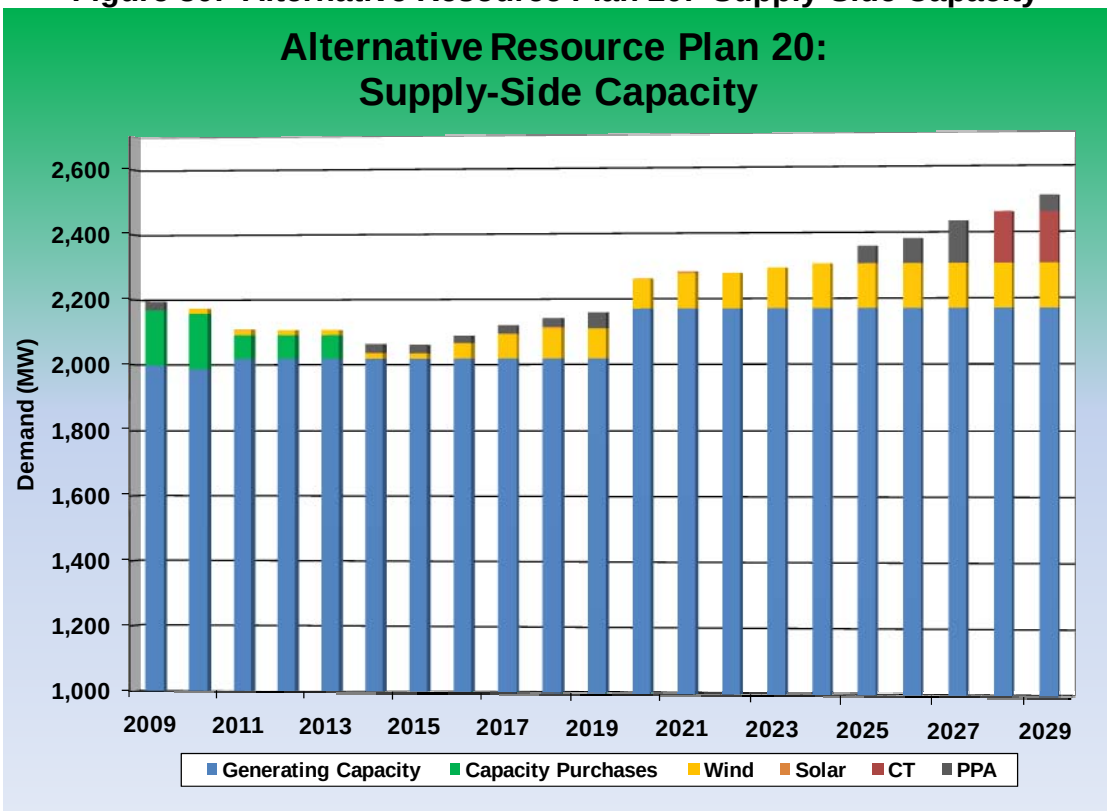


Figure 31: Alternative Resource Plan 21: Supply-Side Capacity

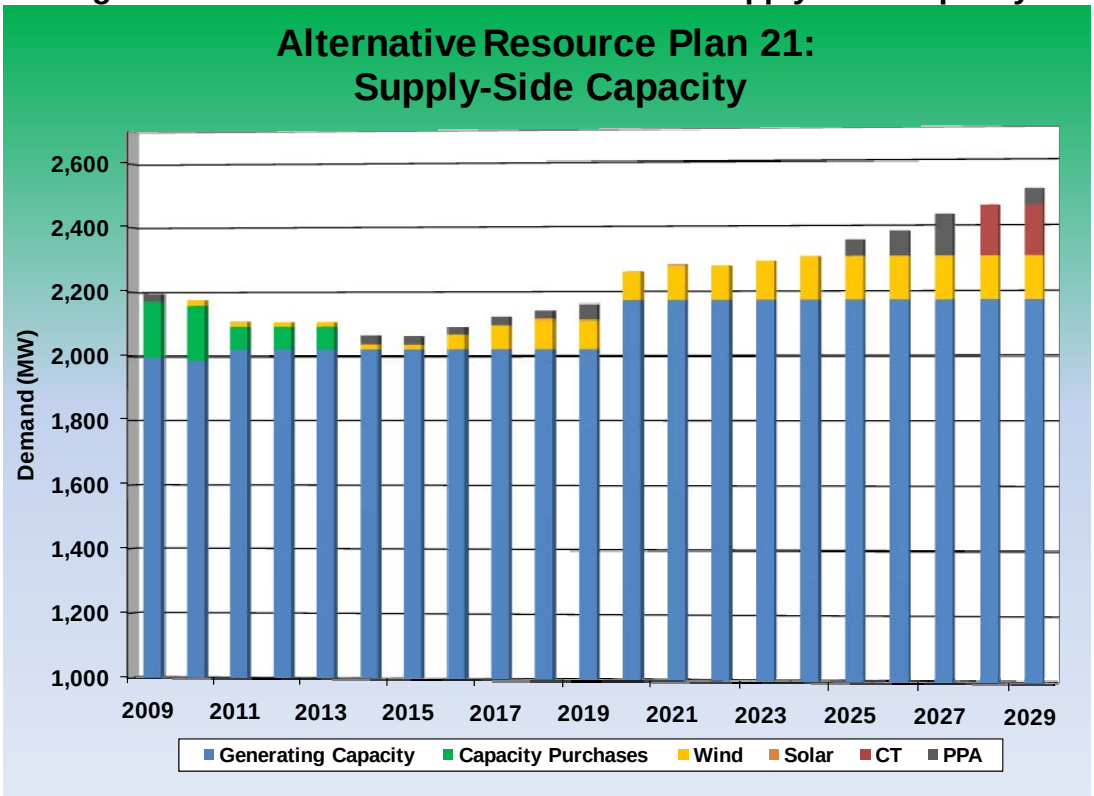


Figure 32: Alternative Resource Plan 22: Supply-Side Capacity

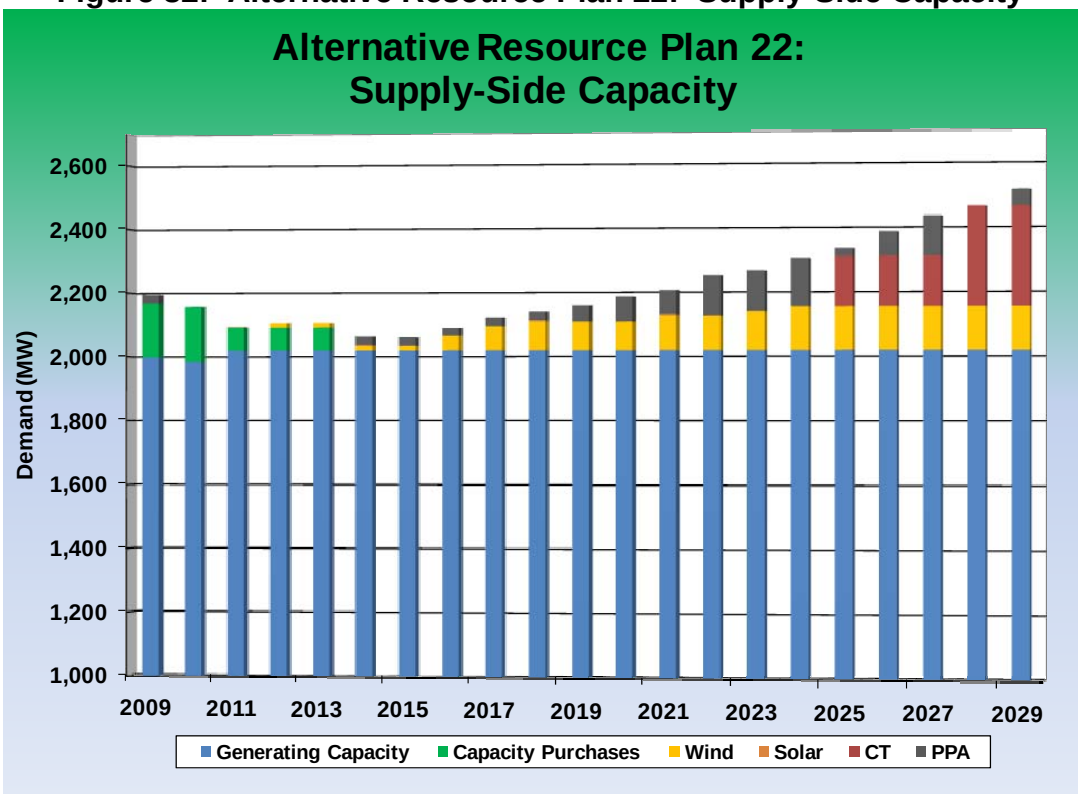


Figure 33: Alternative Resource Plan 23: Supply-Side Capacity

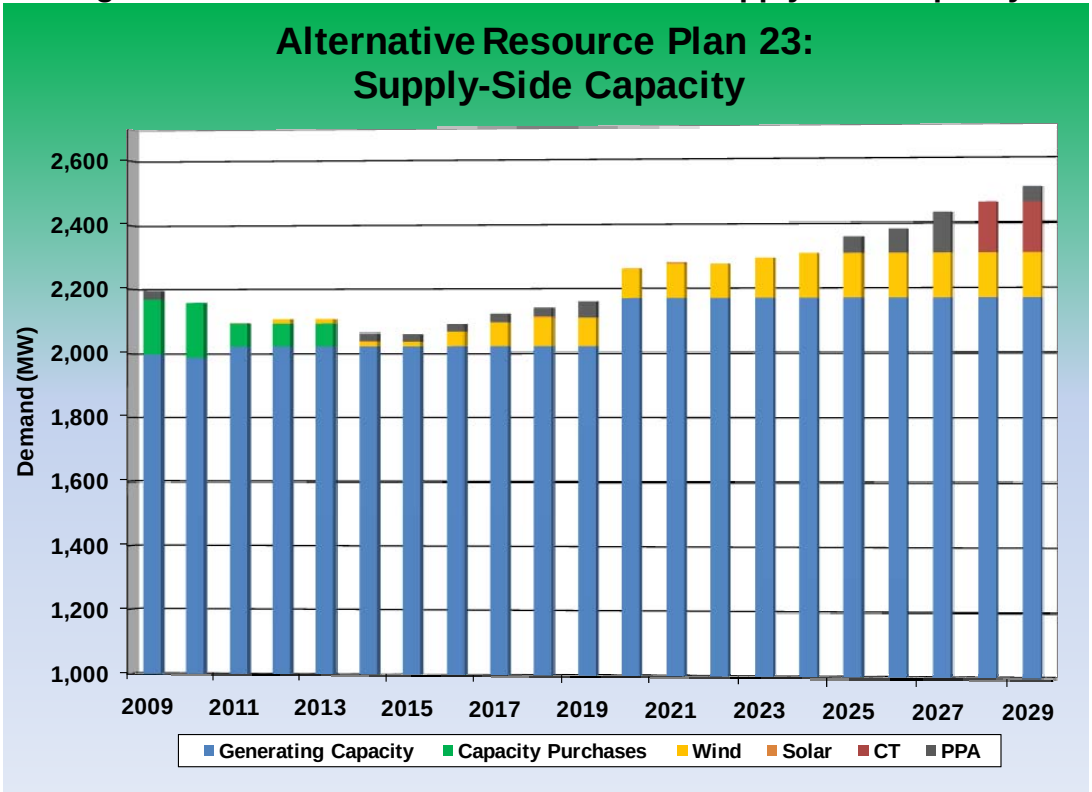
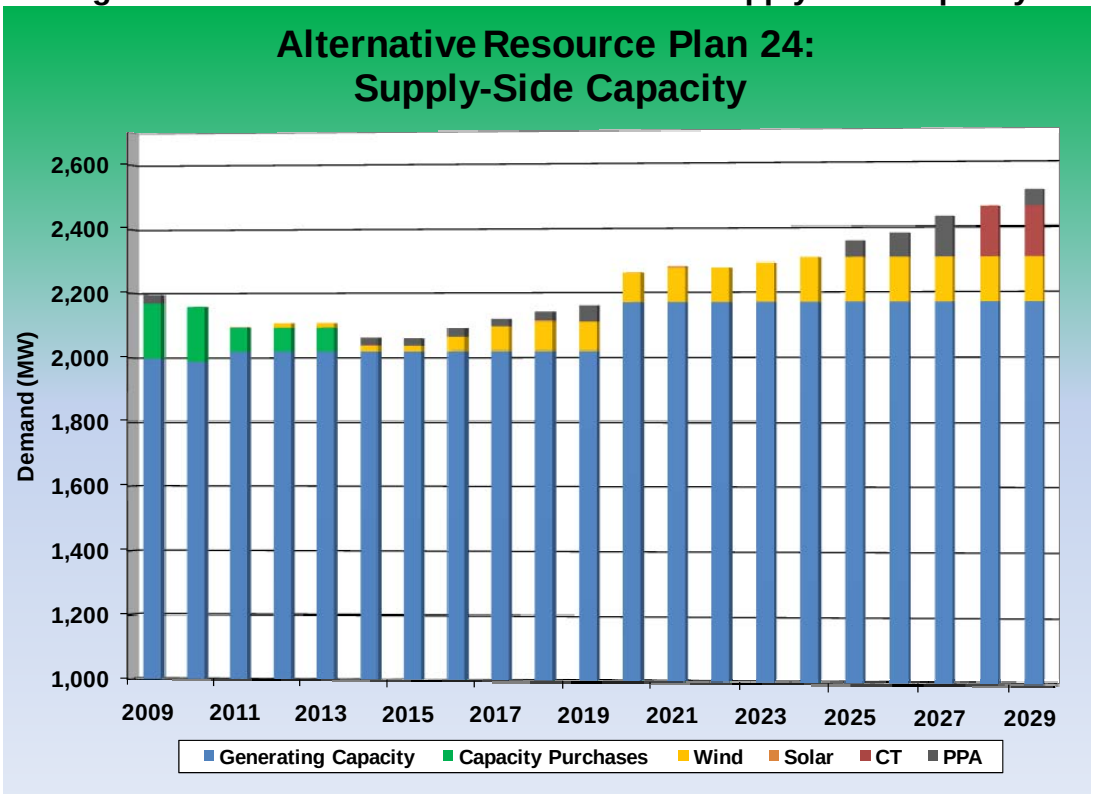


Figure 34: Alternative Resource Plan 24: Supply-Side Capacity



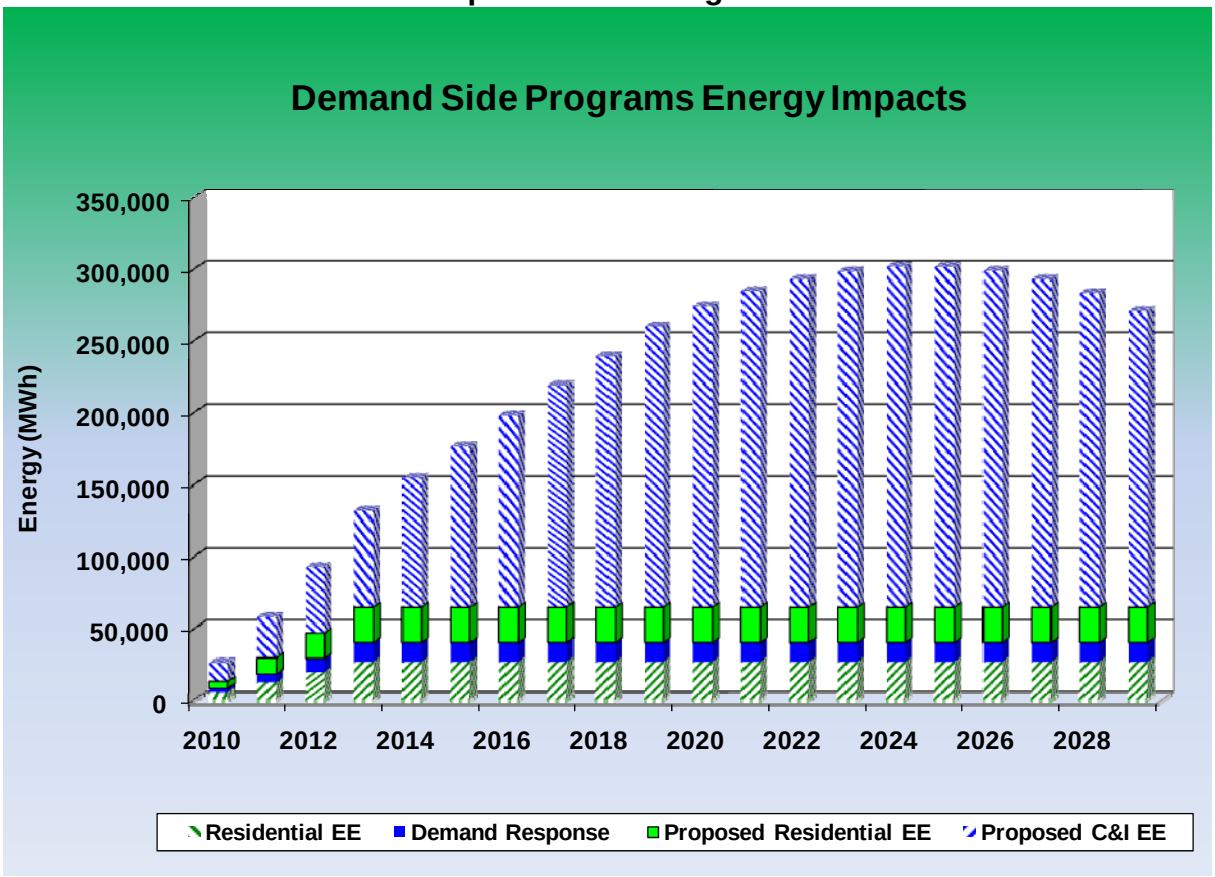
Note that the tabular data that created the twenty-four figures above is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)3 Supply Side Resource Capacity.xlsx”

6.3.4 DSM ENERGY IMPACT

4. The combined impact of all demand-side resources on the base-case forecast of annual energy requirements;

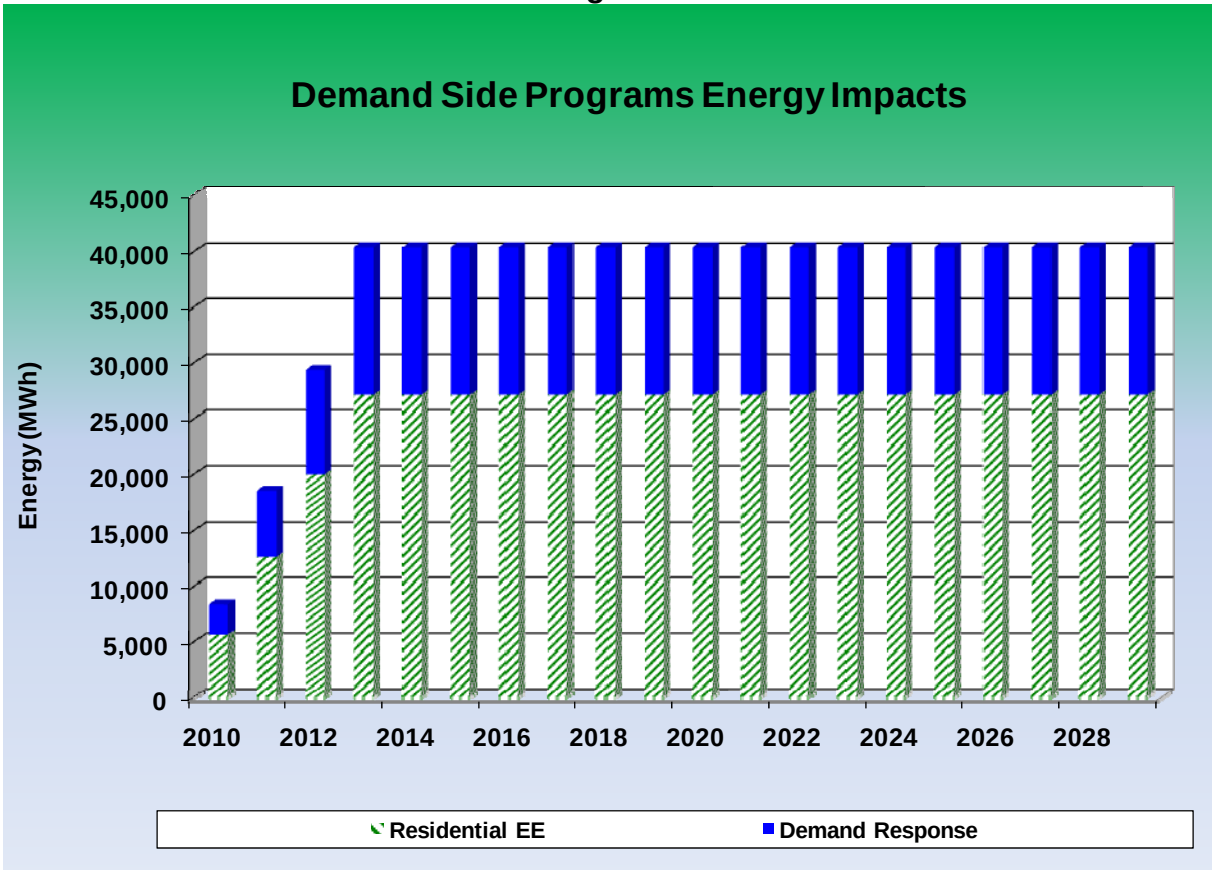
The existing and proposed demand-side resources are comprised of demand response programs, residential energy efficiency programs, and commercial and industrial programs. The estimated impacts of these programs on the base-case for Alternative Resource Plans 1, 3, 5, 6, 7, 9, 11, 12, 13, 14, and 17 through 24 are shown in Figure 35 below:

Figure 35: Demand-Side Programs Energy Impacts From All Existing and Proposed DSM Programs



The existing demand-side resources are comprised of two demand response programs and six energy efficiency programs. Detailed energy impacts for each Individual program are provided in Section 6.3.5. The estimated impacts of these programs on the base-case for Alternative Resource Plan 15 is shown in Figure 36 below:

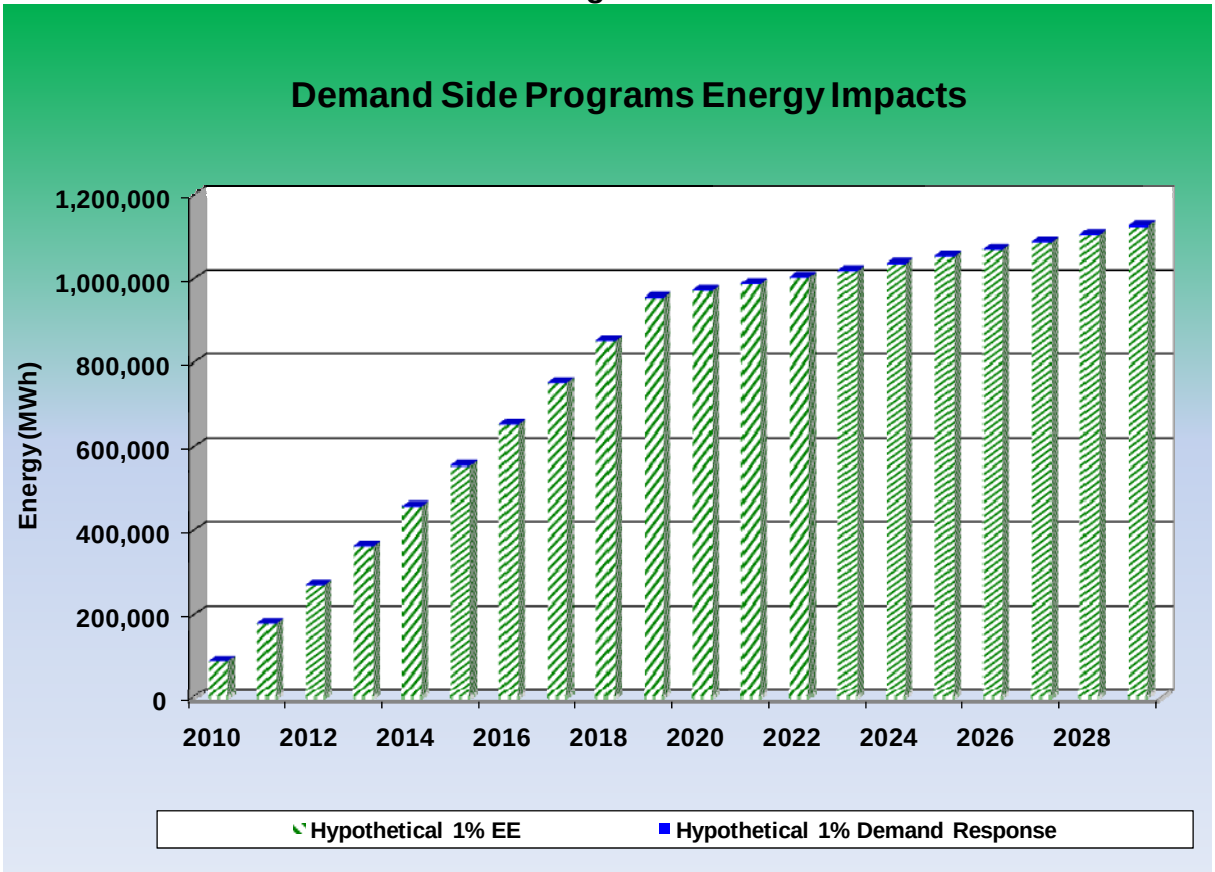
Figure 36: Demand-Side Programs Energy Impacts From All Existing DSM Programs



It should be noted that Alternative Resource Plans 2, 4, 8, and 10 did not include and DSM programs and therefore no figures representing demand-side resources were provided for these four Plans.

Alternative Resource Plan 16 was a hypothetical case of estimating DSM programs to correspond to 1% of retail energy sales. The estimated impact of hypothetical demand response and energy efficiency programs are shown in Figure 37 below:

Figure 37: Demand-Side Programs Energy Impacts From Hypothetical DSM Programs



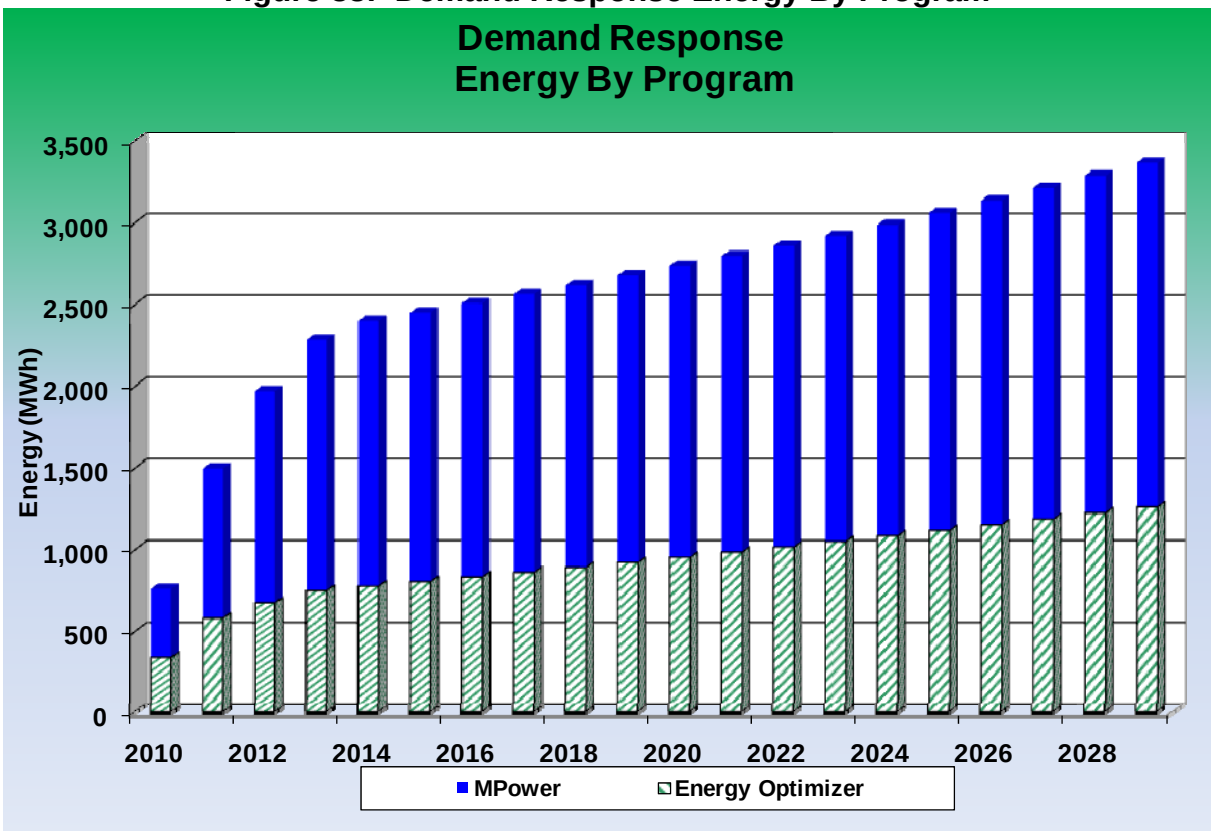
Note that the tabular data that created Figure 35, Figure 36, and Figure 37 are provided on the work paper disc in an Excel file entitled “Rule 060 (C)4 Total DSM Energy Impacts.xls”

6.3.5 DSM ENERGY BY PROGRAM

5. The composition, by program, of the annual energy provided by demand-side resources;

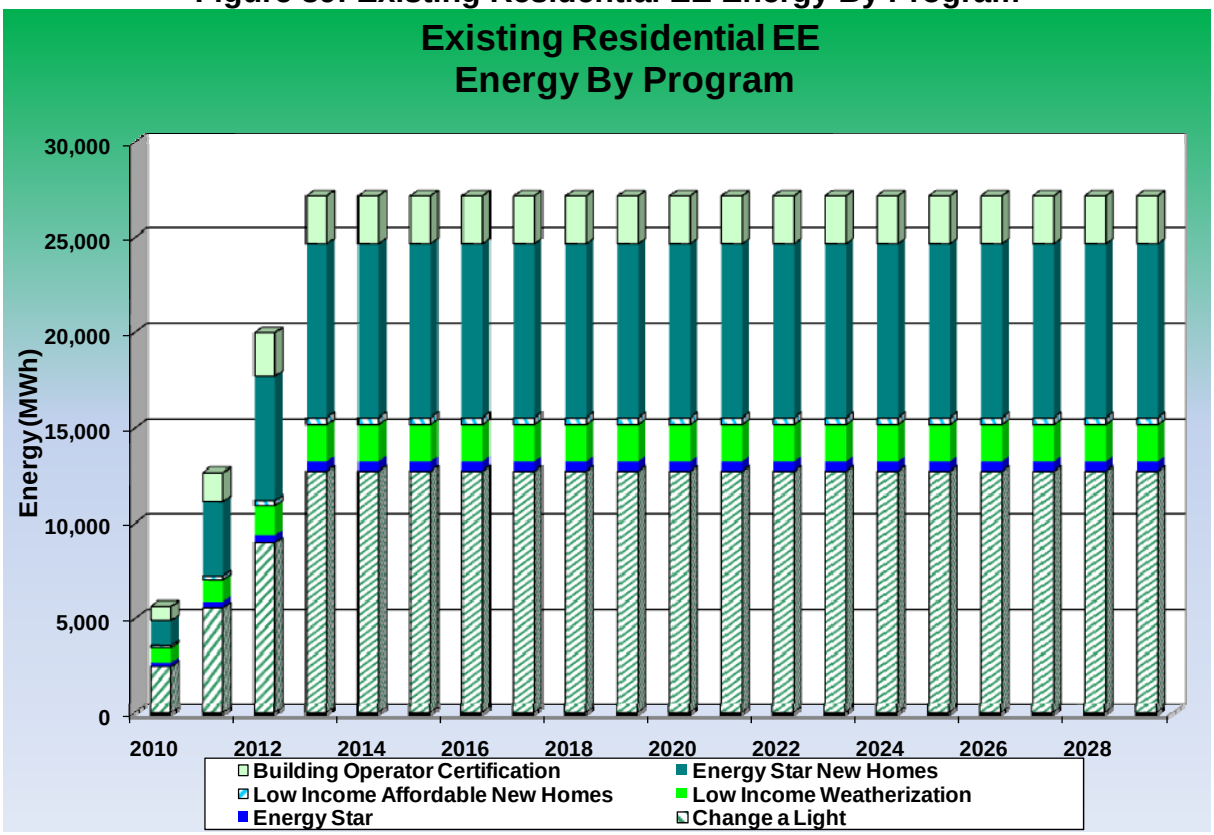
The estimated energy provided by each DSM program is shown in Figure 38 through Figure 41 below:

Figure 38: Demand Response Energy By Program



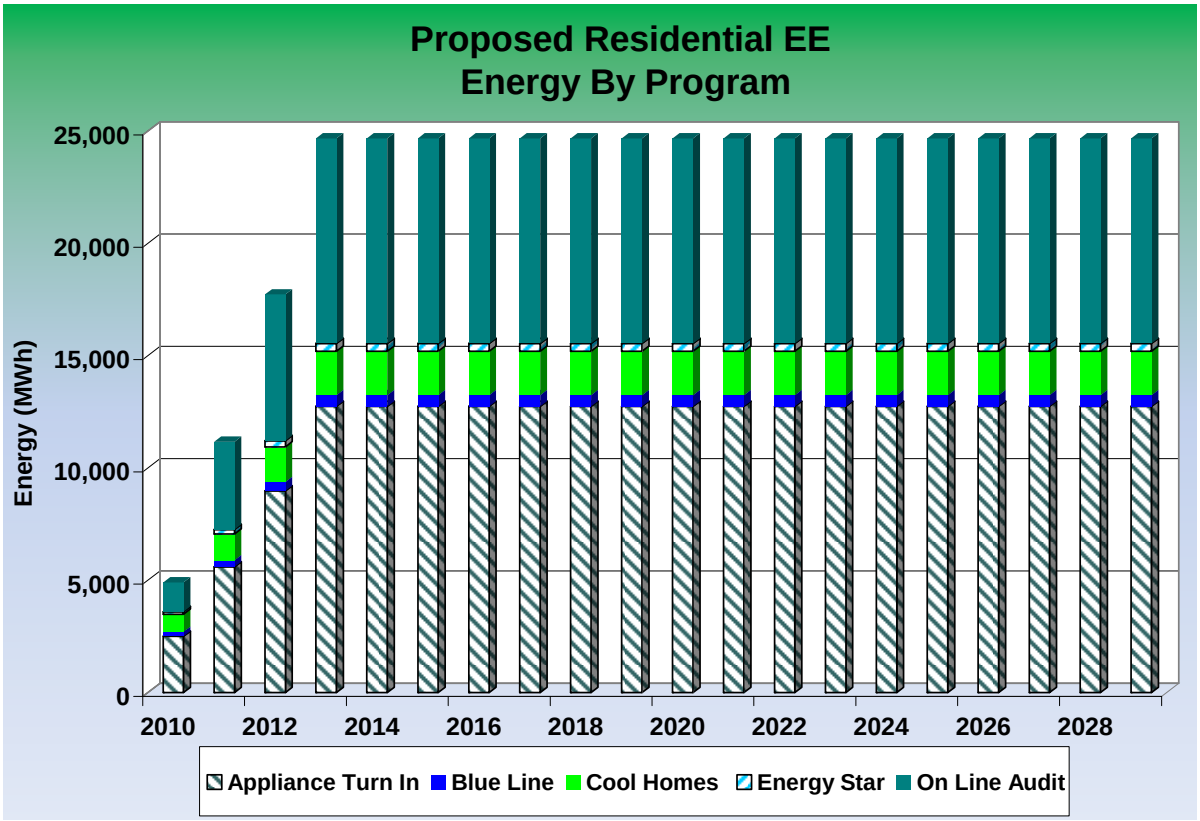
Note that the tabular data that created the above Figure 38 is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)5 Demand Response Capacity And Energy By Program.xls”

Figure 39: Existing Residential EE Energy By Program



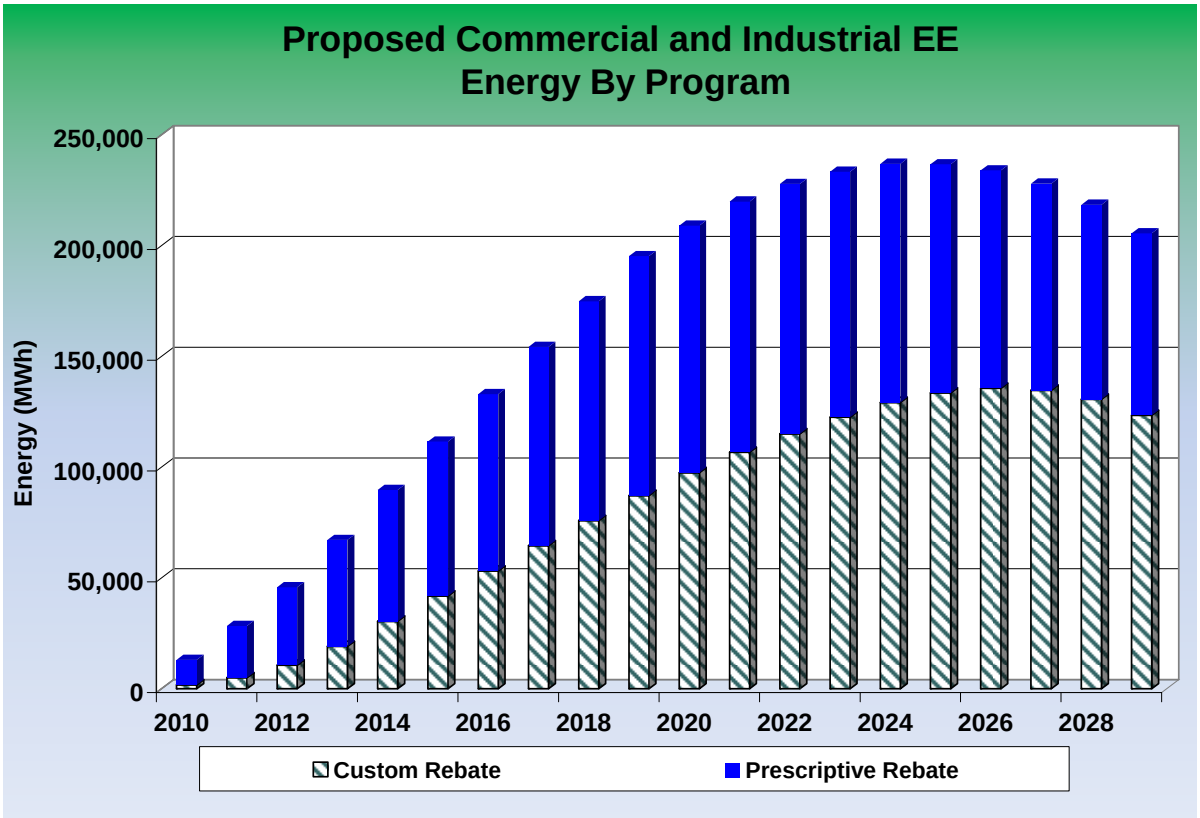
Note that the tabular data that created the above Figure 39 is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)5 Residential EE Capacity And Energy By Program.xls”

Figure 40: Proposed Residential EE Energy By Program



Note that the tabular data that created the above Figure 40 is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)5 Proposed Residential EE Capacity And Energy By Program.xls”

Figure 41: Proposed Commercial and Industrial EE Energy By Program



Note that the tabular data that created the above Figure 41 is provided on the work paper disc in an Excel file entitled “Rule 060 6(C)5 Proposed CandI EE Capacity And Energy By Program.xls”

6.3.6 ENERGY SUPPLY BY RESOURCE

6. The composition, by supply resource, of the annual energy (including losses) provided by supply resources. Existing supply-side resources may be shown as a single resource;

Energy supplied by resource for each plan is plotted in Figure 42 through Figure 65 given below.

Figure 42: Plan01 Generation

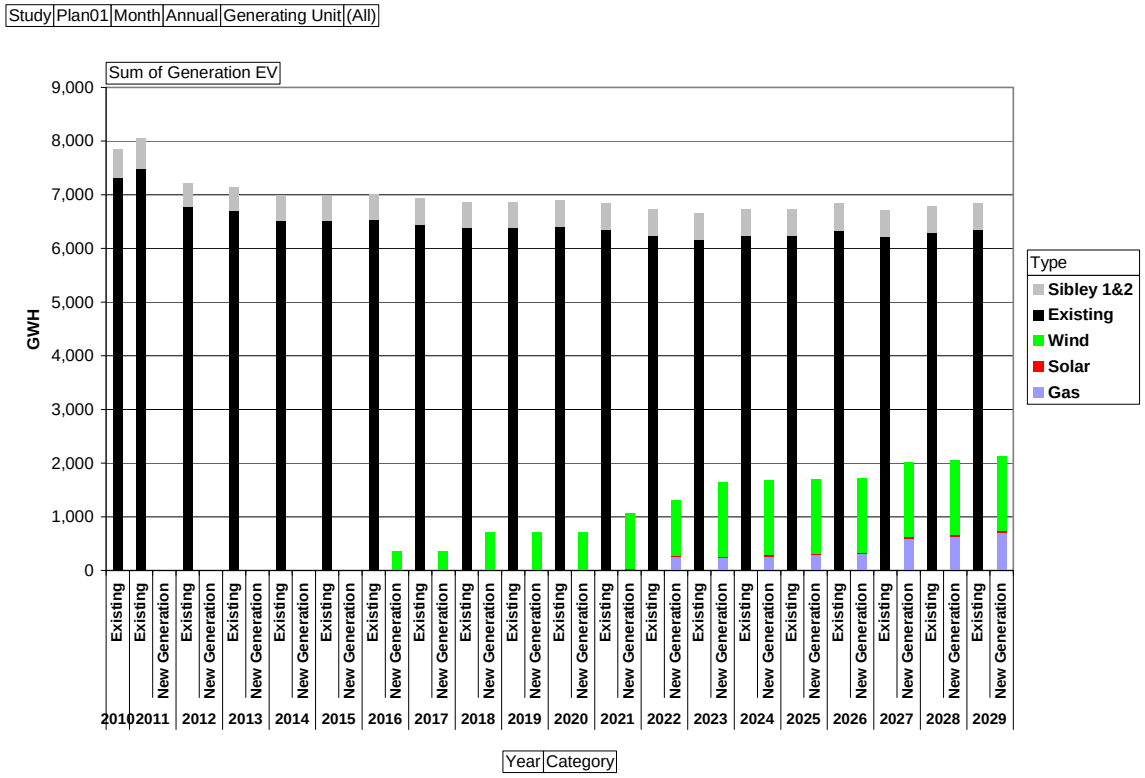


Figure 43: Plan02 Generation

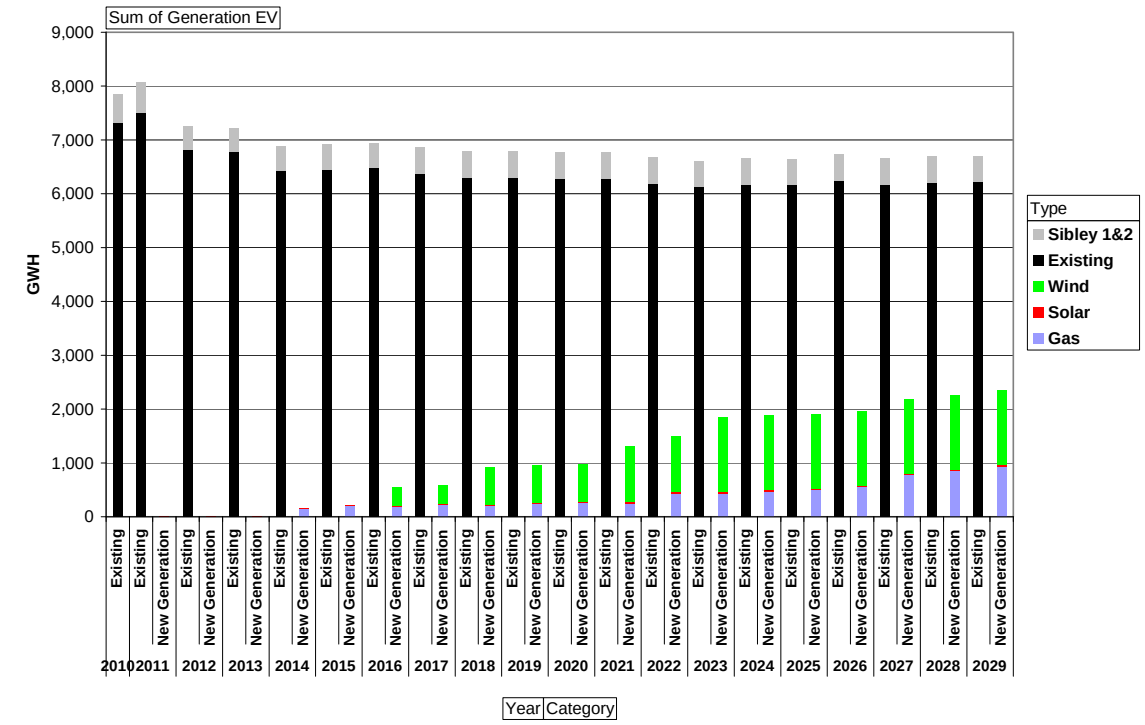


Figure 44: Plan03 Generation

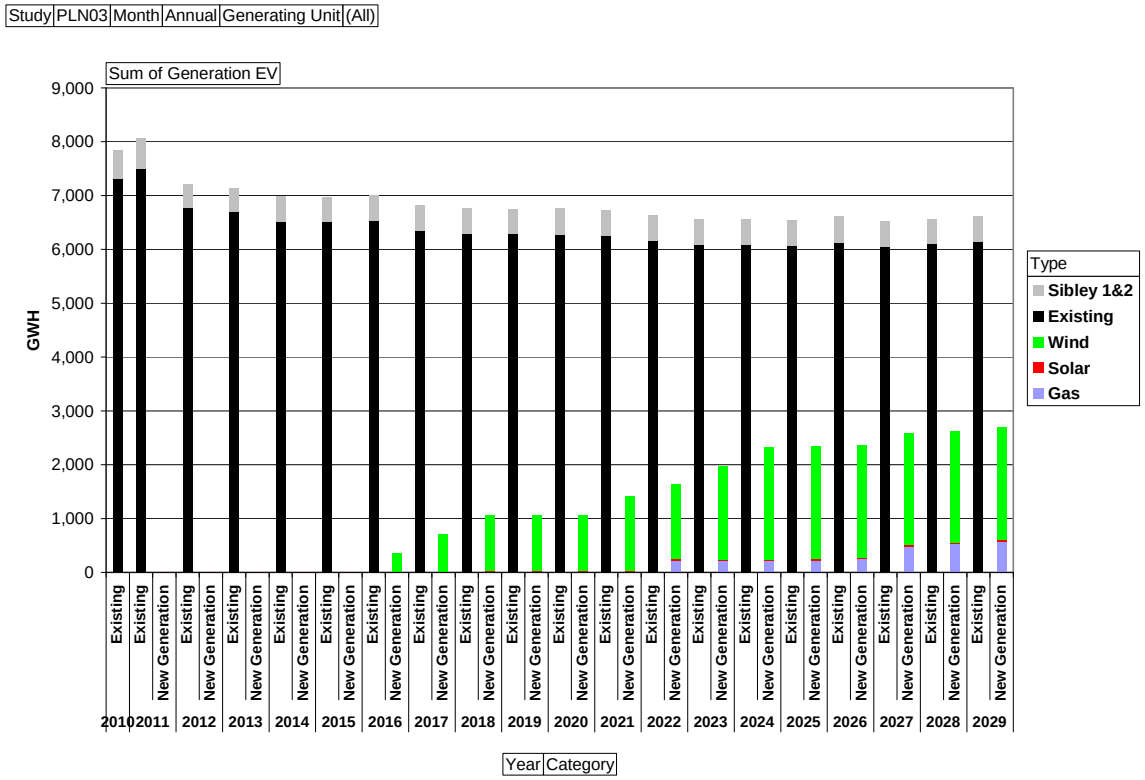


Figure 45: Plan04 Generation

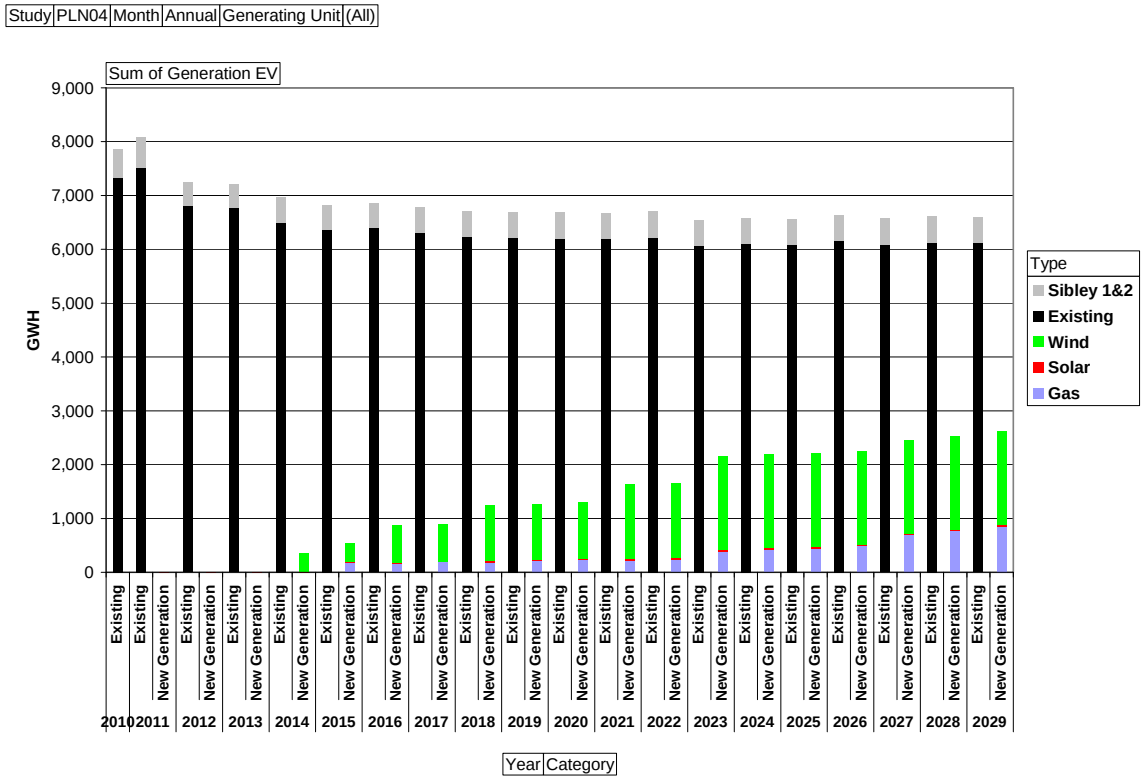


Figure 46: Plan05 Generation

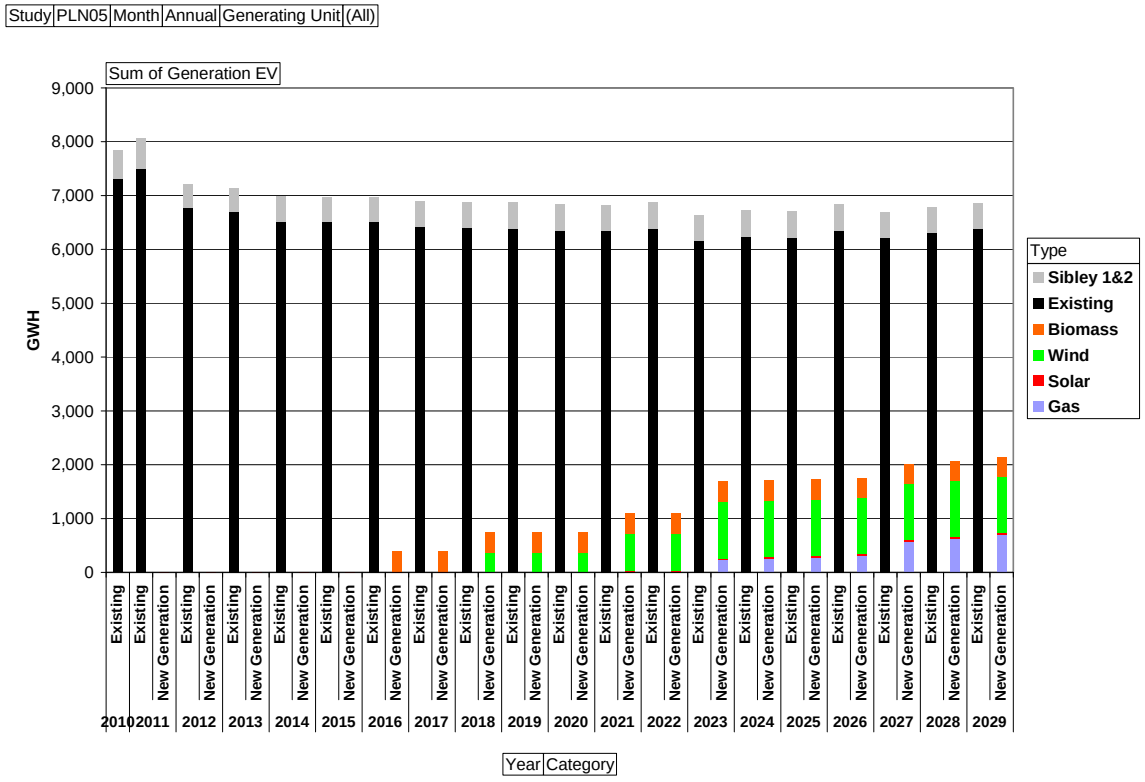


Figure 47: Plan06 Generation

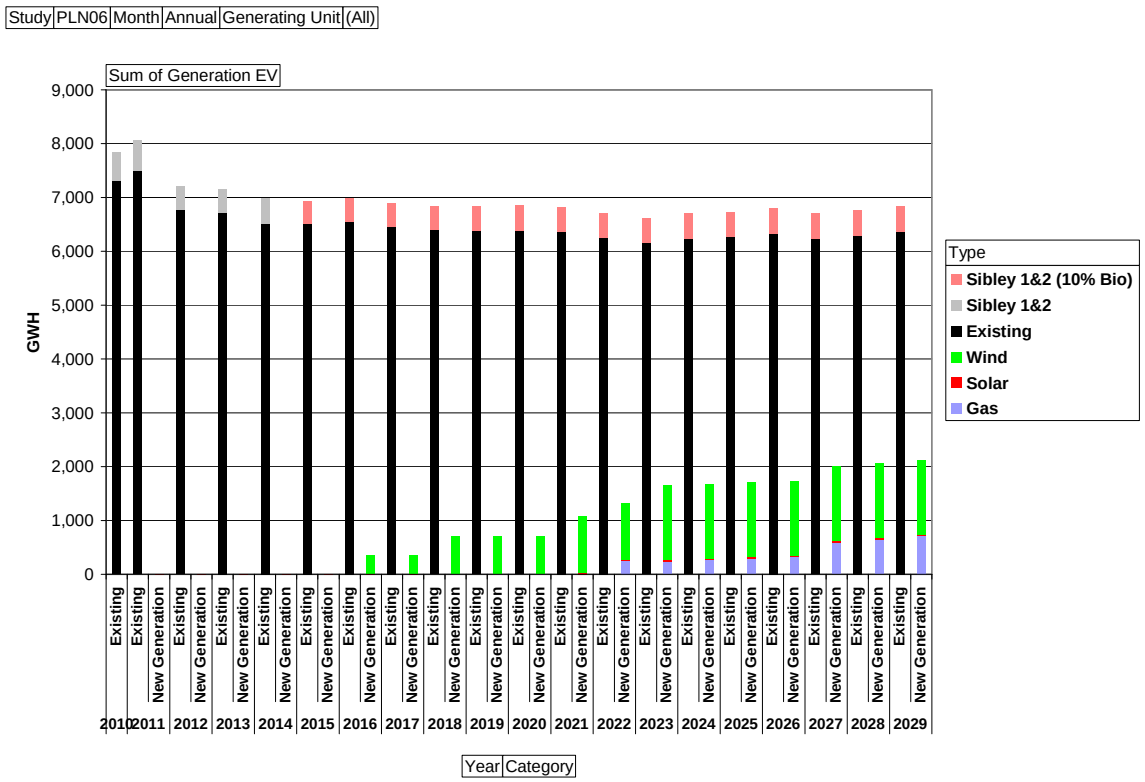


Figure 48: Plan07 Generation

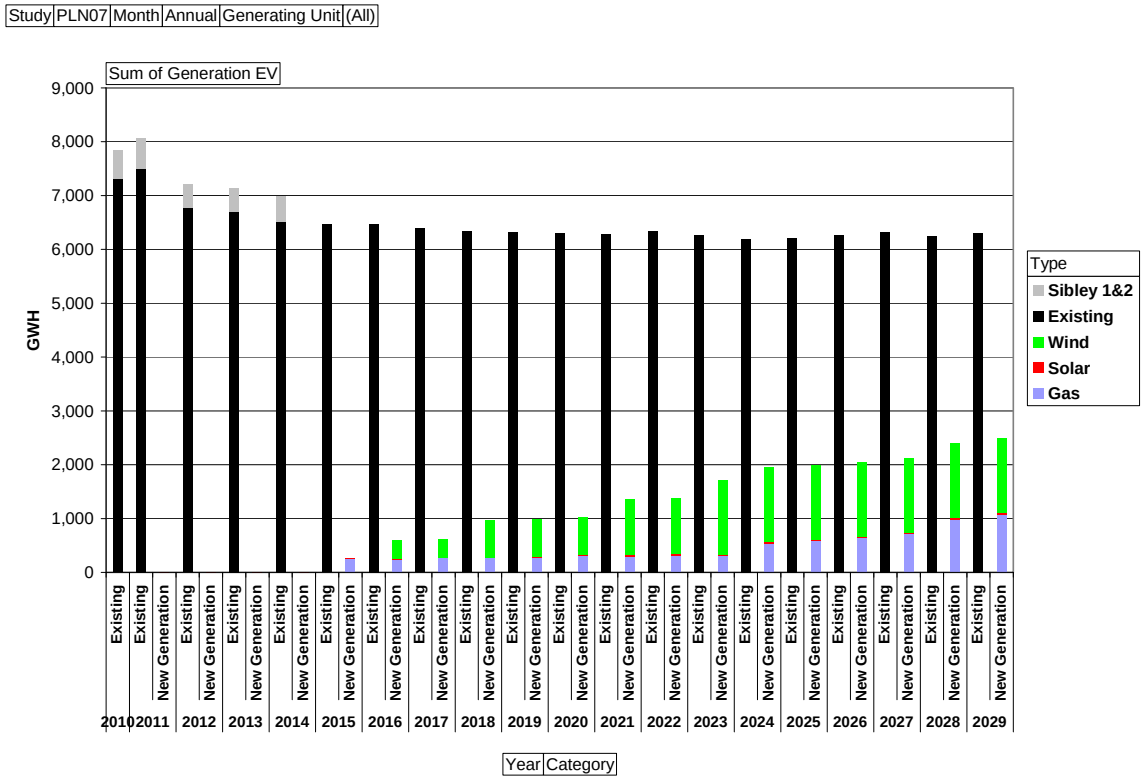


Figure 49: Plan08 Generation

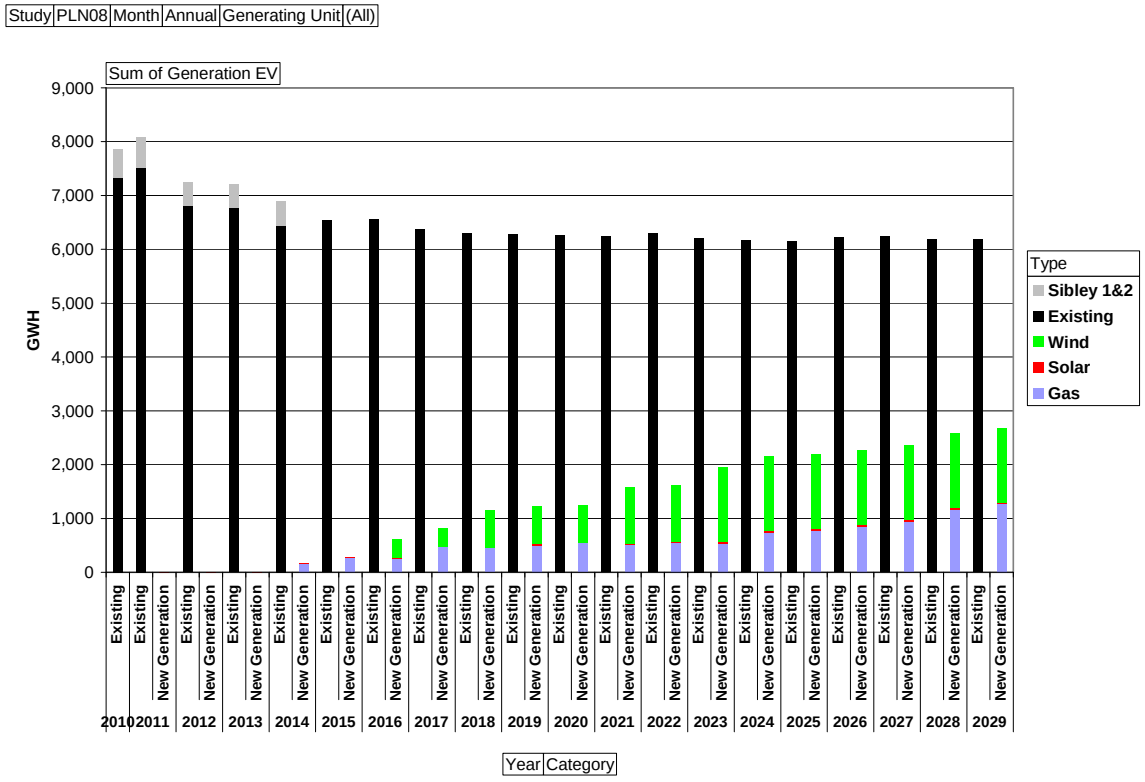


Figure 50: Plan09 Generation

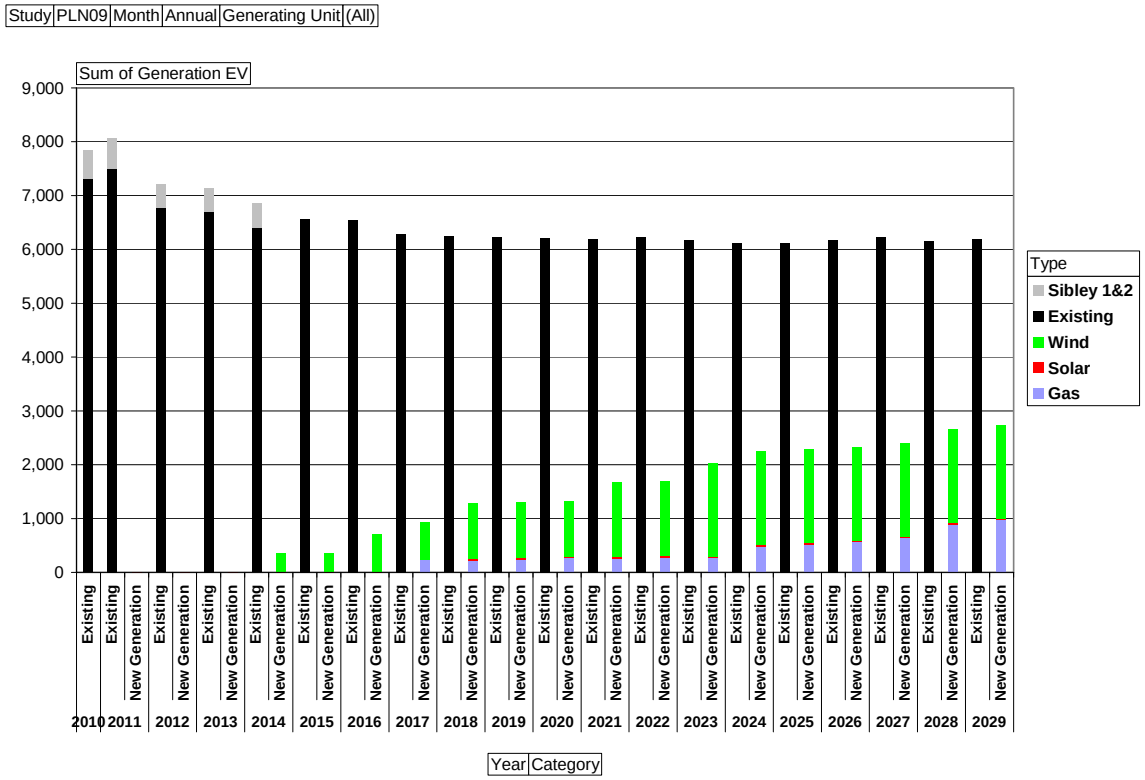


Figure 51: Plan10 Generation

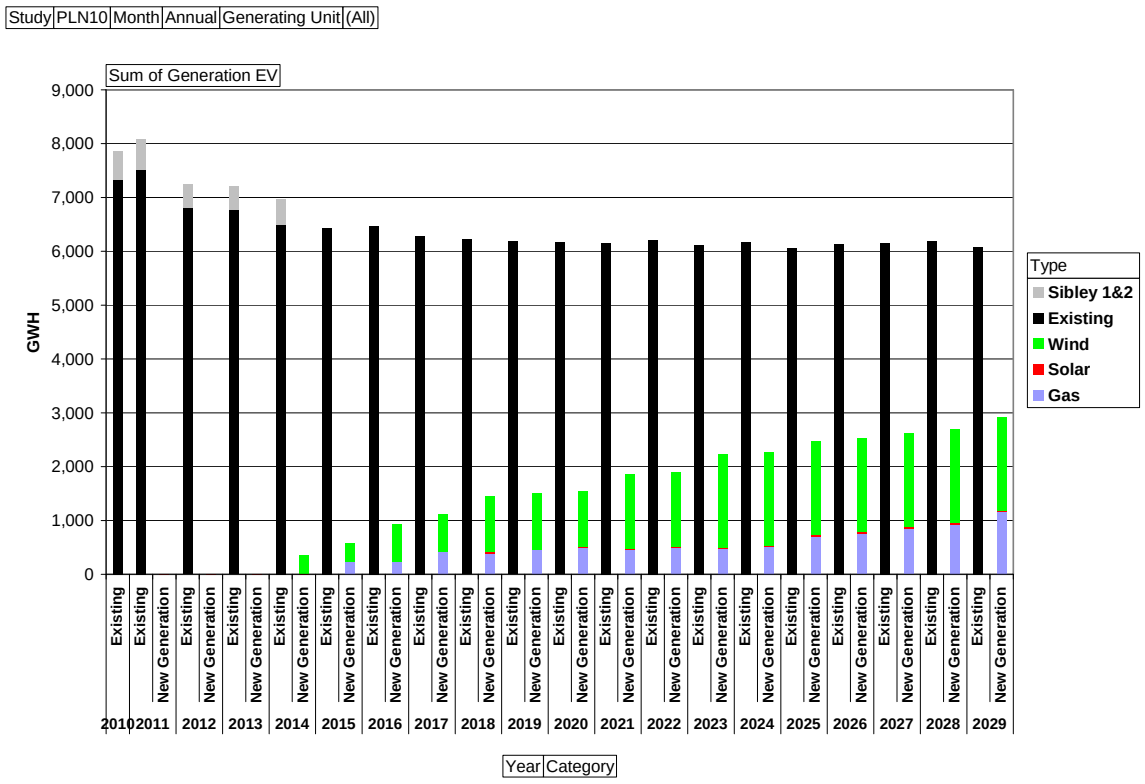


Figure 52: Plan11 Generation

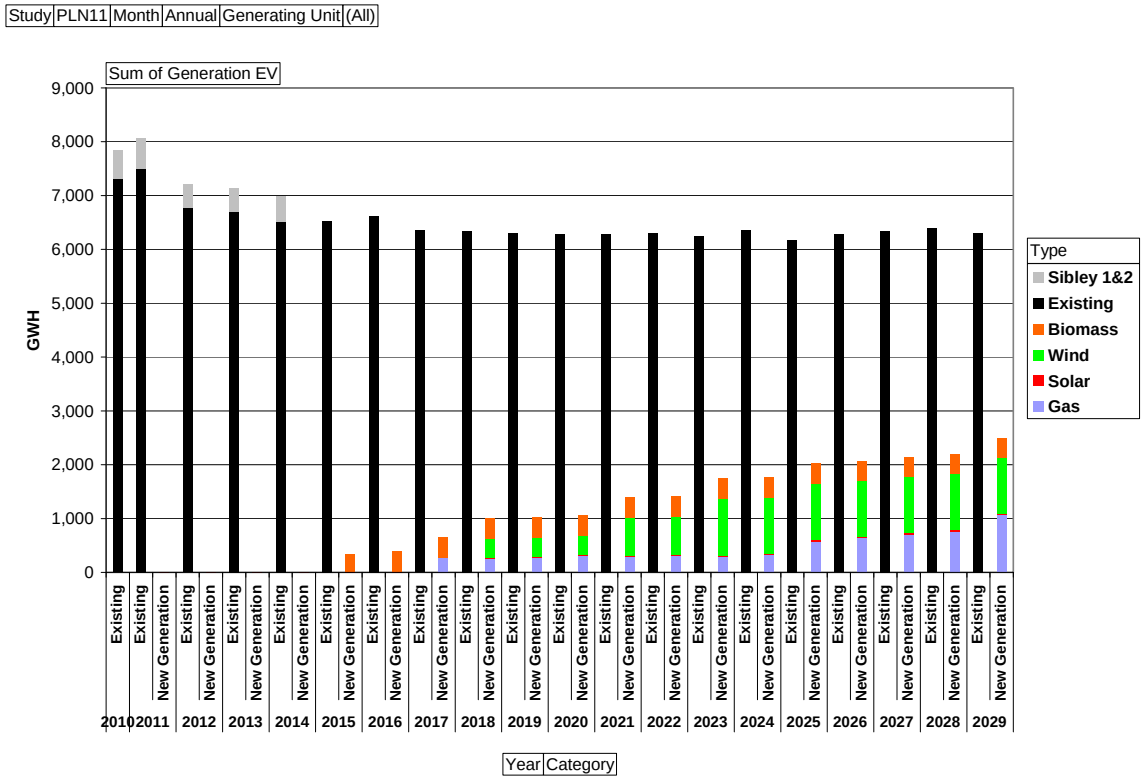


Figure 53: Plan12 Generation

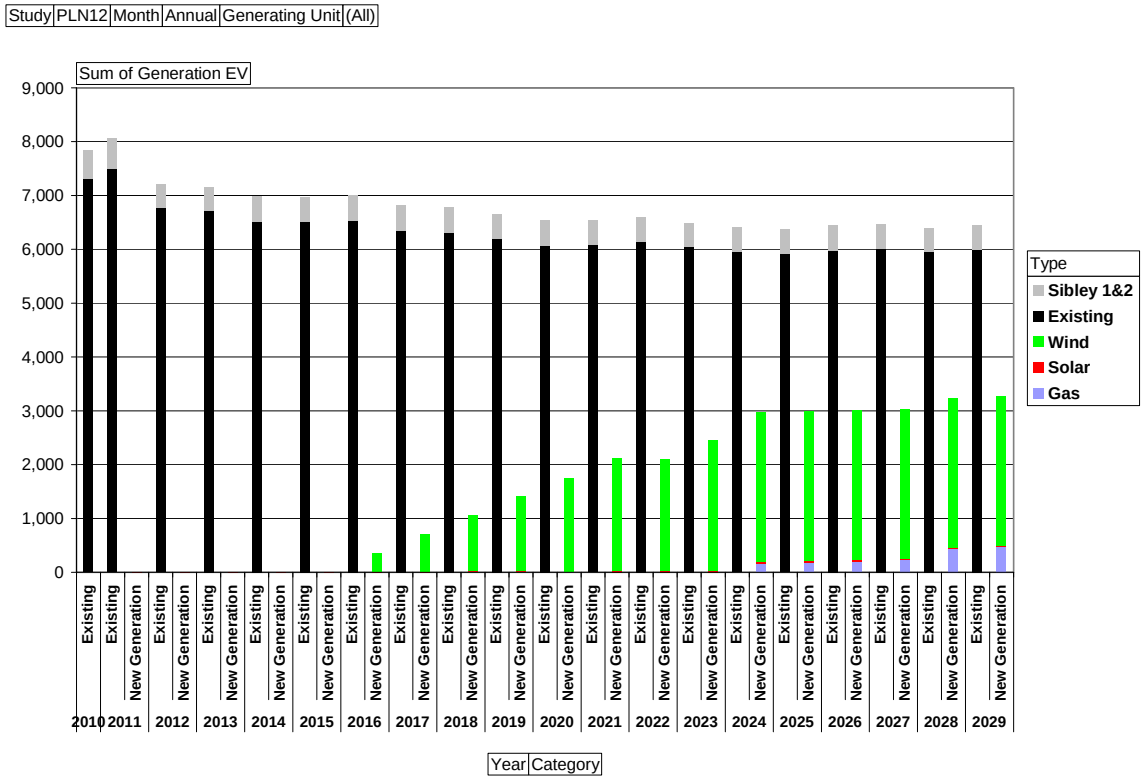


Figure 54: Plan13 Generation

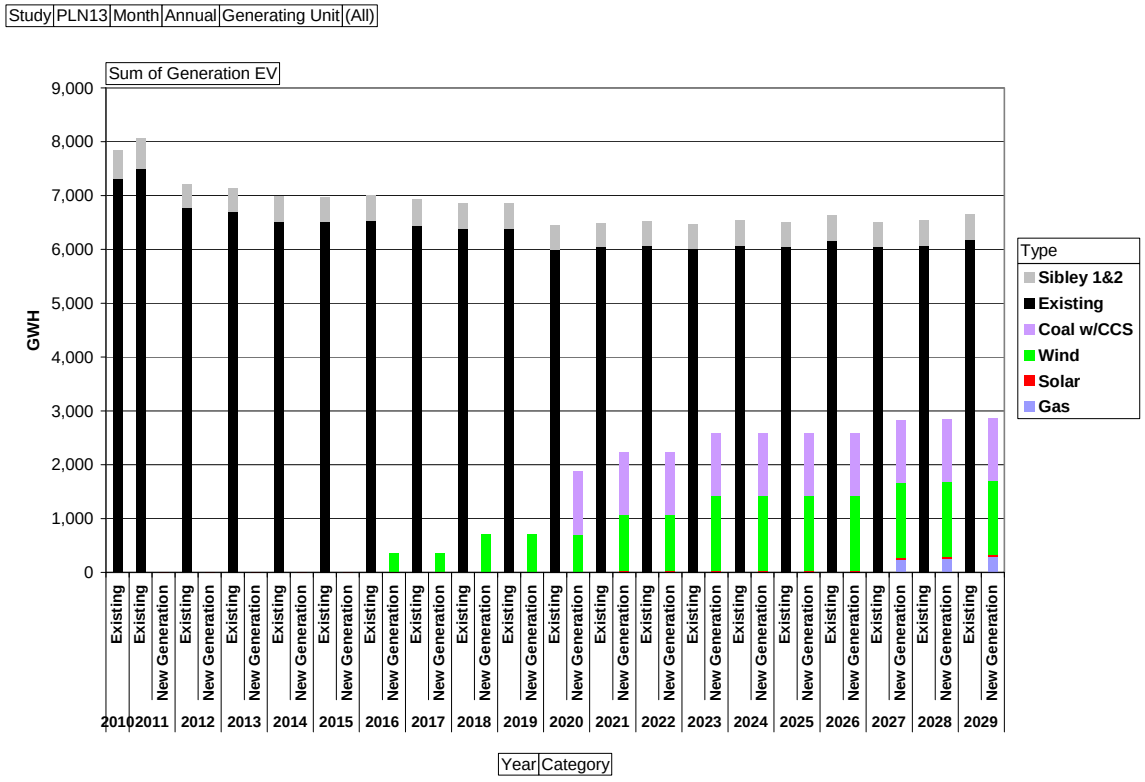


Figure 55: Plan14 Generation

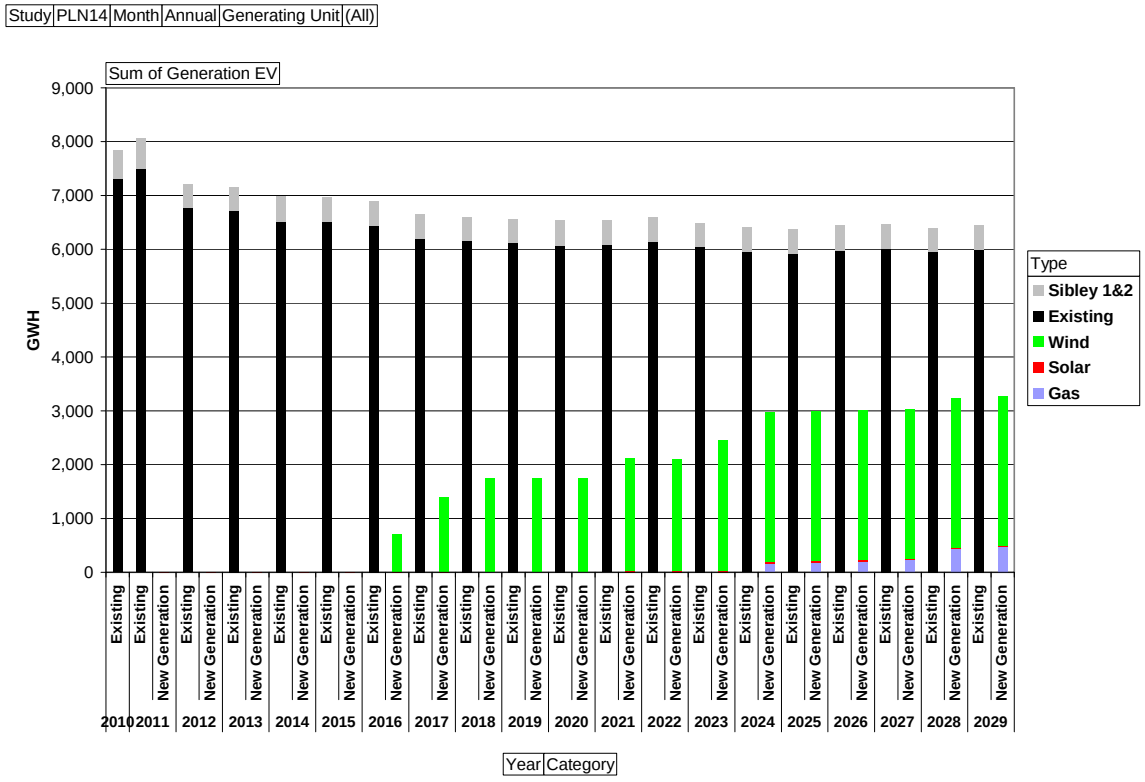


Figure 56: Plan15 Generation

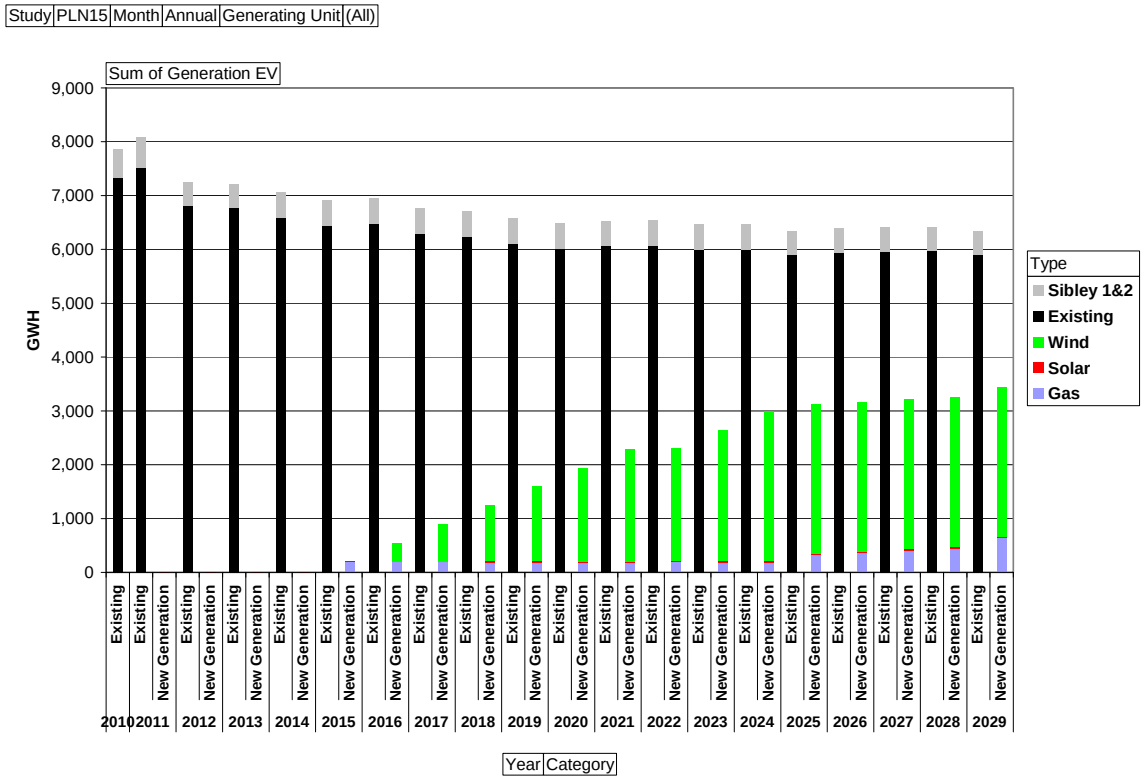


Figure 57: Plan16 Generation

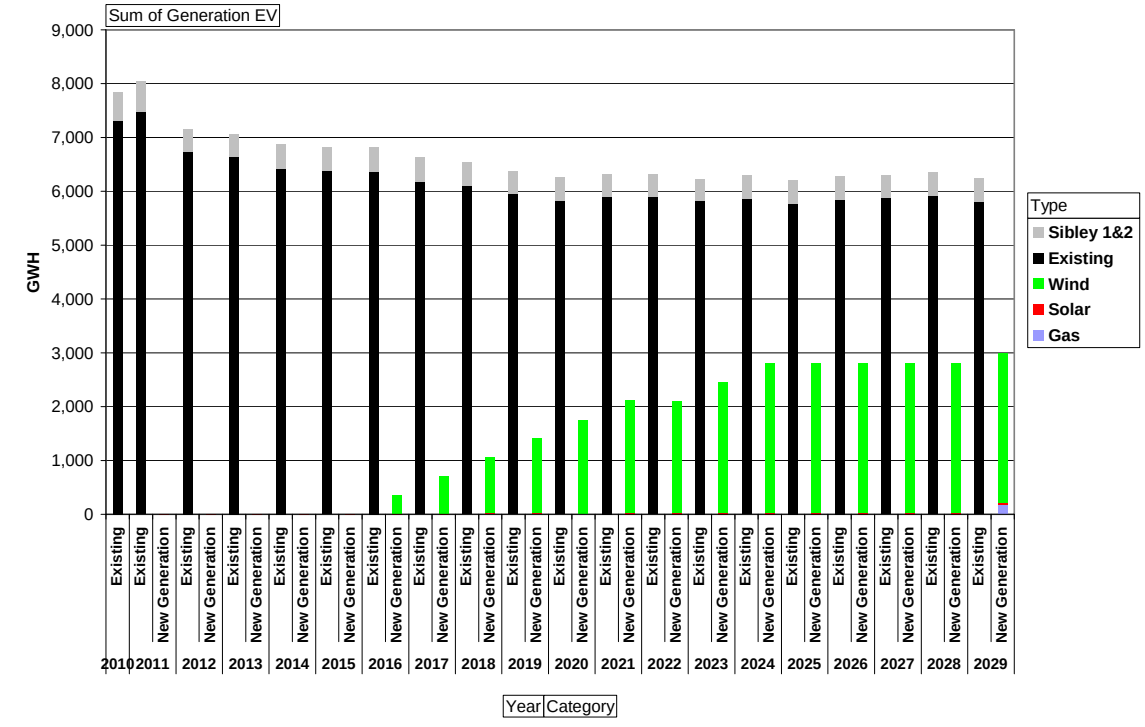


Figure 58: Plan17 Generation

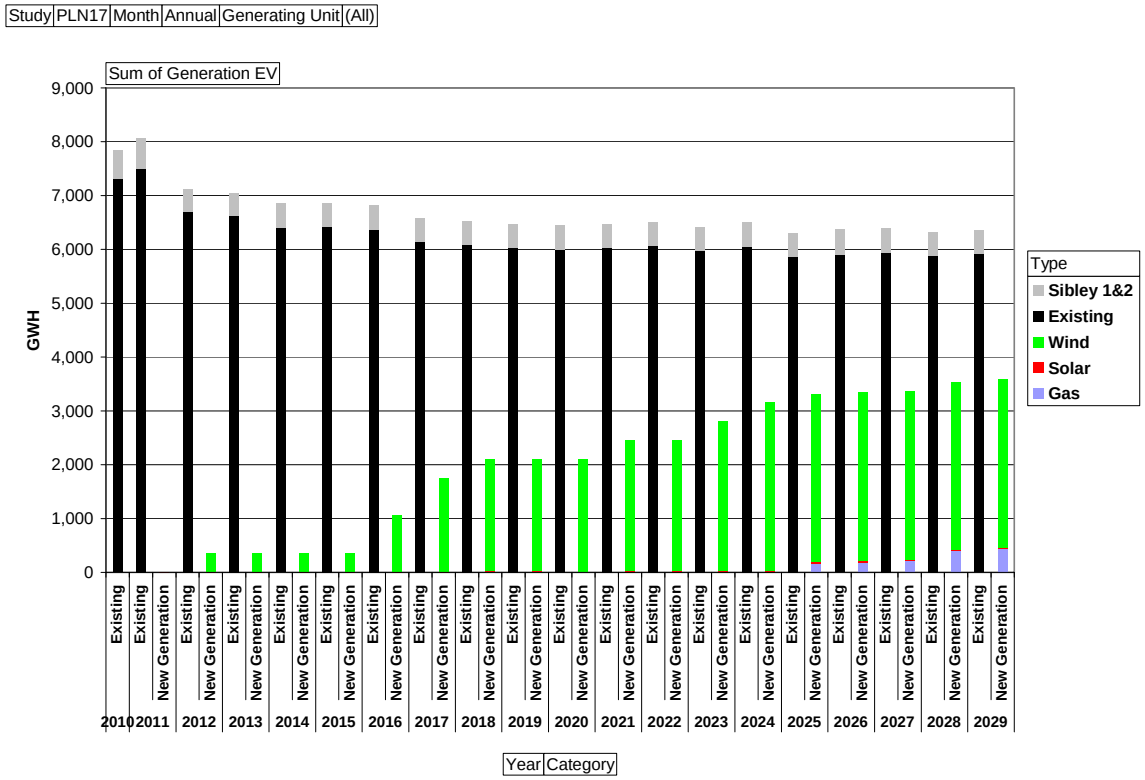


Figure 59: Plan18 Generation

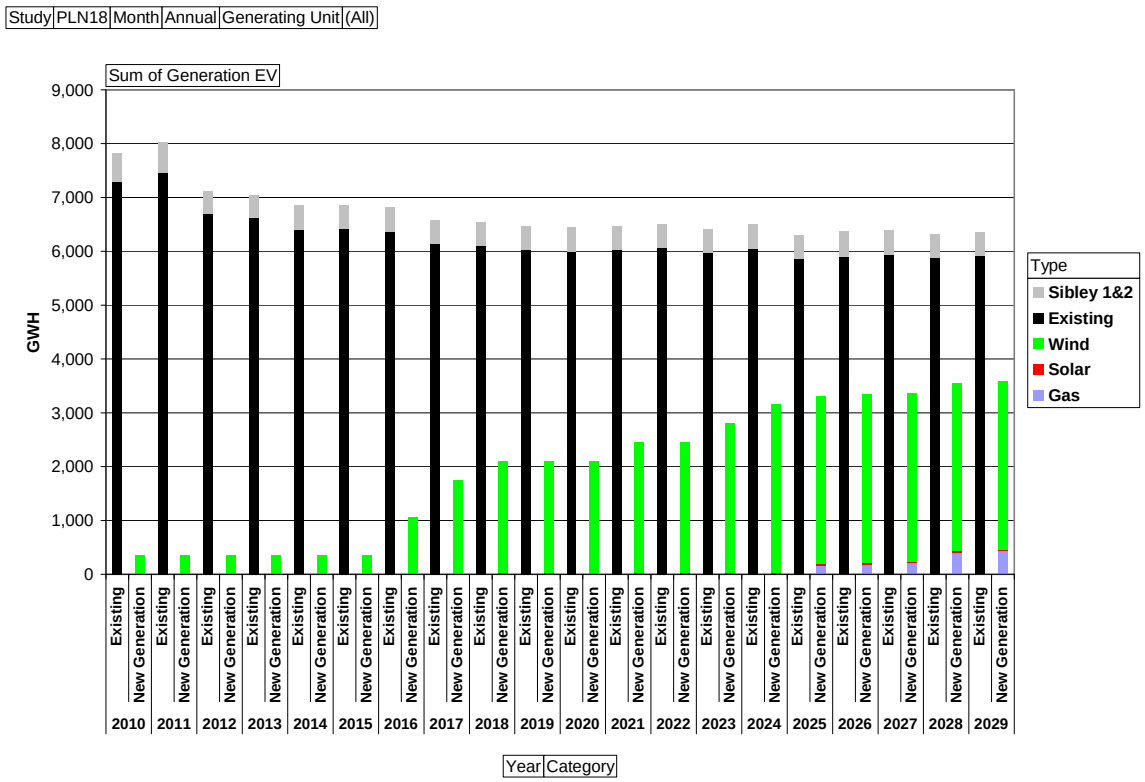


Figure 60: Plan19 Generation

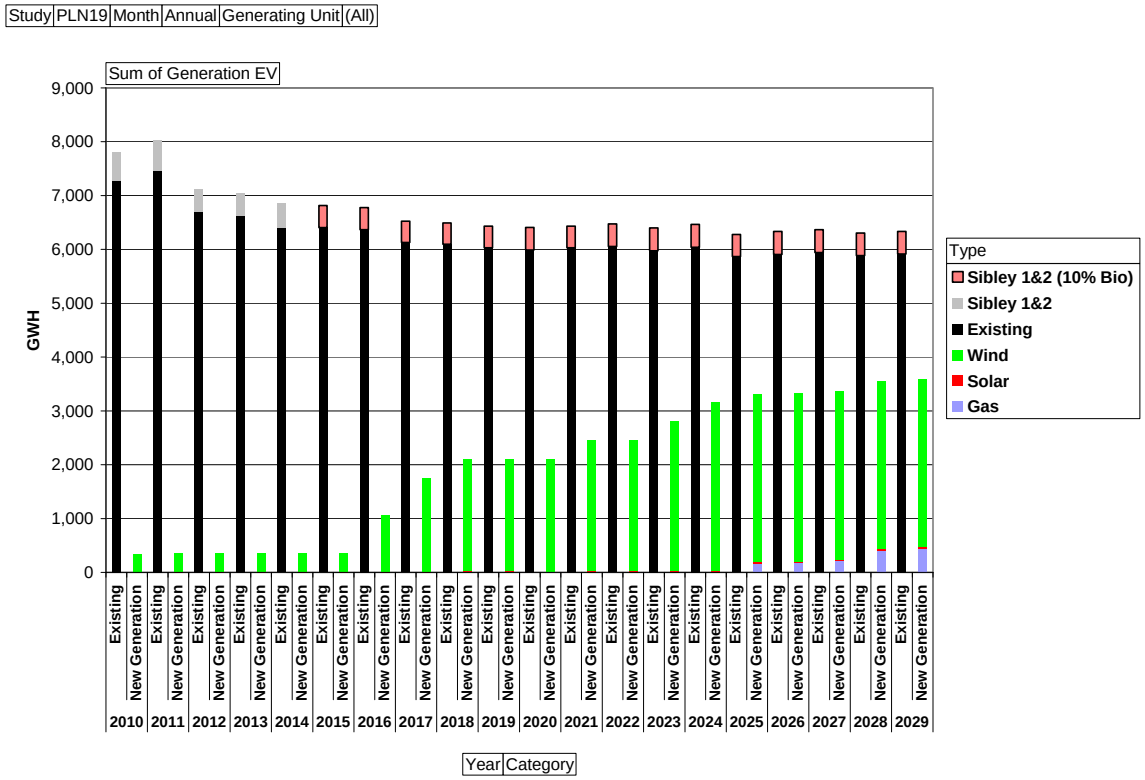


Figure 61: Plan20 Generation

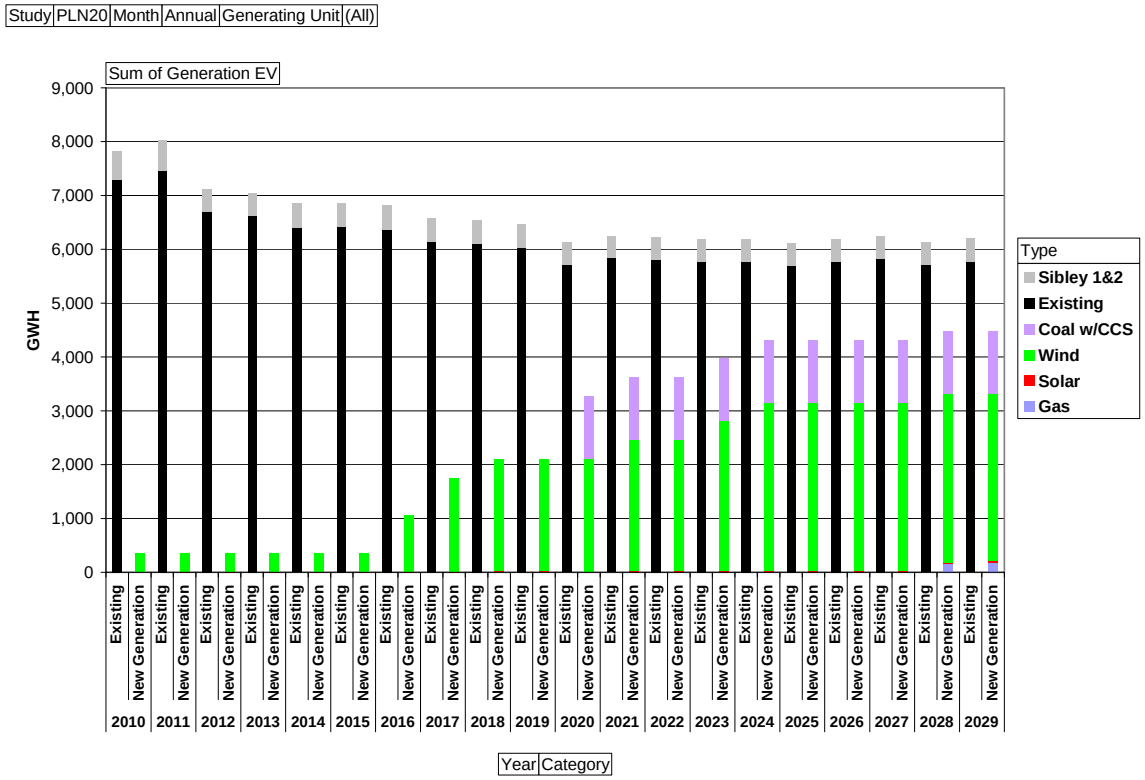


Figure 62: Plan21 Generation

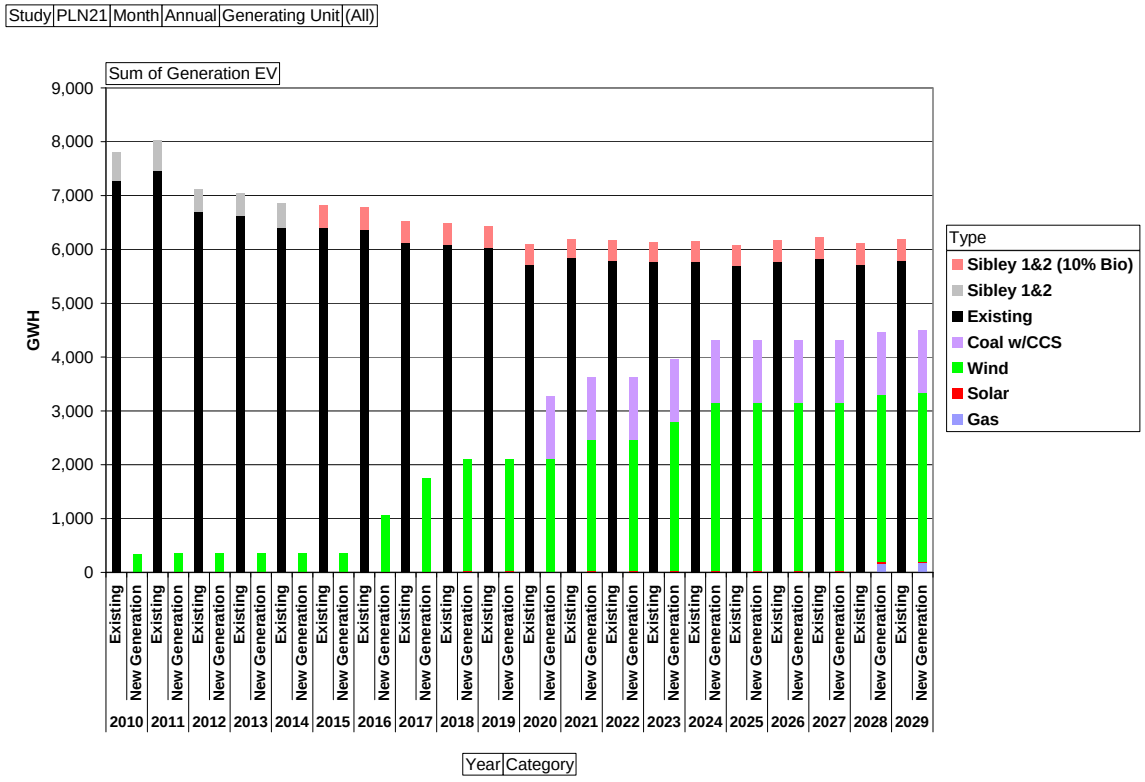


Figure 63: Plan22 Generation

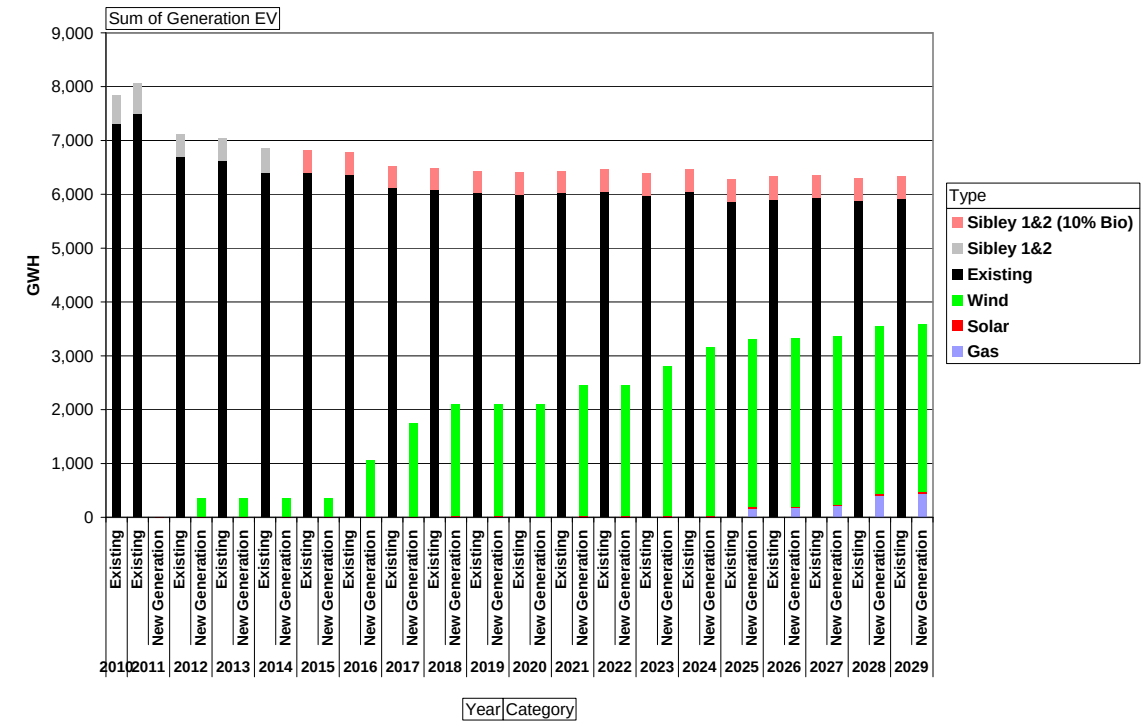


Figure 64: Plan23 Generation

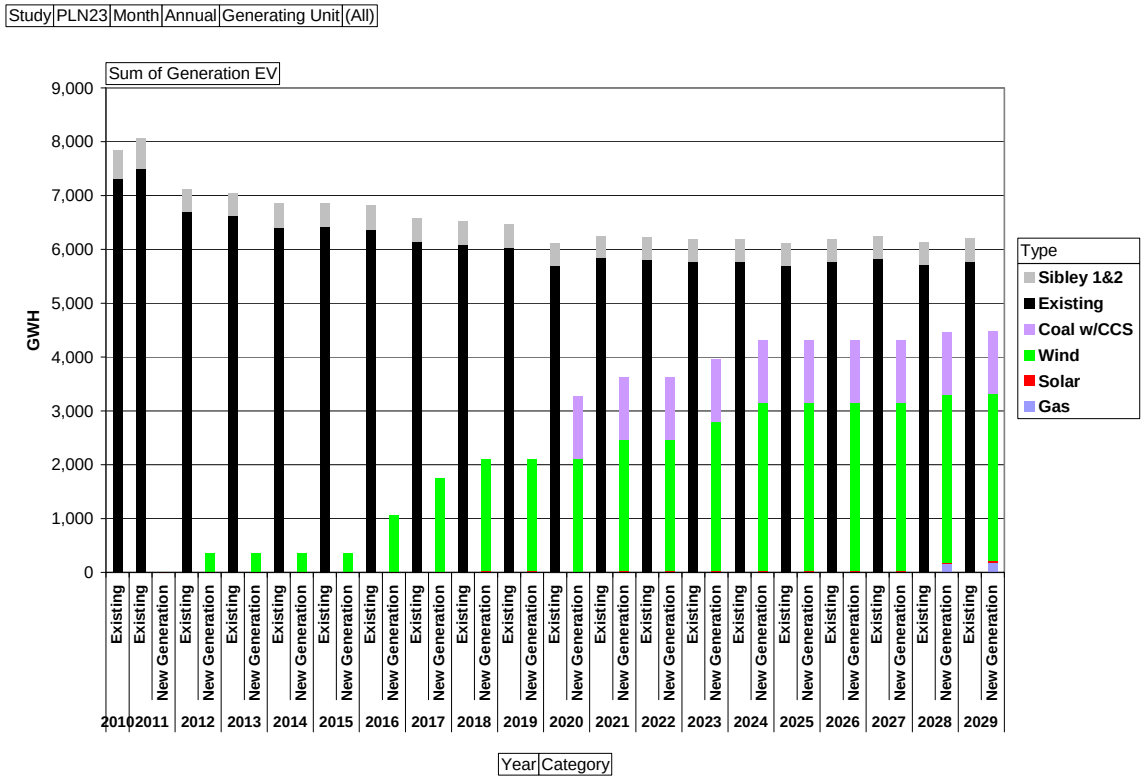
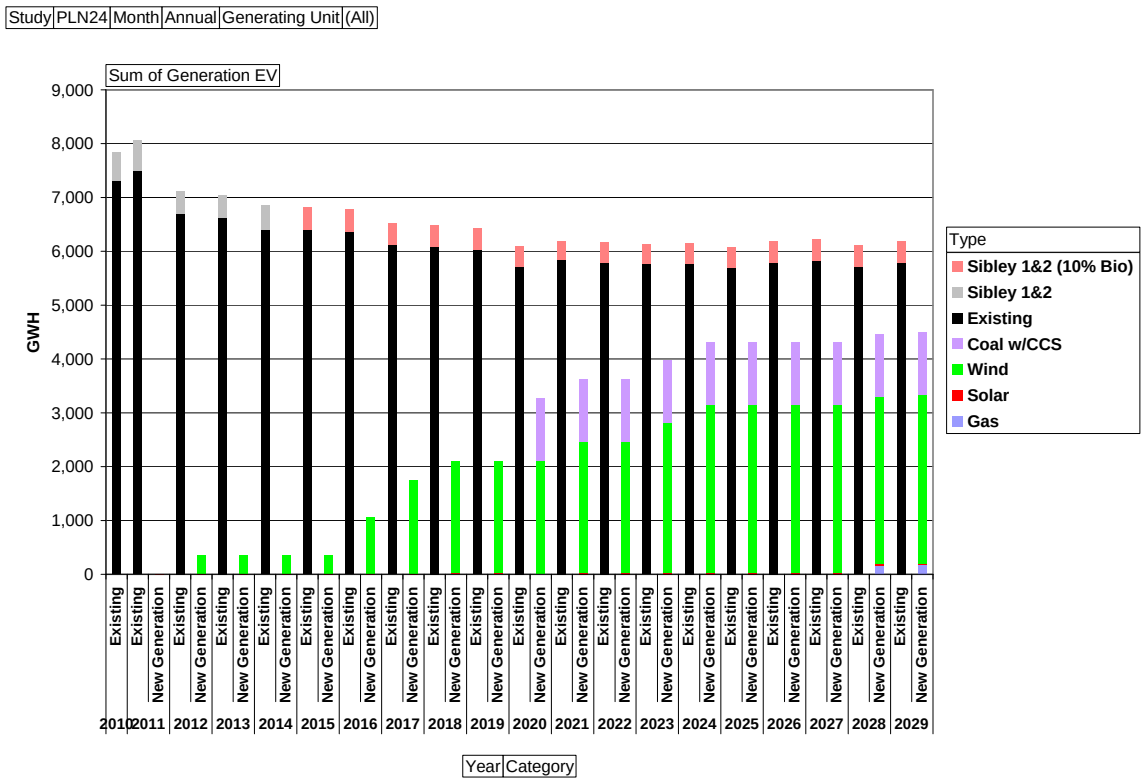


Figure 65: Plan24 Generation



6.3.7 FINANCIAL PERFORMANCE MEASURES

7. The values of the three (3) measures of financial condition identified in subsection (4)(A);

Plots of the values of the three measures of financial condition identified in subsection (4) (A) are given in Figure 66 through Figure 68 below.

Figure 66: PreTax Interest Coverage by Plan

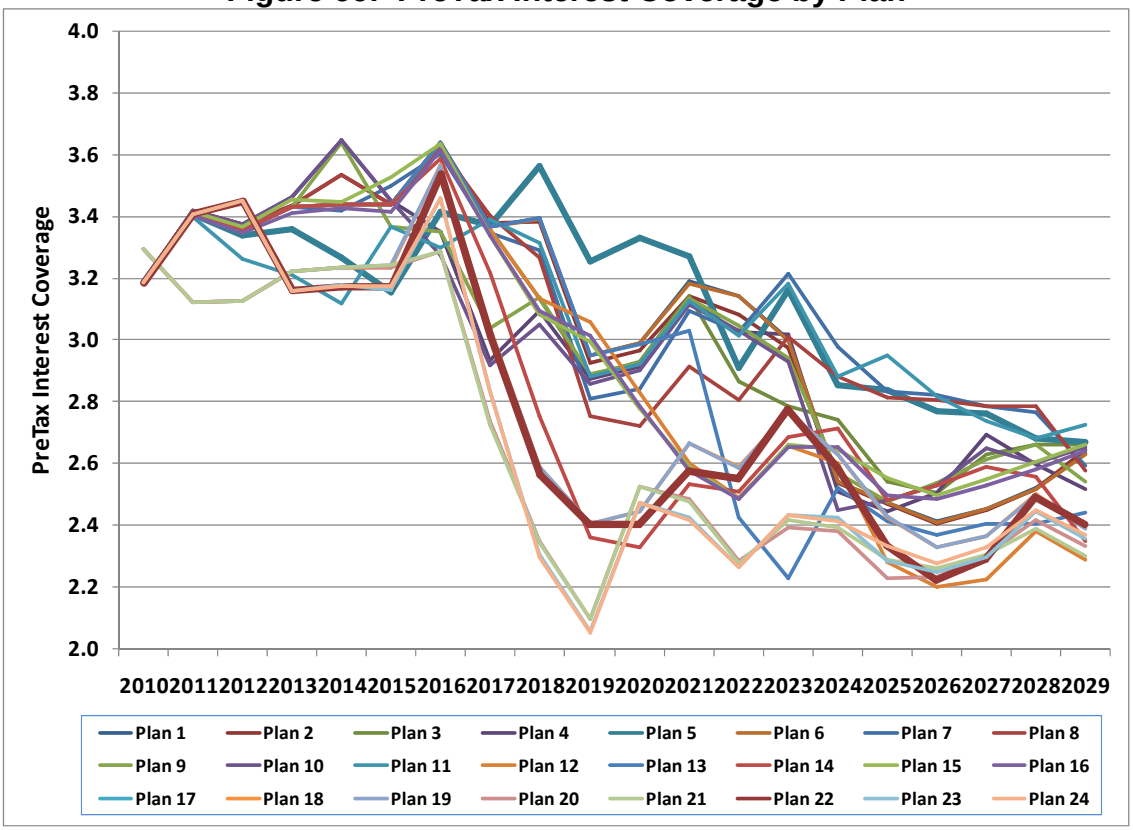


Figure 67: Ratio of Total Debt to Total Capital

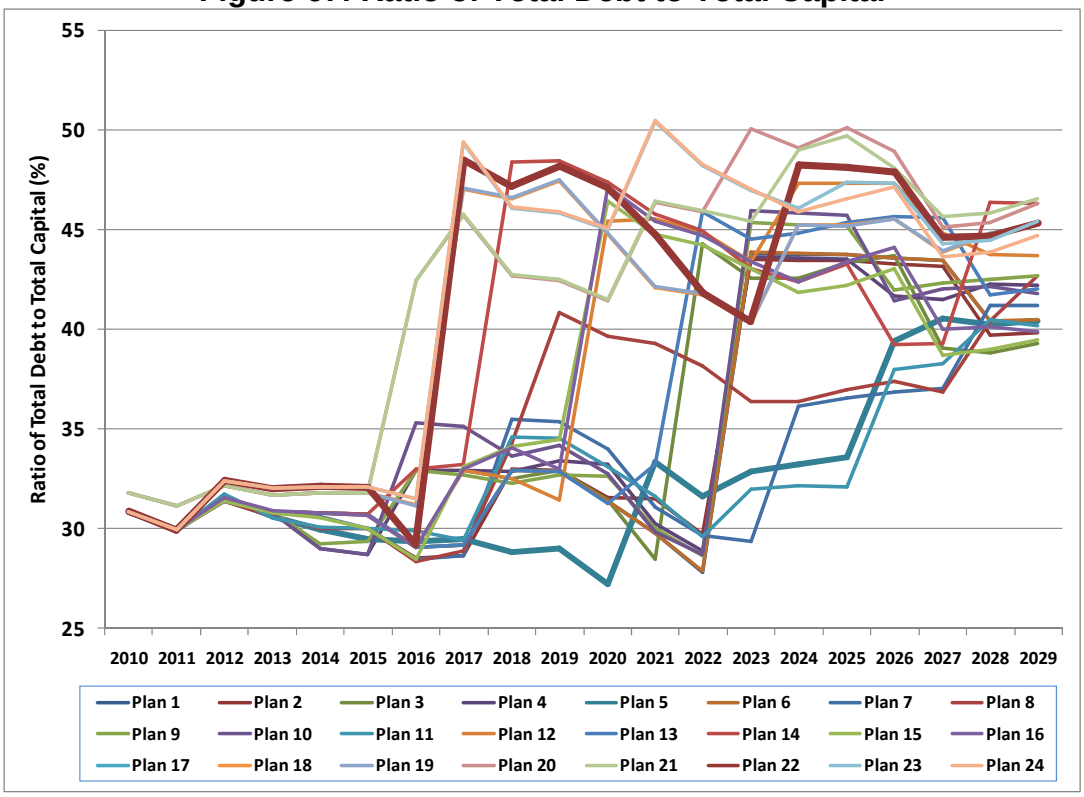
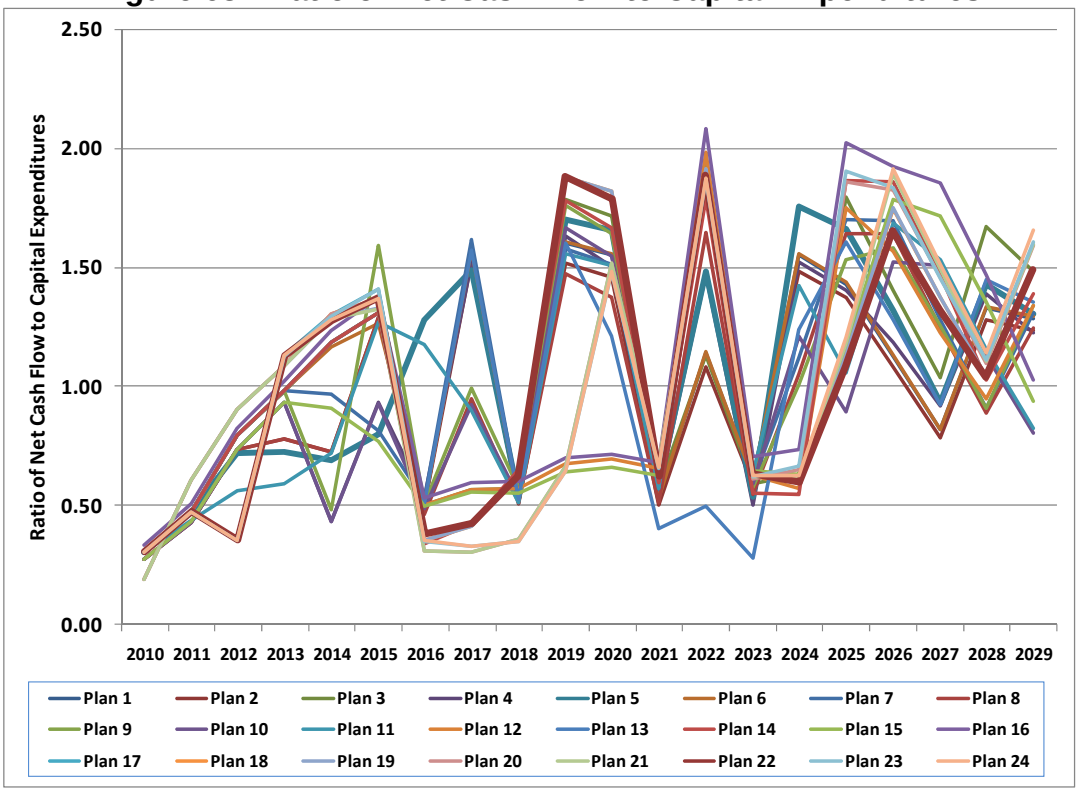


Figure 68: Ratio of Net Cash Flow to Capital Expenditures

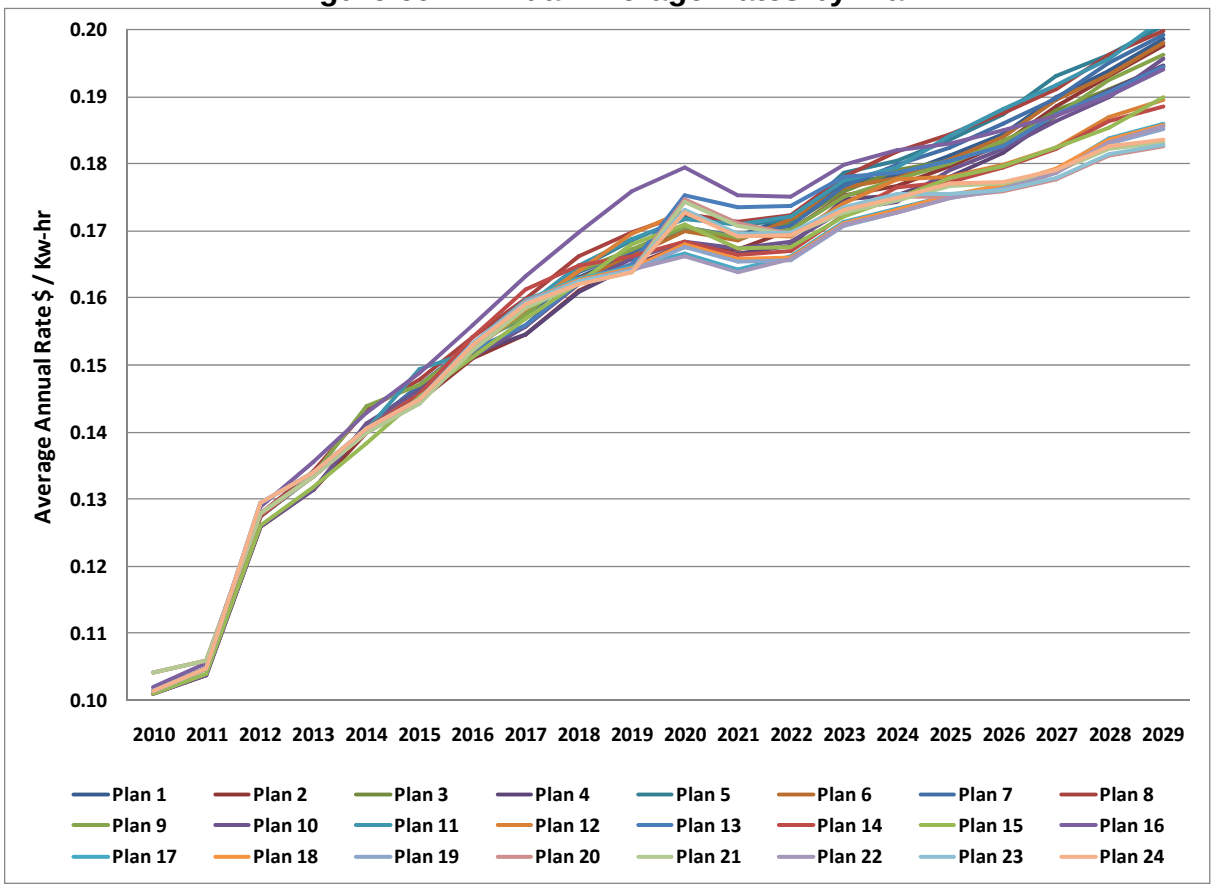


6.3.8 ANNUAL AVERAGE RATES

8. Annual average rates;

Annual average rates are detailed in Figure 69.

Figure 69: Annual Average Rates by Plan



6.3.9 ANNUAL ENVIRONMENTAL POLLUTANT EMISSIONS

9. Annual emissions of each environmental pollutant identified pursuant to 4 CSR 240-22.040(2)(B)1; and

Annual pollutant emissions are detailed in Figure 70 through Figure 72.

Figure 70: Annual SO2 Emissions by Plan

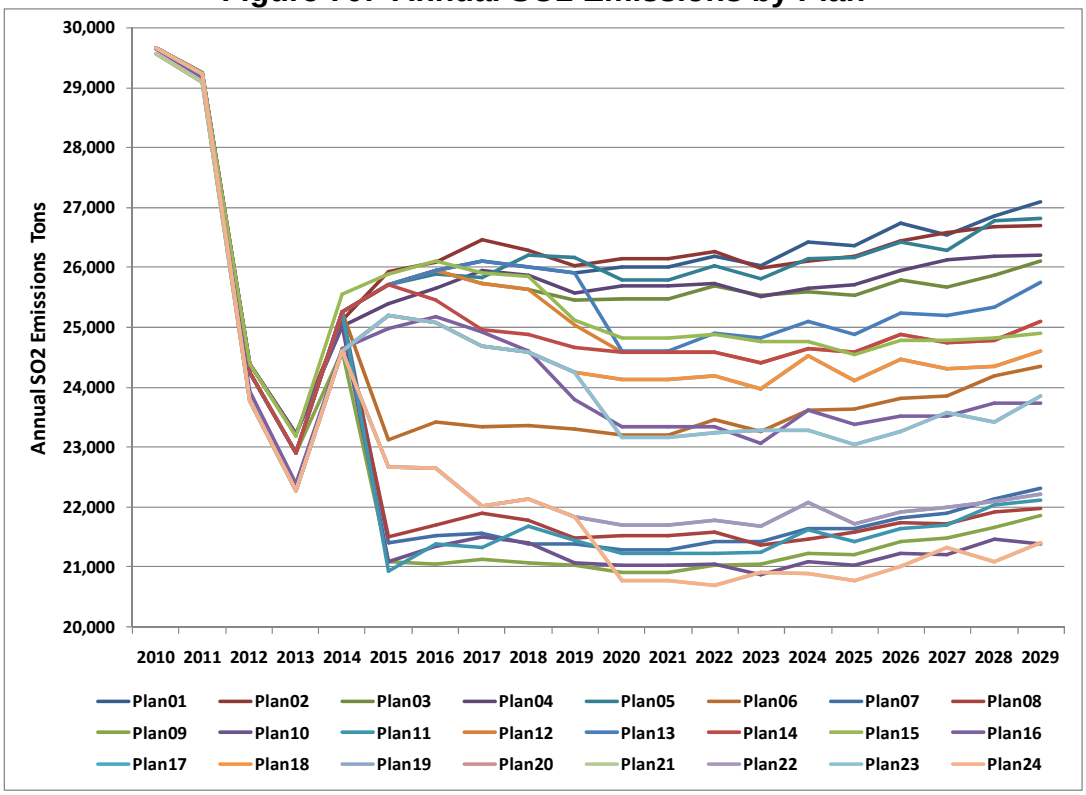


Figure 71: Annual NOx Emissions by Plan

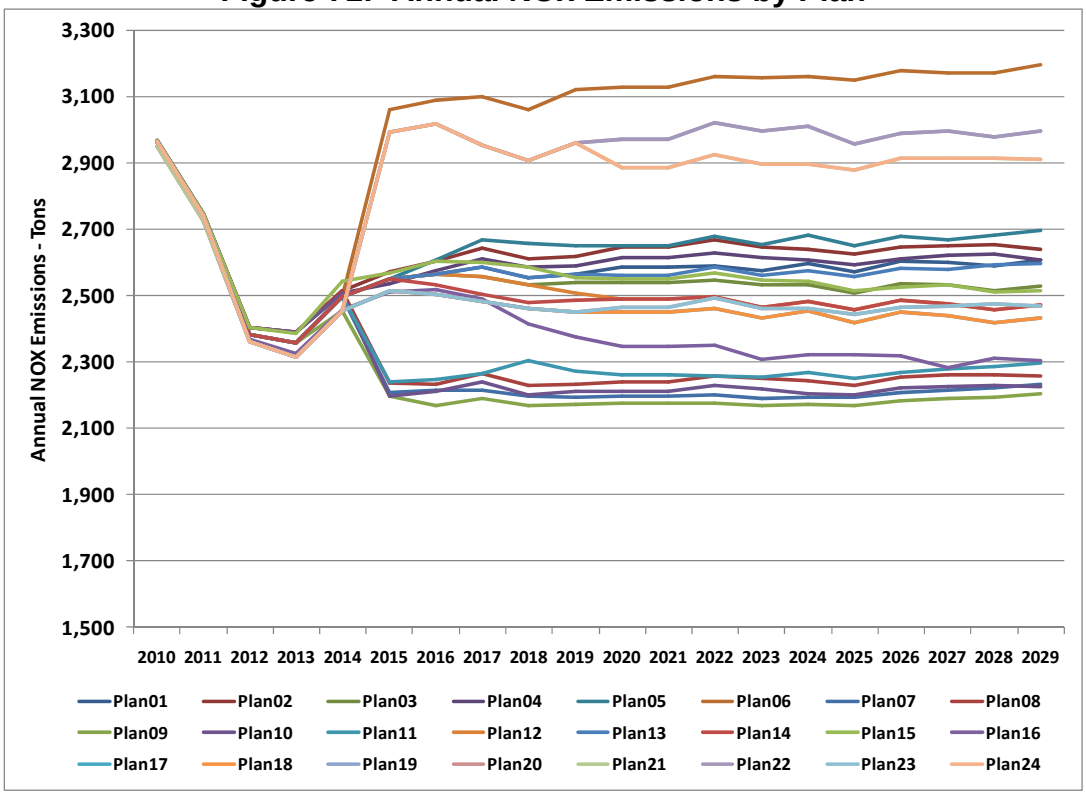
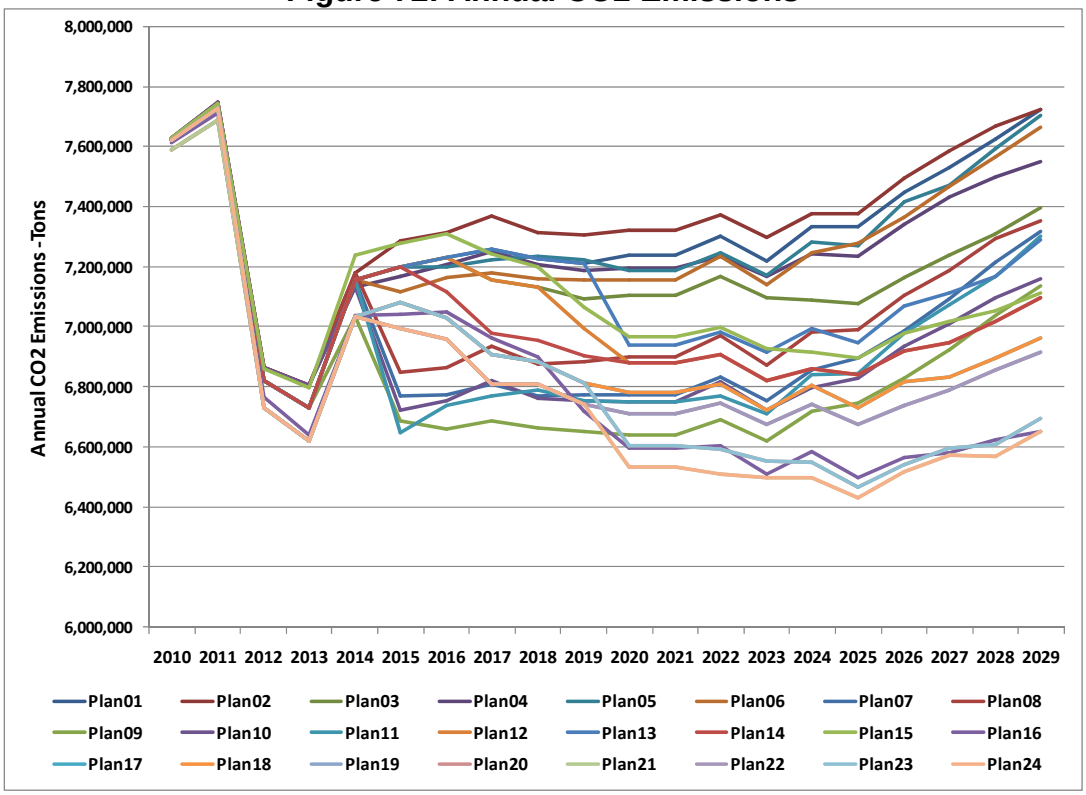


Figure 72: Annual CO2 Emissions

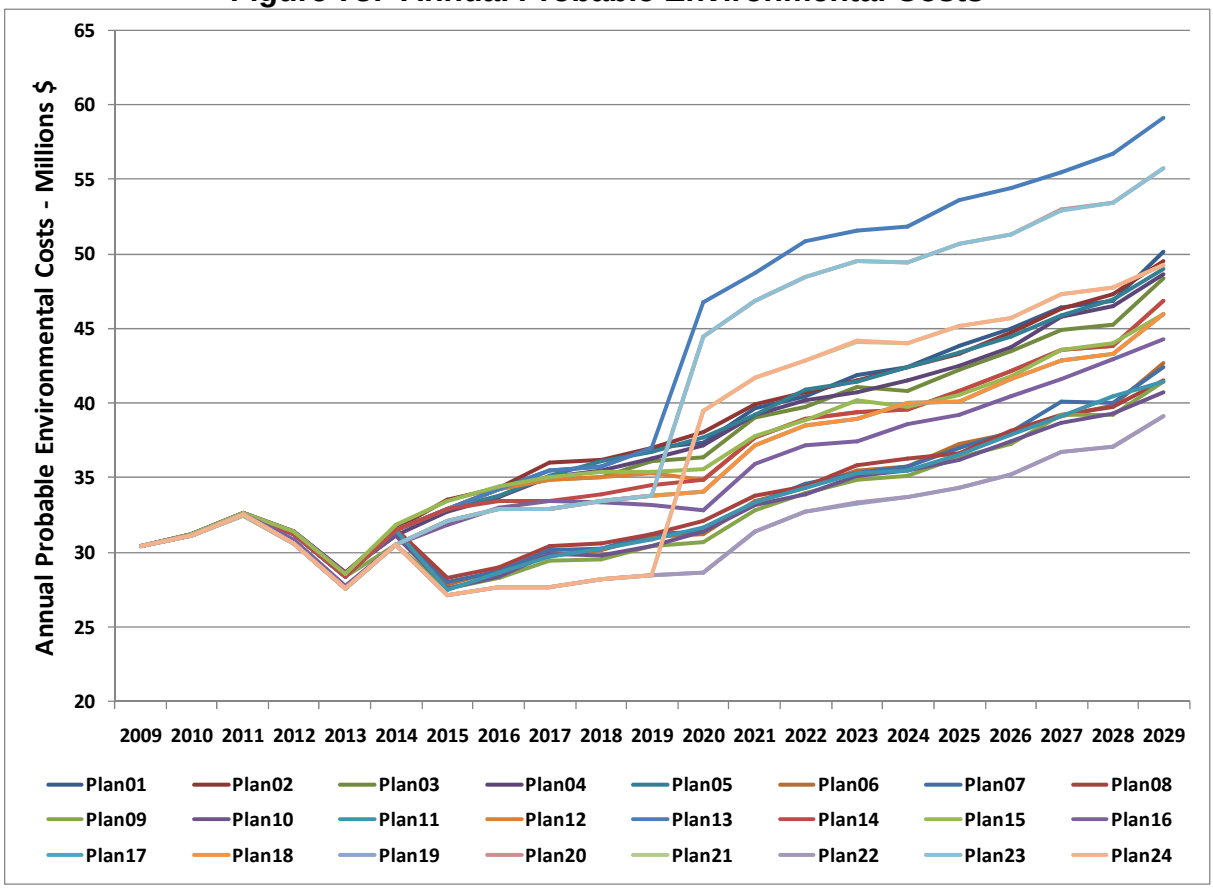


6.3.10 ANNUAL PROBABLE ENVIRONMENTAL COSTS

10. Annual probable environmental costs.

Annual probable environmental costs are shown in Figure 73 below.

Figure 73: Annual Probable Environmental Costs



6.4 RATE CHANGE IMPACT

(D) A discussion of how the impacts of rate changes on future electric loads were modeled and how the appropriate estimates of price elasticity were obtained;

The impact of price elasticity on future loads is discussed in detail in Volume 3.

6.5 MODELING SOFTWARE DESCRIPTION

(E) A description of the computer models used in the analysis of alternative resource plans; and

The MIDAS™ provides hourly chronological dispatch of all system generating assets including unit commitment logic that simulation the actual operation of the utility system resources. The model contains all unit operating variables required to

simulate the units. These variables include but are not limited to, heat rates, fuel costs, variable operation and maintenance costs, sulfur dioxide emission allowance costs, scheduled maintenance outages, forced and derate outages rates each on a per unit basis.

The model can also simulate capacity and energy purchases from or sales to a market in either a firm transaction or as a spot market transaction. In the case of market based transactions, all can be conducted with the impact of environmental credits factored in. The level of purchases or sales can also be limited to any range desired. For this IRP, GMO has limited the ability to purchase firm sales to a level consistent with the company's current operating methods and market conditions.

6.6 LOAD BUILDING PROGRAMS

(F) A description of any proposed load-building programs, a discussion of why these programs are judged to be in the public interest and, for all resource plans that include these programs, plots of the following over the planning horizon:

GMO does not have any existing or proposed load-building programs.

6.6.1 AVERAGE RATES

1. Annual average rates with and without the load-building programs; and

GMO does not have any existing or proposed load-building programs.

6.6.2 ANNUAL UTILITY AND PROBABLE ENVIRONMENTAL COSTS

2. Annual utility costs and probable environmental costs with and without the load-building programs. .

GMO does not have any existing or proposed load-building programs.