NIPSCO 2018 Integrated Resource Plan
Preliminary Lessons Learned

IURC IRP Contemporary Issues Technical Conference
April 15, 2019

NiSource

NIPSCO

Agenda

- Introductions and Overview
- Key Challenges for 2018 IRP and Improvement Plan
- Developing Supply Side Assumptions For IRP Using RFP

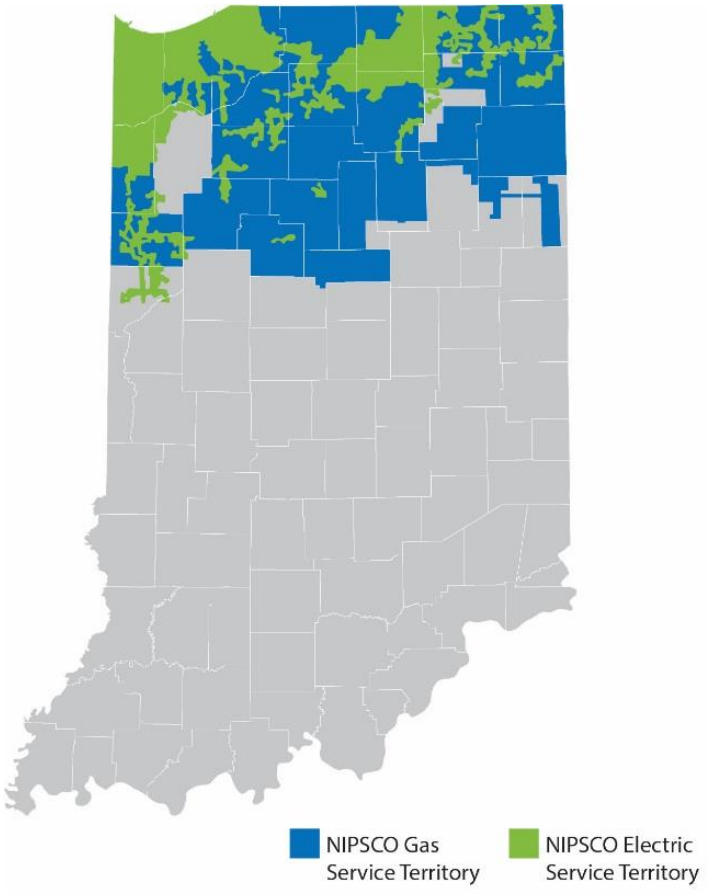
Overview of NIPSCO

Electric

- 468,000 electric customers in 20 counties
- ~2,900 MW generating capacity
  - Owns coal, gas, and hydro plants
  - Additional 100 MW of wind purchased power
- 12,800 miles of transmission and distribution
  - Interconnect with 5 major utilities (3 MISO; 2 PJM)
  - Serves 2 network customers and other independent power producers

Gas

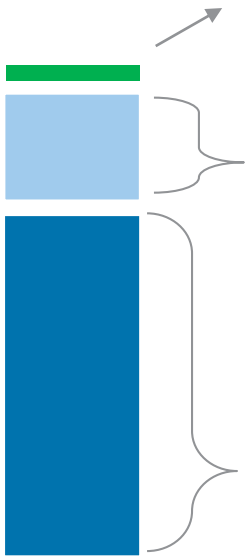
- 819,000 natural gas customers in 32 counties
- 17,000 miles of transmission and distribution lines
- Interconnections with 7 major interstate pipelines
- 2 on-system storage facilities



2,900
Employees

Merrillville, Ind.
Headquarters

Evolving resource planning to meet today's challenges



Other
- Wind Purchase Power Agreement ("PPAs"): 100 MW (2000s)
- Hydro: 10 MW (1920s)

Owned Gas Units
- Sugar Creek Combined Cycle: 535 MW (2000's)
- Bailly #10: 31 MW
- RM Schahfer #16A-B: 155 MW

Owned Coal Units
- RM Schahfer: 1,625 MW (1970's – 80's)
- Michigan City: 469 MW (1974)

Bailly retired in 2018 (450 MW)

Location of NIPSCO generation assets

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Challenges Going Into The 2018 NIPSCO IRP

IRP Process Challenges	Portfolio Challenges
• Shortcomings identified in prior planning cycle (2016) regarding models and analysis techniques	• Coal assets facing pressures from sustained low natural gas prices, environmental regulation and maintenance capital needs
• Difficulty developing reasonable technology cost estimates, given historic trends and rapidly changing costs for renewables and storage	• Diverse replacement options for consideration, including gas, renewables, and energy storage
• Need for greater levels of transparency regarding assumptions with stakeholders	• Large industrial load uncertainty

2018 IRP Improvement Plan

Subject	2016 IRP Feedback	2018 Improvements
Commodity Price Forecasts	• Fuel price projections do not capture the nuanced and dynamic relationships between oil and natural gas, or whether the historic market correlations are evolving • No transparency and availability of underlying assumptions for fuel forecasts	• Utilized independently generated commodity price forecasts using an integrated market model • Provided transparent assumptions related to key inputs and outputs • Benchmarked against publicly available forecasts
Risk Modeling	• NIPSCO IRP planning model was limited to scenarios and sensitivities	• Implemented efficient risk informed (stochastics) analysis with the ability to flex key variables
Scenarios and Sensitivities	• NIPSCO's construction of scenarios and sensitivities in the 2016-2017 IRP is a significant advancement over the 2014 IRP. The clarity of the narratives was commendable and transparency was exceptional	• Built upon the progress made in the 2016 IRP with thematic and modeling informed selections for detailed cost analysis
Capital Cost Assumptions	• Capital cost estimates for new capacity resources were based on proprietary consultant information • No scenario or sensitivity covered uncertainties of resource technology cost	• Leveraged 3rd party and publicly available datasets to develop a range of current and future capital cost estimates for new capacity resources • Conducted an "all-source" Request for Proposals ("RFP") solicitation for replacement capacity resources
Preferred Plan and Scorecard	• Provide additional details around selection of the Preferred Plan and the analysis used to develop • Provide a detailed narrative for those metrics that can be quantified as well as those that do not lead to quantification	• Provided detailed analysis on selection of the preferred plan driven by need for it to be actionable • Developed enhanced scorecard methodology to include more quantifiable metrics that better evaluated tradeoffs • Incorporated rate impact analysis as part of preferred plan metrics
DSM Modeling	• DSM groupings are not getting quite the same treatment as the supply side resources	• Utilized new modeling capabilities will enable DSM to be treated equally with other supply side resources

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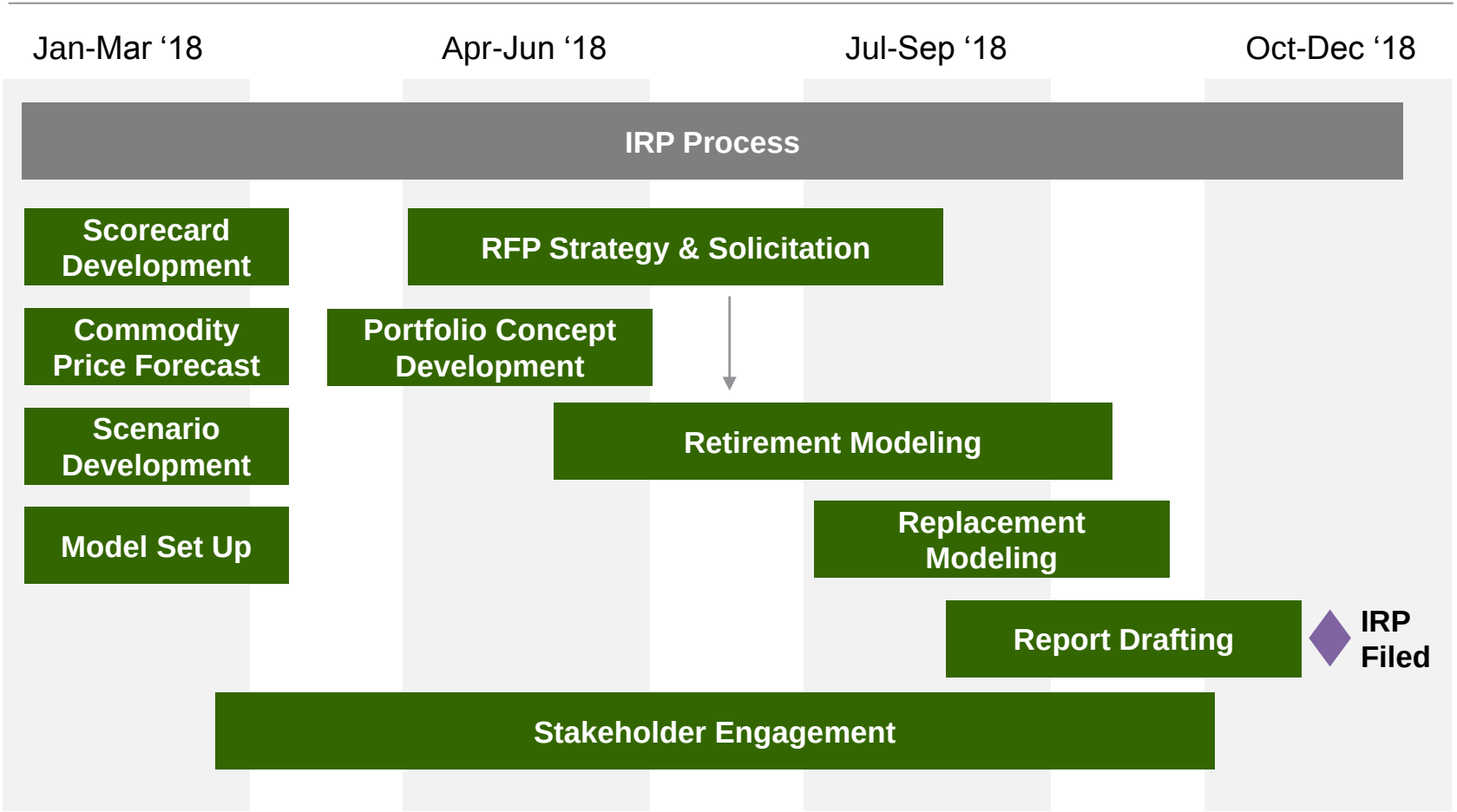
NIPSCO IRP Timeline

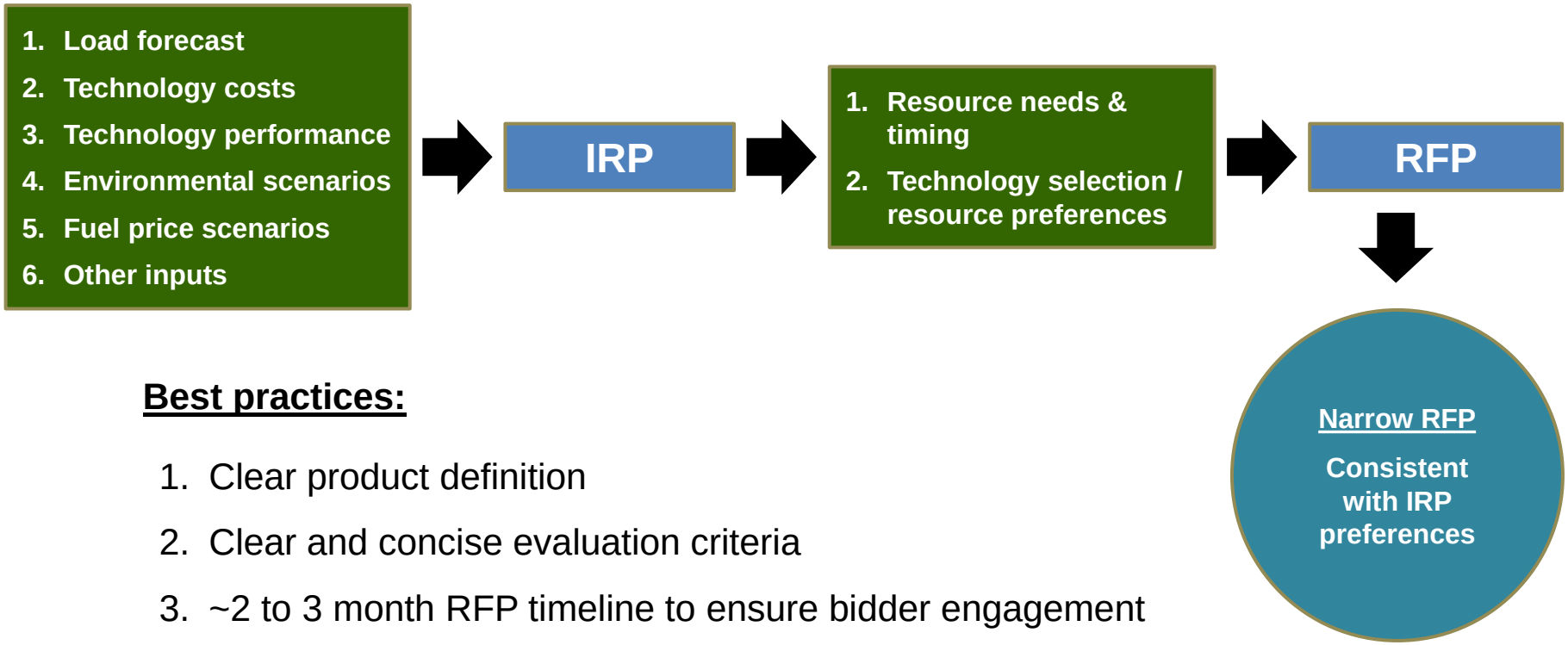


Stakeholders Played a Key Role Throughout the Process

- **NIPSCO held five Public Advisory Meetings and one Technical Webinar**
  - NIPSCO utilized the process to obtain feedback on the design of the request for proposals
  - One Public Advisory Meeting was a webinar to present the request for proposal results
  - Stakeholders were offered the opportunity to make presentations at the Public Advisory meetings
- **Stakeholders provided useful input into the design and construction of the RFP**
- **One-on-one meetings were also conducted with interested parties**
- **Scenarios were run for stakeholders as inputs were provided**
  - Results were reported out to the broader group as part of the Public Advisory Meetings

Linear planning risks inconsistencies between IRP and RFP

Traditional linear IRP to RFP structure

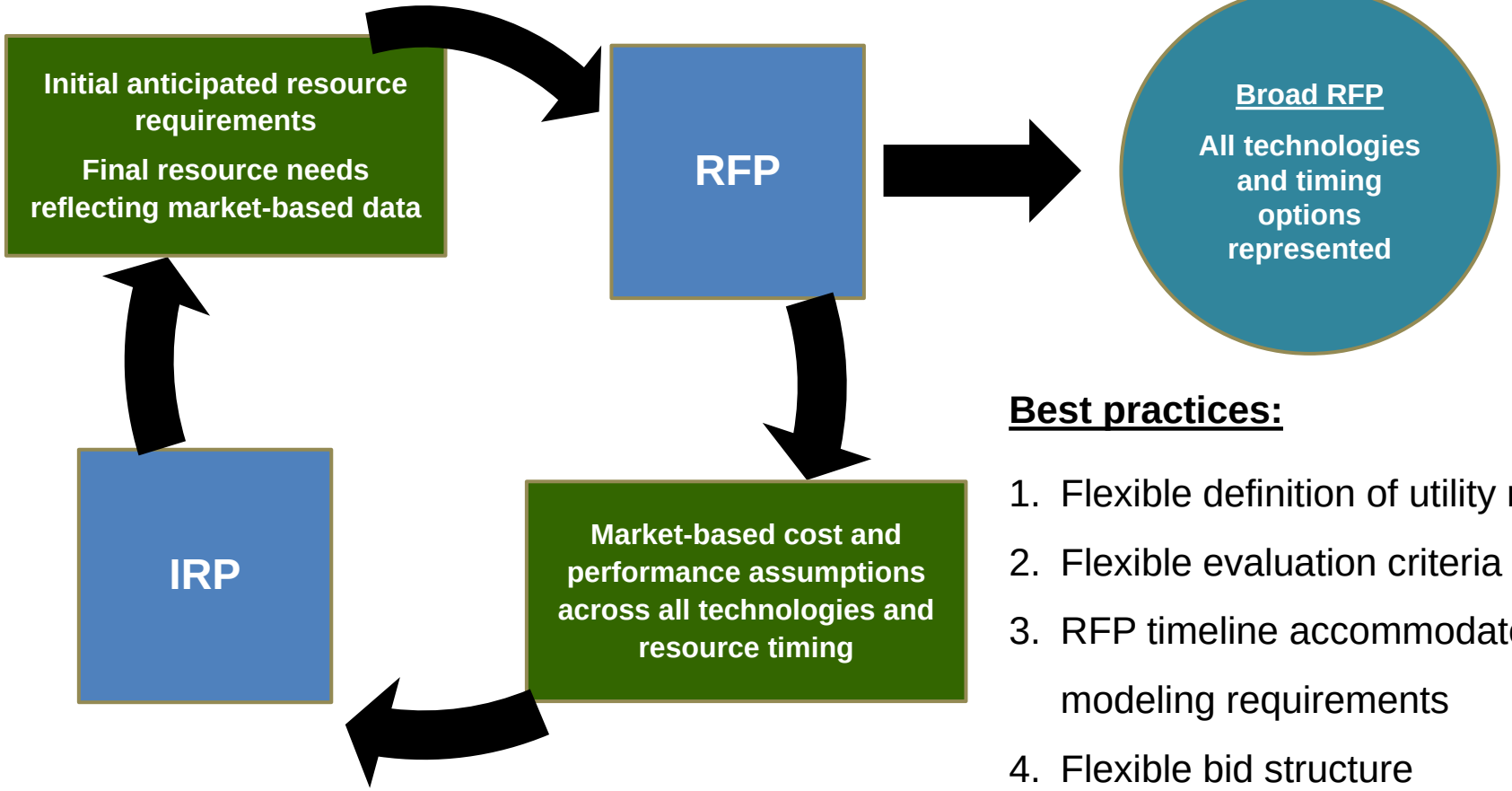


Best practices:

1. Clear product definition
2. Clear and concise evaluation criteria
3. ~2 to 3 month RFP timeline to ensure bidder engagement
4. Firm, binding bid structure
5. Third-party oversight

Integration adds complexity but improves IRP conclusions

Integrated IRP to RFP structure



Best practices:

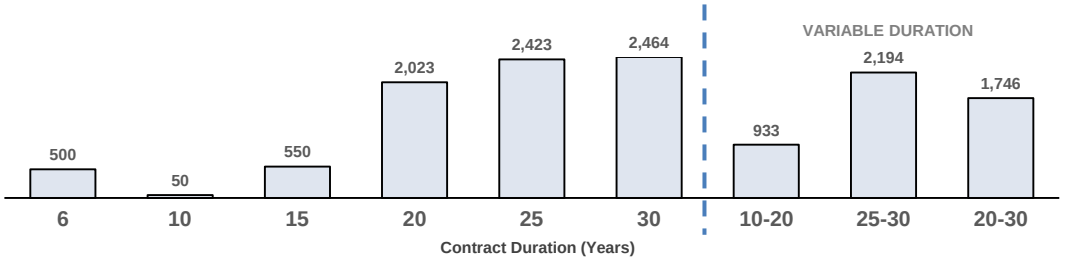
1. Flexible definition of utility needs
2. Flexible evaluation criteria
3. RFP timeline accommodates IRP modeling requirements
4. Flexible bid structure
5. Third-party oversight

RFP Generated Significant Amount Of Responses

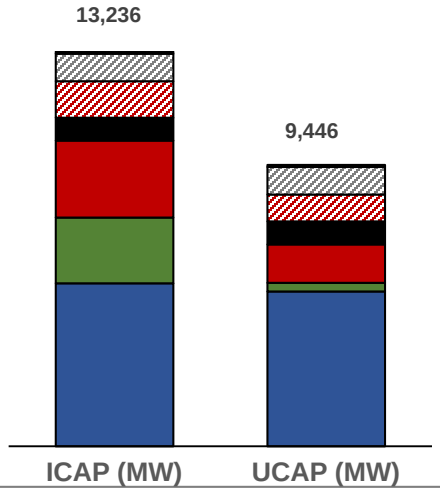
Technology & Ownership
(Overview Of Proposals)

Technology	CCGT*	CT**	Coal	Wind	Wind + Solar + Storage	Solar	Solar + Storage	Storage	Demand Resp.	Total Bids
Asset Sale	4	-	-	1	-	1	-	-	-	6
PPA	8	-	3	6	-	26	7	8	1	59
Option	3	1	-	7	1	8	4	1	-	25
Total	15	1	3	14	1	35	11	9	1	90
Locations	IN, IL	IN	IN, KY	IA, IN, IL, MN	IN	IL, IN, IA	IN	IN	IN	

Duration
(UCAP MW by duration)



Quantity & Technology & Ownership
(RFP Projects By Technology)



	ICAP*** (MW)	UCAP (est. MW)
Demand Response	70	70
Storage	925	925
Solar + Storage	1,220	902
Wind + Solar + Storage	0	0
Coal	772	772
Solar	2,580	1,291
Wind	2,209	287
Natural Gas (CT)	0	0
Natural Gas (CCGT)	5,470	5,199
	13,236	9,446

Note that totals are on a project basis, which eliminates double counting of multiple proposals for the same facility.

- Nearly 10,000 MW of MISO-recognized capacity (UCAP) was offered into the RFP
- A broad set of technologies and fuels, both fossil and renewable, were available
- Ownership and PPA options were available
- Most contract durations skew to 20+ years; several bidders did offer shorter 10-year and 15-year options

*Combined cycle gas turbine
**Combustion turbine
***Installed Capacity

There are more than enough capacity resources bid in to RFP to meet NIPSCO's needs

Integrating RFP results into IRP assumptions

- **As part of NIPSCO's 2018 IRP process, NIPSCO and Charles River Associates ("CRA") developed a methodology to translate specific IRP bids into manageable inputs for the IRP analysis**
  - The IRP was intended to select the best resource mix and future portfolio concept, and *not* select specific assets or projects
  - The IRP was a highly transparent and public process that requires sharing of major inputs
  - The IRP modeling was complex, and resource grouping improved the efficiency of the process

IRP Analysis: Tranche Development and Assessment

- A three-step process to update and run the IRP models

❶ Tranche Development

Aggregated Bids into Groupings by Type

- Bids were organized by:
  - Technology
  - Asset sale or PPA
  - Commitment duration
  - Costs
  - Operational characteristics
- Aggregated cost and operational information was entered into Aurora model to be considered in optimization step

❷ Portfolio Optimization

Selected Portfolios

- Based on capacity need and other constraints, identified which tranches (or portions of tranches) were selected for the portfolio through Aurora optimization

Confirmed Viability

- Confirmed that optimization model is selecting feasible block sizes based on resource-specific data

❸ Portfolio Creation and Modeling

Created & Analyzed Portfolios Based on Optimization

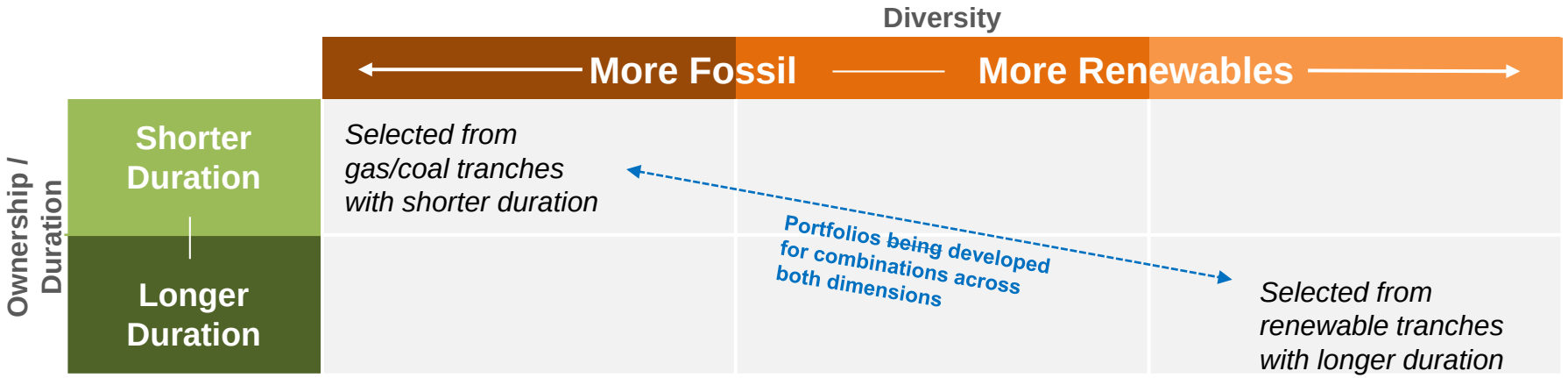
- Tranches were chosen for retirement and replacement analysis based on % selected by optimization model when confirmed as viable
- Portfolios were then run across full set of scenarios and stochastics

New Resource Portfolio Options Constructed around Specific Concepts across Multiple Dimensions

- **Portfolio development and construction are becoming more complex processes, with a need to specifically evaluate tradeoffs across multiple dimensions and objectives**
  - Supply side or demand side
  - Resource type and sustainability/emissions targets (thermal, renewable, storage)
  - Commitment duration and ownership vs. PPA
  - Distributed or central station
- **Constructing specific portfolio concepts around such themes can advance analysis beyond least cost optimization techniques**

Commitment Duration And Resource Diversity Themes

- Built out replacement options across duration and emissions matrix (to test full range of portfolio options across full set of objectives)



Portfolio Creation And Modeling

- RFP projects provided good coverage to construct resource combinations that covered the spectrum of Ownership / Duration and Diversity

Diversity

Ownership / Duration	Higher Carbon Emissions	Average Carbon Emissions	Average-Low Carbon Emissions
Short Duration	**A** MISO Capacity Purchase 400MW Combined Cycle Gas Turbine (“CCGT”) 950MW Purchase Power Agreement (“PPA”)	**B** MISO Capacity Purchase 400MW CCGT PPA 250MW Renewable PPA 690MW	**C** MISO Capacity Purchase 400MW Renewable PPA 950MW
Long Duration	**D** MISO Capacity Purchase 50MW CCGT 1,300MW	**E** MISO Capacity Purchase 50MW CCGT 620MW Renewables 670MW	**F** MISO Capacity Purchase 50MW Renewables 1,300MW

Notes: Values above reflect 2023 additions shown in UCAP; additional generic solar additions are included in all portfolios starting in 2028.
All portfolios include a total of 125 MW (peak) DSM by 2023 and 370 MW (peak) DSM by 2038.

Summary of Lessons Learned from Integrating RFP Into IRP

Ensuring bidders understood the integrated process was critical in order to yield aggressive, market-based bids and pricing

- An integrated IRP / RFP timeline will be longer than a standalone RFP
- Bidders need to be informed of the process timeline and understand the constraints

Management of data between IRP and RFP phases was critical

- Need to consider approach for organizing bid data early on in the process
- IRP and RFP teams need to be highly coordinated (yet independent)
- Data should be organized to allow for a range of portfolio concepts

Stakeholder engagement throughout the process was important

- Buy-in on process and format of the RFP was valuable for the bidders to assure that a future transaction was likely
- Understanding of how the data was being used in the IRP helped provide stakeholders confidence in the analysis

Appendix

Tranche Development

- **Bids are aggregated and similar resources are combined into representative tranches**
  - Bids are sorted by bid type (PPA or asset sale), technology type, duration, online year, and cost
  - Price and operational characteristics for the tranche are calculated using weighted average of individual bids within the tranche
  - Certain tranches contain only one bid, if the bid had unique characteristics that make it difficult to aggregate

Representative and Illustrative

PPA Solar Tranche Example

Bid Name	Bid Type	ICAP (MW)*	UCAP (MW)	Online Year	PPA Term (years)	Price*	Capacity Factor
Bid 1	Solar	-	-	2023	20	$27.xx	-
Bid 9	Solar	275	138	2023	20	$32.00	24%
Bid 10	Solar	100	50	2023	20	$34.00	24%
Bid 11	Solar	75	38	2023	20	$34.00	23%
Bid 12	Solar	25	13	2023	20	$35.00	24%
Bid 13	Solar	500	250	2023	25	$35.00	25%
Bid 26	Solar	-	-	2023	20	$73.xx	-

Tranche Name	Tranche Type	# of Resources	ICAP (MW)	UCAP (MW)	Online Year	PPA Term (weighted average years)	Price (weighted average)	Capacity Factor (weighted average)
Indiana Solar #3	Solar	5	975	488	2023	23	$33.93	24.2%

*Capacity and bid prices are rounded to the nearest 25 MW and dollar respectively to preserve confidentiality.

Tranche Development

- **Some technology types have multiple bids with the same project, requiring tranches to be developed for PPA and asset sale options and for different durations, as necessary**

Representative and Illustrative

CCGT Tranche Example

PPA

Bid Name	Bid Type	ICAP (MW)*	UCAP (MW)*	Online Year	PPA Term (years)
PPA Bid 1	CCGT	250	250	2023	6
PPA Bid 2	CCGT	625	575	2023	30
PPA Bid 3	CCGT	625	625	2023	30
PPA Bid 4	CCGT	725	700	2023	20
PPA Bid 5	CCGT	600	600	2023	30

Tranche Name	# Of Resources	ICAP (MW)	UCAP (MW)	Online Year	PPA Term (years)	Cost range** ($/kW-mo)
PPA CCGT #1	1	250	250	2023	6	
PPA CCGT #2	4	2,575	2,500	2023	27	

Sale

Bid Name	Bid Type	ICAP (MW)*	UCAP (MW)*	Online Year
Sale Bid 1	CCGT	625	625	2023
Sale Bid 2	CCGT	625	625	2023
Sale Bid 3	CCGT	1,025	925	2023
Sale Bid 4	CCGT	725	700	2023

Tranche Name	# Of Resources	ICAP (MW)	UCAP (MW)	Online Year	Price Range** ($/kW)
Sale CCGT #1	2	1,250	1,250	2023	
Sale CCGT #2	2	1,750	1,750	2023	

*Capacity is rounded to the nearest 25 MW.
**Given the small number of projects within each CCGT tranche, PPA costs and asset sale prices are not being shown to preserve confidentiality. Note that PPAs were structured as tolling arrangements with fixed cost capacity payments (in $/kW-mo) plus certain variable charges (in $/MWh).

Portfolio Optimization and Selection

- **Optimization modeling allows for portions of tranches containing multiple resources to be selected**
  - After the optimization step, CRA confirms that resource selection is reasonable given available resources in tranche

Representative and Illustrative

Sample Optimization Model Output (Percentage Selected)				
Tranche Name	Illustrative 2023 Retirement Portfolio			
	No Retirements	Schahfer 17/18 Retires	All Schahfer Retires	All Schahfer + Michigan City Retire
Indiana Solar + Storage #2 (PPA)		100%	100%	100%
Indiana Solar + Storage #3 (PPA)			100%	100%
Indiana Solar #2 (PPA)		96%	100%	100%
Indiana Solar #3 (PPA)			100%	100%
Indiana Solar #4 (PPA)			8%	70%
Indiana Wind #1 (PPA)		83%	83%	83%
Indiana Wind #2 (PPA)		57%	57%	57%

Confirm viability based on resources in tranche when portions are selected*

- Indiana Solar #4:
  - 8% of Indiana Solar #4 tranche is ~100 MW of nameplate solar, a reasonable block size for this technology and tranche based on the bids within it
- Indiana Wind #1:
  - 5 unique resources in tranche, 4 least expensive bids make up 89% of tranche, close to optimization model selection of 83%

*The optimization model may select only portions of a tranche, due to capacity need, reserve margin constraints, and other economic factors.