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VECTREN PUBLIC STAKEHOLDER MEETING

DECEMBER 13, 2019

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WELCOME AND SAFETY SHARE

LYNNAE WILSON

INDIANA ELECTRIC CHIEF BUSINESS OFFICER

SAFETY SHARE

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Holiday Safety Tips

- Inspect electrical decorations for damage before use. Cracked or damaged sockets, loose or bare wires, and loose connections may cause a serious shock or start a fire
- Do not overload electrical outlets. Overloaded electrical outlets and faulty wires are a common cause of holiday fires. Avoid overloading outlets
- Use LED lights. Never connect more than three strings of incandescent lights. More than three strands can cause a fire
- Use battery-operated candles. Candles start almost half of home decoration fires (National Fire Protection Association - NFPA)
- Keep combustibles at least three feet from heat sources. Heat sources that are too close to a decoration are a common factor in home fires
- Protect cords from damage. To avoid shock or fire hazards, cords should never be pinched by furniture, forced into small spaces such as doors and windows, placed under rugs, located near heat sources, or attached by nails or staples
- Stay in the kitchen when something is cooking. Unattended cooking equipment is the leading cause of home cooking fires (NFPA).
- Turn off, unplug, and extinguish all decorations when going to sleep or leaving the house. Half of home fire deaths occur between the hours of 11pm and 7am (NFPA).

2019/2020 STAKEHOLDER PROCESS

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August 15, 2019	October 10, 2019	December 13, 2019	March 20, 2020[1]
• 2019/2020 IRP Process • Objectives and Measures • All-Source RFP • Environmental Update • Draft Reference Case Market Inputs & Scenarios	• RFP Update • Draft Resource Costs • Sales and Demand Forecast • DSM MPS/ Modeling Inputs • Scenario Modeling Inputs • Portfolio Development	• Draft Portfolios • Draft Reference Case Modeling Results • All-Source RFP Results and Final Modeling Inputs • Scenario Testing and Probabilistic Modeling Approach and Assumptions	• Final Reference Case and Scenario Modeling Results • Probabilistic Modeling Results • Risk Analysis Results • Preview the Preferred Portfolio

1 Updated

AGENDA

Time		
9:00 a.m.	Sign-in/Refreshments	
9:30 a.m.	Welcome, Safety Message	Lynnae Wilson, CenterPoint Energy Indiana Electric Chief Business Officer
9:50 a.m.	Follow-up Information Since Our Last Stakeholder Meeting	Matt Rice, Vectren Manager of Resource Planning
10:30 a.m.	Break	
10:40 a.m.	Draft Reference Case Results	Peter Hubbard, Manager of Energy Business Advisory, Pace Global
11:40 a.m.	Lunch	
12:40 p.m.	Final RFP Modeling Inputs	Matt Lind, Resource Planning & Market Assessments Business Lead, Burns and McDonnell
1:40 p.m.	Break	
1:50 p.m.	Portfolio Development	Matt Rice, Vectren Manager of Resource Planning
2:20 p.m.	Scenario Testing and Probabilistic Modeling	Peter Hubbard, Manager of Energy Business Advisory, Pace Global
2:50 p.m.	Next Steps	Matt Rice, Vectren Manager of Resource Planning
3: 00 p.m.	Adjourn	

MEETING GUIDELINES

1. Please hold most questions until the end of each presentation. Time will be allotted for questions following each presentation. (Clarifying questions about the slides are fine throughout)
2. For those that wish to participate remotely, please log in via the link provided Link to join in your RSVP and follow the phone instructions when prompted. To speak during the meeting, please make a request in the chat function, and we will open up your individual line.
3. If you wish to listen only, you may call in with the phone number provided in your RSVP: 1-415-655-0003 | Access code: 806 147 760. You will not be able to speak during the meeting utilizing this option.
4. There will be a parking lot for items to be addressed at a later time.
5. Vectren does not authorize the use of cameras or video recording devices of any kind during this meeting.
6. Questions asked at this meeting will be answered here or later.
7. We will do our best to capture notes but request that you provide written feedback (concepts, inputs, methodology, etc.) at IRP@CenterPointEnergy.com following the meeting. Additional questions can also be sent to this e-mail address.

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FOLLOW-UP INFORMATION SINCE OUR LAST STAKEHOLDER MEETING

MATT RICE

VECTREN MANAGER OF RESOURCE PLANNING

VECTREN COMMITMENTS FOR 2019/2020 IRP

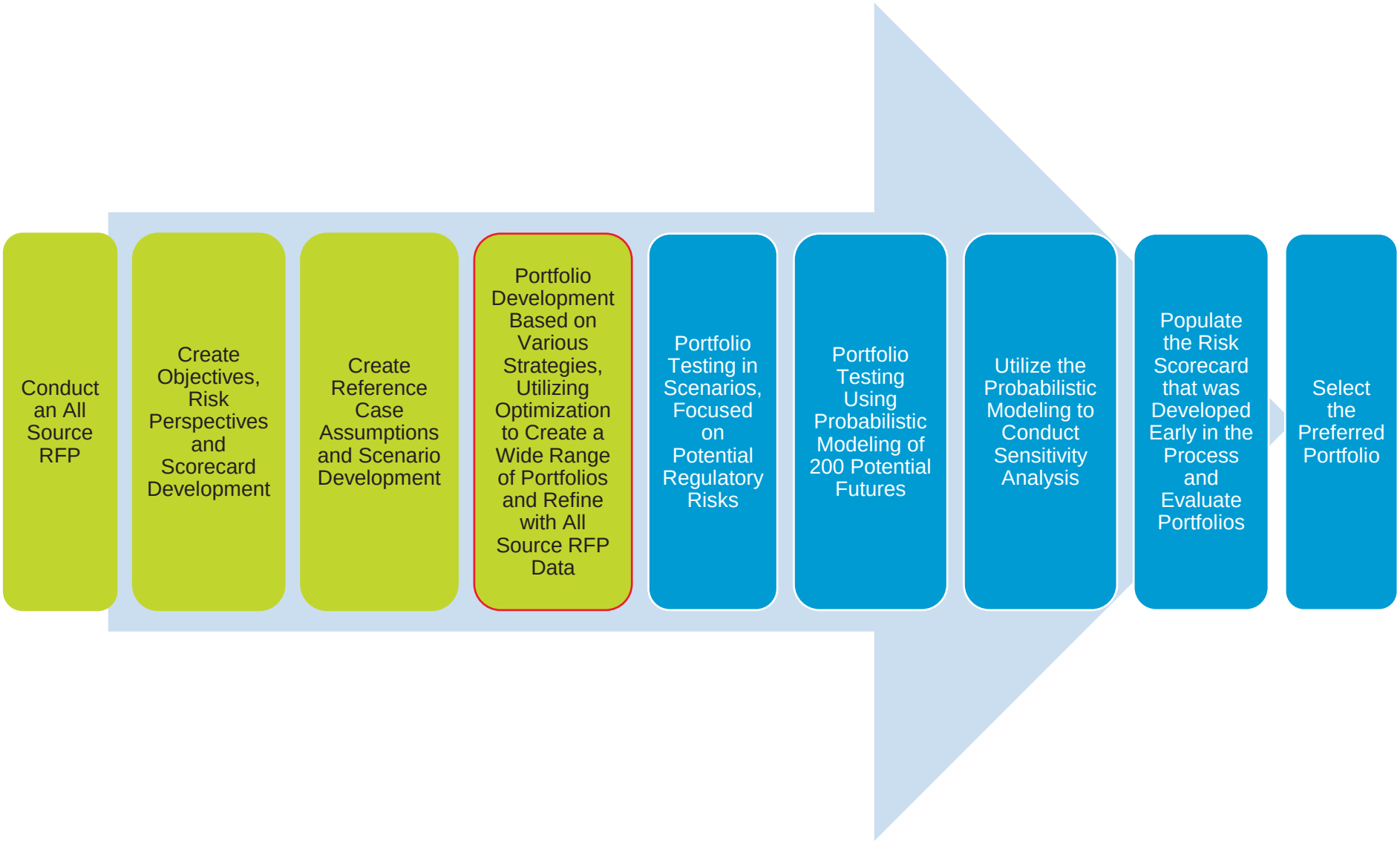
By the end of this stakeholder meeting Vectren will have made significant progress towards the following commitments

- ✓ Utilizing an All-Source RFP to gather market pricing & availability data
- ✓ Including a balanced, less qualitative risk score card; draft was shared at the first public stakeholder meeting
- ✓ Performing an exhaustive look at existing resource options
- ✓ Using one model for consistency in optimization, simulated dispatch, and probabilistic functions
- ✓ Working with stakeholders on portfolio development
- ✓ **Modeling more resources simultaneously**
- ✓ **Testing a wide range of portfolios in scenario modeling and ultimately in the risk analysis**
- ✓ **Providing a data release schedule and provide modeling data ahead of filing for evaluation**
- ✓ **Striving to make every encounter meaningful for stakeholders and for us**

Vectren will continue to work towards the remaining commitments over the next several months

- Ensuring the IRP process informs the selection of the preferred portfolio
- Conducting a sensitivity analysis
- Including information presented for multiple audiences (technical and non-technical)

2019/2020 IRP PROCESS



TENTATIVE DATA RELEASE SCHEDULE

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- Modeling files
  - Reference Case modeling files (confidential – available February 2020)
  - Scenarios modeling files (confidential – available April 2020)
  - Probabilistic modeling files (confidential – available May 2020)
- Sales and Demand Forecast
  - Report (not confidential – available now)
- RFP
  - Bid information (confidential)
  - Report (confidential – available March 2020)
- Various Power Supply Reports
  - Conversion (confidential – available February 2020)
  - Scrubber options (confidential – available February 2020)
  - ACE Study (confidential – available February 2020)
  - ELG (confidential – available February 2020)
  - Brown 1x1 CCGT (confidential – available March 2020)
- Pipeline cost assumptions (confidential – available February 2020)

STAKEHOLDER FEEDBACK

Request	Response
Add a scenario or replace a scenario with a Carbon Dividend modeled after HB 763, which includes a CO_2 price in 2022 of $15, increasing by $10 per ton each year ($185 by 2039)	Our High regulatory case includes a high CO_2 fee and dividend. While there is no guarantee that a carbon dividend future would exactly mirror HB 763, we will run a sensitivity for portfolio development based on HB 763 to determine what type of portfolio it creates. Assuming that it is different than other portfolios that we are considering, we can include the portfolio in the risk analysis. We do not plan to create a 6th scenario
A cap and trade scenario is not a likely potential future	Cap and Trade is a real possibility. Beyond ACE, it was the only carbon compliance law in the US to date. The 80% reduction of CO_2 future, which is in alignment with the Paris Accord, is a reasonable potential future (our middle bound). Scenarios are not predictions of the future but provide plausible futures boundary conditions
It is premature to model a seasonal construct, referring to summer and winter (MISO) UCAP accreditation	As mentioned in the last meeting, MISO is moving to a seasonal construct. Vectren evaluated other potential calculations for accrediting solar with capacity in the winter. Determined that a weighted average of daily peak conditions could yield an 11% UCAP for solar in the winter, as opposed to 0%. Increased solar penetration would still reduce this amount of accreditation over time

STAKEHOLDER FEEDBACK

Request	Response
Referring to hydro studies cited at the 2nd stakeholder meeting, please clarify what the difference between estimated potential capacity, estimate of feasible capacity, and estimated optimal capacity is. Additionally, there was a request to increase the Vectren hydro modeling assumption from 50 MWs at each nearby dam to 100 MWs each	The DOE/NREL study, which provided estimated potential capacity, is a high level estimate of potential using generic modeling assumptions and not taking economics into consideration. The Army Corp of Engineers uses specific conditions on the Ohio to refine the DOE/NREL initial estimates into realistic project potential. 50 MWs at each dam is more in line with the range provided in the Army Corp of Engineers study. Vectren will evaluate two blocks of 50 MWs within scenario modeling and portfolio development
The NREL Life Cycle GHG study is dated	We had a discussion with First Solar on their perspective regarding lifecycle of greenhouse gas emissions for solar resources. An IEA study with updated assumptions on solar found a similar result to the NREL study for local solar resources. Additionally, Vectren likes the fact that NREL's study is fairly comprehensive. Vectren plans to utilize the NREL Study for estimated life cycle CO_2e for most resource types
NREL Life Cycle GHG study does not consider storage	Evaluating options
NREL Life Cycle GHG study does not consider gas resources and Vectren should simply utilize an alternate calculation for natural gas resources	The NREL study did consider gas resources. Various gas studies considered for the analysis included methane leaks as part of the study (see appendix)

STAKEHOLDER FEEDBACK

Request	Response
Add a CO_2 price to the Reference Case	We have added the mid-range CO_2 price to the Reference Case. ACE runs for 8 years and is replaced (see slide 20)
Your trended weather projections do not look anything like Purdue's	We reached out to Purdue University. They provided some clarification on the differences between their study and ours, including using different set points for heating and cooling degree days. Itron reviewed and estimated that the HDD trend is the same, while the CDD trend is nearly two times higher in the Purdue dataset. Utilizing the Purdue CDD trend would add approximately 40 MWs to Vectren's forecast over the next 20 years, which is well within our high bound forecast. We do not plan to update our load forecast, based on this analysis
Follow-up on updates to Industrial DR tariff	Report back progress in the next IRP stakeholder meeting
$5k for Aurora is paying for transparency	Met with CAC, Pace, and Energy Exemplar (Aurora) on Oct. 24th. To address CAC's concern, Pace will work to provide relevant input tables from modeling, which include model settings. Each table will need to be exported separately. Additionally each relevant help function page will be exported separately. While time consuming, Pace will work to accommodate this request for stakeholders. Modeling files will be shared later in the process as timely analysis takes precedent

MISO UPDATE

- John Bear, CEO of MISO, recently testified before the Subcommittee on Energy. Reiterated the importance of the Renewable Integration Impact Assessment (RIAA) analysis
  - While MISO is fuel source neutral, they have learned that renewable penetration of 30% would challenge MISO's ability to maintain the planning reserve margin and operate the system within acceptable voltage and thermal limits
  - Maintaining reliability at 40% renewable level becomes significantly more complex. Currently MISO is studying 50% penetration level
  - Implications include tight operating conditions (need to utilize emergency procedures to manage reliability risk)
  - Requires a shift in market processes and protocols
    - We can no longer be confident that the system will be reliable year round based on peak demand in the summer. **All hours matter**
    - Resources must provide enough, and the right kinds of critical attributes needed to keep the system operating in a reliable, steady state, such as frequency response, voltage control, and black-start capability
    - We can no longer be confident that the existing transmission system can adapt to the new paradigm of smaller, decentralized intermittent renewable resources
  - Fleet of the future: improved availability, flexibility, and visibility. MISO is working to hold members responsible to deliver attributes and is developing incentives for these attributes

CCR / ELG – PROPOSED RULE SUMMARIES

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- CCR
  - Advances date the cease use of all unlined ponds by 2 months, from October 31, 2020 to **August 31, 2020**
  - Short-term extension available to November 30, 2020
  - Site-specific extension available which would allow continued use of pond until **October 15, 2023**. Requires submitting a demonstration and work plan to EPA for approval
  - Permanent Cessation of Boiler extension
    - AB Brown – use of pond until October 17, 2028 if closure is completed by same date
      - This extension option is not feasible for AB Brown due to size and scope of closure
    - FB Culley – use of pond until October 17, 2023 if closure is completed by same date
- ELG
  - No extension for Bottom Ash Transport Water (BATW)
  - Revised limits for BATW on an "as needed" basis
    - 10% volume discharge on a 30-day rolling average
  - Boilers retiring by 2028 would only be subject to TSS limits; however, the earlier CCR deadline to cease disposal by October 2023 is the driver for compliance at AB Brown

CCGT STUDY

- No firm bids were received for gas CCGTs and nothing was on/near our system
- FERC recently updated a rule that allows for an expedited process within the MISO Queue to replace existing resources at or below existing interconnection rights
- As part of the IRP, it is prudent to study options with regards to existing resources, which includes existing Vectren sites
- Currently performing a study to obtain a +/- 10% cost estimate for a small/midsized 1x1 CCGT (F-class and H-class) at the Brown site to be included in final IRP modeling (consistent with CCGT units included within the tech. assessment at +/- 50%)
- Benefits of the Brown site
  - Electric infrastructure in place to support a 400-500 MW unit
  - Would allow Vectren to utilize existing assets at the site
  - Would preserve tax base and jobs in Posey County

BAGS 2 RETIRED

- Retiring Broadway Avenue Generating Station 2 (65 MWs of installed capacity) by the end of the year
  - Typical life is 30-40 years; Unit has been in service for 38 years
  - Highest heat rate (least efficient) of current generating fleet
  - Recent five year capacity factor just over 1%
  - Several million dollars needed for known repairs
  - High probability of additional expenses in the near future given current age and condition

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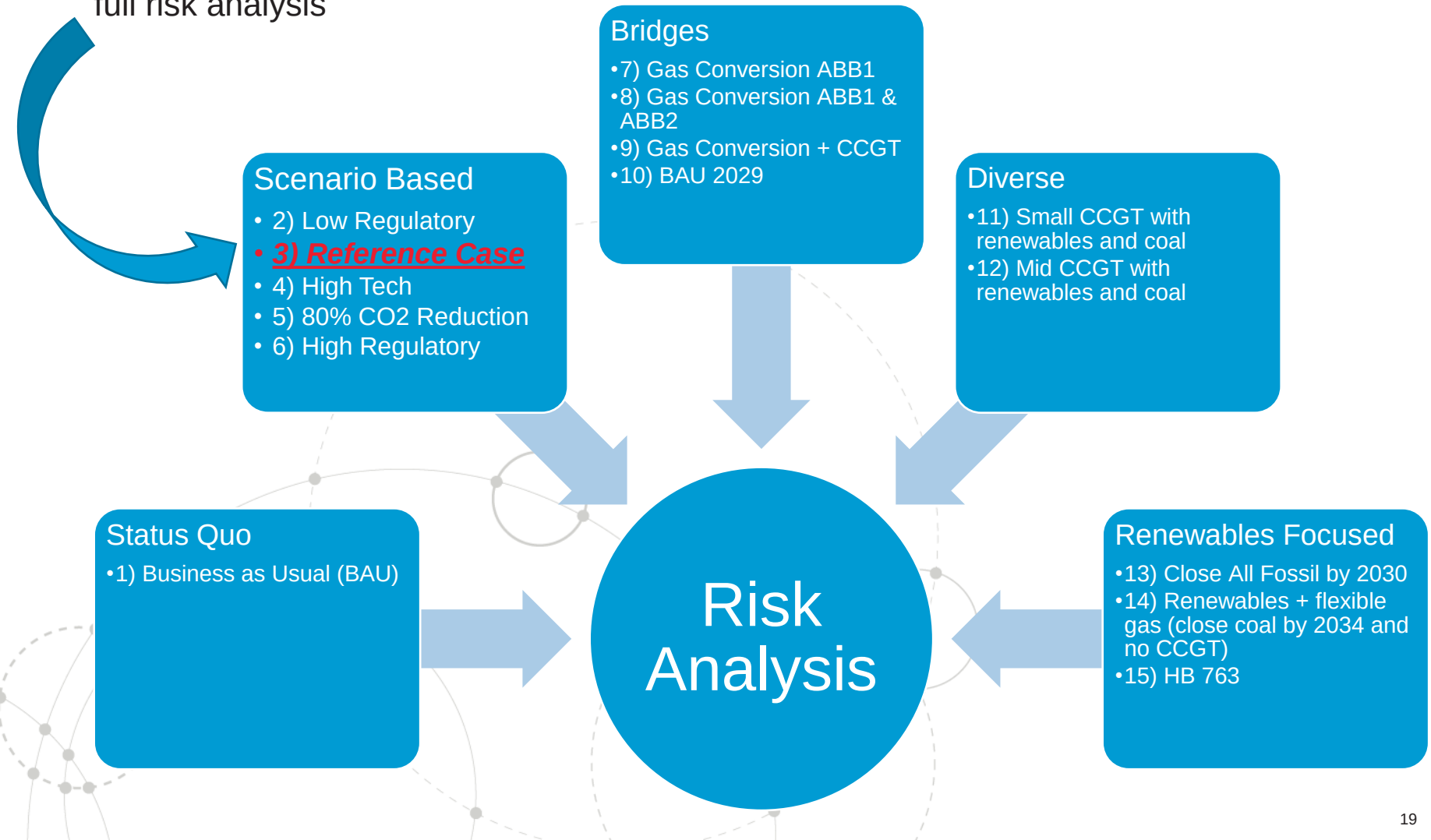
DRAFT REFERENCE CASE MODELING RESULTS

PETER HUBBARD

MANAGER OF ENERGY BUSINESS ADVISORY, PACE GLOBAL

WIDE RANGE OF PORTFOLIOS

The final reference case is 1 of 15 potential portfolios that will be analyzed over the coming months. The preferred portfolio will be selected based on the results of the full risk analysis



FINAL DRAFT REFERENCE CASE INPUTS

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Input	Unit	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
Coal (ILB mine)	2018$/MMBtu	1.78	1.66	1.64	1.63	1.61	1.61	1.59	1.58	1.59	1.59	1.58
CO2	2018$/ton	0.00	0.00	0.00	0.00	3.57	5.10	6.63	7.65	9.18	11.22	14.79
Gas (Henry Hub)	2018$/MMBtu	2.77	2.76	3.06	3.24	3.38	3.49	3.62	3.78	3.96	4.09	4.17
Vectren Peak Load	MW	1,115	1,102	1,168	1,176	1,183	1,192	1,200	1,209	1,219	1,229	1,239
Customer-Owned Solar DG Capacity*	MW	9.3	14.6	20.7	27.1	34.2	41.7	49.6	57.7	66.3	75.1	84.3
EV Peak Load**	MW	0.4	2.0	9.8	13.8	17.8	21.8	25.9	30.0	34.2	38.3	42.3
Energy Efficiency and Company DG	MW	6.0	9.2	15.7	22.6	28.8	33.1	39.0	45.2	48.8	50.5	47.6
Demand Response	MW	35.2	51.7	52.7	61.6	64.4	67.3	70.1	73.0	75.8	78.7	81.5
Wind (200 MW)	2018$/kW	1,334	1,330	1,328	1,326	1,324	1,324	1,324	1,324	1,326	1,328	1,330
Solar (100 MW)	2018$/kW	1,414	1,264	1,205	1,168	1,130	1,096	1,064	1,038	1,012	993	973
Li-Ion Battery (50 MW, 4 hr)	2018$/kW	2,088	1,811	1,654	1,518	1,452	1,391	1,342	1,301	1,263	1,232	1,201
Flow Battery (50 MW, 6 hr)	2018$/kW	2,968	2,665	2,450	2,242	2,116	1,996	1,892	1,803	1,719	1,651	1,586
Gas CC F-Class (442 MW with DF)	2018$/kW	1,301	1,291	1,275	1,261	1,251	1,242	1,233	1,224	1,216	1,207	1,199
Gas CT F-Class (237 MW)	2018$/kW	712	707	697	688	683	677	672	667	662	657	653
USC Coal w/ CCS	2018$/kW	5,621	5,536	5,424	5,309	5,201	5,097	4,992	4,891	4,794	4,698	4,605

** Res/Com Demand Impact = 0.295*
*** EV Coincident Factor = 0.211*

Revised from last meeting

DRAFT REFERENCE CASE EXISTING RESOURCE OPTIONS

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			2023					2026	2029	2039
Unit	**Fuel**	**Installed Net Capacity (MW)**	**Upgrade Path 1 *(FGD, ELG, CCR, ACE)***	**Upgrade Path 2 *(ELG, CCR, ACE)***	**Convert to Gas**	**Continue Agreement / Exit Agreement**	**Retire**	**Exit Agreement**		
ABB1	Coal	245	Option	Option	Option	n/a	Option	n/a	If Upgrade Path 2, unit retires in 2029	If Upgrade Path 1 or Convert, unit to run to 2039
ABB2	Coal	245	Option	Option	Option	n/a	Option	n/a	If Upgrade Path 2, unit retires in 2029	If Upgrade Path 1 or Convert, unit to run to 2039
ABB3	Gas	85								Unit to run to 2039
ABB4	Gas	85								Unit to run to 2039
FBC2	Coal	90	n/a	Option	Option	n/a	Option	n/a	n/a	If Upgrade Path 2 or Convert, unit to run to 2039
FBC3	Coal	270								Unit to run to 2039
W4	Coal	150	n/a	n/a	n/a	Option	n/a	Exit	n/a	n/a
OVEC	Coal	32								Ownership share to run to 2039
Benton	Wind	30								PPA for 30 MW thru 2028
Fowler	Wind	50								PPA for 50 MW thru 2030
Troy	Solar	50								Self-build solar to run to 2039

DRAFT REFERENCE CASE NEW RESOURCE OPTIONS

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Type	Resource	Limitations	Capacity Options			
RE and Storage	Hydroelectric	Max 2 units	50 MW			
	Wind Energy	400 MW per year	200 MW			
	Wind plus Storage	150 MW per Year	50 MW wind (10 MW/40 MWh battery)			
	Solar Photovoltaic	500 MW per year	10 MW	50 MW	100 MW	
	Solar plus Storage	150 MW per Year	50 MW solar (10 MW / 40 MWh battery)			
	Lithium-Ion Battery Storage	300 MW per year	10 MW / 40 MWh	50 MW / 200 MWh		
	Flow Battery Storage	400 MW per Year	10 MW / 60 MWh	10 MW / 80 MWh	50 MW / 300 MWh	50 MW / 400 MWh
Demand Side Management*	Low Income Energy Efficiency	Required	0.7 MW			
	Optional Energy Efficiency	7 optional resources	Bin 1: 2.2 MW	Bin 2: 2.3 MW	Bin 3: 2.4 MW	Bin 4: 2.5 MW
			Bin 5: 2.2 MW	Bin 6: 2.3 MW	Bin 7: 0.5 MW	
	Demand Response	1 required, 1 optional	Bin 1: 21.1 MW	Bin 2: 5.8 MW		
Coal	Supercritical with CCS	Max 1 unit	500 MW			
	Ultrasupercritical with CCS	Max 1 unit	750 MW			
Waste to Energy	Chipped Wood Biomass	3 units per year	50 MW			
	Landfill Gas	3 units per year	4.5 MW			
Combined Heat & Power	2x 9MW Recip Wartsila	4 units per year	18 MW			
	1 x Titan 250 CTG	4 units per year	20 MW			
Combined Cycle	1x1 F Class CCGT Unfired	1 Per Year	357 MW			
	1x1 F Class CCGT Fired	1 Per Year	443 MW			
	1x1 G/H Class Unfired	1 Per Year	410 MW			
	1x1 G/H Class Fired	1 Per Year	511 MW			
Simple Cycle	1x E Class Frame SCGT	Max 3 units	85 MW			
	1x F Class Frame SCGT		237 MW			
	1x G/H Class Frame SCGT		279 MW			

* EE and DR bins are modeled as supply-side resources and are divided into 2020-2023, 2024-2026, and 2027-2039; Shown here is the max reduction averaged from 2020 to 2039

Note: Simple cycle aeroderivatives have been excluded from the resource options due to high pressure gas requirements. Reciprocating engines were excluded based on cost.

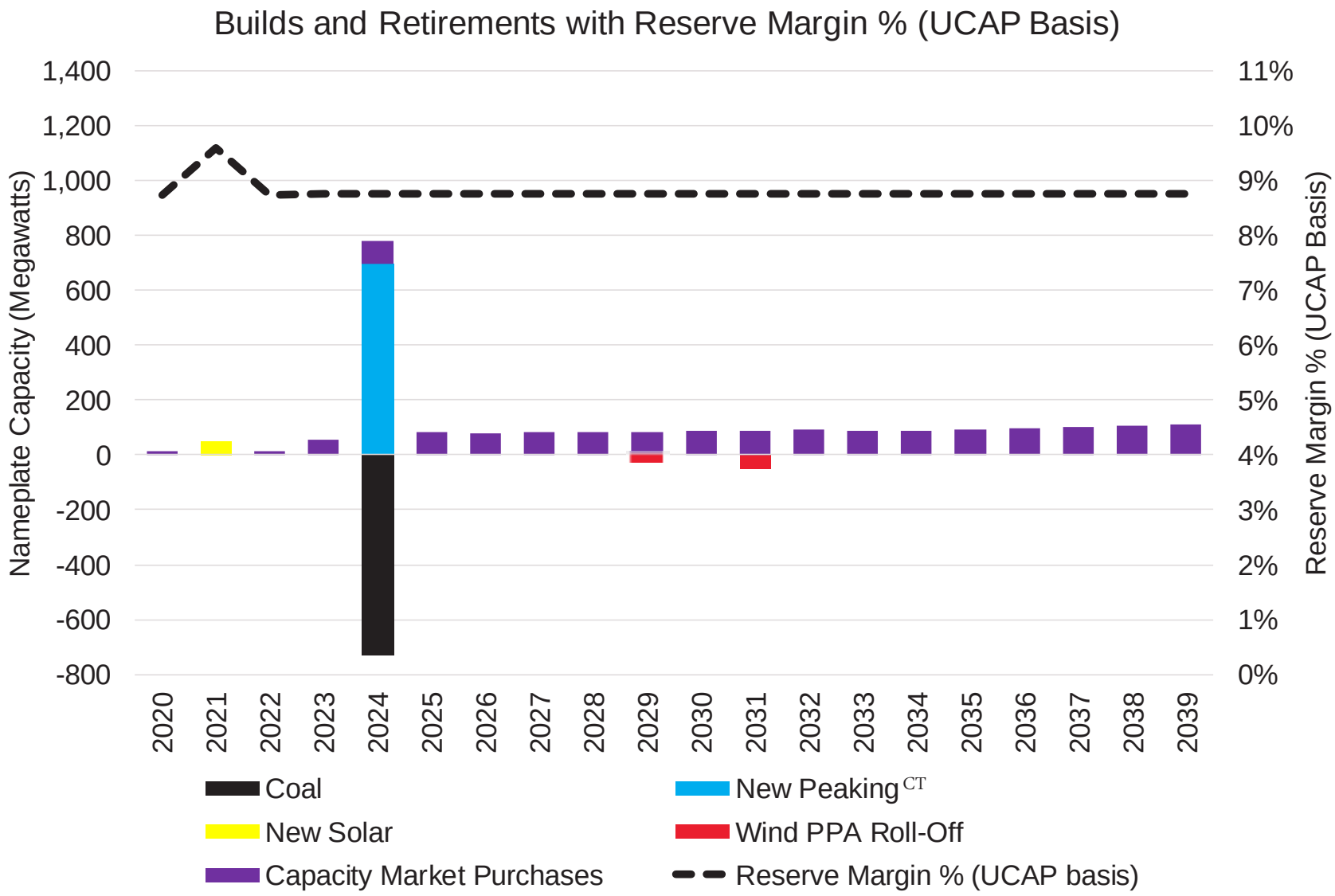
DRAFT REFERENCE CASE MODELING PARAMETERS

- Maximum of 3 gas CTs (E/F/H class) are allowed as early as 1/1/2024
- Maximum of 1 gas CC is allowed as early as 6/1/2024. 2x1 CCGT (600-800 MW) is not included as a resource option
- Aeroderivative CTs are excluded from the resource options due to requirements for high-pressure gas supply. Reciprocating engines were excluded based on cost
- Capacity market purchases 2020-2023 are limited to 300 MW per year, after which they are limited to 180 MW per year
- Renewable energy builds can be as much as 400 MW wind per year, 500 MW solar per year, 300-400 MW storage per year, and 150 MW RE+storage per year, while hydroelectric plants are limited to 2 in total

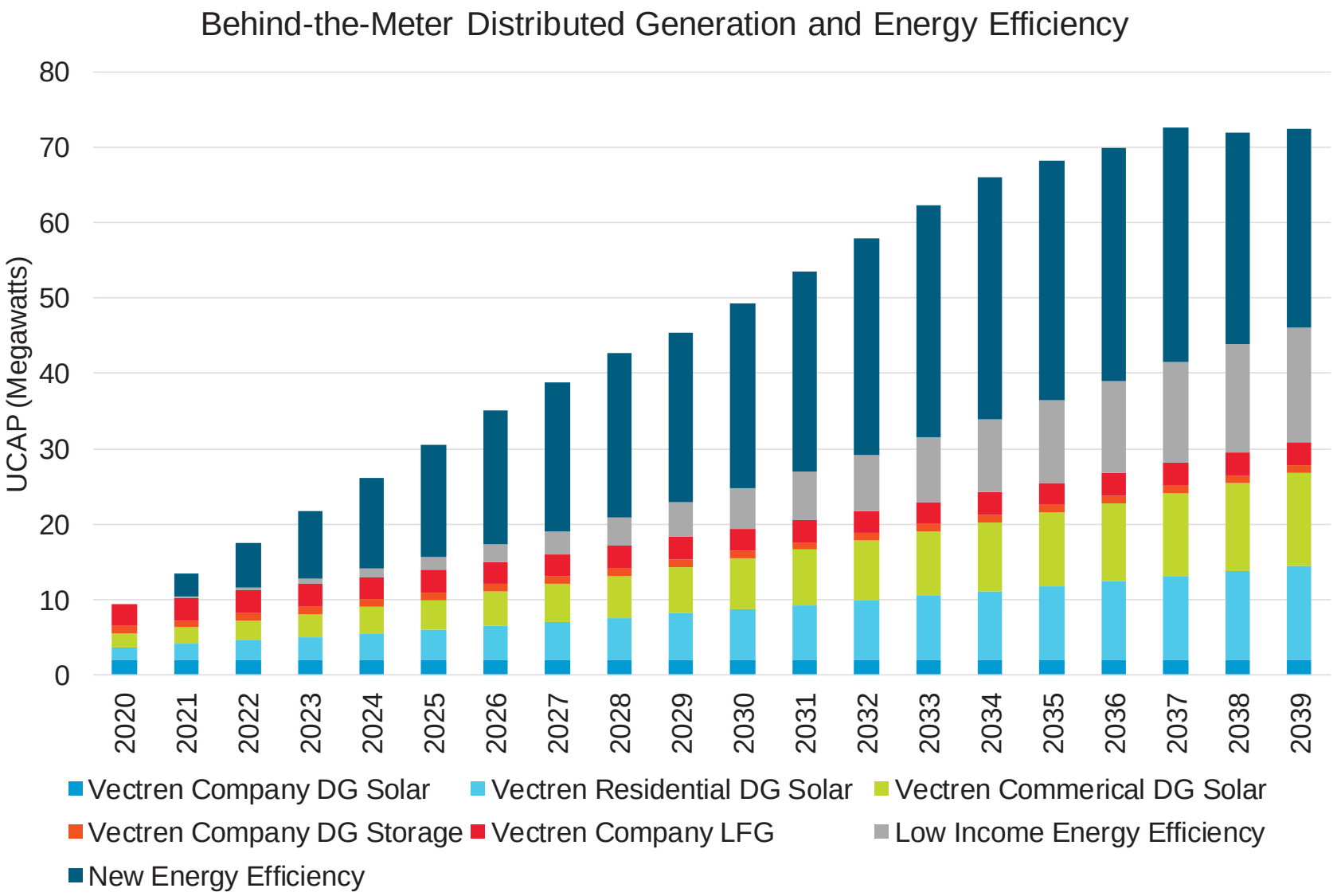
DRAFT REFERENCE CASE PERFORMANCE CHARACTERISTICS

- All coal units except FB Culley 3 are retired at the end of 2023
- The 3 combustion turbine replacements for retired coal capacity operate at an average capacity factor of 7% over the forecast period
- The Planning Reserve Margin target (UCAP basis) is 8.9%. Apart from the CT's that replace coal capacity, the target is adhered to via capacity market purchases that average 90 MW from 2023-2039 or 8% of Vectren coincident (to MISO) peak demand
- Prior to coal retirements, Vectren is a net exporter of energy into MISO. After the coal retirements, Vectren would become a net importer of energy
- Relative to the first year of analysis (2019), CO_2 emissions decline by 47% in the year following coal retirements and decline by 61% by 2039
- Energy Efficiency was selected and equates to approximately 1% of sales

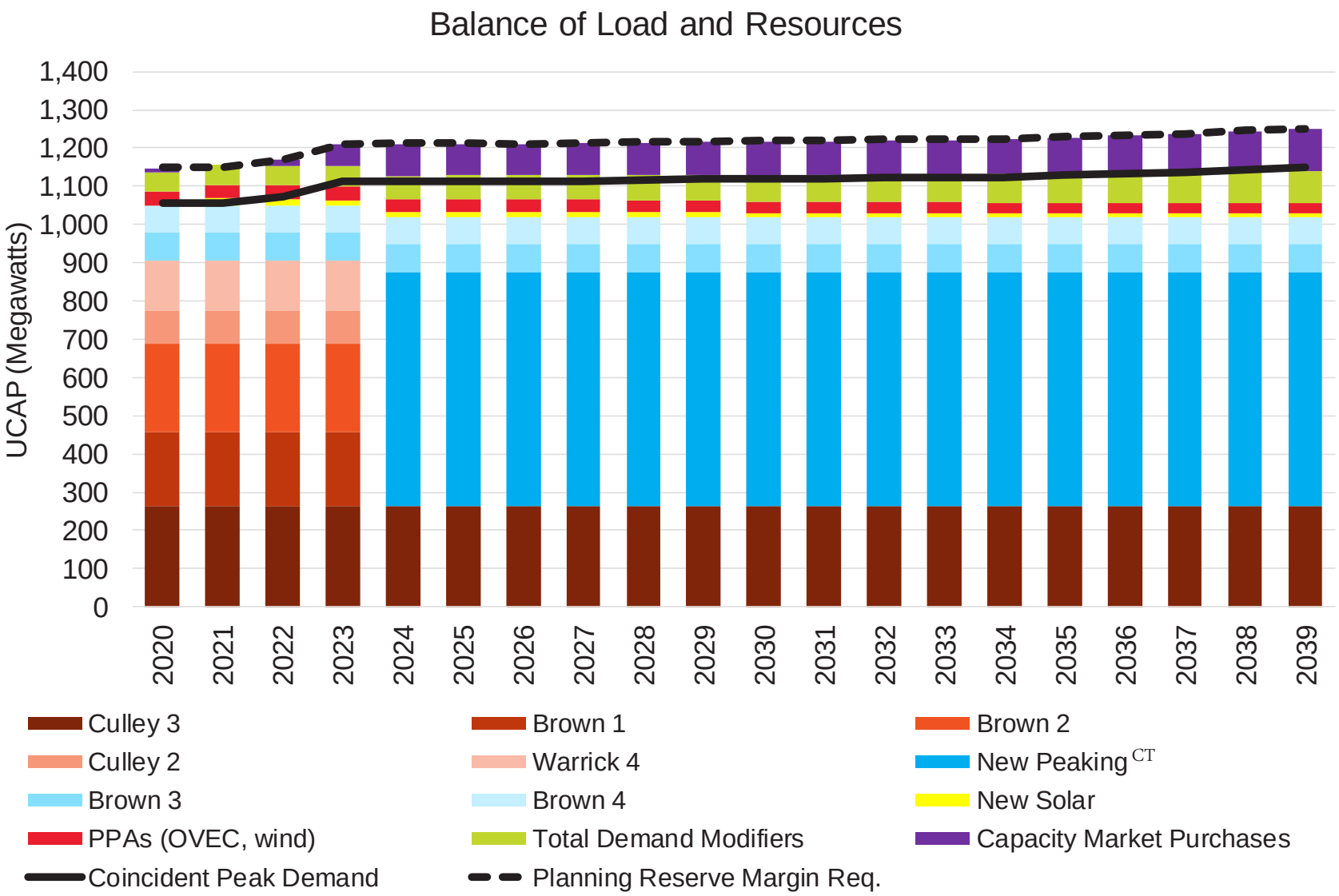
DRAFT REFERENCE CASE SEES 3 F-CLASS CT'S (697 MW) REPLACE 730 MW OF COAL CAPACITY



DRAFT REFERENCE CASE DISTRIBUTED GENERATION AND ENERGY EFFICIENCY



DRAFT REFERENCE CASE PORTFOLIO



SCENARIO MODELING CONSIDERATIONS

- Reference Case modeling will be updated. Final results may vary
  - RFP results will be included
  - 1x1 CCGT costs will be refined with +/-10% estimates
  - Pipeline costs will be refined for CT options
- Other scenarios with lower costs for renewables and Energy Efficiency may select more of these resources
- Reference Case results show the least cost portfolio given the determined future. This portfolio may not ultimately be least cost once subjected to probabilistic modeling (200 future states)
- Vectren will select a portfolio among approximately 15 based on the results of the full risk analysis

DRAFT FGD SCRUBBER SENSITIVITY ANALYSIS

- All FGD scrubber options for replacing the Dual Alkali system were found to have significantly higher NPVs relative to the Reference Case
- Early results indicate that the Limestone Inhibited Oxidation scrubber has the lowest portfolio NPV of these 4 technologies
  - Four Flue Gas Desulfurization (FGD) scrubber technologies were evaluated in the reference case
  - Note that some options cause other environmental control systems to be modified or replaced. These cost estimates are included in the analysis.
  - Each of the four options was examined in an otherwise identical portfolio and modeled to 2039
- The lowest portfolio NPV of each option will be utilized for the Business as Usual (BAU) portfolio

FGD Scrubber Option
Ammonia Based (NH3)
Circulating Dry Scrubber (CDS)
Limestone Forced Oxidation (LSFO)
Limestone Inhibited Oxidation (LSIO)

Ammonia Based and LSFO have the potential for future by-product sales.

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FINAL RFP MODELING INPUTS

MATT LIND

RESOURCE PLANNING & MARKET ASSESSMENTS
BUSINESS LEAD, BURNS AND MCDONNELL

RFP PROCESS UPDATE

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- Received Proposals
- Initial Proposal Review
- Clarified Information with Bidders
- Group Proposals
- Interconnection & Network Upgrade Analysis
- Evaluation of Proposals
- Aggregated Group Data for IRP
- Receive Results from IRP
- Due Diligence and Negotiations
- Definitive Agreements Executed
- File Petitions with Regulatory Bodies

ROLE OF THE ALL-SOURCE RFP

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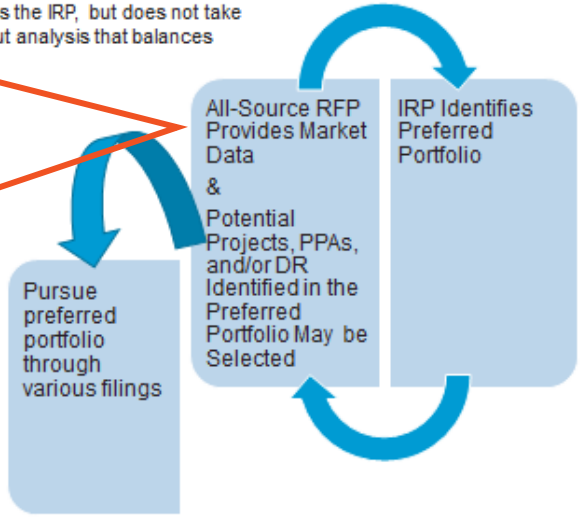
The All-Source RFP informs the IRP, but does not take the place of well thought out analysis that balances multiple objectives

- Average delivered cost by resource will inform modeling
- Resources to be modeled on a tiered basis
- The full IRP analysis, including risk analysis, will test a diverse set of resource mixes and will ultimately identify a preferred portfolio
- Vectren will pursue resources consistent with those identified in the preferred portfolio



RFP PROPOSALS

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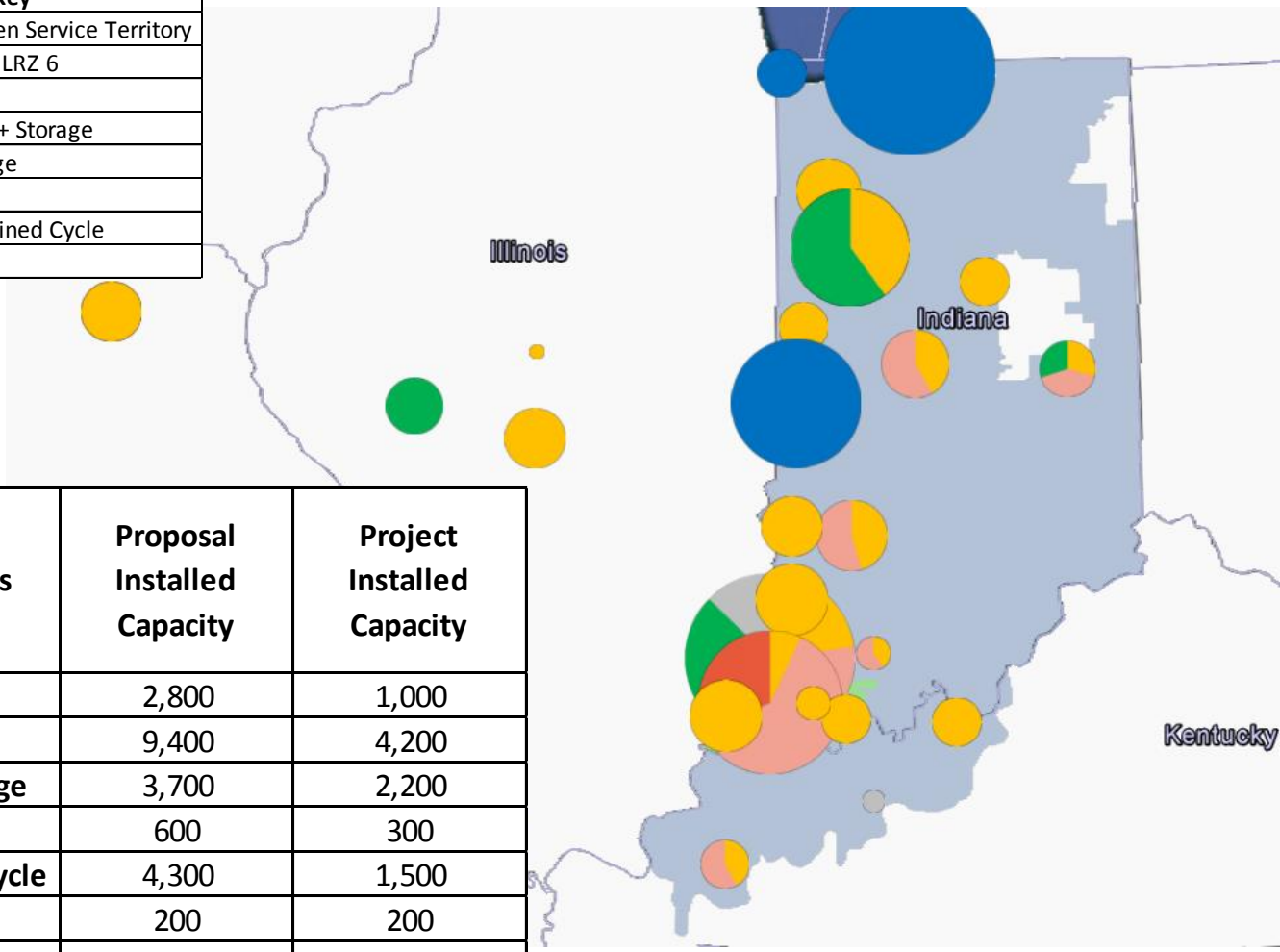
Key	
	Vectren Service Territory
	MISO LRZ 6
	Solar
	Solar + Storage
	Storage
	Wind
	Combined Cycle
	Coal



2019 RFP Responses (MW)	Proposal Installed Capacity	Project Installed Capacity
Wind	2,800	1,000
Solar	9,400	4,200
Solar + Storage	3,700	2,200
Storage	600	300
Combined Cycle	4,300	1,500
Coal	200	200
LMR/DR	100	100
System Energy	300	100
Total	**21,400**	**9,600**

RFP PROPOSALS - TIER 1

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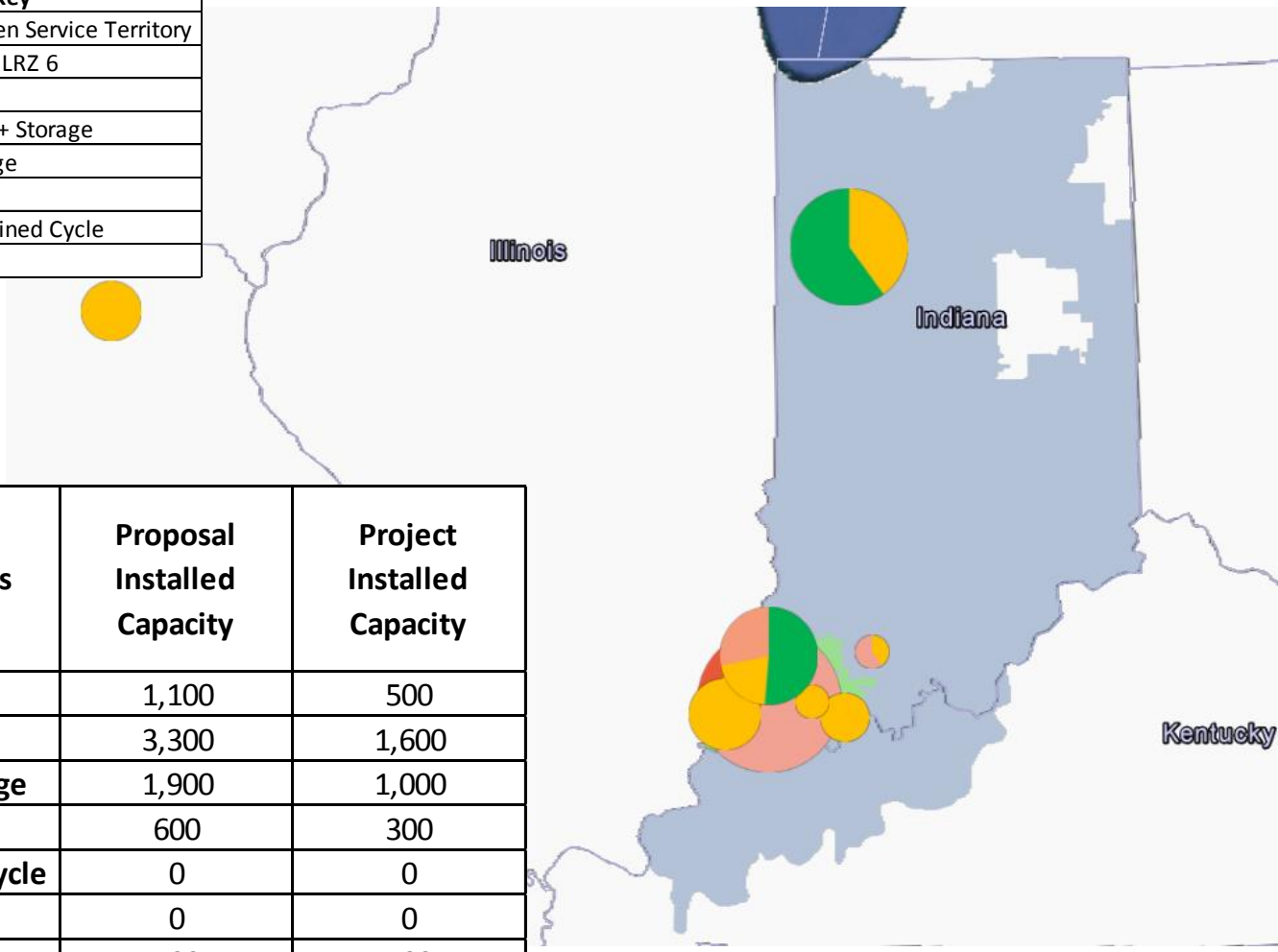
- Due Diligence and Negotiations
- Definitive Agreements Executed
- File Petitions with Regulatory Bodies

Key	
	Vectren Service Territory
	MISO LRZ 6
	Solar
	Solar + Storage
	Storage
	Wind
	Combined Cycle
	Coal



2019 RFP Responses (MW)	Proposal Installed Capacity	Project Installed Capacity
Wind	1,100	500
Solar	3,300	1,600
Solar + Storage	1,900	1,000
Storage	600	300
Combined Cycle	0	0
Coal	0	0
LMR/DR	100	100
System Energy	0	0
Total	**7,000**	**3,500**

PROPOSAL GROUPING

VECTREN
A CenterPoint Energy Company

- Received Proposals
- Initial Proposal Review
- Clarified Information with Bidders
- **Group Proposals**
- Interconnection & Network Upgrade Analysis
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	Grouping[1]	RFP Count	Tier 1	Tier 2
1	Coal PPA	2	0	2
2	LMR/DR PPA	1	1	0
3	CCGT PPA	2	0	2
4	CCGT Purchase	5	0	5
5	Wind Purchase	2	0	2
6	12-15 Year Wind PPA	9	4	5
7	20 Year Wind PPA	2	1	1
8	Storage Purchase	4	4	0
9	Storage PPA	4	4	0
10	Solar + Storage PPA	6	5	1
11	Solar + Storage Purchase	9	5	4
12	Solar + Storage Purchase/PPA	4	1	3
13	Solar Purchase/PPA	6	1	5
14	12-15 Year Solar PPA	8	3	5
15	20 Year Solar PPA	16	10	6
16	25-30 Year Solar PPA	9	3	6
17	Solar Purchase	18	7	11
N/A	Energy Only	3	0	3
	Total	**110**	**49**	**61**

- Total installed capacity of RFP bids in Tier 1 ~5X greater than Vectren's peak load
- Resource options from the technology assessment will supplement these options as needed

110 Proposals

Tier 1
- Binding Pricing
- Delivered to SIGE.SIGW OR On System

→ IRP Inputs

Tier 2
- Non-Binding Pricing
- Congestion / delivery risk

→ Potential IRP Inputs Based on Evaluation

1. Updated Tier 1 & Tier 2 classification based on interactions with bidders

TRANSMISSION INTERCONNECTION COSTS

VECTREN
A CenterPoint Energy Company

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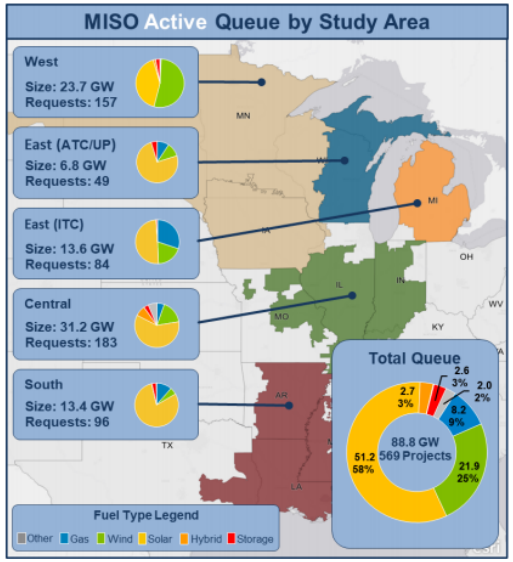
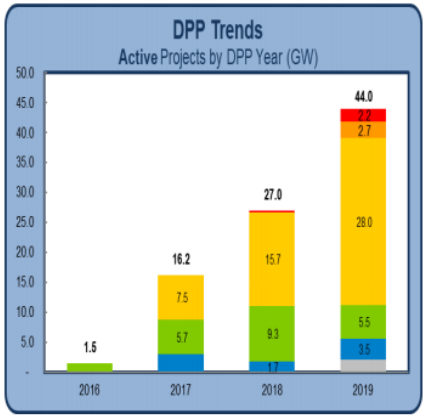
Generator Interconnection: Overview

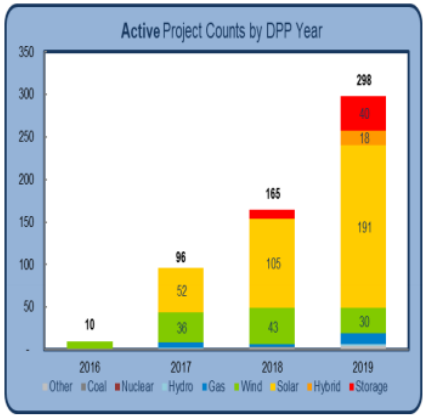
*The current generator interconnection active queue consists of **569** projects totaling **88.8** GW*

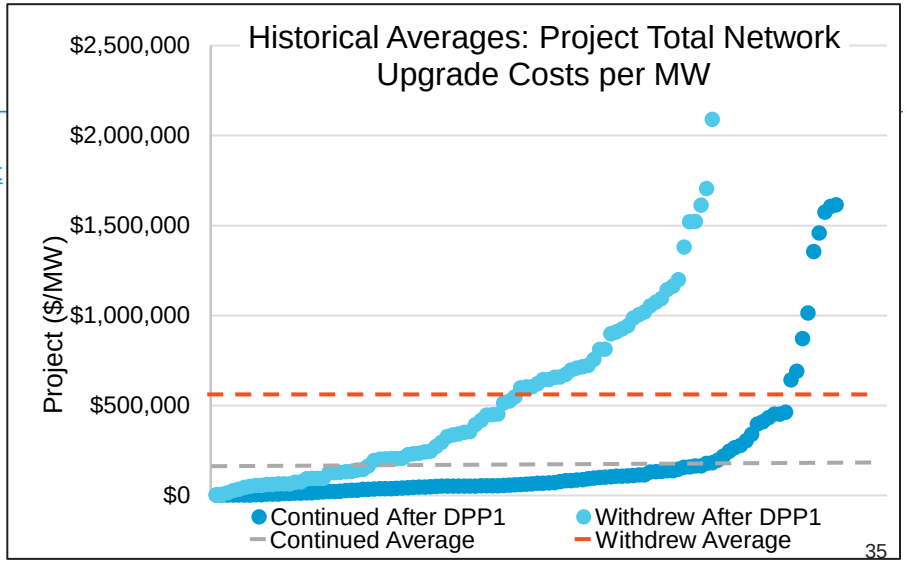


https://www.misoenergy.org/planning/policy-studies/Renewable-integration-impact-assessment

DPP Project Trends







TIER 1 COST SUMMARY

VECTREN
A CenterPoint Energy Company

- Received Proposals
- Initial Proposal Review
- Clarified Information with Bidders
- Group Proposals
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- **Evaluation of Proposals**
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	Bid Group	# Proposals	# Projects	Proposal ICAP (MW)	Project ICAP (MW)	Capacity Weighted Average LCOE ($2019/MWh)	Capacity Weighted Purchase Price ($/kW)[2]
1	Coal PPA	0					
2	LMR/DR PPA	0					
3	CCGT PPA	0					
4	CCGT Purchase	0					
5	Wind Purchase	0					
6	12-15 Year Wind PPA	4	1	800	200		
7	20 Year Wind PPA	1	1	300	300		
8	Storage Purchase	4	2	305	152	$157	
9	Storage PPA	4	2	305	152	$135	
10	Solar + Storage PPA	5	3	902	526	$44	
11	Solar + Storage Purchase	5	3	862	486	TBD[1]	$1,417[3]
12	Solar + Storage Purchase/PPA	1	1	110	110		
13	Solar Purchase/PPA	1	1	80	80		
14	12-15 Year Solar PPA	3	2	350	225	$32	
15	20 Year Solar PPA	10	8	1,522	1,227	$35	
16	25-30 Year Solar PPA	3	2	400	275	$34	
17	Solar Purchase	7	6	902	732	TBD[1]	$1,262

1. The method for realizing tax incentives is being reviewed by Vectren
2. $/kW costs are in COD$, purchase option cost is the purchase price unsubsidized by applicable tax incentives and does not reflect ongoing operations and maintenance costs
3. Cost based on simultaneous MW injectable to the grid

RFP PROCESS UPDATE

VECTREN
A CenterPoint Energy Company

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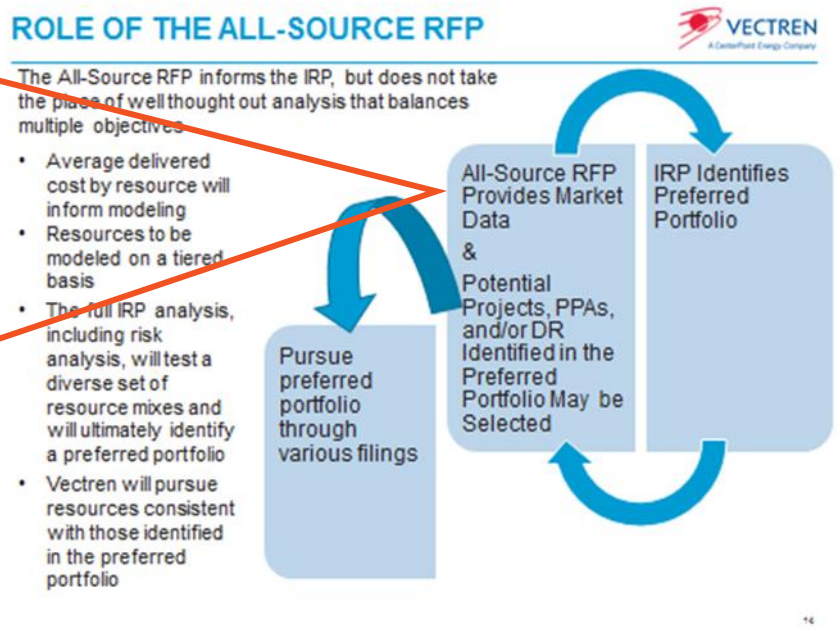

VECTREN
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PORTFOLIO DEVELOPMENT

MATT RICE

VECTREN MANAGER OF RESOURCE PLANNING

STAKEHOLDER PORTFOLIO FEEDBACK

VECTREN
A CenterPoint Energy Company

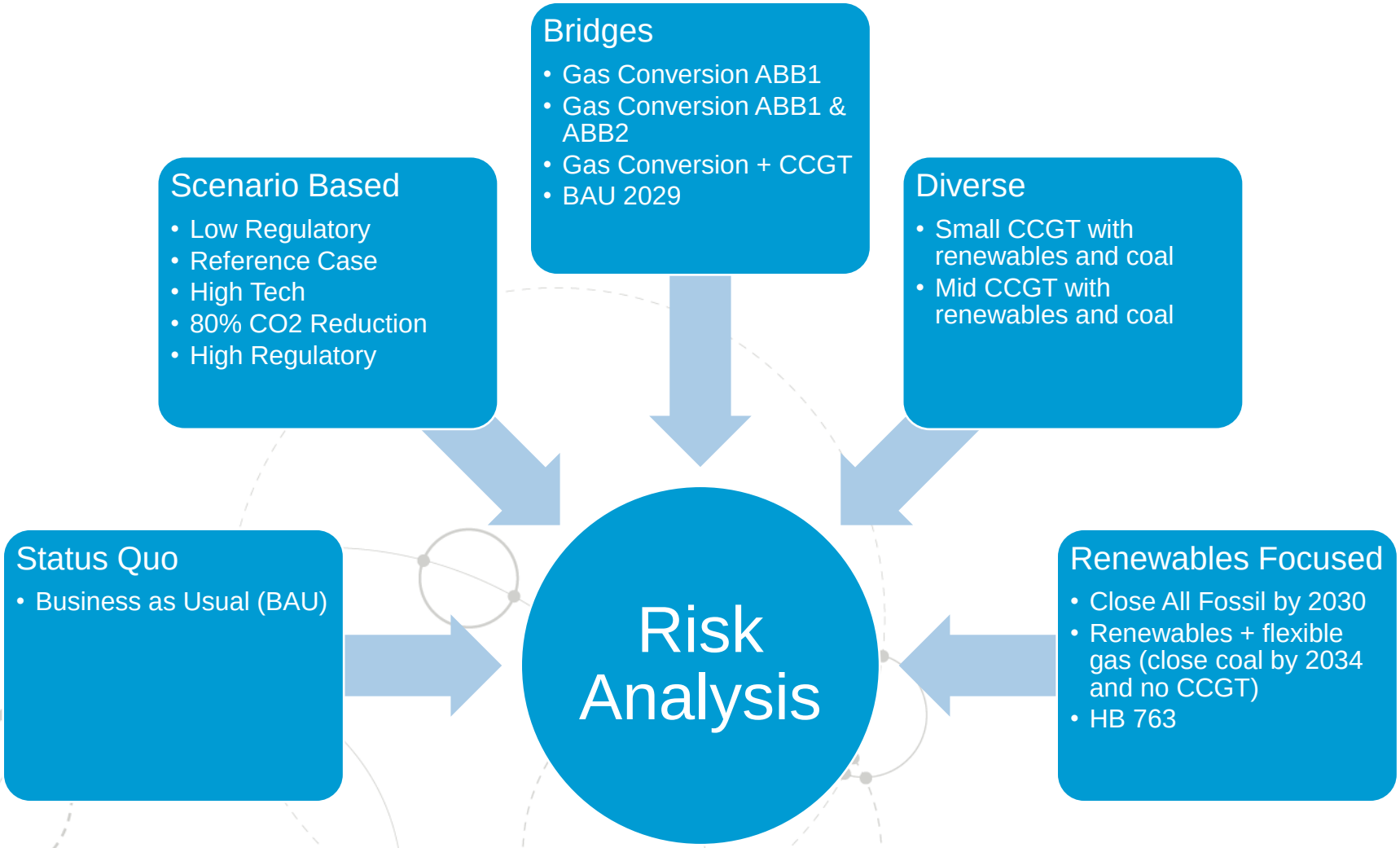
Request	Response
Small CCGT and conversion at Brown	We will run this portfolio with generic assumptions, but need to acknowledge some challenges. Should this portfolio look attractive, additional study would be needed around air permits, water use, and use of the switchyard. Additionally, this option does not benefit from expedited study at MISO due to capacity beyond current levels at the Brown site
HR 763 Portfolio	Will run a sensitivity to create a portfolio based on HR 763 CO_2 price assumptions and compare to other portfolios. If significantly different, we include in the risk analysis
100% RPS by 2030 Portfolio	Will include this portfolio
NIPSCO like portfolio	We understand the environmental perspective that this means no new fossil and close coal as soon as possible. NIPSCO currently has a gas CCGT and two gas peaker plants. Each utility has different circumstances. We do not plan to run a portfolio that completely mirrors NIPSCO
Close all Coal by 2024	We plan to move forward with approved upgrades for Culley 3 and therefore, do no plan to run this portfolio. We will include a portfolio that closes Culley 3 by 2030 and by 2034 in another portfolio
CT and Renewables, Close all coal by 2030	Will include a similar portfolio
Business as Usual (BAU) portfolio	Will include this portfolio
BAU Until 2029 Portfolio	Will include this portfolio
100% RPS by 2039	Will include a similar portfolio

STAKEHOLDER PORTFOLIO FEEDBACK

Request	Response
Lobby to Extend Net Metering (Remove cap)	If that the net metering law were to be updated to full, traditional net metering, Vectren's load forecast would decline. The IRP takes into account a low load forecast within probabilistic modeling and deterministic scenarios. Portfolios will be developed and tested in low load conditions
Distributed gen (rooftop solar + battery storage)	This option would require an extensive study to be conducted with attributes similar to an EE program. We know from experience that building distributed solar and storage is costly, complicated, and requires risk mitigation. We do not plan to run this portfolio. This could be evaluated in future IRPs
Various bridge portfolios to provide off ramps	We will model both short-term and long-term bridge options

WIDE RANGE OF PORTFOLIOS

All portfolios considered include stakeholder input, directly or indirectly.



We will consider short term bridge options (extension of W4 contract, market capacity purchase, short term ppa, etc.) for portfolio development in all scenarios and in other portfolios where it makes sense

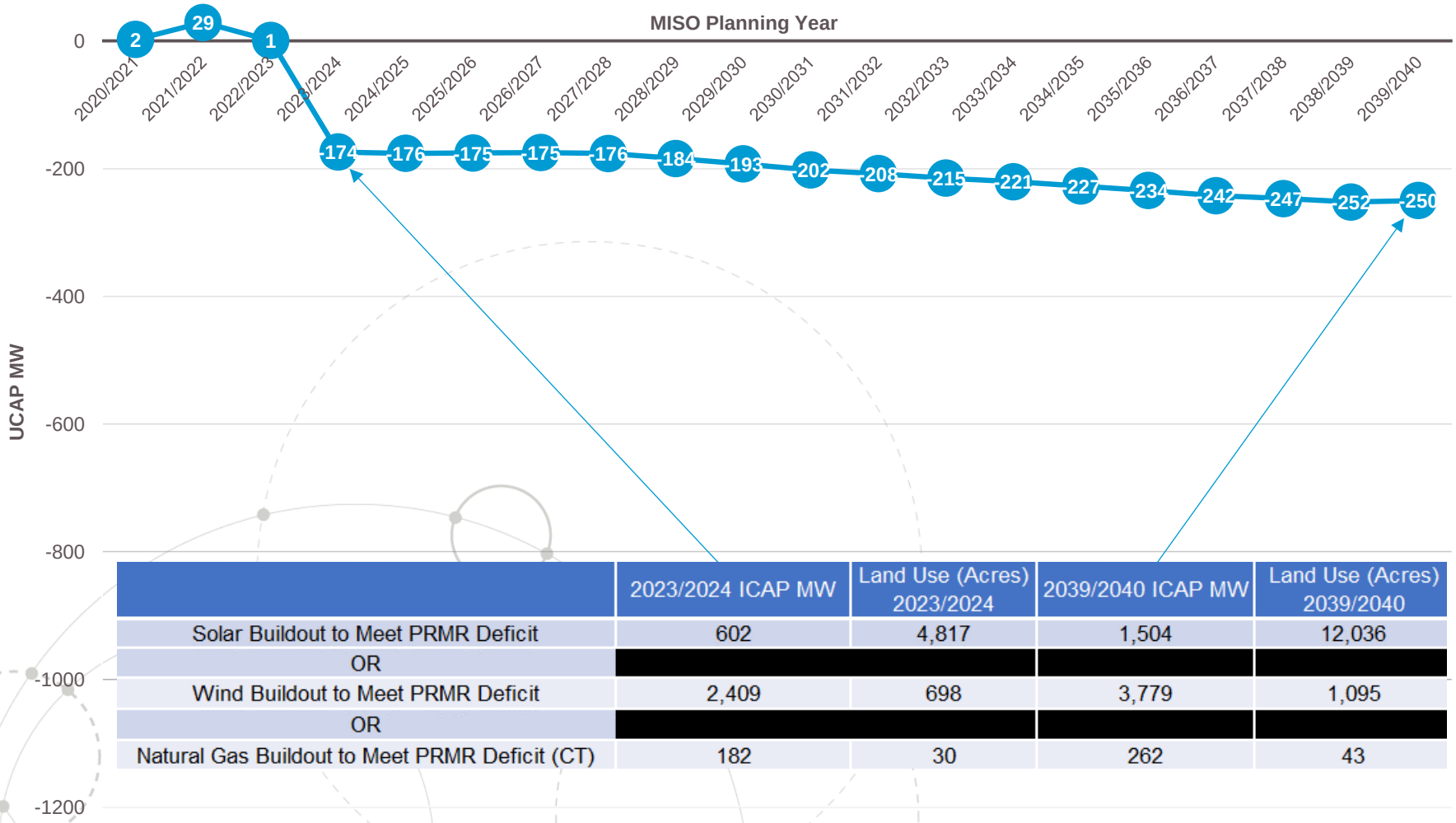
STATUS QUO

- The Business As Usual portfolio can be considered a reference portfolio
  - Vectren ends joint operations of W4 in 2024
  - Includes known costs to comply with known EPA rules (ELG/CCR, ACE, 316b) to continue to run Vectren coal plants through 2039
  - Resource need will be optimized based on least cost modeling (All resources available)

Stakeholder Input:
- Fully explore options at AB Brown plant

Business As Usual (BAU)

PLANNING RESERVE MARGIN REQUIREMENT SURPLUS\DEFICIT - BAU



	2023/2024 ICAP MW	Land Use (Acres) 2023/2024	2039/2040 ICAP MW	Land Use (Acres) 2039/2040
Solar Buildout to Meet PRMR Deficit	602	4,817	1,504	12,036
OR				
Wind Buildout to Meet PRMR Deficit	2,409	698	3,779	1,095
OR				
Natural Gas Buildout to Meet PRMR Deficit (CT)	182	30	262	43

PRMR - Planning Reserve Margin Requirement

SCENARIO BASED PORTFOLIOS

- Scenarios were created with stakeholder input. A portfolio will be created for each potential deterministic future based on least cost optimization. Insights will be gathered:
  - Potential selection of long and short-term bridge options
  - How resource mixes change given varying futures
  - Range of portfolio costs
- Once run, Vectren will utilize insights to help shape portfolio development
- Portfolios will be compared for similarities and differences. If each varies significantly, they will all be included in the risk analysis
- Insights gained may be included in developing other portfolios

Stakeholder Input:
- Reference Case CO_2
- Lower renewables and storage costs
- CO_2 Fee and Dividend

Scenario Based
Low Reg.
Reference Case
High Tech
80% CO_2
High Reg.

BRIDGES

- Vectren is considering various bridge options, including converting coal units to gas
  - Convert AB Brown 1 & 2 by 2024 and run for 10 years. Close FB Culley 2 and end joint operations of Warrick 4 by 2024. Optimize for need (all resources available)
  - Convert AB Brown 1 and retire AB Brown 2 by 2024 + add a small CCGT in 2025. Optimize for need (All resources available). Short term bridge options will be considered
- Vectren will also create a portfolio that continues operation of existing coal units through 2029. We will allow the model to optimize (all resources available) beyond 2030

Stakeholder Input:
- Fully consider gas conversion
- Consider running coal until 2030
- Don't run coal beyond 2030
- Include a portfolio that converts ABB1 and adds a small CCGT
- Consider flexibility

- Gas Conversion
- Gas Conversion + CCGT
- BAU 2029

PLANNING RESERVE MARGIN REQUIREMENT SURPLUS\DEFICIT - BRIDGE

Bridge - Convert Brown 1 & Brown 2	2023/2024 ICAP MW	Land Use (Acres) 2023/2024	2039/2040 ICAP MW	Land Use (Acres) 2039/2040
Solar Buildout to Meet PRMR Deficit	897	7,176	4,594	36,754
OR				
Wind Buildout to Meet PRMR Deficit	3,589	1,040	11,541	3,345
OR				
Natural Gas Buildout to Meet PRMR Deficit (CCGT)	272	44	800	131

PRMR - Planning Reserve Margin Requirement

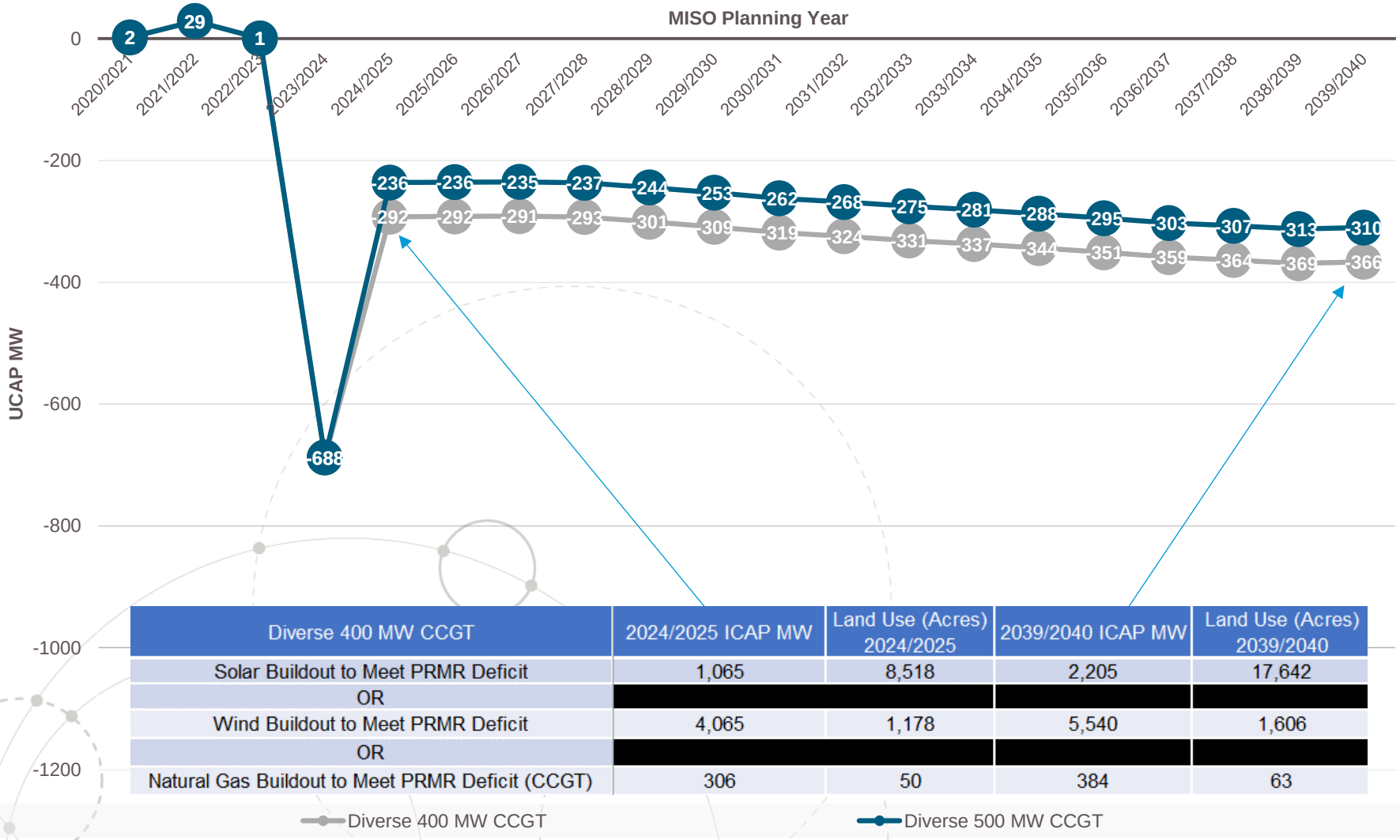
DIVERSE

- One of Vectren's objectives is resource diversity. As such, Vectren is evaluating portfolios that contain some coal, some gas, and some renewables/DSM/storage options
  - Small CCGT ~400 MWs at the Brown site will be included, along with Culley 3. Optimize with renewables, DSM, and storage for remaining need
  - Mid-sized CCGT ~500 MWs will be included at the Brown site, along with Culley 3. Optimize with renewables, DSM, and storage for remaining need
- A 2x1 CCGT (600-800 MW) will not be considered in portfolio development
- The Brown site offers several advantages: existing interconnection rights, reuse of some equipment and facilities, tax base for Posey county, and jobs for existing employees
- Short term bridge options will be considered

Stakeholder Input:
- Gas plant too large for a small utility
- Did not consider smaller gas plant options in the risk analysis

-Small CCGT with renewables and coal
-Mid-sized CCGT with renewables and coal

PLANNING RESERVE MARGIN REQUIREMENT SURPLUS\DEFICIT - DIVERSE



Diverse 400 MW CCGT	2024/2025 ICAP MW	Land Use (Acres) 2024/2025	2039/2040 ICAP MW	Land Use (Acres) 2039/2040
Solar Buildout to Meet PRMR Deficit	1,065	8,518	2,205	17,642
OR				
Wind Buildout to Meet PRMR Deficit	4,065	1,178	5,540	1,606
OR				
Natural Gas Buildout to Meet PRMR Deficit (CCGT)	306	50	384	63

PRMR - Planning Reserve Margin Requirement

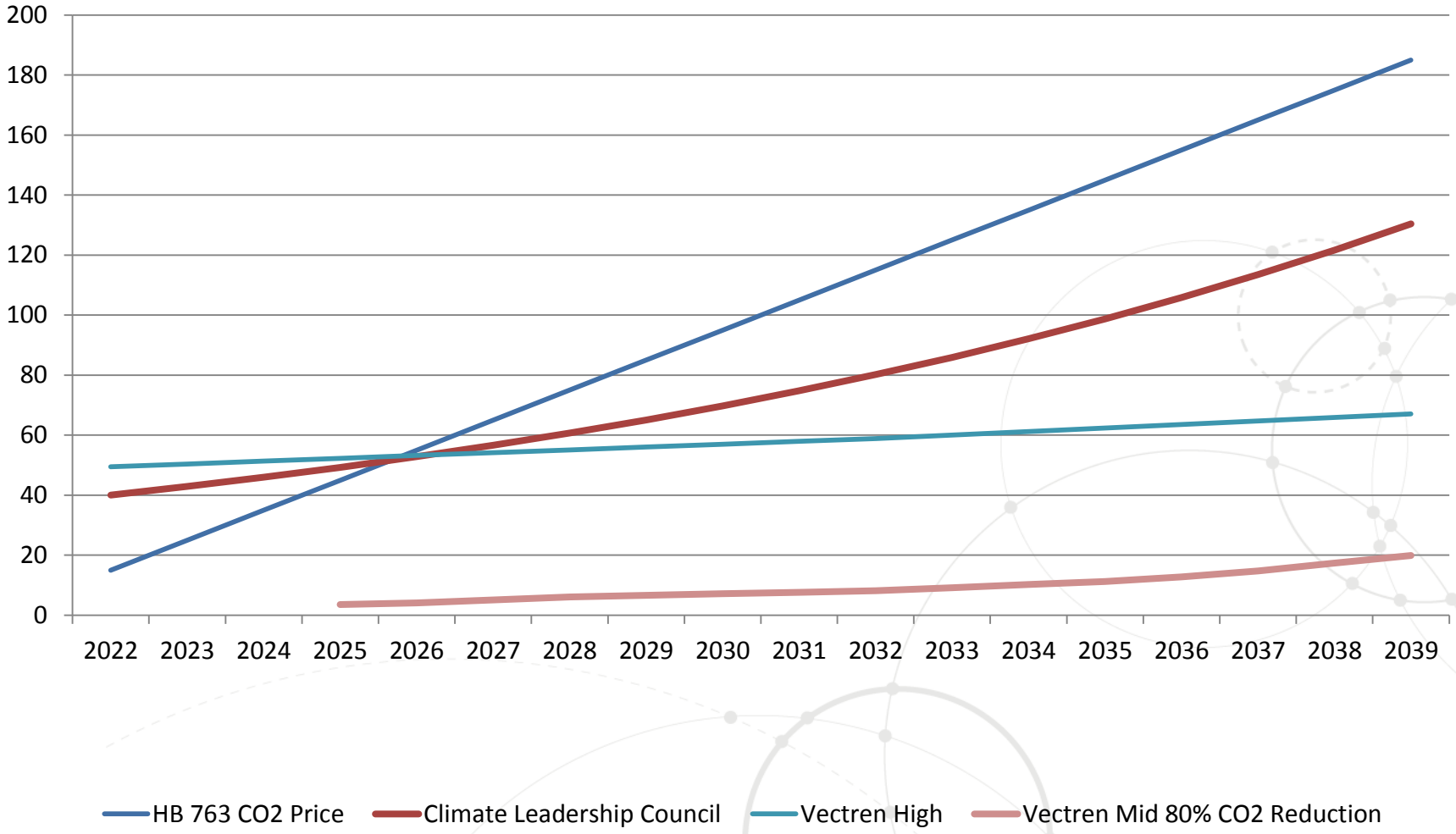
RENEWABLES FOCUSED

- Vectren continues to fully explore renewable resources through market pricing and portfolio development
  - Close all fossil generation by 2030. Will require voltage support. Optimize for renewables, demand response, energy efficiency, and storage
  - Close all coal by 2034 (All but Culley 3 are closed in 2024). Optimize for renewables, demand response, energy efficiency, and Storage. Flexible gas (CTs) will be allowed within the optimization for capacity (No CCGTs)
  - Build a portfolio based on House Bill 763, which includes a \$15 CO_2 price, escalating to \$185 by 2039. Compare and determine if portfolio is sufficiently different from other renewables portfolios. Optimize for need

Stakeholder Input:
- Fully consider renewable resources
- 100% renewable by 2030
- Consider flexible gas and renewables
- Include a scenario on HB763

- Close All Fossil by 2030
- Renewables + flexible gas (close all coal by 2034)
- HB 763

CO_2 PRICE RANGES WITH HB 763



PLANNING RESERVE MARGIN REQUIREMENT SURPLUS\DEFICIT - RENEWABLES

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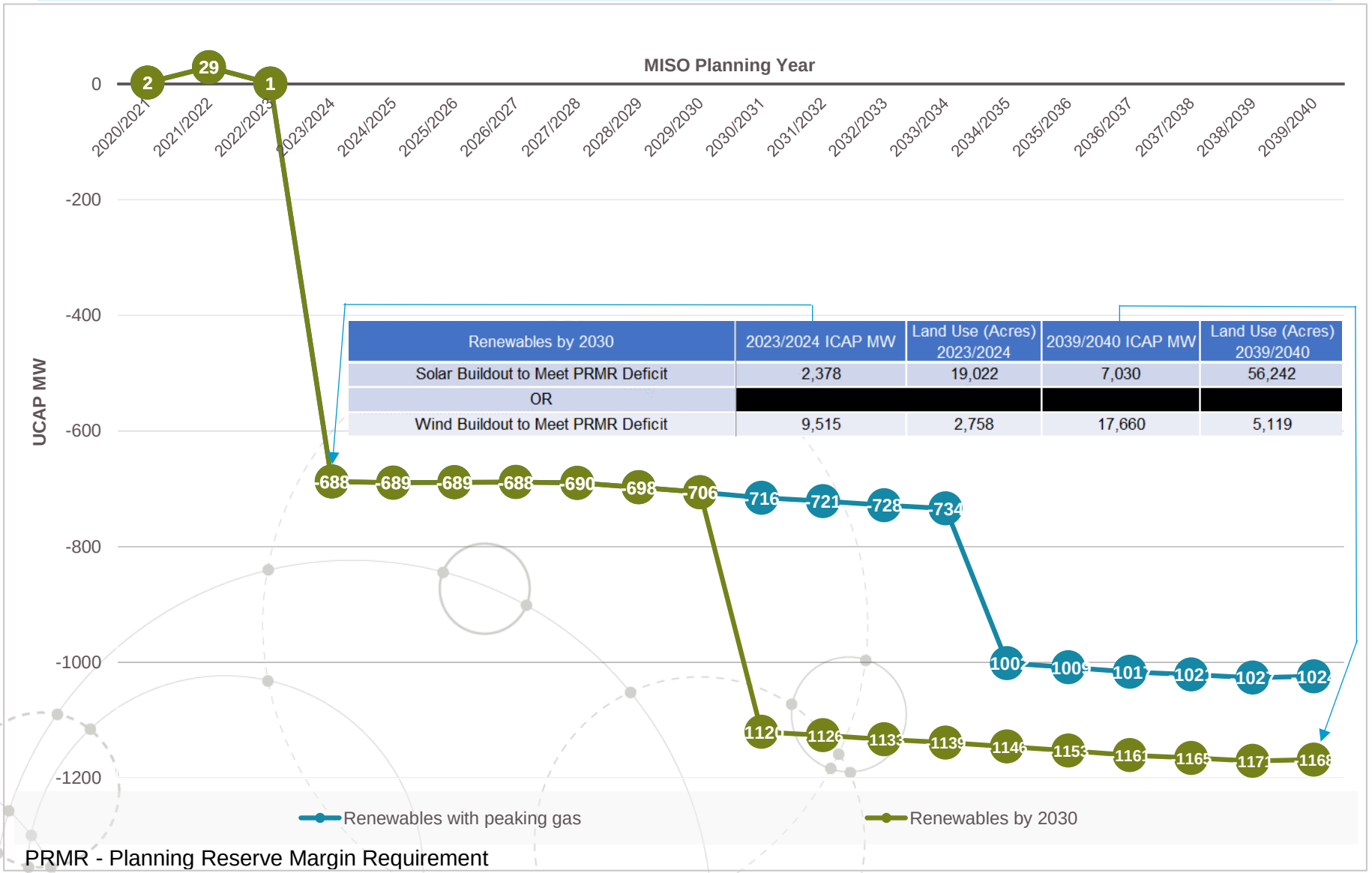

Renewables by 2030	2023/2024 ICAP MW	Land Use (Acres) 2023/2024	2039/2040 ICAP MW	Land Use (Acres) 2039/2040
Solar Buildout to Meet PRMR Deficit	2,378	19,022	7,030	56,242
OR				
Wind Buildout to Meet PRMR Deficit	9,515	2,758	17,660	5,119

PRMR - Planning Reserve Margin Requirement

VECTREN
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SCENARIO TESTING AND PROBABILISTIC MODELING

PETER HUBBARD

MANAGER OF ENERGY BUSINESS ADVISORY, PACE GLOBAL

PORTFOLIOS WILL BE TESTED BOTH IN SCENARIOS AND PROBABILISTIC FRAMEWORK

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Deterministic Modeling (Scenarios) and Probabilistic Modeling (Stochastics) Provide Complementary Analysis

Probabilistic Modeling is the basis for Portfolio Risk Analysis and Balanced Scorecard results

Advantages

- Exhaustive potential futures can be analyzed
- Uses impartial statistical rules and correlations

Disadvantages

- Link between statistical realizations and the real world can be difficult to understand

Deterministic Modeling complements Stochastics; Portfolios will be simulated in each Scenario

Advantages

- Well-suited for testing a wide range of regulatory req's
- Deterministic modeling is transparent, easy to understand

Disadvantages

- Does not capture the full range of key inputs
- Does not capture volatility
- Time consuming to run several potential futures

Market Driver	Varied Stochastically
Load	✔
Natural Gas Prices	✔
Coal Prices	✔
CO2 Prices	✔
Capital Costs for New Entry	✔

LOW REGULATORY CASE INPUTS

Input	Unit	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
Coal (ILB mine)	2018$/MMBtu	1.78	1.66	1.64	1.63	1.61	1.61	1.59	1.58	1.59	1.59	1.58
CO2	2018$/ton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas (Henry Hub)	2018$/MMBtu	2.77	2.76	4.10	5.12	5.20	5.62	5.60	5.95	6.12	6.23	6.85
Vectren Peak Load	MW	1,115	1,102	1,217	1,311	1,314	1,352	1,357	1,390	1,381	1,386	1,423
Customer-Owned Solar DG Capacity*	MW	9.3	14.6	21.6	30.2	38.0	47.3	56.1	66.3	75.1	84.7	96.8
EV Peak Load**	MW	0.4	2.0	10.2	15.4	19.8	24.7	29.3	34.5	38.7	43.2	48.6
Energy Efficiency and Company DG	MW	6.0	9.2	15.7	22.6	28.8	33.1	39.0	45.2	48.8	50.5	47.6
Demand Response	MW	35.2	51.7	52.7	61.6	64.4	67.3	70.1	73.0	75.8	78.7	81.5
Wind (200 MW)	2018$/kW	1,334	1,330	1,328	1,326	1,324	1,324	1,324	1,324	1,326	1,328	1,330
Solar (100 MW)	2018$/kW	1,414	1,264	1,205	1,168	1,130	1,096	1,064	1,038	1,012	993	973
Li-Ion Battery (50 MW, 4 hr)	2018$/kW	2,088	1,811	1,654	1,518	1,452	1,391	1,342	1,301	1,263	1,232	1,201
Flow Battery (50 MW, 6 hr)	2018$/kW	2,968	2,665	2,450	2,242	2,116	1,996	1,892	1,803	1,719	1,651	1,586
Gas CC F-Class (442 MW with DF)	2018$/kW	1,301	1,291	1,275	1,261	1,251	1,242	1,233	1,224	1,216	1,207	1,199
Gas CT F-Class (237 MW)	2018$/kW	712	707	697	688	683	677	672	667	662	657	653
USC Coal w/ CCS	2018$/kW	5,621	5,536	5,424	5,309	5,201	5,097	4,992	4,891	4,794	4,698	4,605

** Res/Com Demand Impact = 0.295*
*** EV Coincident Factor = 0.211*

Revised from last meeting

HIGH TECHNOLOGY CASE INPUTS

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Input	Unit	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
Coal (ILB mine)	2018$/MMBtu	1.78	1.66	1.49	1.27	1.25	1.25	1.25	1.25	1.25	1.25	1.25
CO2	2018$/ton	0.00	0.00	0.00	1.20	2.06	2.38	2.94	3.89	5.46	6.85	8.50
Gas (Henry Hub)	2018$/MMBtu	2.77	2.76	2.82	2.33	2.13	2.04	2.13	2.02	2.12	2.07	2.20
Vectren Peak Load	MW	1,115	1,102	1,217	1,311	1,314	1,352	1,357	1,390	1,381	1,386	1,423
Customer-Owned Solar DG Capacity*	MW	9.3	14.6	21.6	30.2	38.0	47.3	56.1	66.3	75.1	84.7	96.8
EV Peak Load**	MW	0.4	2.0	10.2	15.4	19.8	24.7	29.3	34.5	38.7	43.2	48.6
Energy Efficiency and Company DG	MW	6.0	9.2	15.7	22.6	28.8	33.1	39.0	45.2	48.8	50.5	47.6
Demand Response	MW	35.2	51.7	52.7	61.6	64.4	67.3	70.1	73.0	75.8	78.7	81.5
Wind (200 MW)	2018$/kW	1,334	1,330	1,249	1,167	1,123	1,160	1,152	1,166	1,139	1,142	1,143
Solar (100 MW)	2018$/kW	1,414	1,264	1,120	975	964	942	897	877	818	809	818
Li-Ion Battery (50 MW, 4 hr)	2018$/kW	2,088	1,811	1,513	1,214	1,156	1,096	1,042	965	928	901	894
Flow Battery (50 MW, 6 hr)	2018$/kW	2,968	2,665	2,220	1,774	1,678	1,538	1,408	1,231	1,268	1,124	1,020
Gas CC F-Class (442 MW with DF)	2018$/kW	1,301	1,291	1,275	1,261	1,251	1,242	1,233	1,224	1,216	1,207	1,199
Gas CT F-Class (237 MW)	2018$/kW	712	707	697	688	683	677	672	667	662	657	653
USC Coal w/ CCS	2018$/kW	5,621	5,536	5,424	5,309	5,201	5,097	4,992	4,891	4,794	4,698	4,605

** Res/Com Demand Impact = 0.295*
*** EV Coincident Factor = 0.211*

Revised from last meeting

80% REDUCTION CASE INPUTS

Input	Unit	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
Coal (ILB mine)	2018$/MMBtu	1.78	1.66	1.49	1.27	1.25	1.25	1.25	1.25	1.25	1.25	1.25
CO2	2018$/ton	0.00	0.00	0.00	3.57	5.10	6.63	7.65	9.18	11.22	14.79	19.89
Gas (Henry Hub)	2018$/MMBtu	2.77	2.76	3.06	3.24	3.38	3.49	3.62	3.78	3.96	4.09	4.17
Vectren Peak Load	MW	1,115	1,102	1,131	1,060	1,025	1,039	1,038	1,038	1,053	1,053	1,065
Customer-Owned Solar DG Capacity*	MW	9.3	14.6	20.0	24.4	29.6	36.3	42.9	49.5	57.3	64.3	72.5
EV Peak Load**	MW	0.4	2.0	9.5	12.4	15.4	19.0	22.4	25.8	29.5	32.8	36.4
Energy Efficiency and Company DG	MW	6.0	9.2	15.7	22.6	28.8	33.1	39.0	45.2	48.8	50.5	47.6
Demand Response	MW	35.2	51.7	52.7	61.6	64.4	67.3	70.1	73.0	75.8	78.7	81.5
Wind (200 MW)	2018$/kW	1,334	1,330	1,249	1,167	1,123	1,160	1,152	1,166	1,139	1,142	1,143
Solar (100 MW)	2018$/kW	1,414	1,264	1,120	975	964	942	897	877	818	809	818
Li-Ion Battery (50 MW, 4 hr)	2018$/kW	2,088	1,811	1,513	1,214	1,156	1,096	1,042	965	928	901	894
Flow Battery (50 MW, 6 hr)	2018$/kW	2,968	2,665	2,220	1,774	1,678	1,538	1,408	1,231	1,268	1,124	1,020
Gas CC F-Class (442 MW with DF)	2018$/kW	1,301	1,291	1,275	1,261	1,251	1,242	1,233	1,224	1,216	1,207	1,199
Gas CT F-Class (237 MW)	2018$/kW	712	707	697	688	683	677	672	667	662	657	653
USC Coal w/ CCS	2018$/kW	5,621	5,536	5,424	5,309	5,201	5,097	4,992	4,891	4,794	4,698	4,605

** Res/Com Demand Impact = 0.295*
*** EV Coincident Factor = 0.211*

Revised from last meeting

HIGH REGULATORY CASE INPUTS

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Input	Unit	2019	2021	2023	2025	2027	2029	2031	2033	2035	2037	2039
Coal (ILB mine)	2018$/MMBtu	1.78	1.66	1.49	1.27	1.25	1.25	1.25	1.25	1.25	1.25	1.25
CO2	2018$/ton	0.00	0.00	50.40	52.28	54.17	56.05	57.94	60.06	62.41	64.77	67.12
Gas (Henry Hub)	2018$/MMBtu	2.77	2.76	4.39	6.03	7.10	8.37	7.17	8.40	8.95	8.75	8.63
Vectren Peak Load	MW	1,115	1,102	1,168	1,176	1,183	1,192	1,200	1,209	1,219	1,229	1,239
Customer-Owned Solar DG Capacity*	MW	9.3	14.6	20.7	27.1	34.2	41.7	49.6	57.7	66.3	75.1	84.3
EV Peak Load**	MW	0.4	2.0	9.8	13.8	17.8	21.8	25.9	30.0	34.2	38.3	42.3
Energy Efficiency and Company DG	MW	6.0	9.2	15.7	22.6	28.8	33.1	39.0	45.2	48.8	50.5	47.6
Demand Response	MW	35.2	51.7	52.7	61.6	64.4	67.3	70.1	73.0	75.8	78.7	81.5
Wind (200 MW)	2018$/kW	1,334	1,330	1,249	1,167	1,123	1,160	1,152	1,166	1,139	1,142	1,143
Solar (100 MW)	2018$/kW	1,414	1,264	1,120	975	964	942	897	877	818	809	818
Li-Ion Battery (50 MW, 4 hr)	2018$/kW	2,088	1,811	1,513	1,214	1,156	1,096	1,042	965	928	901	894
Flow Battery (50 MW, 6 hr)	2018$/kW	2,968	2,665	2,220	1,774	1,678	1,538	1,408	1,231	1,268	1,124	1,020
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** Res/Com Demand Impact = 0.295*
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Revised from last meeting

PROBABILISTIC MODELING PROVIDES THE BASIS FOR IRP SCORECARD METRICS

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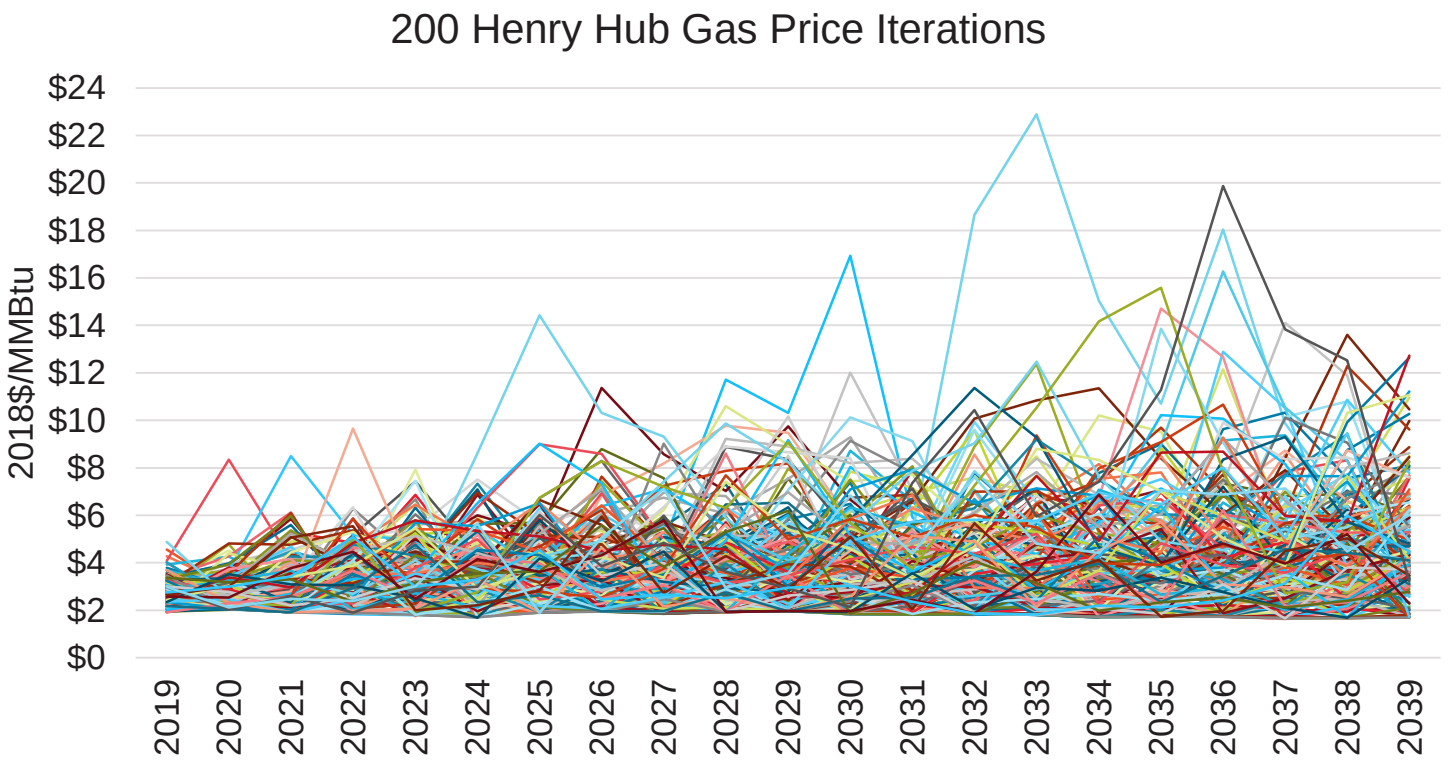
- By measuring each portfolio's performance across 200 iterations, we can quantify each of the measures associated with IRP objectives
- This provides a direct comparison of portfolio performance that will be summarized in the Balanced Scorecard

IRP Objective	Measure	Unit
Affordability	20-Year NPVRR	$
Price Risk Minimization	95th percentile value of NPVRR	$
Environmental Risk Minimization	Life Cycle Greenhouse Gas Emissions	Tons CO_2e
Market Risk Minimization	Energy Market Purchases or Sales outside of a +/- 15% Band	%
	Capacity Market Purchases or Sales outside of a +/- 15% Band	%
Future Flexibility	Uneconomic Asset Risk	$

PROBABILISTIC MODELING

- Probabilistic modeling helps to measure risk from 200 potential future paths for each stochastic variable
- By running each portfolio through 200 iterations, each portfolio's performance and risk profile can be quantified across a wide range of potential futures



PROBABILISTIC VARIABLES AND DRIVERS

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1. Load

- Peak Load
- Average Load

Driver Variables:
- EV and Solar DG (also modeled stochastically)
- Weather
- GDP/ Personal Income
- Expert view on low, mid & high cases

2. Natural Gas

- Henry Hub
- Regional gas basis

Modeling based on:
- Historical Volatility
- Historical Mean Reversion
- Historical Correlation
- Expert view on low, mid & high cases

3. Coal

- ILB
- PRB
- CAPP & NAPP

Modeling based on:
- Historical Volatility
- Historical Mean Reversion
- Historical Correlation
- Expert view on low, mid & high cases

4. CO2

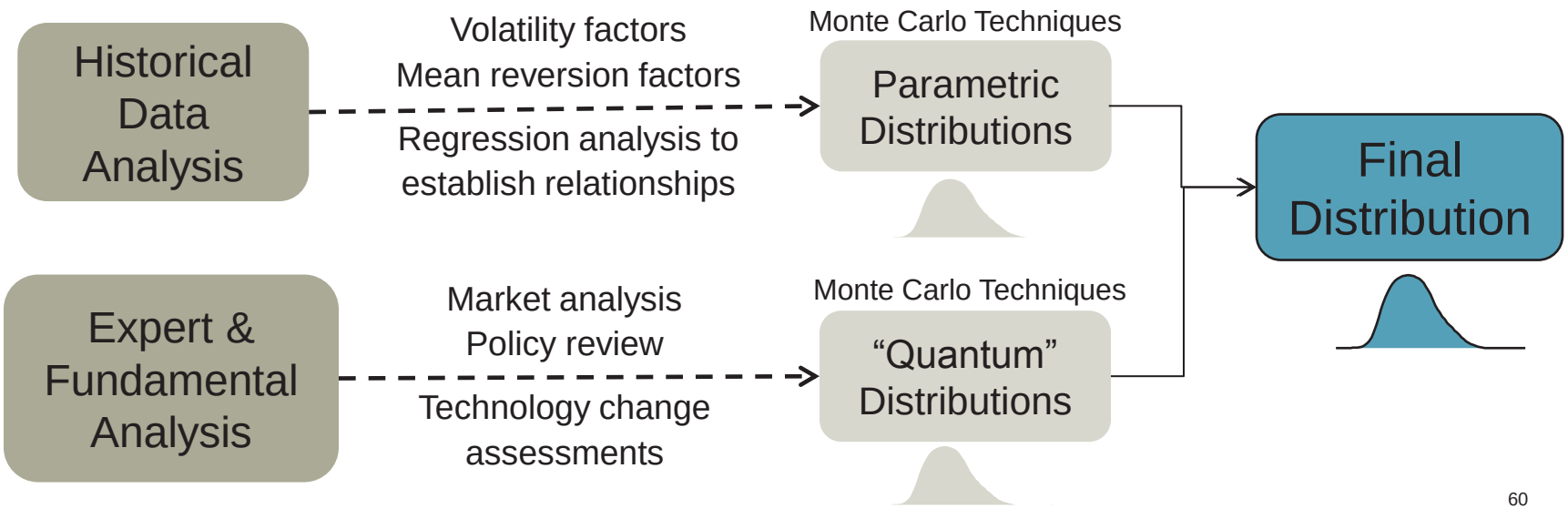
- National CO2 price

Modeling based on:
- Analysis of price required for Paris Agreement compliance
- Social cost of carbon analysis
- Expert view on low, mid & high cases

5. Capital Cost

- Relevant technologies included

Modeling based on:
- Expert view on low, mid & high cases



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NEXT STEPS

MATT RICE

VECTREN MANAGER OF RESOURCE PLANNING

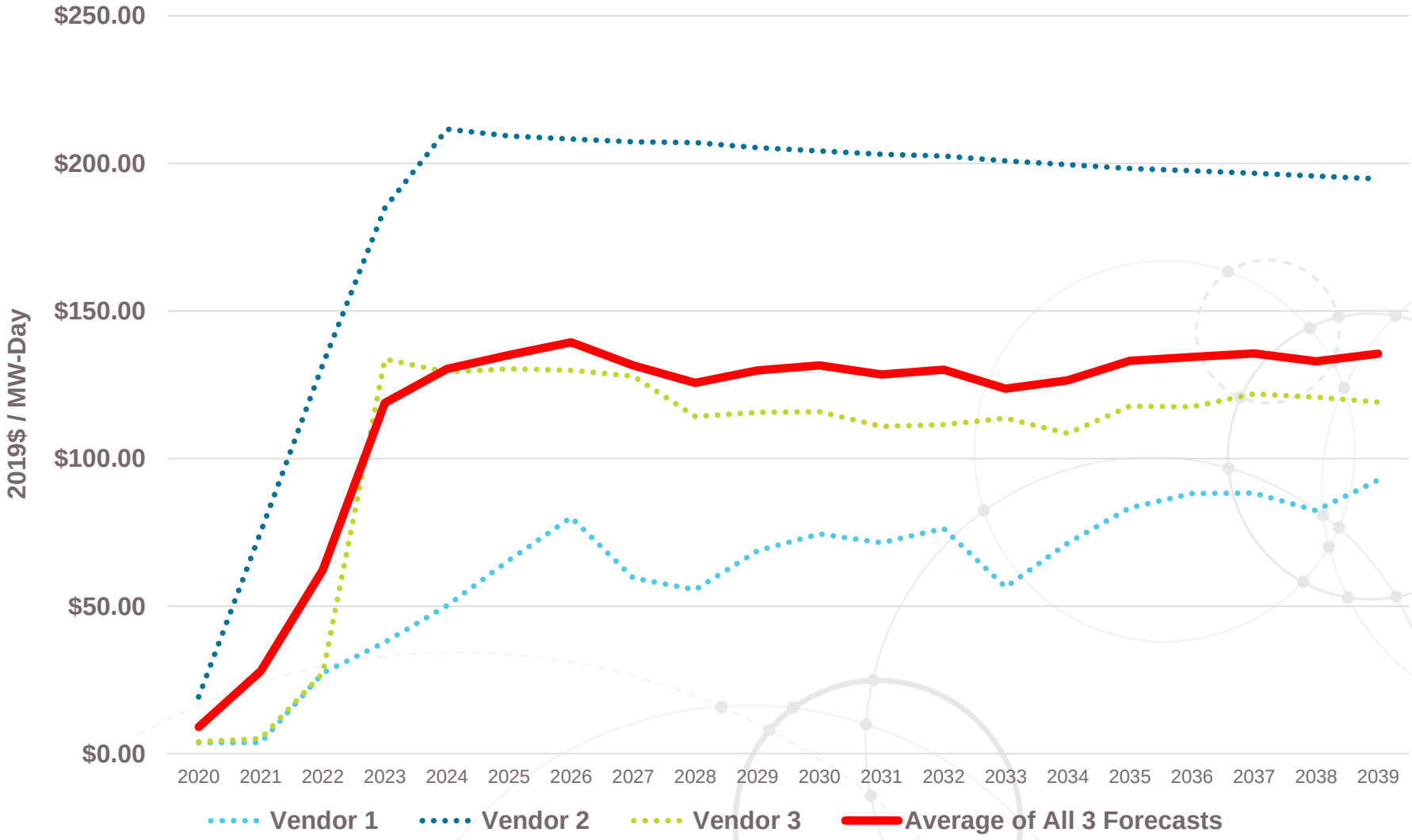
NEXT STEPS

There is a tremendous amount of work to be done between now and our next meeting in March

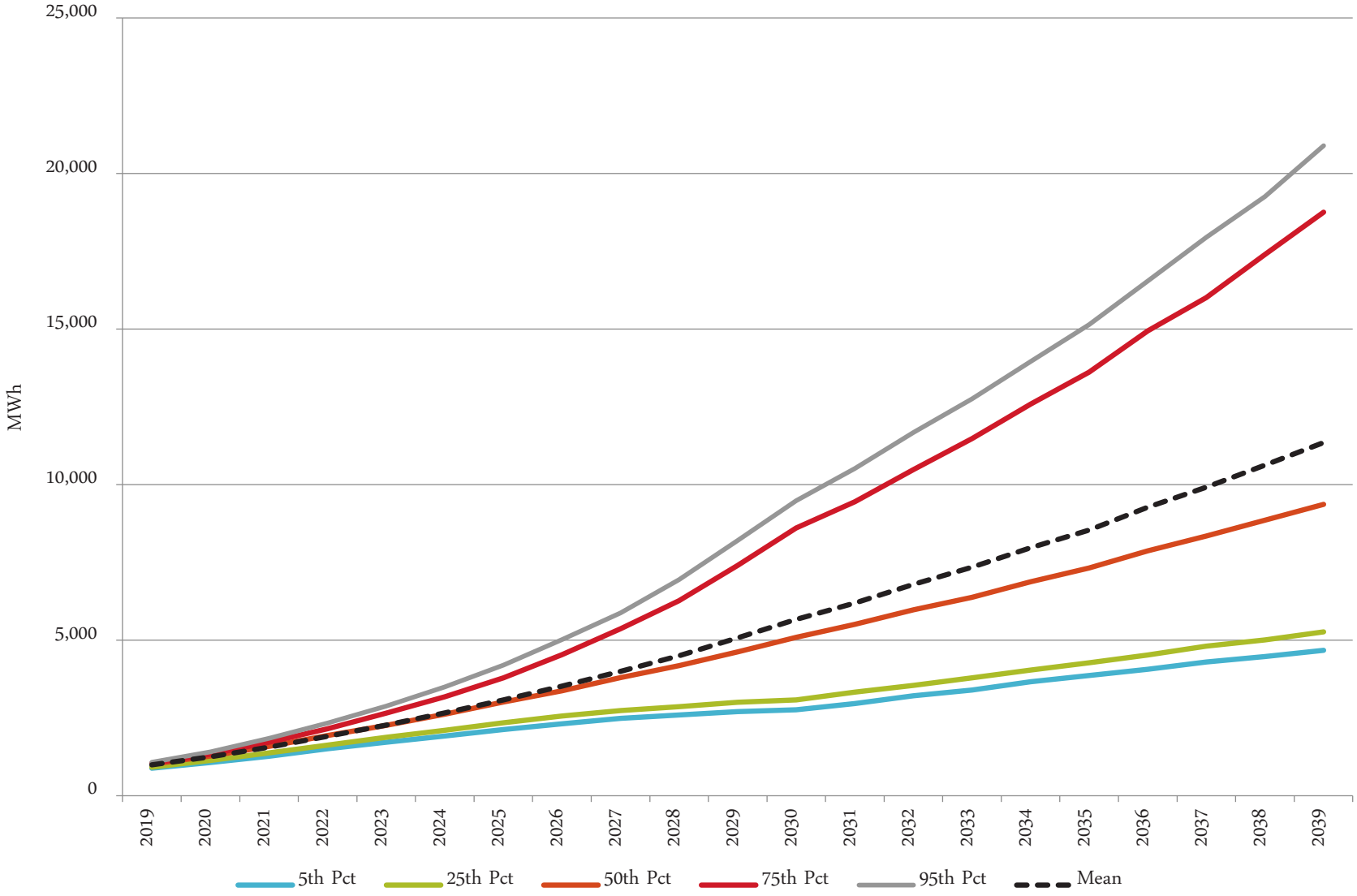
- Finalize all modeling inputs
- Update Reference Case modeling, including RFP results
- Develop scenario based portfolios
- Finalize additional portfolios with insights produced through scenario modeling
- Test portfolios within scenarios and probabilistic modeling
- Analyze results
- Select the preferred portfolio

APPENDIX

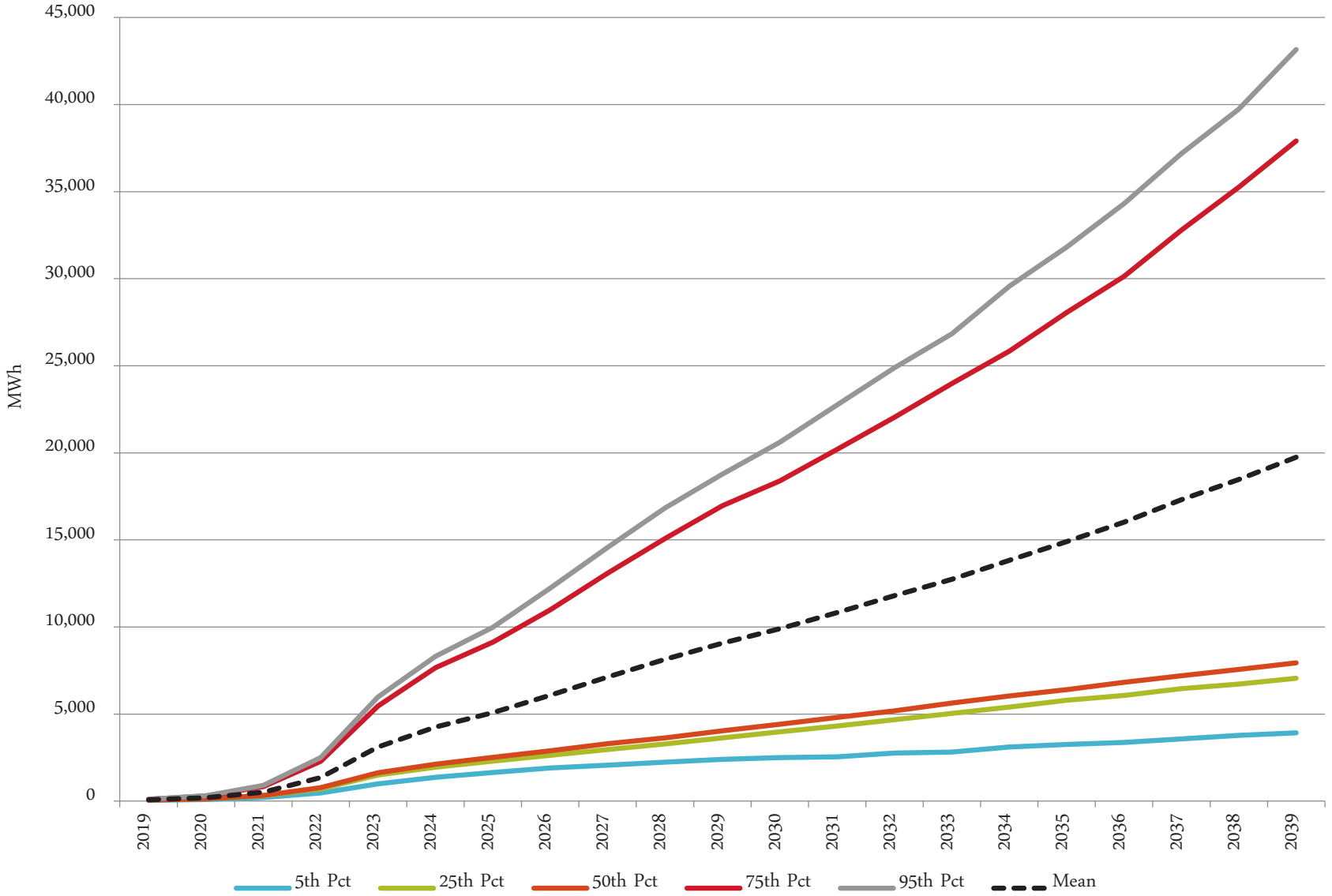
CONSENSUS CAPACITY PRICE FORECAST



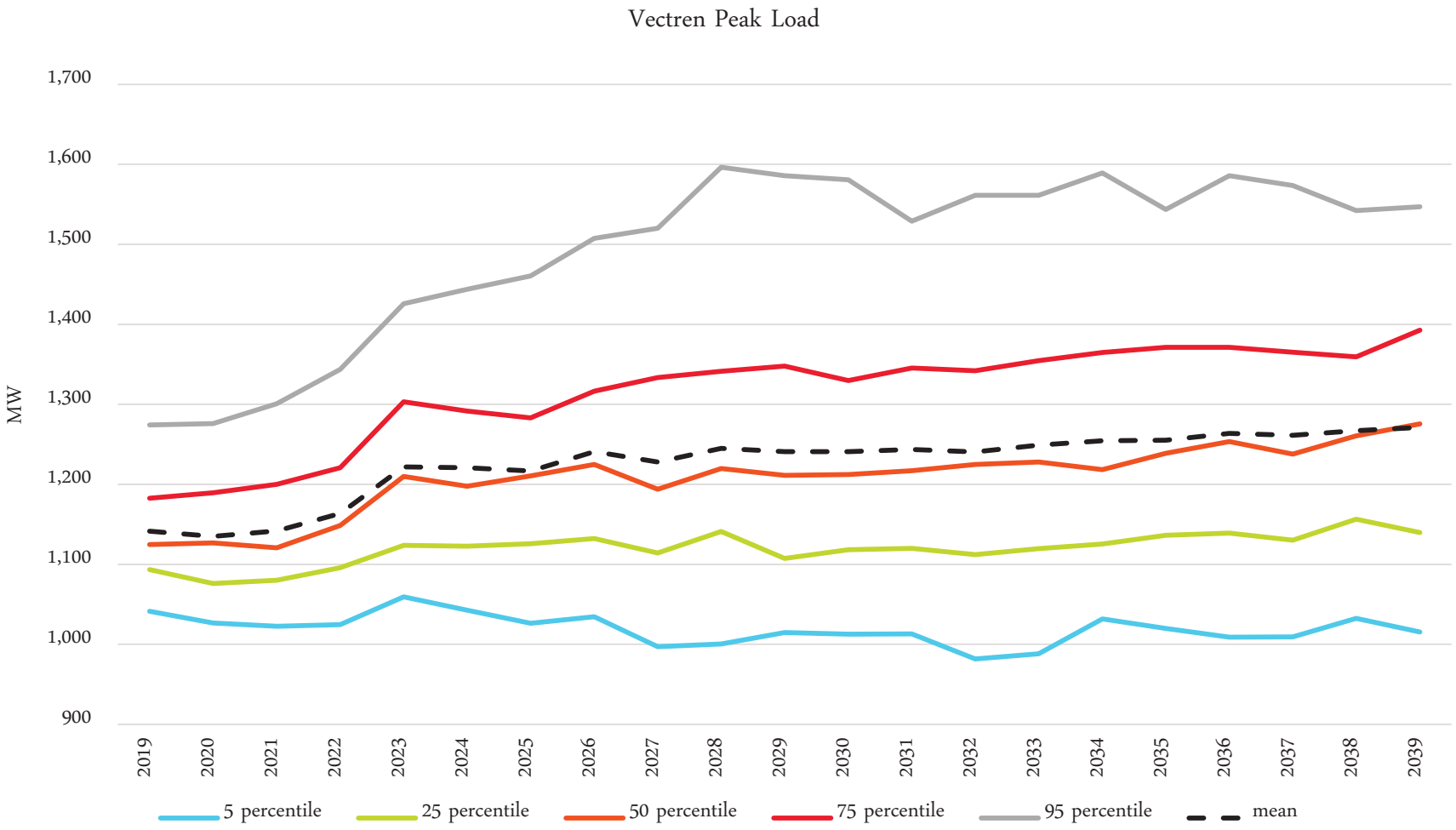
VECTREN SOLAR DISTRIBUTED GENERATION IS A DECREMENT TO VECTREN LOAD



VECTREN ELECTRIC VEHICLE LOAD IS AN INCREMENTAL TO VECTREN LOAD



DISTRIBUTIONS: VECTREN PEAK LOAD (NET OF SOLAR DG, EV LOAD)

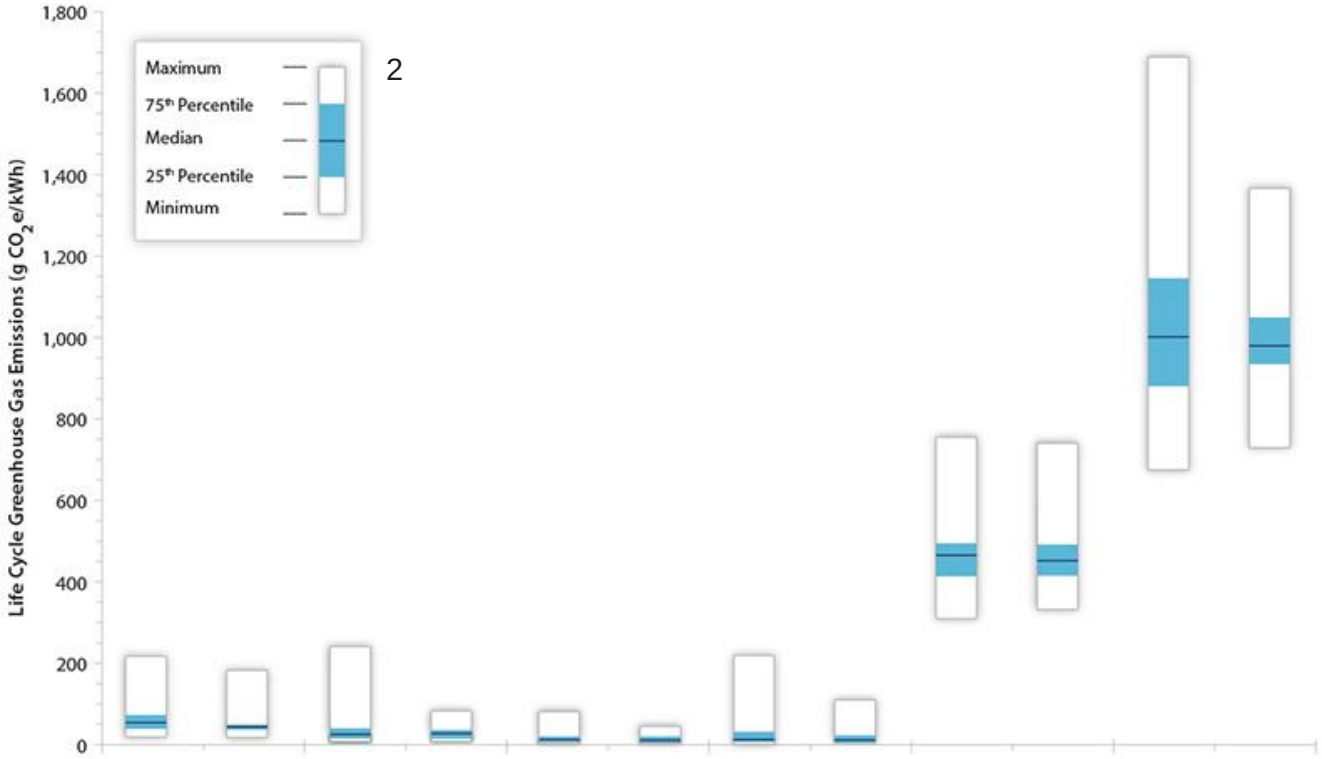


LCA FOR NATURAL GAS ELECTRICITY GEN.

Multiple studies were considered for the NREL study from July 2014[1]

- Methane leakage was considered. Methane emissions rates ranged from 0.66% to 6.2% CH_4 loss/NG produced[1]
- The study noted that there is the possibility of differences in the definition of methane leakage. Some studies include fugitive emissions; some included vented emissions; others might additionally also include methane from combustion
- The NREL study is meant to provide an estimate of life cycle green house gas emissions for various resources. The study did not attempt to fine tune the analysis to a common definition of methane leakage

2



	Photovoltaics (C-Si and Thin Film)	Concentrating Solar Power (Trough and Tower)	Wind (Offshore and Onshore)	Nuclear (Light Water)	Natural Gas CC (Conventional and Unconventional)	Coal (Sub- and Supercritical, IGCC, Fluidized Bed)
Estimates	46	36	126	99	61	164
References	17	10	49	27	45	53

*CC = combined cycle

1 Source: Harmonization of Initial Estimates of Shale Gas Life Cycle Greenhouse Gas Emissions for Electric Power Generation, 2014 Table 1 Page 3 https://www.pnas.org/content/pnas/111/31/E3167.full.pdf

2 Source: https://www.nrel.gov/analysis/assets/images/lca_harm_ng_fig_2.jpg