Northern Indiana Public Service Company LLC
2021 Integrated Resource Plan
**Technical Webinar**
**SUMMARY**

October 12, 2021

**Welcome and Introductions**
**Alison Becker, Manager Regulatory Policy, NIPSCO**

Ms. Alison Becker, Manager, Regulatory Policy, welcomed participants to the virtual technical webinar and provided a safety moment on Insomnia. She then discussed the Webex meeting protocols and walked through the agenda for the day. She then transitioned to Mr. Fred Gomos, Director Strategy and Risk Integration at NiSource, to walk through NIPSCO's reliability approach in the IRP.

**Participants had the following questions and comments, with answers provided after:**

- Will there be the opportunity to discuss a decision around whether an asset is chosen or not with NIPSCO?
    - This topic is not on the agenda for today. However, you may contact Charles River Associates ("CRA") as the administrator of the request for proposals ("RFP"). Notifications have and are going out now.

**Reliability Approach in the IRP**
**Fred Gomos, Director Strategy and Risk Integration, NiSource**

Mr. Gomos set the context for assessing reliability in the IRP by recapping previous reliability assessments in the 2018 IRP and the 2020 Portfolio Analysis and describing how the 2021 IRP approach builds upon the previous body of work. Mr. Gomos explained the three-step approach for reliability in the 2021 IRP. He then provided an overview of how NIPSCO has been assessing reliability in its core economic modeling, anchored to the recent MISO Renewable Integration Impact Assessment report. Mr. Gomos then noted several additional non-economic reliability considerations not captured in the core economic analysis, which is driving the need for the expanded reliability assessment.

**Economic Reliability Analysis – Real-Time Market Dynamics & Ancillary Services**
**Pat Augustine, Vice President, CRA**
**Goran Vojvodic, Principal, CRA**

Mr. Pat Augustine, Vice President at CRA, set the stage for the sub-hourly energy and ancillary services evaluation and provided an overview of Federal Energy Regulatory Commission Order 841. He then walked through CRA's Energy Storage Operations ("ESOP") model, an optimization program that estimates the value of storage and other flexible resources in the sub-

hourly energy and ancillary services markets. He then transitioned to Mr. Goran Vojvodic, Principal at CRA, who summarized the major results of the ESOP analysis by technology. Mr. Vojvodic then reviewed an example chart visualization to illustrate the type of dispatch behavior in the energy and ancillary services markets that is simulated through the modeling exercise. Mr. Augustine then concluded the section by summarizing the incremental real-time energy and ancillary service value projections by technology across the four IRP scenarios and the range of additional value opportunity (net present value revenue requirement cost reduction) at the replacement portfolio level.

**Participants had the following questions and comments, with answers provided after:**

- How did you determine regulation market values?
    - Five-minute price projections were based primarily on historical data and observed relationships between energy and ancillary services prices in the Midcontinent Independent System Operator, Inc. ("MISO") market. There is quite a lot of historical data available for these markets, and at least under current market conditions, regulation and energy prices are highly correlated because there is an opportunity cost of dispatching in the energy market versus being held in reserve for regulation. Functionally, the price development process entailed the following steps: (i) obtain historical five-minute price data for energy and ancillary services prices; (ii) measure the relationships between them; (iii) take these relationships and propagate them forward based on the fundamental energy forecasts that were developed across all four MISO market scenarios. This approach admittedly carries a lot of uncertainty because it uses historical data as the basis, but it is very difficult to try to fundamentally simulate a real time regulation price. Therefore, this approach allows NIPSCO to assess a range of potential future outcomes for planning purposes, and the values here are not incorporated in the core net present value revenue requirement analysis given significant long-term market uncertainty.
- MISO's symmetric REG market (one product for both up and down) results in acute constraints on both energy storage and VER (wind & solar) providing REG. There might be significant economic benefits for introducing an asymmetric REG market. Have you looked? Could you?
    - As mentioned before, in order to participate in the regulation market, a resource has to be able to regulate up and down simultaneously as the question implies. This may constrain resource participation in ways that are not present in other markets that have separate products for regulation up and down. The question's suggestion that a market design change could impact economic outcomes is fair, but we have not evaluated that. To the extent the market design changes in the future, analysis adjustments would be required.

      CRA has done some analysis in other markets which have both REG up and REG down markets, and this requires a slightly different model configuration. In the case of regulation, the modeling has to assume a number of things about whether the resource will be picked up to regulate and thus whether it has enough room to move either up or down. For example, a storage resource cannot be discharging at full output if also providing regulation service. In a reconfigured market, both up and down potential would have to be separately

tracked against separate prices. In other markets, CRA is seeing REG up prices slightly higher than REG down prices, so that may impact the value for different resource types.

**Qualitative Assessment of Reliability Attributes – Scoring Criteria & Results**
**Fred Gomos, Director, Strategy and Risk Integration, NiSource**
**Hisham Othman, Vice President, Transmission and Regulatory Consulting, Quanta Technology, LLC ("Quanta")**

Mr. Gomos described the four-step approach to the non-economic reliability assessment and the incorporation of a third party expert. He also reviewed the guiding principles under which the assessment was performed and focused on the primary goals of the assessment: to understand reliability implications of potential resource additions to the NIPSCO portfolio and to understand the range of potential mitigations associated with different replacement portfolio strategies.

Mr. Gomos then introduced Mr. Hisham Othman, Vice President, Transmission and Regulatory Consulting at Quanta, who provided an overview of the steps Quanta took to perform the reliability assessment and ranking. Mr. Othman reviewed the elements critical to reliable operation of an electric system and provided an overview of the NIPSCO demand and resource assumptions. Mr. Othman then reviewed the eight reliability criteria identified for the assessment and the rationale for each. He then described measurement approaches for each of the eight criteria and the type of analysis that was performed to support each metric. Mr. Othman then provided detailed review of the analysis performed for two of the criteria: Blackstart and Predictability and Firmness of Supply.

Mr. Othman then summarized the overall assessment results, including metrics and the criteria thresholds used for scoring each of the metrics. The resulting ranking of each metric and the methodology to arrive at a cumulative score and rank for each portfolio were discussed. Mr. Othman then transitioned back to Mr. Gomos who concluded the discussion with the ranking of each of the nine replacement portfolios and how the scoring and ranking will be incorporated into NIPSCO's IRP scorecard.

**Participants had the following questions and comments, with answers provided after:**

- To what extent does NIPSCO need to plan reliability services for its own fleet and load vs. services that MISO can and/or does obtain system wide? Is there a potential disconnect between generation resources presented to the MISO market and the levels of each of the reliability services needed?
    - It depends on what service you are looking at and what North American Electric Reliability Corporation standard or MISO tariff provision is governing the particular service. For example, NIPSCO is responsible for having a blackstart plan that is approved by MISO. For other criteria, under normal system conditions, many of these services are provided and managed by MISO as the system operator. The earlier analysis on ancillary services tried to quantify some of that value. However, NIPSCO is also trying to understand the requirements for the Company under islanded conditions when the larger grid is not available. For example, for criteria like voltage support or short circuit strength, they would have to actually be within the service territory to be able to function and operate in a reliable fashion under such conditions. Other services today are not

procured in the market but they are still provided as part of the interconnection requirements.

- With NIPSCO being in the heart of the Eastern Interconnection, the largest interconnected grid in the world, the present rate of change of frequency ("RoCoF") levels for the biggest design basis events are about an order of magnitude lower than have been problematic in small, islanded systems around the world. Is there any analysis that shows RoCoF is problematic in the foreseeable future?
    - Related to the rate of change of frequency, it is true that the larger the system, the lower the impact. It's been a problem in island systems like Hawaii, and one of the things we look at is also the ability of the NIPSCO system to operate in an islanded fashion in order to be able to restart. So if you think of those scenarios where you need to actually reliably restart the system, those implications come into play. When connected to the rest of the MISO and the Eastern Interconnect, you are absolutely right that there are no foreseeable impacts for RoCoF. However for situations where the system needs to restart, then you also need to consider resources to have enough mitigation in place to be able to actually operate and restart the system.
- For what it's worth, I'm of the opinion that MISO's symmetric market is an expensive anachronism. Notice in Hisham's chart that most of the independent system operators ("ISOs") now have asymmetric REG markets now. Not urgent, but it will become more expensive. I was excited that Quanta had essentially the entire setup necessary to answer the question "what would the saving results from an asymmetric REG market". That would advise the discussion.
    - It is true that in asymmetrical markets, different resources have capabilities in one direction, while others may have capabilities in the other direction. While some Northeastern markets also have single regulation constructs like MISO, it is certainly true that other ISOs have two products, and the hypothesis that this reduces system costs overall may be correct. The reliability assessment has not been focused on a system-wide cost view, nor a scenario analysis associated with potential market design changes. However, NIPSCO appreciates the comments, and the Company will need to continue to track market design changes as it evaluates different resources in the future.
- We certainly agree that energy adequacy is critical and certainly it is more meaningful than adequacy judged by capacity value, but if I understand the appendix files this metric was judged based on performance of the portfolio dispatched as an islanded systems without any connection to MISO during one year and then picking out the worst performing week for each, is that correct? And if so, why does that Black Swan event make sense, wouldn't you want to evaluate these portfolios under representative emergency conditions?
    - Yes that is correct. The idea is that NIPSCO is under an emergency situation where the system is islanded and needs to be serving its native load. Thus we consider whether there are enough resources to serve critical load under those conditions and have not quantified the probability of such a "black swan" event happening.
- What I mean by representative emergency conditions is that, for example, if you are looking at situations in which max gen events are happening in MISO, one of the things you can observe is that load actually increases significantly and so I'm not sure why it would make sense to simulate these portfolios under typical meteorological conditions and not account for the types of factors that tend to happen under those kinds of conditions. I certainly agree that our ability to plan reliably is getting more and more

constrained and because of data we don't even understand, including the ways in which climate change is affecting the frequency and severity of weather events, but it seems like to the extent you could look backward and evaluate those things, you would want to do so under a set of assumptions that make the performance of both resources look consistent with the weather event that is actually being experienced. And I would extend that also to things like the probability of forced outage, which increases at both high and low temperature extremes and to the probability of fuel supply interaction which is also temperature-related. It just seems like that makes more sense than to kind of simulate NIPSCO as an islanded system for a period of one year and take the worst possible week, because if that was an actual scenario, that to me would imply some sort of apocalyptic conditions that happened as opposed to a severe weather event.

    - That is a very good comment we will take it into advisement. The analysis that was done does not really imply that NIPSCO would become an islanded system for a year, but is intended to evaluate what the worst week throughout the year might be. But you are right that we are not simulating weather, load, or forced outage events across a distribution of outcomes, and we will think about if we want to add another measure under that metric and if we can accomplish that within the time frame.

- Does your "energy not served" analysis use stochastic analysis drawing on the availability distributions for the various resource types? If not, what analysis did you use?
    - This analysis was not based on a statistical assessment of uncertainty. Instead, NIPSCO is taking the average profiles for solar and wind and dispatching other portfolio elements against the base load profile to assess how much energy can be served. There is clearly additional risk associated with weather conditions and the resilience of resources to those weather conditions, but that was not evaluated with this analysis.
- Another approach to reliability, rather than using islanding, would be to use energy inflows and outflows by hour? Rather than constraining NIPSCO's system to be islanded it seems like reliability risk especially as pertains to energy adequacy – when you look at the equilibrium of the Midwest energy system or the eastern interconnect and as more intermittent resources are built out system wide, it seems like the risk is really related to those hours in which say the net end loads are relatively high – those would be the hours say from the catastrophic basis drawing on the drawing on the variability of intermittent resources or even the availability of dispatchable resources. It just seems like that would be another approach to thinking about the reliability of the portfolio without having to do the islanding.
    - This is actually quite similar to what we have done in the stochastic portfolio analysis that is part of the core economic portfolio modeling. You might recall that the stochastic analysis incorporates different iterations of commodity prices and renewable output for wind and solar and evaluates, from an economic perspective, NIPSCO's exposure to the market. Keep in mind that under normal operating conditions, NIPSCO is constantly selling and buying energy to and from the market, so this exposure is economic and less about physical transmission limitations. So, in the stochastic economic analysis, energy adequacy hour by hour across 500 iterations of potential fuel, power, and renewable output outcomes were evaluated. In that analysis, NIPSCO did find that in the near term, more natural gas resources exposed the portfolio to

commodity price volatility risk, but over the long term, very heavy reliance on renewables exposed the portfolio to significant market exposure risk when prices were spiking and renewables were not available. So overall, the approach the question just laid out has largely already been picked up in the economic analysis.

From a reliability perspective, the analysis has been focusing on more technical, non-economic factors, such as frequency, our ability to regulate voltage, our ability to black start the system, etc. However, NIPSCO will consider about whether we can perform any further reviews for the reliability assessment based on your question.

- Nice blackstart analysis. I fully agree with your statements about the need for GFM (grid forming) on the energy storage to realize blackstart and other benefits. It is important to note that grid forming for batteries, while commercially proven, is not the default. Many BESS are being built without GFM today. Do you agree with those (like me) who are of the opinion that GFM should be required for all battery energy storage projects?
    - Yes, that will become a major consideration in the future. As more inverter-based resources are built, they will become the backbone of the system going forward, and trying to build them from the start with the right capability with the right specs is the right thing to do. Retrofitting later on is going to be more expensive, so prioritizing grid forming capability in the future is important. If NIPSCO looks at storage systems and at the inverter cost or the percentage of the cost relative to the inverters, adding the grid forming inverter is unlikely to swing the economics negatively, so it is better to have those capabilities up front. Not only that, inverters that can operate under a low short circuit ratio are preferable to ones that require a higher short circuit ratio to operate because that is also going to be a declining capability of the grid going forward. In addition, the analysis so far is up to the year 2030 and they could actually become even more critical if we were to advance the analysis to the year 2040.

      This analysis also informs how we engage with some of the developers that bid into the RFP, particularly storage projects. If we now know that grid forming inverters are something that would be required or highly preferred, we can go back to developers and ask if that is specified in their project or what would it cost to be included in the project. So, I think that's an example of something this study informs for ultimate RFP project selection and execution.

**Next Steps**
**Alison Becker, Manager Regulatory Policy, NIPSCO**

Ms. Becker closed the session by thanking attendees for their participation and feedback. She then outlined key next steps in the IRP process and invited participants to reach out for one-on-one discussions.