STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

VERIFIED PETITION OF NORTHERN INDIANA PUBLIC SERVICE COMPANY LLC FOR APPROVAL PURSUANT TO IND. CODE §§ 8-1-2-42(a), 8-1-8.8-11, AND TO THE EXTENT NECESSARY IND. CODE § 8-1-2.5-6, OF A RENEWABLE ENERGY POWER PURCHASE AGREEMENT WITH JORDAN CREEK WIND FARM LLC, INCLUDING TIMELY COST RECOVERY.	)))))))	) CAUSE NO. 45195

DIRECT TESTIMONY & ATTACHMENTS OF ELIZABETH A. STANTON, PHD, ON BEHALF OF CITIZENS ACTION COALITION OF INDIANA, INC.

MARCH 15, 2019

IURC
INTERVENOR'S – CAC
EXHIBIT NO. 1
4-23-19 CR
DATE REPORTER

Direct Testimony of Elizabeth A. Stanton, PhD
On Behalf of Citizens Action Coalition of Indiana, Inc.
Cause No. 45195
March 15, 2019

Q. Please state your name and business address.

A. My name is Elizabeth A. Stanton. I am the Director and Senior Economist of the Applied Economics Clinic and a Senior Research Fellow at the Global Development and Environment Institute at Tufts University.

Q. Please describe the Applied Economics Clinic.

A. The Applied Economics Clinic is a non-profit economic and energy consulting group providing expert testimony, analysis, modeling, policy briefs, and reports to public interest groups on the topics of environment, consumer protection, and equity. The Clinic also serves to train the next generation of expert technical witnesses and analysts by providing applied, on-the-job training to graduate students in related fields and working proactively to support diversity among both student workers and professional staff. The Clinic is an independent non-profit housed at Tufts University's Global Development and Environment Institute and began operations in February 2017.

Q. Please describe your professional background and experience.

A. I am a researcher and analyst with more than 17 years of professional experience as a political and environmental economist. I have authored more than 150 reports, policy studies, white papers, journal articles, and book chapters on topics related to energy, the economy, and the environment. I founded and direct the Applied

Economics Clinic and am a Senior Research Fellow with the Global Development and Environment Institute at Tufts University.

In my previous position as a principal economist at Synapse Energy Economics, I led studies examining environmental regulation, cost-benefit analyses, and the economics of energy efficiency and renewable energy. I have submitted expert testimony and comments in Minnesota, Louisiana, Indiana, Illinois, Vermont, New Hampshire, Massachusetts, and several federal dockets. My recent work includes extensive analysis of the EPA's proposed Clean Power Plan, critiquing the analyses used to support a flawed valuation method for nuclear power plants, developing testimony on Global Warming Solutions Act ("GWSA") compliance for the Massachusetts Departments of Energy Resources and Environmental Protection, and analysis of the claimed need for new gas pipelines in New England, and the southeastern U.S.

Prior to joining Synapse, I was a senior economist with the Stockholm Environment Institute's ("SEI") Climate Economics Group, where I was responsible for leading the organization's work on the Consumption-Based Emissions Inventory ("CBEI") model and on water issues and climate change in the western United States. While at SEI, I led domestic and international studies commissioned by the United Nations Development Programme, Friends of the Earth-U.K., and Environmental Defense.

My articles have been published in Ecological Economics, Renewable Climatic Change, Environmental and Resource Economics, Environmental Science & Technology, and other journals. I have also published books, including *Climate*

Change and Global Equity (Anthem Press, 2014) and *Climate Economics: The State of the Art* (Routledge, 2013), which I co-wrote with Frank Ackerman. I am also coauthor of *Environment for the People* (Political Economy Research Institute, 2005, with James K. Boyce) and co-editor of *Reclaiming Nature: Worldwide Strategies for Building Natural Assets* (Anthem Press, 2007, with Boyce and Sunita Narain).

I earned my Ph.D. in economics at the University of Massachusetts-Amherst, and have taught economics at Tufts University, the University of Massachusetts-Amherst, and the College of New Rochelle, among others.

My professional resume is attached as Attachment EAS-1.

Q. Have you testified previously before the Indiana Utility Regulatory Commission ("Commission" or "IURC")?

A. Yes. I have filed testimony on behalf of Citizens Action Coalition of Indiana, Inc. ("CAC"), in Cause Nos. 43955 DSM 4, 44872, and 44927. Today, I am also filing testimony on behalf of CAC in Cause Nos. 45196, 45159, and in this proceeding.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of CAC.

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to describe my assessment of Northern Indiana Public Service Company's ("NIPSCO") 2018 Integrated Resource Plan ("IRP") and whether the Power Purchase Agreement ("PPA") at issue in this proceeding is consistent with the NIPSCO 2018 IRP.

Q. What is NIPSCO proposing in this proceeding?

A. NIPSCO seeks approval and associated cost recovery of a wind energy purchase agreement between NIPSCO and Jordan Creek Wind Farm LLC ("Jordan Creek") dated January 3, 2019, totaling approximately 400 megawatts ("MW") (nameplate capacity) for its customers. Verified Petition, p. 4. NIPSCO relies upon its 2018 IRP in support of this application. *See* Petitioner's Exhibit 2, Attachment 2-A.

Q. Have you already performed an analysis of NIPSCO's 2018 Integrated Resource Plan ("IRP") upon which this filing its based?

A. Yes. On behalf of CAC, I participated in the NIPSCO 2018 IRP stakeholder process, including participation in informal discovery, stakeholder meetings, and additional meetings with the Company. I reviewed NIPSCO's all-source request for proposals ("RFP") and the responses to the RFP. After NIPSCO submitted its completed 2018 IRP, I evaluated the final product and co-authored comments submitted on behalf of CAC. I incorporate those comments into this testimony as Attachment EAS-2.

Q. Please summarize your conclusions and recommendations regarding NIPSCO's 2018 IRP.

A. NIPSCO's 2018 IRP methodology and process reflect considerable improvements. Our assessment of NIPSCO's 2018 IRP reviewed more than 50 of the IURC's requirements for Indiana IRPs. Our analysis acknowledged and commended the substantial leadership demonstrated by NIPSCO in its 2018 IRP analysis—including an array of best practices, such as: (1) conducting an all-source request for proposals ("RFP") to inform model inputs which gave NIPSCO an unusual level

of credibility from which to forecast the cost of utility scale, supply-side generators; (2) transparent inclusion of input forecasts, outputs and assumptions; (3) a thorough description of most aspects of screening and portfolio selection; and (4) fair consideration of a wide range of supply-side alternatives without arbitrary limitations on the amount of those resources that can be selected or unsupported cost additions. Attachment EAS-2, p. 3.

Our concerns with NIPSCO's 2018 IRP included: (1) that scenarios were constructed based on storylines that conflated ideas rather than explored explicit risks to NIPSCO; (2) shortcomings of NIPSCO's update to its 2016 energy efficiency market potential study; (3) inconsistent modeling parameters and limited consideration of load forecast sensitivities; (4) omission of information about distributed generation, advanced metering, or smart grids; (5) unsubstantiated selection of one preferred resource portfolio for reliability reasons over another that was more cost effective and less risky, and failure to provide clear details and results from the reliability model that supported selecting retirement Portfolio 6 instead of Portfolio 8; and (6) use of a model whose vendor will not permit non-licensees, even under a confidentiality agreement, to access the model's manual or the full model database. Overall, these concerns were alleviated by the reasonableness and transparency of the rest of NIPSCO's 2018 IRP.

Along with the best practices described above, NIPSCO's 2018 IRP vastly improved relative to its 2016 IRP in the following ways:

- stakeholders were able to review commodity price forecasts used in the modeling;

- NIPSCO did not rely on the proxy costs of a generic combined cycle gas turbine to compare retirement portfolios;
- NIPSCO did not impose arbitrary limits on renewable resource choices; and
- NIPSCO made good faith efforts to address criticisms of its 2016 IRP throughout the stakeholder process, including development and presentation of an improvement plan with tangible action items.

Attachment EAS-2, p. 3.

Q. Is the Jordan Creek PPA at issue in this proceeding consistent with the NIPSCO 2018 IRP?

A. Yes. The cost assumptions associated with the new wind resource options modeled in the NIPSCO 2018 IRP are consistent with the cost of the Jordan Creek PPA.[1] The Jordan Creek PPA is also consistent with the timing for procuring wind resources in the IRP's preferred portfolio. Petitioner's Exhibit 2, Attachment 2-A, Section 9.3.

Q. What is your recommendation?

A. It is my recommendation that the Jordan Creek PPA be approved by the IURC.

Q. Does this conclude your testimony?

A. Yes.

[1] Please see my workpaper submission of NIPSCO's Response to ICC Request 1-001, Confidential Attachment L for this analysis by NIPSCO.

VERIFICATION

I, Elizabeth A. Stanton, PhD, affirm under penalties of perjury that the foregoing representations are true and correct to the best of my knowledge, information and belief.

March 15, 2019

Elizabeth A. Stanton, PhD

Date

Attachment EAS-1

Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

Elizabeth A. Stanton, Ph.D., Director and Senior Economist
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PROFESSIONAL EXPERIENCE

Applied Economics Clinic. Somerville, MA. *Director and Senior Economist*, February 2017 – Present.

The Applied Economics Clinic provides technical expertise to public service organizations working on topics related to the environment, consumer rights, the energy sector, and community equity. Dr. Stanton is the Founder and Director of the Clinic (www.aeclinic.org).

Liz Stanton Consulting, Arlington, MA. *Independent Consultant*, August 2016 – January 2017.

Providing consulting services on the economics of energy, environment and equity.

Synapse Energy Economics Inc., Cambridge, MA. *Principal Economist*, 2012 – 2016.

Consulted on issues of energy economics, environmental impacts, climate change policy, and environmental externalities valuation.

Stockholm Environment Institute - U.S. Center, Somerville, MA. *Senior Economist*, 2010–2012; *Economist*, 2008 – 2009.

Wrote extensively for academic, policy, and general audiences, and directed studies for a wide range of government agencies, international organizations, and nonprofit groups.

Global Development and Environment Institute, Tufts University, Medford, MA. *Researcher*, 2006 – 2007.

Political Economy Research Institute, University of Massachusetts-Amherst, Amherst, MA. *Editor and Researcher – Natural Assets Project*, 2002 – 2005.

Center for Popular Economics, **University of Massachusetts-Amherst**, Amherst, MA. *Program Director*, 2001 – 2003.

EDUCATION

University of Massachusetts-Amherst, Amherst, MA

Doctor of Philosophy in Economics, 2007

New Mexico State University, Las Cruces, NM

Master of Arts in Economics, 2000

School for International Training, Brattleboro, VT

Bachelor of International Studies, 1994

Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

AFFILIATIONS

Global Development and Environment Institute, Tufts University, Medford, MA.

Senior Research Fellow, 2007 – present

PAPERS AND REPORTS

Stanton, E.A., R. Lopez, and B. Woods. *Review of Proposed CAFE and CO_2 Standards.* Applied Economics Clinic. 2018. Prepared for California Attorney General Office and California Air Resources Board. [redacted]

Stanton, E.A., R. Lopez, B. Woods, T. Stasio, and A. Sommer. *Report on Indiana's 2018 Draft Statewide Analysis of Future Resource Requirements of Electricity*. Applied Economics Clinic. 2018. Prepared for Citizens Action Coalition of Indiana. [redacted]

Stanton, E.A. *Massachusetts Comprehensive Energy Plan: Comments on Stakeholder Meeting Presentation.* Applied Economics Clinic. 2018. Prepared for Conservation Law Foundation. [redacted]

Stanton, E.A. *Massachusetts Battery Storage Measures: Benefits and Costs.* Applied Economics Clinic. 2018. Prepared for Clean Energy Group. [redacted]

Stanton, E.A. *Review of Massachusetts Efficiency Program Administrator's April 2018 Draft 2019-2021 Energy Efficiency Plan.* Applied Economics Clinic. 2018. Prepared for Conservation Law Foundation. [redacted]

Stanton, E.A., and T. Comings. *Massachusetts Clean Energy Bill Provisions Boost Jobs.* Applied Economics Clinic. 2018. Prepared for Barr Foundation. [redacted]

Stanton, E.A., T. Comings, R. Wilson, S. Alisalad, E.N Marzan, C. Schlegel, B. Woods, J. Gifford, E. Snook, and P. Yuen. 2018. *An Analysis of the Massachusetts 2018 'Act to Promote a Clean Energy Future' Report.* Applied Economics Clinic. Prepared for Barr Foundation. [redacted]

Woods, B., C. Schlegel, and E.A. Stanton. 2018. *Massachusetts' Clean Energy Policy Overview.* Applied Economics Clinic. Prepared for Barr Foundation. [redacted]

Comings, T., E.A. Stanton, and B. Woods. 2018. *The ABCs of Boston CCE*. Applied Economics Clinic. Prepared for Barr Foundation. [redacted]

Stanton, E.A., E.N. Marzan, and S. Alisalad. 2018. *Accessing Energy Efficiency in Massachusetts.* Applied Economics Clinic. Prepared for Conservation Law Foundation. [redacted]

Stanton, E.A., R. Wilson, and B. Woods. 2018. *Missed Opportunities for Energy Efficiency in Virginia*. Applied Economics Clinic. Prepared for the Consumers Union. [redacted]

Stanton, E.A., T. Comings, and A. Sommer. 2018.*The Husker Energy Plan: A New Energy Plan for Nebraska.* Applied Economics Clinic. Prepared for the Nebraska Wildlife Foundation. [redacted]

Comings, T., E.A. Stanton, and B. Woods. 2017. *An Analysis of Community Choice Energy for Boston.* Applied Economics Clinic. Prepared for Barr Foundation. [redacted]

Wilson, R., T. Comings, and E.A. Stanton. 2017. *Ratepayer Impacts of ConEd's 20-Year Shipping Agreement on the Mountain Valley Pipeline.* Applied Economics Clinic. Prepared for the Environmental Defense Fund. [redacted]

Sommer, A. and E.A. Stanton. 2017. *Report on Vectren 2016* IRP. Applied Economics Clinic. Prepared on behalf of Earthjustice, Indiana Distributed Energy Alliance, Sierra Club, and Valley Watch. Submitted to the Indiana Utility Regulatory Commission. [redacted]

Sommer, A. and E.A. Stanton. 2017. *Report on Indiana Power & Light 2016* IRP. Applied Economics Clinic. Prepared on behalf of Earthjustice, Indiana Distributed Energy Alliance, Sierra Club, and Valley Watch. Submitted to the Indiana Utility Regulatory Commission. [redacted]

Sommer, A. and E.A. Stanton. 2017. *Report on Northern Indiana Public Service Company's 2016* IRP. Applied Economics Clinic. Prepared on behalf of Earthjustice, Indiana Distributed Energy Alliance, Sierra Club, and Valley Watch. Submitted to the Indiana Utility Regulatory Commission. [redacted]

Stanton, E.A., P. Knight, P. Luckow, A. Allison, T. Vitolo, J. Barnes, B. Inskeep, and C. Barnes. 2016. *Envisioning Pennsylvania's Energy Future: Powering the Commonwealth's Energy Needs with 100 Percent Renewables by 2050.* Prepared by Synapse Energy Economics and EQ Research for Delaware Riverkeeper Network. [redacted]

Wilson, R., S., Fields, P. Knight, E. McGee, W. Ong, N. Santen, T. Vitolo, and E.A. Stanton. 2016. *Are the Atlantic Coast Pipeline and the Mountain Valley Pipeline Necessary?* Prepared by Synapse Energy Economics for Southern Environmental Law Center and Appalachian Mountain Advocates. [redacted]

Knight, P. and E.A. Stanton. 2016. *"Sorting Out New England's Pipeline Needs: A Round Up of Recent Studies and What They Mean.* Synapse Energy Economics White Paper. [redacted]

Stanton, E.A., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. R. Santen, K. Takahashi. 2016. *The RGGI Opportunity 2.0: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate Targets.* Prepared by Synapse Energy Economics for Sierra Club, Pace Energy and Climate Center, and Chesapeake Climate Action Network. [redacted]

Jackson, S., P. Luckow, E.A. Stanton, A. Horowitz, P. Peterson, T. Comings, J. Daniel, and T. Vitolo. 2016. *Reimagining Brayton Point: A Guide to Assessing Reuse Options for the Somerset Community*. Prepared by Synapse Energy Economics for Coalition for Clean Air South Coast, Clean Water Action, and Toxics Action Center. [redacted]

Stanton, E. A., P. Knight, A. Allison, T. Comings, A. Horowitz, W. Ong, N. R. Santen, and K. Takahashi. 2016. *The RGGI Opportunity: RGGI as the Electric Sector Compliance Tool to Achieve 2030 State Climate Targets.* Prepared by Synapse Energy Economics for Sierra Club, Pace Energy and Climate Center, and Chesapeake Climate Action Network. [redacted]

Luckow, P., E.A. Stanton, S. Fields, W. Ong, B. Biewald, S. Jackson, and J. Fisher. 2016. *Spring 2016 National Carbon Dioxide Price Forecast*. Synapse Energy Economics White Paper. [redacted]

Knight, P., A. Allison, W. Ong, N. R. Santen, and E.A. Stanton. 2016. *Cutting Electric Bills with the Clean Power Plan.* Prepared by Synapse Energy Economics for The Energy Foundation. [redacted]

Horowitz, A., S. Jackson, A. Allison, and E.A. Stanton. 2016. *Environmental Justice and the Clean PowerPlan.* Prepared by Synapse Energy Economics for The Energy Foundation. [redacted]

Jackson, S., N. R. Santen, P. Knight, S. Fields, B. Biewald, and E.A. Stanton. 2015. *Clean Power Plan Handbook: A Guide to the Final Rule for Consumer Advocates.* Prepared by Synapse Energy Economics for National Association of State Utility Consumer Advocates. [redacted]

Wilson, R., T. Comings, and E.A. Stanton. 2015. *Analysis of the Tongue River Railroad Draft Environmental Impact Statement.* Prepared by Synapse Energy Economics for Sierra Club and Earthjustice. [redacted]

Knight, P., S. Fields, S. Jackson, W. Ong, N. R. Santen, B. Biewald, and E.A. Stanton. 2015. *Multi-State Compliance with the Clean Power Plan in CP3T.* Prepared by Synapse Energy Economics for the National Association of State Utility Consumer Advocates. [redacted]

Vitolo, T., P. Luckow, S. Fields, P. Knight, B. Biewald, and E.A. Stanton. 2015. *Lower Electric Costs in a Low- Emission Future.* Prepared by Synapse Energy Economics for The Energy Foundation. [redacted]

Stanton, E. A., T. Comings, S. Jackson, and E. Karaca. 2015. *Atlantic Coast Pipeline Benefits Review.* Prepared by Synapse Energy Economics for Southern Environmental Law Center. [redacted]

Wilson, R., M. Whited, S. Jackson, B. Biewald, and E.A. Stanton. 2015. *Best Practices in Planning for Clean Power Plan Compliance.* Prepared by Synapse Energy Economics for the National Association of State Utility Consumer Advocates. [redacted]

Fields, S., S. Jackson, P. Knight, and E.A. Stanton. 2015. *Internal briefing on Clean PowerPlan compliance in Ohio.* Prepared by Synapse Energy Economics for Office of the Ohio Consumers' Counsel. [redacted]

Luckow, P., E.A. Stanton, S. Fields, B. Biewald, S. Jackson, J. Fisher, and R. Wilson. 2015. *2015 Carbon Dioxide Price Forecast.* Synapse Energy Economics White Paper. [redacted]

Knight, P., A. Allison, E.A. Stanton. 2015. *Preliminary Clean Power Plan Analysis for Kentucky.* Prepared by Synapse Energy Economics for Kentuckians for the Commonwealth. [redacted]

Stanton, E. A., P. Knight, J. Daniel, B. Fagan, D. Hurley, J. Kallay, E. Karaca, G. Keith, E. Malone, W. Ong, P. Peterson, L. Silvestrini, K. Takahashi, and R. Wilson. 2015. *Massachusetts Low Gas Demand Analysis: Final Report.* Prepared by Synapse Energy Economics for the Massachusetts Department of Energy Resources. [redacted]

Fields, S., E.A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, and K. Takahashi. 2014. *Calculating Alabama's 111(d) Target.* Prepared by Synapse Energy Economics for the Southern Environmental Law Center. [redacted]

Fields, S., E.A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, and K. Takahashi. 2014. *Calculating Georgia's 111(d) Target.* Prepared by Synapse Energy Economics for the Southern Environmental Law Center. [redacted]

Fields, S., E.A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, and K. Takahashi. 2014. *Alternate Scenarios for 111(d) Implementation in North Carolina.* Prepared by Synapse Energy Economics for the Southern Environmental Law Center. [redacted]

Stanton, E. A., S. Jackson, B. Biewald, and M. Whited. 2014. *Final Report: Implications of EPA's Proposed "Clean Power Plan."* Prepared by Synapse Energy Economics for the National Association of State Utility Consumer Advocates. [redacted]

Stanton, E. A., J. Daniel, T. Vitolo, P. Knight, D. White, and G. Keith. 2014. *Net Metering in Mississippi: Costs, Benefits, and Policy Considerations.* Prepared by Synapse Energy Economics for the Public Service Commission of Mississippi. [redacted]

Knight, P., E.A. Stanton, B. Biewald, J. Daniels, S. Fields, S. Jackson, A. Napoleon, J. Rosenkranz, and K. Takahashi. 2014. *Internal briefing on Clean Power Plan implementation in Virginia.* Prepared by Synapse Energy Economics for Sierra Club. [redacted]

Jackson, S. and E.A. Stanton. 2014. *Internal briefing on Clean Power Plan implementation in Minnesota.* Prepared by Synapse Energy Economics for Sierra Club. [redacted]

Knight, P., E.A. Stanton, B. Biewald, J. Daniels, S. Fields, S. Jackson, A. Napoleon, J. Rosenkranz, and K. Takahashi. 2014. *Internal briefing on Clean Power Plan implementation in Florida.* Prepared by Synapse Energy Economics for Sierra Club. [redacted]

E.A. Stanton, S. Jackson, B. Biewald, M. Chang, J. Daniels, S. Fields, P. Knight, A. Napoleon, M. Whited, and K. Takahashi. 2014. *Internal briefing on Clean Power Plan implementation in Arizona, Montana, Nevada, and Utah.* Prepared by Synapse Energy Economics for Sierra Club. [redacted]

E.A. Stanton, S. Jackson, B. Biewald, M. Chang, J. Daniels, S. Fields, P. Knight, A. Napoleon, and K. Takahashi. 2014. *Internal briefing on Clean Power Plan implementation Illinois.* Prepared by Synapse Energy Economics for Sierra Club. [redacted]

Luckow, P., E.A. Stanton, B. Biewald, S. Fields, S. Jackson, J. Fisher, and F. Ackerman. 2014. *CO_2 Price Report, Spring 2014: Includes 2013 CO_2 Price Forecast.* Synapse Energy Economics White Paper. [redacted]

Fisher, J., P. Knight, E.A. Stanton, and B. Biewald. 2014. *Avoided Emissions and Generation Tool (AVERT): User Manual. Version 1.0.* Prepared by Synapse Energy Economics for the U.S. Environmental Protection Agency. [redacted]

Stanton, E. A., M. Whited, and F. Ackerman. 2014. *Estimating the Cost of Saved Energy in Utility Efficiency Programs.* Prepared by Synapse Energy Economics for the U.S. Environmental Protection Agency. [redacted]

Stanton, E. A., F. Ackerman, and J. Daniel. 2013. *Comments on the 2013 Technical Update of the Social Cost of Carbon*. Prepared by Synapse Energy Economics for the Environment, Economics and Society Institute. [redacted]

Luckow, P., E.A. Stanton, B. Biewald, J. Fisher, F. Ackerman, and E. Hausman. 2013. *2013 Carbon Dioxide Price Forecast.* Synapse Energy Economics White Paper. [redacted]

Stanton, E. A., S. Jackson, G. Keith, E. Malone, D. White, and T. Woolf. 2013. *A Clean Energy Standard for Massachusetts.* Prepared by Synapse Energy Economics for the Massachusetts Clean Energy Center and the Massachusetts Departments of Energy Resources, Environmental Protection, and Public Utilities. [redacted]

Knight, P., E.A. Stanton, J. Fisher, and B. Biewald. 2013. *Forecasting Coal Unit Competitiveness: Coal Retirement Assessment Using Synapse's Coal Asset Valuation Tool (CAVT).* Prepared by Synapse Energy Economics for Energy Foundation. [redacted]

Hornby, R., P. Chernick, D. White, J. Rosenkranz, R. Denhardt, E. Stanton, J. Glifford, B. Grace, M. Chang, P. Luckow, T. Vitolo, P. Knight, B. Griffiths, and B. Biewald. 2013. *Avoided Energy Supply Costs in New England: 2013 Report.* Prepared by Synapse Energy Economics for the Avoided-Energy-Supply-Component (AESC) Study Group. [redacted]

Stanton, E. A., T. Comings, K. Takahashi, P. Knight, T. Vitolo, and E. Hausman. 2013. *Economic Impacts of the NRDC Carbon Standard.* Prepared by Synapse Energy Economics for the Natural Resources Defense Council. [redacted]

Stanton, E.A. 2013. Background research, consulting and support related to the Danish Energy Agency, Organisation for Economic Co-operation, and the UNEP Riso Centre's "*National Greenhouse Gas Emissions Baseline Scenarios: Learning from Experiences in Developing Countries.*" [redacted]

Whited, M., D. White, S. Jackson, P. Knight, and E.A. Stanton. 2013. *Declining Markets for Montana Coal.* Prepared by Synapse Energy Economics for Northern Plains Resource Council. [redacted]

Stanton, E. A. and F. Ackerman. 2013. *Climate Impacts on Agriculture: A Challenge to Complacency?* Global Development and Environment Institute Working Paper 13-01. [redacted]

Stanton, E. A., F. Ackerman, T. Comings, P. Knight, T. Vitolo, and E. Hausman. 2013. *Will LNG Exports Benefit the United States Economy?* Prepared by Synapse Energy Economics for the Sierra Club. [redacted]

Ackerman, F., T. Vitolo, E. Stanton, and G. Keith. 2013. *Not-so-smart ALEC: Inside the attacks on renewable energy*. Prepared by Synapse Energy Economics for the Civil Society Institute. [redacted]

Ackerman, F., E.A. Stanton, and R. Bueno. 2012. *Climate Policy and Development: An Economic Analysis.* Economics for Equity and the Environment (E3 Network) Working Paper. [ ]

Stanton, E. A. and M. Taylor. 2012. *A Good Environment for Jobs.* Economics for Equity and the Environment (E3 Network) Working Paper. [ ]

Stanton, E. A., F. Ackerman, and R. Bueno. 2012. *Reason, Empathy, and Fair Play: The Climate Policy Gap.* UNDESA Working Paper No.113. [ ]

Erickson, P., M. Lazarus, E.A. Stanton, C. Chandler, R. Bueno, F. Ackerman, C. Munitz, and J. Cegan. 2012. *Greenhouse Gas Emissions in King County: An Updated Geographic-plus Inventory, a Consumption-based Inventory, and an Ongoing Tracking Framework.* Prepared by Stockholm Environment Institute-U.S. Center for King County, Washington. [ ]

Stanton, E. A., R. Bueno, J. Cegan, and C. Munitz. 2012. *King County Community Greenhouse Gas Emissions Inventory – Consumption Methodology: Technical Report.* Prepared by Stockholm Environment Institute-U.S. Center for King County, Washington. [ ]

Stanton, E. A., J. Cegan, R. Bueno, and F. Ackerman. 2012. *Estimating Regions' Relative Vulnerability to Climate Damages in the CRED Model.* Stockholm Environment Institute-U.S. Center Working Paper WP-US-1103. [ ]

Stanton, E.A. 2012. *Development without Carbon as Climate Policy.* Economics for Equity and the Environment (E3 Network) Working Paper. [ ]

Ackerman, F., E.A. Stanton, and R. Bueno. 2012. *Epstein-Zin utility in DICE: Is risk aversion irrelevant to climate policy?* Economics for Equity and the Environment (E3 Network) Working Paper. [ ]

Stanton, E. A., R. Bueno, and M. Davis. 2011. *Real People, Real Impacts: The Climate Impact Equity Lens.* Stockholm Environment Institute-U.S. Center Report. [ ]

Stanton, E. A. and R. Bueno. 2011. *The CIEL Backgrounder: Understanding the Climate Impact Equity Lens.* Stockholm Environment Institute-U.S. Center Report. [ ]

Stanton E.A. 2011. *Development without Carbon: Climate and the Global Economy through the 21st Century.* Stockholm Environment Institute-U.S. Center Report. [ ]

Erickson, P., M. Lazarus, E.A. Stanton, and F. Ackerman. 2011. *Consumption-Based Greenhouse Gas Emissions Inventory for Oregon – 2005: Summary Report.* Prepared by Stockholm Environment Institute-U.S. Center for the State of Oregon Department of Environmental Quality. [ ]

Stanton, E.A., R. Bueno, F. Ackerman, P. Erickson, R. Hammerschlag, and J. Cegan. 2011. *Consumption-Based Greenhouse Gas Emissions Inventory for Oregon – 2005: Technical Report.* Prepared by Stockholm Environment Institute-U.S. Center for the State of Oregon Department of Environmental Quality. [ ]

Ackerman, F. and E.A. Stanton. 2011. *The Social Cost of Carbon.* Economics for Equity and the Environment (E3 Network) White Paper. [ ]

Stanton, E.A., R. Bueno, J. Cegan, and C. Munitz. 2011. *Consumption-Based Emissions Inventory for San Francisco: Technical Report.* Prepared by Stockholm Environment Institute-U.S. Center for the City of San Francisco, California. [ ]

Stanton, E. A. and F. Ackerman. 2011. *Developing Baselines for Climate Policy Analysis.* Prepared by Stockholm Environment Institute-U.S. Center as additional guidance for *"United Nations Environmental Programme (UNEP) MCA4climate Initiative: A practical framework for planning pro-development climate policies."* [ ]

Ackerman, F. and E.A. Stanton. 2011. *A practical framework for planning pro- development climate policies.* Prepared by Stockholm Environment Institute-U.S. Center as additional guidance for *"United Nations Environmental Programme (UNEP) MCA4climate Initiative: A practical framework for planning pro-development climate policies."* [ ]

Ackerman, F. and E.A. Stanton. 2011. *The Last Drop: Climate Change and the Southwest Water Crisis.* Stockholm Environment Institute-U.S. Center Report funded by the Kresge Foundation. [ ]

Stanton, E. A. and E. Fitzgerald. 2011. *California Water Supply and Demand: Technical Report.* Stockholm Environment Institute-U.S. Center Report funded by the Kresge Foundation. [ ]

Bueno, R. and E.A. Stanton. 2011. *Casting DICE for 350 ppm.* Stockholm Environment Institute-U.S. Center Working Paper WPUS-1101. [ ]

Stanton, E. A. and F. Ackerman. 2010. *Emission Reduction, Interstate Equity, and the Price of Carbon.* Prepared by Stockholm Environment Institute-U.S. Center Economics for Equity and the Environment (E3 Network). [ ]

Stanton, E. A. and F. Ackerman. 2010. *No State Left Behind: A Better Approach to Climate Policy.* Economics for Equity and the Environment (E3 Network) White Paper. [ ]

Ackerman, F., E.A. Stanton, and R. Bueno. 2010. *CRED: A New Model of Climate and Development.* United Nations Department of Economic and Social Affairs Working Paper No.96. [ ]

Stanton, E. A., M. Davis, and A. Fencl. 2010. *Costing Climate Impacts and Adaptation: A Canadian Study on Coastal Zones.* Prepared by Stockholm Environment Institute-U.S. Center for the National Round Table on the Environment and the Economy Economic Risks and Opportunities of Climate Change Program. [ ]

Ackerman, F. and E.A. Stanton. 2010. *The socio-economic implications of climate change on FYR Macedonia and national policy options on adaptation.* United Nations Development Programme (UNDP) Report. [ ]

Ackerman, F., E.A. Stanton, S. DeCanio, E. Goodstein, R. Howarth, R. Norgaard, C. Norman, and K. Sheeran. 2009. *The Economics of 350: The Benefits and Costs of Climate Stabilization*. Economics for Equity and the Environment (E3 Network), Stockholm Environment Institute-U.S. Center, and Ecotrust Report. [redacted]

Stanton, E. A., F. Ackerman, and K. Sheeran. 2009. *Understanding Interstate Differences in U.S. Greenhouse Gas Emissions*. Stockholm Environment Institute-U.S. Center Working Paper WP-US-1004. [redacted]

Stanton, E. A., F. Ackerman, and K. Sheeran. 2009. *Greenhouse Gases and the American Lifestyle: Understanding Interstate Differences in Emissions*. Economics for Equity and the Environment (E3 Network), and Ecotrust Report. [redacted]

Stanton, E. A., F. Ackerman, and F. Resende. 2009. *The Socio-Economic Impact of Climate Change in Armenia*. Stockholm Environment Institute-U.S. Center for the United Nations Development Programme (UNDP). [redacted]

Stanton, E. A. and F. Ackerman. 2008. *Generated User Benefits and the Heathrow Expansion: Understanding Consumer Surplus*. Prepared by Stockholm Environment Institute-U.S. Center for Friends of the Earth England, Wales and Northern Ireland. [redacted]

Stanton, E. A. and F. Ackerman. 2008. *Out of the Shadows: What's Behind DEFRA's New Approach to the Price of Carbon*. Prepared by Stockholm Environment Institute-U.S. Center for Friends of the Earth England, Wales and Northern Ireland. [redacted]

Bueno, R., C. Herzfeld, E.A. Stanton, and F. Ackerman. 2008. *The Caribbean and Climate Change: The Costs of Inaction*. Prepared by Stockholm Environment Institute-U.S. Center for Environmental Defense Fund. [redacted]

Ackerman, F. and E.A. Stanton. 2008. *The Cost of Climate Change: What We'll Pay if Global Warming Continues Unchecked*. Prepared by Stockholm Environment Institute-U.S. Center for Natural Resources Defense Council. [redacted]

Stanton, E.A. 2008. Literature review of water resources infrastructure and related environmental costs and benefits for "*Default Case Study Values and Management Options for WEAP in Massachusetts.*" Prepared by Stockholm Environment Institute-U.S. Center for Keep Water Local, a project of the Massachusetts Riverways Program, Commonwealth of Massachusetts. [redacted]

Stanton, E.A. and F. Ackerman. 2007. *Florida and Climate Change: The Costs of Inaction*. Prepared by Global Development and Environmental Institute – Tufts University for Environmental Defense. [redacted]

Stanton, E.A. 2007. *United States-Specific Human Development Index: Methodology and Data*. Report commissioned by American Human Development Report Project, as a technical background paper to *The Measure of America: American Human Development Report 2008-2009*. [redacted]

Ackerman, F. and E.A. Stanton. 2006. *Climate Change – the Costs of Inaction.* Prepared by Global Development and Environmental Institute – Tufts University for Friends of the Earth England, Wales and Northern Ireland. [ ]

Ackerman, F. and E.A. Stanton. 2006. *Implications of REACH for the Developing Countries.* Global Development and Environmental Institute – Tufts University for European Parliament, Directorate- General for External Policies of the Union. [ ]

TESTIMONY AND EXPERT COMMENTS

Stanton, E.A. 2018. *Testimony Regarding the Joint Statewide Three-Year Energy Efficiency Plan for Massachusetts, 2019-2021.* Applied Economics Clinic. [ ]

Stanton, E.A. 2018. *Comment on August 2018 Analysis of the Avoided Costs of Compliance of the MA GWSA.* Applied Economics Clinic. [ ]

Stanton, E.A. 2018. *Testimony Regarding Consistency of Petition with [Eversource] Portfolio Objectives, Adequacy of Alternatives Considered, and Consistency with State Environmental Policies.* Testimony to the Commonwealth of Massachusetts Department of Public Utilities on behalf of the Conservation Law Foundation, Docket No. DPU 17-175. [ ]

Stanton, E.A. 2018. *Testimony Regarding Consistency of Petition with [National Grid] Portfolio Objectives, Adequacy of Alternatives Considered, and Consistency with State Environmental Policies.* Testimony to the Commonwealth of Massachusetts Department of Public Utilities on behalf of the Conservation Law Foundation, Docket No. DPU 17-174. [ ]

Stanton, E.A. 2018. *Testimony Regarding Consistency of Petition with [Columbia Gas] Portfolio Objectives, Adequacy of Alternatives Considered, and Consistency with State Environmental Policies.* Testimony to the Commonwealth of Massachusetts Department of Public Utilities on behalf of the Conservation Law Foundation, Docket No. DPU 17-172. [ ]

Stanton, E.A. 2018. *Testimony Regarding Consistency of Petition with [Berkshire Gas] Portfolio Objectives, Adequacy of Alternatives Considered, and Consistency with State Environmental Policies.* Testimony to the Commonwealth of Massachusetts Department of Public Utilities on behalf of the Conservation Law Foundation, Docket No. DPU 17-145. [ ]

Stanton, E.A. 2017. *Testimony on Entergy New Orleans' Request to Construct New Orleans Power Station.* Testimony to the Council for the City of New Orleans on behalf of Alliance for Affordable energy, Deep South for Environmental Justice, 350 Louisiana- New Orleans, and the Sierra Club. Docket No. UD-16-02. October 16, 2017. [ ]

Stanton, E.A. 2017. *Testimony Regarding Natural Gas Price Hedging in Florida.* Testimony to the Florida Public Service Commission on behalf of the Sierra Club. Docket No. 20170057-EI. August 10, 2017. [ ]

Stanton, E.A. 2017. *Testimony Regarding the Petition of Vectren for Approval of Its Proposed Demand Side Management and Energy Efficiency Programs for 2016-2018.* Testimony to the Indiana Utility Regulatory Commission on behalf of Citizens Action Coalition of Indiana. Cause No.44927 DSM-4. July 26, 2017. [ ]

Stanton, E.A. 2017. *Testimony Regarding Brockton Power Co., LLC.* Testimony to the Commonwealth of Massachusetts Department of Environmental Protection Office of Appeals and Dispute Resolution on behalf of the Residents of Brockton, West Bridgewater, and East Bridgewater. OADR Docket No. 2011-025 & 026. June 27, 2017. [ ]

Stanton, E.A. 2017. *Declaration in the matter of Clean Water Action, et al. v. E. Scott Pruitt, regarding the U. S. EPA's Steam Electric Effluent Limitation Guidelines*. Declaration prepared on behalf of Earthjustice and Environmental Integrity. June 14, 2017.

Stanton, E.A. 2017. *Testimony Regarding Northern Indiana Public Service Company's CPCN for Environmental Compliance Projects.* Testimony to the Indiana Utility Regulatory Commission on behalf of Citizens Action Coalition of Indiana. Cause No.448872. April 3, 2017.

Stanton, E.A. 2017. *Testimony Regarding the Petition of Duke Energy Indiana, Inc. for Approval of Its Proposed Demand Side Management and Energy Efficiency Programs for 2016-2018.* Testimony to the Indiana Utility Regulatory Commission on behalf of Citizens Action Coalition of Indiana. Cause No.43955 DSM-4. March 21, 2017. [ ]

Stanton, E.A. 2017. *Expert Comments Regarding Massachusetts' Department of Environmental Protection's Rulemaking Required by Section 3(d) of the Global Warming Solutions Act.* Expert comments submitted by Conservation Law Foundation. February 24, 2017. [ ]

Stanton, E.A. 2016. *Testimony Regarding the National Grid Analysis of Economic Benefits of Proposed Access Northeast Gas Pipeline.* Testimony to the Massachusetts Department of Public Utilities on behalf of Conservation Law Foundation. Docket No. 16-05. June 20, 2016. [ ]

Stanton, E.A. 2016. *Testimony Regarding the Eversource Analysis of Economic Benefits of Proposed Access Northeast Gas Pipeline.* Testimony to the Massachusetts Department of Public Utilities on behalf of Conservation Law Foundation. Docket No. 15-181. June 13, 2016. [ ]

Stanton, E.A. 2016. *Testimony on Byron Fleet Benefits.* Testimony to the Illinois Property Tax Appeal Board on behalf of Whitt Law, Docket Nos. 12-01248 and 12-02297. May 18, 2016. [ ]

Stanton, E.A., P. Knight, F. Ackerman, and N. R. Santen. 2015. *Byron Fleet Benefit Rebuttal.* Expert comments submitted by Whitt Law to the Illinois Property Tax Appeal Board, Docket Nos. 12-01248 and 12-02297. April 3, 2015. [ ]

Nogee, A., M. Chang, P. Knight, and E.A. Stanton. 2015. *Electricity Market Restructuring and the Nuclear Industry.* Expert comments submitted by Whitt Law testimony regarding Byron Station to the Illinois Property Tax Appeal Board, Docket Nos. 12-01248 and 12-02297. April 3, 2015. [ ]

Stanton, E.A. 2015. *Testimony on the Economic Analyses of a Proposed Brockton Power Company Generating Facility*. Testimony before the Massachusetts Department of Environmental Protection on behalf of Alternatives for Community & Environment, Docket No. 2011-025 & 026. [ ]

Stanton, E.A. and P. Knight. 2015. *Testimony in Opposition to HB 208 Repealing the New Hampshire Regional Greenhouse Gas Initiative*. Testimony to the Science, Technology and Energy Committee on behalf of New Hampshire's Office of Consumer Advocate. January 22, 2015. [redacted]

Stanton, E.A. 2014. *Testimony Regarding the Cost of Compliance with the Global Warming Solutions Act*. Testimony to the Commonwealth of Massachusetts Department of Public Utilities on behalf of the Massachusetts Department of Energy Resources and the Department of Environmental Protection, Docket No. DPU 14-86. [redacted]

Stanton E.A., F. Ackerman, and J. Daniel. 2014. *Comments on the 2013 Technical Update of the Social Cost of Carbon.* Submitted to the U.S. Office of Management and Budget as part of Environment, Economics, and Society Institute comments on Docket No. OMB-2013-0007. [redacted]

Stanton, E.A. 2013. *Testimony Regarding the Prudency of Public Service of New Hampshire's Scrubber Project at Merrimack Station. Testimony* on behalf of the Conservation Law Foundation. Testimony to the New Hampshire Public Utilities Commission, Docket No. DE 11-250. [redacted]

Stanton E.A., J. Daniel, F. Ackerman, and S. Jackson. 2013. *Review of EPA's June 2013 Steam Electric Effluent Limitations and Guidelines (40 CFR Part 423).* Submitted as part of Earthjustice/Sierra Club/Environmental Integrity Project testimony on Docket No. EPA-HQ-OW-2009-0819. [redacted]

Stanton, E.A., P. Knight, and F. Ackerman. 2013. *LaSalle Fleet Benefit Rebuttal.* Expert comments submitted by Whitt Law to the Illinois Property Tax Appeal Board, Dockets No. 09-04906.001-I-3, 09-04906.002-I-310-03549.001, 10-03549.002, 12-00643.001, 12-00643.002, 12-00643.003. [redacted]

Nogee A., M. Chang, P. Knight, and E.A. Stanton. 2013. *Electricity Market Restructuring and the Nuclear Industry.* Expert comments submitted by Whitt Law testimony regarding LaSalle Station to the Illinois Property Tax Appeal Board, Dockets No. 09-04906.001-I-3, 09-04906.002-I-310-03549.001, 10-03549.002, 12-00643.001, 12-00643.002, 12-00643.003. [redacted]

Stanton, E.A. 2013. *Testimony Regarding Vermont Gas System's Petition for Authorization to Construct New Natural Gas Transmission Pipeline*. Testimony on behalf of the Conservation Law Foundation to the State of Vermont Public Service Board, Docket No. 7970. [redacted]

Ackerman, F., and E.A. Stanton. 2011. *Regulation of Cooling Water Intake Structures at Existing Facilities.* Comments submitted to the U.S. Environmental Protection Agency, Docket ID EPA-HQ-OW-2008-0667. [redacted]

Ackerman, F. and E.A. Stanton. 2010. *Testimony on EPA's 'Coal Combustion Residuals: Proposed Rule'.* Comment submitted as part of Earthjustice/Environmental Integrity Project testimony on Docket ID EPA-HQ-RCRA- 2009-6040. [redacted]

Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

JOURNAL ARTICLES

Luckow, P., J. Daniel, S. Fields, E.A. Stanton, and B. Biewald. 2014. "CO_2 Price Forecast: Planning for Future Environmental Regulations." EM Magazine, June 2014, 57-59. [redacted]

Stanton, E.A. 2014. "What Carbon Costs Us." *Economists for Peace & Security Quarterly* 27 (4): 7-8. [redacted]

Ackerman, F., E.A. Stanton, and R. Bueno. 2013. "Epstein-Zin utility in DICE: Is risk aversion irrelevant to climate policy?" *Environmental and Resource Economics* 56 (1): 73-84. [redacted]

Stanton, E.A. 2012. "Modeling Pessimism: Does Climate Stabilization Require a Failure of Development?" *Environmental Development* 3: 65-76. [redacted]

Stanton, E.A. 2012. "The Tragedy of Maldistribution: Climate, Sustainability, and Equity." *Sustainability* 4 (3): 394-411. [redacted]

Erickson, P., D. Allaway, M. Lazarus, and E.A. Stanton. 2012. "A Consumption-Based GHG Inventory for the U.S. State of Oregon." *Environmental Science & Technology* 46 (7): 3679-3686. [redacted]

Ackerman, F., E.A. Stanton, and R. Bueno. 2011. "CRED: A new model of climate and development." *Ecological Economics* 85: 166-176. [redacted]

Ackerman, F. and E.A. Stanton. 2012. "Climate Risks and Carbon Prices: Revising the Social Cost of Carbon." *Economics: The Open-Access, Open-Assessment E-Journal* 6 (2012-10): 1-25. [redacted]

Ackerman, F., E.A. Stanton, S. DeCanio, E. Goodstein, R. Howarth, R. Norgaard, C. Norman, and K. Sheeran. 2010. "The Economics of 350." *Solutions* 1 (5): 49-56. [redacted]

Ackerman, F., E.A. Stanton, and R. Bueno. 2010. "Fat Tails, Exponents, Extreme Uncertainty: Simulating Catastrophe in DICE." *Ecological Economics* 69 (8): 1657-1665. [redacted]

Stanton, E.A. and F. Ackerman. 2009. "Climate and development economics: Balancing science, politics and equity." *Natural Resources Forum* 33 (4): 262-273. [redacted]

Stanton, E.A., F. Ackerman, and S. Kartha. 2009. "Inside the Integrated Assessment Models: Four Issues in Climate Economics." *Climate and Development* 1 (2): 166-184. [redacted]

Stanton, E.A. 2009. "Negishi welfare weights in integrated assessment models: The mathematics of global inequality." *Climatic Change* 107 (3): 417-432. [redacted]

Ackerman, F., E.A. Stanton, C. Hope, and S. Alberth. 2009. "Did the Stern Review Underestimate U.S. and Global Climate Damages?" *Energy Policy* 37 (7): 2717-2721. [redacted]

Ackerman, F. and E.A. Stanton. 2008. "Can Climate Change Save Lives? A comment on 'Economy-wide estimates of the implications of climate change: Human health'". *Ecological Economics* 66 (1): 8-13. (Previous edition appeared as Global Development and Environment Institute Working Paper No.06-05.) [redacted]

Ackerman, F., E.A. Stanton, B. Roach, and A. S. Andersson. 2008. "Implications of REACH for Developing Countries." *European Environment* 18 (1): 16-29. [ ]

Ackerman, F., E.A. Stanton, and R. Massey. 2007. "European Chemical Policy and the United States: The Impacts of REACH." *Renewable Resources Journal* 25 (1). (Previously published as Global Development and Environment Institute Working Paper No.06-06.) [ ]

Applied Economics Clinic
Economic and Policy Analysis of Energy, Environment and Equity

BOOKS AND BOOK CHAPTERS

Ackerman, F. and E.A. Stanton. 2015. "Climate Impacts on Agriculture: A Challenge to Complacency?" In *The Oxford Handbook of the Macroeconomic of Global Warming,* eds. Bernard, L. and W. Semmler. New York: Oxford University Press. (Previous edition appeared as Global Development and Environment Institute Working Paper No.13-01.)

Ackerman, F. and E.A. Stanton. 2014. *Climate and Global Equity*. London: Anthem Press.

Ackerman, F. and E.A. Stanton. 2013. *Climate Economics: The State of the Art (Routledge Studies in Ecological Economics)*. Oxford: Routledge.

Stanton, E.A. 2011. "Greenhouse Gases and Human Well-Being: China in a Global Perspective." In *The Economics of Climate Change in China: Towards and Low-Carbon Economy* eds. Gang, F., N. Stern, O. Edenhofer, X. Shanda, K. Eklund, F. Ackerman, L. Lailai, K. Hallding. London: Earthscan. (Previous version appeared as Stockholm Environment Institute-U.S. Center Working Paper WP-US-0907.)

Boyce, J. K., E.A. Stanton, and S. Narain, eds. 2007. *Reclaiming Nature: Worldwide Strategies for Building Natural Assets*. London: Anthem Press.

Boyce, J. K., E.A. Stanton, and S. Narain. 2007. "Land Reform and Sustainable Development." In *Reclaiming Nature: Worldwide Strategies for Building Natural Assets,* eds. Boyce, J. K., E.A. Stanton, and S. Narain. London: Anthem Press.

Stanton, E.A. 2007. "Inequality and the Human Development Index." PhD dissertation, University of Massachusetts-Amherst, 2007.

Stanton, E.A. and J. K. Boyce. 2005. *Environment for the People*. Political Economy Research Institute: Amherst, MA.

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Economic and Policy Analysis of Energy, Environment and Equity

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College of New Rochelle, New Rochelle, NY

Assistant Professor, Department of Social Sciences, 2007 – 2008

Tufts University, Medford, MA

Adjunct Professor, Department of Urban Environmental Policy and Planning, 2007, 2017

Fitchburg State College, Fitchburg, MA

Adjunct Professor, Social Sciences Department, 2006

University of Massachusetts-Amherst, Amherst, MA

Adjunct Professor, Department of Economics, 2003 – 2006

Castleton State College and the Southeast Vermont Community Learning Collaborative, Dummerston, VT

Adjunct Professor, 2005

School for International Training, Brattleboro, VT

Adjunct Professor, Program in Intercultural Management, Leadership, and Service, 2004

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Attachment EAS-2

March 1, 2019

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Re: Comments on NIPSCO's 2018 Integrated Resource Plan

Dear Director Borum, Chief Technical Advisor Pauley, and Assistant General Counsel Comeau,

Pursuant to the Indiana Utility Regulatory Commission's ("IURC" or "Commission") Integrated Resource Planning Rule, 170 IAC 4-7, Citizens Action Coalition of Indiana ("CAC"), Earthjustice, Indiana Distributed Energy Alliance ("IndianaDG"), Sierra Club, and Valley Watch (collectively, "Commenters") hereby submit the attached report by Elizabeth A. Stanton, PhD, and Bryndis Woods with Applied Economics Clinic and Anna Sommer and Chelsea Hotaling with Sommer Energy, LLC, on the 2018 Integrated Resource Plan ("IRP") submitted by the Northern Indiana Public Service Company ("NIPSCO"). We appreciate the opportunity to comment and to engage in this public IRP stakeholder process.

The comments were organized to address NIPSCO's compliance with the specific informational, procedural, and methodological requirements of the Commission's IRP rule. Although these comments are not meant to be comprehensive reviews of NIPSCO's IRP process, resource planning practices, or preferred resource plans, the report offers comments in a number of places that have a broader applicability to the IRP process in Indiana.

Thank you very much for this opportunity. We look forward to the issuance of and opportunity to comment on the Director's Draft Report. Please feel free to contact Jennifer Washburn, Counsel at Citizens Action Coalition, with any questions or concerns.

Respectfully,

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Report on NIPSCO 2018 IRP

Submitted to the IURC on March 1, 2019

Authors:

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on behalf of CAC, Earthjustice, IndianaDG, Sierra Club, and Valley Watch

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Overview

The following comments on the 2018 Integrated Resource Plan submitted by Northern Indiana Public Service Company ("NIPSCO" or the "Company") were prepared by Elizabeth A. Stanton, PhD, and Bryndis Woods of the Applied Economics Clinic, and Anna Sommer and Chelsea Hotaling of Sommer Energy, LLC. These comments were prepared for Citizens Action Coalition of Indiana ("CAC"), Earthjustice, Indiana Distributed Energy Alliance ("IndianaDG"), Sierra Club, and Valley Watch pursuant to the Indiana Utility Regulatory Commission's ("IURC" or "Commission") Integrated Resource Planning Rule, 170 Ind. Admin. Code 4-7.[1]

In our analysis, we reviewed the methodology and available information used to support NIPSCO's proposal to retire its remaining coal-fired generating units by 2028 and replace all its coal capacity with renewable capacity. We acknowledge and commend the substantial leadership demonstrated by NIPSCO in its current IRP analysis—including an array of best practices, such as:

- conducting an all-source request for proposals ("RFP") to inform model inputs which gives NIPSCO an unusual level of credibility from which to forecast the cost of utility-scale, supply-side generators;
- transparent inclusion of input forecasts, outputs and assumptions;
- a thorough description of most aspects of screening and portfolio selection; and
- fair consideration of a wide range of supply-side alternatives without arbitrary limitations on the amount of those resources that can be selected or unsupported cost additions.

This IRP is also a vast improvement upon NIPSCO's 2016 IRP insofar as it:

- does not rely upon commodity price forecasts that stakeholders cannot review;
- does not compare retirement portfolios merely to the proxy costs of a combined cycle gas turbine ("CCGT");
- does not put arbitrary limits on renewable resource choices; and
- from the first stakeholder workshop, and throughout the remainder of the process, NIPSCO made good faith efforts to address criticisms of its 2016 IRP by the Director and by stakeholders, including developing and presenting an improvement plan with tangible action items.

Some gaps remain in comprehensively meeting the requirements of the IURC's IRP Rule; these issues are described below and include problems with scenario design, an incomplete update of the 2016 energy efficiency market potential assessment, and a failure to provide details of the IRP's reliability analysis on which the selection of the preferred portfolio relies.

Our review of NIPSCO's 2018 Integrated Resource Plan ("IRP") is organized in response to guidance on IRP preparation in the IURC's IRP Rule (specifically, 170 IAC 4-7-2, 4-7-4 through 4-7-9). Table 1, on the following page, summarizes twelve groups of Indiana IRP requirements and specifies the section in which those requirements will be addressed in detail. More

[1] All references to the Commission's IRP Rule, 170 Ind. Admin. Code 4-7, refer to the final rule, effective as of January 5, 2019.

generally, our review raised the following main categories of concerns with the NIPSCO 2018 IRP and how it aligns with the IRP Rule:

- Scenarios were constructed based on storylines that conflated ideas rather than explored explicit risks to NIPSCO. However, this problem was largely mollified by five factors discussed in Section 9 of these comments.
- Weaknesses in NIPSCO's update to its 2016 energy efficiency market potential study including failure to account for large-scale shifts in end uses and load curves over the 30-year period modeled, a failure to account for the overestimation of costs and savings typical of demand-side management ("DSM") plans, a lack of evaluation of targeted impacts of DSM programs, insufficient detail on energy efficiency bundles including the targeted impact of DSM programs, and inconsistent language between discovery responses and the IRP narrative.
- Inconsistent modeling parameters and limited consideration of load forecast sensitivities.
- Omission of information about distributed generation, advanced metering, or smart grids.
- Unsubstantiated selection of one preferred resource portfolio for reliability reasons over another that was more cost effective and less risky, and failure to adequately explain the reasoning behind selecting retirement Portfolio 6 instead of Portfolio 8 (specifically, providing clear details and results from the reliability model).
- Use of a model whose vendor will not permit non-licensees, even under a confidentiality agreement, to access the model's manual or the full model database. This limitation was tempered by Charles River Associates' efforts to document the model inputs and results, but is a concern for future planning related dockets and IRPs. This is an issue that only the model's vendor, Energy Exemplar, can fully resolve, since it is likely very difficult for a user of Aurora to manually export all this information. The alternative would be to use a model that permits full transparency in the future.

Table 1. Summary of evaluation of NIPSCO's achievement of Indiana IRP requirements

	Requirement	Findings	Citation
1	**Communicate core concepts to nontechnical audiences** The IRP should present results in a manner that all audiences, technical and nontechnical, can easily understand and interpret.	Mostly	See Section 1
2	**Provide complete documentation** The IRP should include all information necessary for stakeholders to understand how it was carried out.	Partial	See Section 2
3	**Development of input forecasts** The IRP should clearly explain how model forecasts were developed and utilized.	Mostly	See Section 3
4	**Description of existing and potential resources** The IRP should include a full explanation of the existing electric power resources.	Met	See Section 4
5	**Screening of potential resources** The IRP should describe the screening process in detail and give equal consideration to all resource alternatives.	Mostly	See Section 5
6	**Description of model structure and assumptions** The IRP should explain the modeling methodology utilized and provide supporting documentation.	Partial	See Section 6
7	**Development of retirement portfolios** The IRP should describe when and why existing electric power resources will be retired.	Met	See Section 7
8	**Development of candidate resource portfolios** The IRP should describe all candidate resource portfolios under consideration, including supply- and demand-side measures.	Mostly	See Section 8
9	**Development of future scenarios** The IRP should utilize and describe a wide range of future scenarios, including the base case scenario.	Mostly	See Section 9
10	**Selection of preferred portfolio** The IRP should describe the preferred portfolio and explain the method used to select it.	Mostly	See Section 10
11	**Impacts of preferred portfolio** The IRP should describe how the preferred portfolio will be implemented and its impact on utility operations and finance.	Met	See Section 11
12	**Consultation with stakeholders** The IRP should include information about how stakeholders were engaged throughout the IRP development process.	Met	See Section 12

Analysis

1. Does the IRP communicate core IRP concepts and results to nontechnical audiences?

By and large, yes. NIPSCO's 2018 IRP includes an executive summary which is likely the primary document communicating core IRP concepts and results to nontechnical audiences. We agree that this document satisfies this aspect of the rule. However, the summary of its 2019-2021 Action Plan is lacking in detail. With respect to the resources it intends to acquire to replace the Schahfer coal units, NIPSCO simply says, it will "[s]elect replacement projects identified from the 2018 RFP evaluation process, prioritizing resources that have expiring federal tax incentives to achieve lowest customer cost."[2] While NIPSCO might not be sharing the specific projects it intends to acquire or contract within this IRP, the resource tranches it modeled were developed from the RFP responses it received. As such, it is our interpretation that new resources will be largely consistent with the tranches that were selected as least-cost. Therefore, it is unclear why NIPSCO could not be more specific in its 2019-2021 Action Plan about the type and timing of those new resources. It is our hope that this is merely an oversight rather than a placeholder that would give NIPSCO the wiggle room to acquire resources significantly different than those contained in the preferred plan.

Table 2. Evaluation of selected Indiana IRP requirements regarding communicating core concepts to nontechnical audiences

	Requirement	Findings	Citation
1	[illegible]	Mostly	
1-1	An IRP summary that communicates core IRP concepts and results to non-technical audiences	Met	170 IAC 4-7-2 (c)(3)
1-2	An IRP summary that is readily available on the utility's website	Met	170 IAC 4-7-2 (c)(3)
1-3	A non-technical discussion of inputs, methods, and definitions	Partial	170 IAC 4-7-4 (11)(A-C)

1-1. Does the IRP include a summary that communicates core IRP concepts and results to non-technical audiences?

Yes. NIPSCO's IRP includes an executive summary that clearly and succinctly presents critical basic information about the IRP process, findings, and next steps. It describes NIPSCO's existing resources, preferred resource portfolio, key factors influencing the preferred resource

[2] 2018 IRP Submission, p. 2.

portfolio, short term action plan, public advisory process, and the resource types and load characteristics.

1-2. Is there an IRP summary that is readily available on the utility's website?

Yes. The IRP Executive Summary[3] is readily available on NIPSCO's website.

1-3. Does the IRP include a non-technical discussion of inputs, methods, and definitions?

Partially. Section 2.3.1 in NIPSCO's IRP includes a discussion of its market forecast inputs—including references to other IRP sections for more detail—and Section 3.2 includes a discussion of the development of NIPSCO's forecast, including methods and data sources. It does not, however, include a detailed description of new resources to be acquired in the preferred portfolio.

[3] NIPSCO. October 30, 2018. 2018 Integrated Resource Plan Executive Summary. Available online: https://www.nipsco.com/docs/default-source/default-document-library/2018-nipsco-irp-executive-summary.pdf.

2. Is the IRP documentation complete?

Partially. While NIPSCO's IRP was responsive to stakeholder information requests and described its ongoing efforts to improve the resource planning process, other documentation requirements were not met or only partially met—such as providing complete model documentation, detailing a proposed schedule for customer end-use surveys, or discussing NIPSCO's efforts to develop and maintain an electricity consumption database. Overall, NIPSCO was prompt in its responsiveness to our inquiries, improved transparency of key modeling details like commodity pricing, and went to significant effort to provide a technical appendix, the entire completion of which was hampered by the model's vendor.

Table 3. Evaluation of selected Indiana IRP requirements regarding the provision of complete documentation

	Requirement	Findings	Citation
2	[illegible]	[illegible]	[illegible]
2-1	Provide information related to the IRP development as requested by an interested party within 15 business days of a written request	Met	170 IAC 4-7-2.6(b)
2-2	A technical appendix containing supporting documentation sufficient to allow an interested party to evaluate the data and assumptions in the IRP, including data sets and data sources used to establish alternative forecasts	Partial	170 IAC 4-7-2(c)(2); 4-7-4(12)
2-3	Documentation of the model(s) used sufficient to understand methodological approach of the model and model inputs and outputs including constraints on the optimization.	Not Met	170 IAC 4-7-4 (19),(28); 4-7-8(a)
2-4	IRP must include a discussion of efforts to develop and maintain a database of electricity consumption patterns	Partial	170 IAC 4-7-4 (13)
2-5	IRP must include a proposed schedule for customer end-use surveys	Not Met	170 IAC 4-7-4 (15)
2-6	IRP must describe ongoing efforts to improve the resource planning process	Met	170 IAC 4-7-8 (c)(9)

Certain documentation sufficient to understand the methodological approach of the model is missing. The documentation needed to meet this requirement is almost always the manual for the model. When asked to provide the manual NIPSCO responded, "Charles River Associates followed up with the licensor of Aurora, and they confirm that there is no separate user manual beyond the in-application help feature. They indicated that the help content is accessible to licensees only, so we aren't be [sic] able to extract all of the help content and simply send it along. The software is not available online (without a license)."[4]

[4] NIPSCO Response to CAC Request 1-003.

We, therefore, have an ongoing concern with the use of any Energy Exemplar (the Aurora licensor) model due to this issue. The model manual would typically give insight into how the model performs its optimization and the simplifying assumptions it makes to reach a result. These details cannot be summarized sufficiently in a single or even multiple page description of a model. In addition, models often allow users to set tens if not hundreds of different parameters that can have major implications on the results and/or the interpretation of the results. These include constraints on the optimization function, as well as the manner in which the model should produce outputs, e.g., whether capital costs are represented as revenue requirements or carrying charges.

Charles River Associates ("CRA") spent a significant amount of effort documenting model outputs and certain model inputs and settings in its IRP submission, but this documentation is unique to CRA and to this particular IRP, i.e., it is not necessarily the manner in which this information would be provided by a user of Aurora or in any future case involving Aurora. And while CRA clarified its resource selection constraints through discovery, it is always our preference to verify resource selection ourselves by examining the model input files. We are aware of at least one Indiana utility that claimed to have not used resource selection constraints, but an examination of the utility's modeling files showed otherwise. Please note that our review of Confidential Appendix D does give us reasonable certainty that the resource selection constraints were consistent with the manner in which they are described by CRA, but, in our view, this is not a long-term solution to providing this information. The long-term solution is either for Energy Exemplar to allow export of the model inputs and outputs and the help menu to non-licensees including intervenors, interested stakeholders, and Commission staff who sign a non-disclosure agreement or for Indiana utilities including NIPSCO to use a model other than Aurora that is more compliant with the public stakeholder process used in Indiana.

2-1. Did NIPSCO provide information related to the IRP development as requested by an interested party within 15 business days of a written request?

Yes. Although there were a couple of data delays, NIPSCO by and large worked with stakeholder parties to provide information needed in a timely manner. At times, NIPSCO even provided data within hours of the request. We greatly appreciated NIPSCO's responsiveness here. This was another significant change from its 2016 IRP—in the 2016 IRP, we had significant difficulty gathering all the information needed for our review.[5]

[5] CAC *et al.*'s Report on NIPSCO 2016 IRP, March 16, 2017, p. 12, available here: https://www.in.gov/iurc/files/CAC%20EJ%20IDEA%20SC%20WW%20Comments%20on%20NIPSCO%20IRP%20PUBLIC--3-16-17.pdf

2-2. Does the IRP include a technical appendix containing supporting documentation sufficient to allow an interested party to evaluate the data and assumptions in the IRP, including data sets and data sources used to establish alternative forecasts?

Partially. While CRA worked to make the data as transparent as possible within Appendix D, due to the limitations of the Aurora model and Energy Exemplar's (Aurora's vendor) refusal to provide certain information to non-licensees, these files were not complete with respect to model inputs. We are reasonably confident that resource selection constraints were consistent with the manner in which CRA described them and no additional red flags regarding the inputs were apparent to us. But going forward, the full set of model inputs needs to be provided.

The IRP's Appendix D does include some inputs and key outputs in the form of NIPSCO's energy and demand forecasts, the characteristics and costs per unit of resources evaluated, and the calculation of the revenue requirement for all of the retirement and replacement portfolios. In other words, NIPSCO provided the data that lends itself to export, e.g., annual generation, capital and O&M costs, commodity prices, etc. But model inputs and settings that are unique to Aurora, and therefore more difficult to draw out manually, were not reported. It is likely to be extremely difficult for any user of Aurora to fully document this data; instead Aurora's vendor, Energy Exemplar, needs to develop uniform reporting of model inputs and outputs or permit stakeholders and Commission staff to view this information through a read-only license without cost.

2-3. Did NIPSCO provide documentation of the model(s) used sufficient to understand the methodological approach of the model, and model inputs and outputs including constraints on the optimization?

No. As discussed above, NIPSCO did not provide sufficient documentation of the Aurora model due to model license limitations. NIPSCO did include Appendix C which provides a description of Aurora and the companion model, PERFORM (see Section 6.1 below), but only gives an overview of the models used. This is not a substitute for providing the model manual.

2-4. Does the IRP include a discussion of efforts to develop and maintain a database of electricity consumption patterns?

Partially. Section 3.2.1 in NIPSCO's IRP discusses its internal data sources noting that information about "Class energy sales, number of customers by class, internal peak demand, historical interruptions and electric prices" are collected internally by NIPSCO and used to "develop the long term sales and demand forecast."[6] However, NIPSCO "does not currently maintain and has no plans in the future to develop a database of electricity consumption

[6] 2018 IRP Submission, p. 18.

patterns by DSM program…[or] by end use,"[7] as required by section 170 IAC 4-7-4(13) of the IRP rule.

2-5. Does the IRP include a proposed schedule for customer end-use surveys?

No. Although NIPSCO's IRP states that "NIPSCO is considering using customer surveys to obtain data on end-use appliance penetration, end-use saturation rates, and end-use electricity consumption patterns as part of its updated MPS",[8] it fails to provide further detail and does not include a proposed schedule for customer surveys as required by section 170 IAC 4-7-4(15) of the IRP rule. CAC, in its role on NIPSCO's DSM Oversight Board, has told us that NIPSCO intends to conduct an end-use analysis for its forthcoming market potential study. If this is indeed the case, that would satisfy this requirement.

2-6. Does the IRP describe ongoing efforts to improve the resource planning process?

Yes. Section 2.2.2 in NIPSCO's IRP describes feedback from the 2016 IRP process and efforts to improve the 2018 IRP process (see Figure 1).

Figure 1. NIPSCO 2018 IRP Table 2-1: Process Improvement

Subject	2016 IRP Feedback	2018 Improvement Plan
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 Proposal 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 • Developed enhanced scorecard methodology to include more quantifiable metrics that better evaluate tradeoffs
DSM Modeling	• DSM groupings are not getting quite the same treatment as the supply side resources	• Utilized new modeling capabilities to enable DSM to be treated equally with other supply side resources

Source: Reproduced from NIPSCO 2018 IRP Submission, p. 10.

[7] 2018 IRP Submission, p. 211.
[8] 2018 IRP Submission, p. 211.

3. Does the IRP include a discussion of the development of input forecasts?

Yes. NIPSCO's 2018 IRP submission includes a thorough discussion of the development of its input forecasts, including: peak and energy demand forecasts, procurement, fuel and emission considerations, commodity prices, and DSM assumptions. Nonetheless, our review raised several concerns regarding NIPSCO's updates to its 2016 energy efficiency market potential study including a failure to account for large-scale shifts in end uses and load curves over the 30-year period modeled, and a failure to account for the overestimation of costs and savings typical of DSM plans.

Table 4. Evaluation of selected Indiana IRP requirements regarding the development of input forecasts

	Requirement	Findings	Citation
3	Discussion of Input Forecasts	Mostly	
3-1	A detailed analysis of historical and forecasted peak demand and energy usage, including three alternative forecasts and a consideration of alternate assumptions	Met	170 IAC 4-7-4 (2),(3); 4-7-5 (b),(c)
3-2	A discussion of how the utility's fuel and emission allowance inventories have been taken into account	Met	170 IAC 4-7-4 (20),(21),(23)
3-3	A discussion of how the utility's relevant procurement planning practices have been taken into account	Met	171 IAC 4-7-4 (20),(21),(23)
3-4	A discussion of how commodity prices for the IRP were developed	Met	170 IAC 4-7-4 (28)
3-5	A discussion of how DSM assumptions were developed for the IRP	Partial	170 IAC 4-7-4 (29),(31); 170 IAC 4-7-6(6)

3-1. Does the IRP include a detailed analysis of historical and forecasted peak demand and energy usage, including three alternative forecasts and a consideration of alternate assumptions?

Yes. Section 3 in NIPSCO's IRP discusses its energy and demand forecast, and Section 3.12 presents forecasted energy and demand and alternative forecasts. Three alternative forecasts are included: Base, High Growth, and Low Growth scenarios. Alternative assumptions beyond growth are not considered or discussed.

3-2. Does the IRP include a discussion of how the utility's fuel and emission allowance inventories have been taken into account?

Yes. Section 7.4 in NIPSCO's IRP notes that NIPSCO does not need additional allowances for compliance with the Clean Air Act Title IV Acid Rain Program or the Cross-State Air Pollution Rule.

3-3. Does the IRP include a discussion of how the utility's relevant procurement planning practices have been taken into account?

Yes. Section 4.1 in NIPSCO's IRP discusses its fuel procurement strategy, including a description of supply and procurement strategies as well as environmental compliance and pricing outlooks for coal and natural gas.

3-4. Does the IRP include a discussion of how commodity prices for the IRP were developed?

Yes. Section 2.3 in NIPSCO's IRP highlights the approaches used for the commodity price forecasts. NIPSCO commissioned Charles River Associates ("CRA") to develop commodity forecasts for natural gas prices, coal prices, emission allowance prices, and power prices. CRA used a Natural Gas Fundamentals model for the natural gas forecast. CRA used the North American Electricity and Environment Model ("NEEM") to assess emission allowance prices, coal consumption and pricing, and capacity expansion and retirements. CRA licenses the AURORA model for hourly MISO market prices at the zonal level. NIPSCO worked with CRA for the development of the natural gas, coal, and emission price forecasts. Section 4 in NIPSCO's IRP provides details on current gas procurement strategies and coal procurement and current contracts/transportation agreements. Section 8 in NIPSCO's IRP provides greater detail about the approach used by CRA for the different commodity forecasts for the Base case.

3-5. Does the IRP include a discussion of how DSM assumptions were developed for the IRP?

Partially. Section 5 in NIPSCO's IRP highlights the development of demand-side management ("DSM") resources for the IRP. NIPSCO reported that GDS Associates modified a prior market potential study developed by Applied Energy Group in order to come up with the energy efficiency bundles modeled in this IRP. Section 5.6.3 in NIPSCO's IRP includes the demand response load reduction assumptions used by the utility. NIPSCO assumes five different demand response programs. The impact of load reduction is based on program performance for NIPSCO's current or past programs. The Interruptible Rider was determined from actual program performance. The remaining program impacts were derived through an average of existing or past program performance from programs in states within the region.

The energy efficiency programs were reportedly modeled in three different bundles. GDS created energy efficiency bundles based on each measure's cost of saved energy over its

measure life. GDS determined the DSM bundles by grouping the programs according to the levelized cost per kWh over the lifetime of the programs.

While it is a positive that GDS added measures to NIPSCO's prior market potential study in both the residential and commercial sectors as well as recommended that NIPSCO expand the measures covered by existing programs and add additional programs, we have two overarching concerns about this potential study update. First, and this is universal to all market potential studies, it is not credible to argue that a potential study can forecast energy efficiency cost and savings for a period of time as long as 2019 to 2048. While the fundamental end-uses of electricity—e.g., cooling, refrigeration, lighting, etc.—are likely to remain the same and their demand is likely to grow with beneficial electrification, the efficiency measures that provide for those end-uses are expected to change radically in cost and electric consumption.

A partial solution to the problem of broad shifts in energy efficiency measures and load curves is to examine fixed increments of energy efficiency, i.e., decrements to load, in order to 1) develop a generation supply avoided cost forecast, and 2) test the optionality that a particular supply-side expansion plan preserves (or not). NIPSCO performed a truncated version of this that capped the decrements at the potential identified in its market potential study, but it did not make that modeling part of its IRP filing. Because this recommended analysis is intended to avoid the problems in relying purely upon market potential studies to characterize energy efficiency over a long period of time, it would have been preferable to use decrements in smaller amounts up to a reasonably aggressive efficiency savings, e.g., 2 percent incremental savings.

Our second concern regarding the market potential study update is that, in order to "extend projected kWh and kW savings and budgets to cover years 2022 to 2048,"[9] "GDS used the NIPSCO 2019 to 2021 DSM Plan as the first three years of the updated DSM Plan".[10] NIPSCO's 2019 to 2021 DSM Plan was used to characterize the residential sector measures and may have been used to characterize the commercial sector measures as well. NIPSCO does not make its methodology clear in terms of how NIPSCO extended the 2019-2021 cost and savings figures out to 2022-2048. For the handful of years for which the data are available, planned savings and costs have been very different than actuals (see Table 5).

In addition, NIPSCO did not analyze assumptions regarding differing levels of costs and savings for its bundles; rather; it treated those assumptions as single point estimates. Additional concerns with the modeling of NIPSCO's energy efficiency bundles are discussed in Section 8.3 of these comments.

[9] 2018 IRP Submission, Appendix B, p. 155.
[10] 2018 IRP Submission, Appendix B, p. 146.

Table 5. Planned versus actual comparison for NIPSCO DSM programs

DSM Program Savings (MWh)		
2016	76,086	108,338
2017	129,268	114,060
DSM Program Cost ($)		
2016	$11,301,569	$13,646,274
2017	$14,436,679	$14,171,833

Sources: Actual DSM program savings and costs: (1) Cause No. 44634, NIPSCO Response to CAC Data Request 1-16 (NIPSCO 2012-2016 Annual Scorecards); (2) Cause No. 44634, NIPSCO Submission of 2017 Scorecard; (3) NIPSCO's 2016 IRP, filed November 1, 2016, available online: https://www.nipsco.com/docs/default-source/about-nipsco-docs/2016-irp.pdf.

4. Does the IRP include a description of existing and potential resources?

Yes, IRP Sections 4 and 5 and Appendix B include descriptions of the existing and potential resources included in CRA's modeling. NIPSCO's IRP includes detailed descriptions of each of its generating resources, its power purchase agreements and its demand response programs. NIPSCO was also able to provide a great deal of transparency regarding its description of potential resources and their costs because NIPSCO used (and shared) summary responses to its all-source request for proposals ("RFP") to characterize new resources. Importantly, NIPSCO's decisions to use an independent consultant to conduct its RFP, to allow stakeholders the opportunity to review the proposed RFP and RFP responses, and to include the RFP results in its IRP provided a level of detail, credibility and transparency that is not typically present in the IRPs we have reviewed in Indiana.

We note that there is very little discussion of cogeneration or distributed generation in NIPSCO's IRP. With regards to cogeneration, we recommend that NIPSCO explicitly discuss projects that its customers have expressed interest in to the extent that NIPSCO is aware of them. We understand the limitations on utilities' ability to model cogeneration—it can be very difficult to generalize about cogeneration projects sufficiently to capture them in an IRP. But with its heavy proportion of industrial customers, the possibility of new cogeneration projects deserve scrutiny. With regards to distributed generation, NIPSCO can most easily simulate its impact by modeling it as a sensitivity to load consistent with the minimum level of distributed generation that can be added under Indiana law.

Table 6. Evaluation of selected Indiana IRP requirements regarding existing and potential resource descriptions

	Requirement	Findings	Citation
4	[illegible]	Met	
4-1	A description of the utility's existing electric power resources	Met	170 IAC 4-7-4(4); 4-7-6(a)
4-2	A description of the utility's possible alternative future resources	Met	170 IAC 4-7-4(6); 4-7-6(a)
4-3	A description of the utility's process for selecting possible alternative future resources	Met	170 IAC 4-7-4(5); 4-7-6(a)

4-1. Does the IRP include a description of the utility's existing electric power resources?

Yes. Section 4.4 in NIPSCO's IRP provides an overview of NIPSCO's generating capacity, including detailed descriptions of each of its generating resources, its power purchase agreements and demand response programs.

4-2. Does the IRP include a description of the utility's possible alternative future resources?

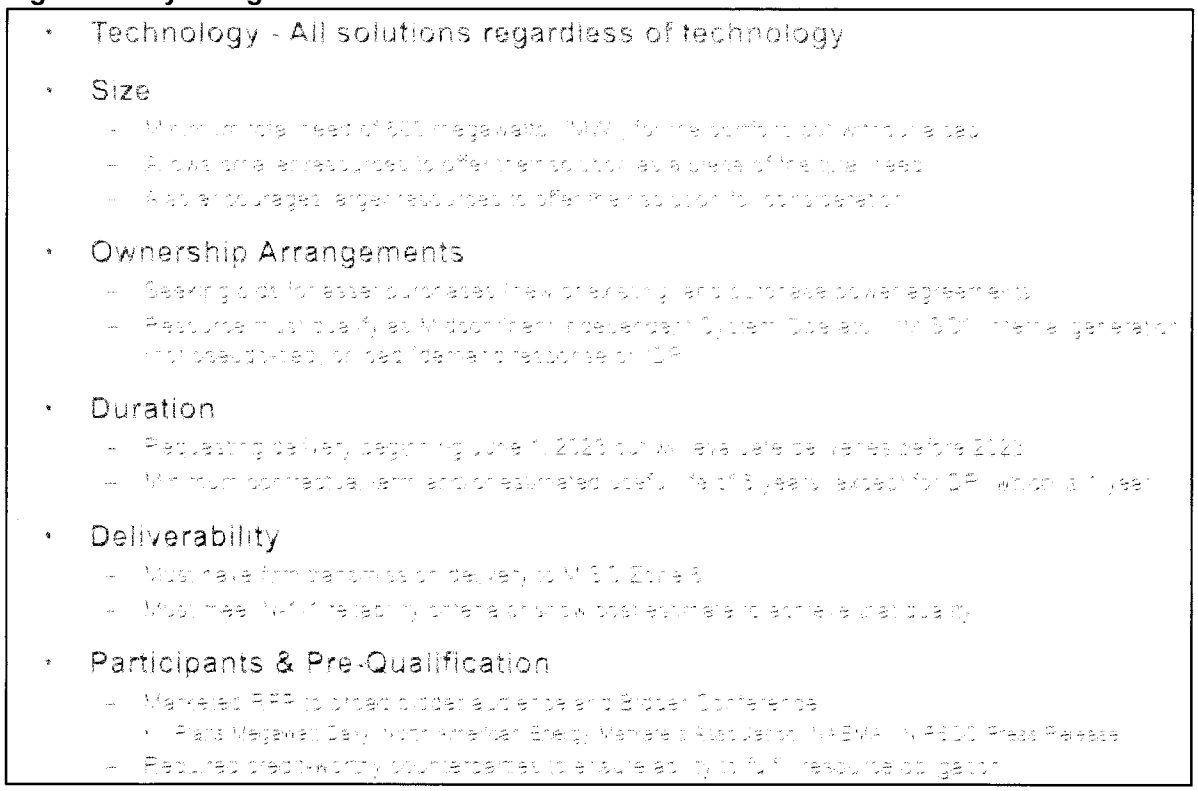
Yes. Section 4.9 in NIPSCO's IRP describes possible alternative future resources. The Company includes information about possible alternative future resources from what the Company calls a "third-party data source review" used to determine feasible technology options and cost estimates. NIPSCO describes this third-party data source review as: "A review of multiple third-party data sources to assess current and future estimates of resource technology cost, as well as plausible cost ranges, and performance characteristics."[11]

It is noteworthy, particularly for the other Indiana utilities with IRPs in progress, that "much of the [RFP] cost information was relatively consistent with the third-party data review, but renewable offers were at the low end of the estimates observed in the public literature."[12] The fact that NIPSCO conducted an all-source RFP gives it an unusual level of credibility from which to forecast the cost of utility-scale, supply-side generators that is not typically present in the IRPs we have reviewed in Indiana. And because those RFP results were used to characterize new resources at least in the near term, it is not necessary for this review to comment on the NIPSCO's "third-party data source review" or how its results might have been used to characterize possible alternative future resources.

We commend NIPSCO for taking seriously this important part of the IRP analysis, especially considering one of the major disputes in prior resource plans and related proceedings has been related to the price assumptions for various sources of capacity and energy. In the months leading up to its IRP submission to the IURC, NIPSCO provided stakeholders access to and the opportunity to comment on and recommend improvements to the proposed RFP under a nondisclosure agreement. Stakeholders were also able to review the RFP responses under a nondisclosure agreement to ensure the IRP accurately categorized its tranches of various resource technologies. NIPSCO also included many key characteristics in the RFP that are commendable and likely helped to lead to a successful conclusion to the RFP (see slide 12 of July 24, 2018 NIPSCO Presentation[13]):

[11] 2018 IRP Submission, p. 50.
[12] 2018 IRP Submission, p. 56.
[13] Available online: https://www.nipsco.com/docs/default-source/about-nipsco-docs/7-24-2018-nipsco-irp-public-advisory-presentation.pdf.

Figure 2. Key Design Elements of the All-Source RFP



Because the RFP resulted in a significant response across resource types and NIPSCO utilized a third-party consultant to review those bids, NIPSCO provided greater transparency to its IRP, narrowed the issues of controversy in future resource proceedings, and established more credibility around the cost of its preferred plan.

4-3. Does the IRP include a description of the utility's process for selecting possible alternative future resources?

Yes. Section 4.9 in NIPSCO's IRP describes possible alternative future resources, including the actual responses to the all-source request for proposals ("RFP") that NIPSCO used to provide "transactable cost and price information to be incorporated in the IRP analysis".[14] In addition, NIPSCO allowed retirement of existing units to be compared to the selection of a broad range of new resources, whose costs and performance were characterized in large part by the RFP results.

We commend NIPSCO for conducting the RFP for purposes of this IRP, as this is clearly a best practice, and for being transparent with bidders about its needs and plans to procure resources as a result of the RFP.

[14] 2018 IRP Submission, p. 56.

5. Does the IRP include a discussion of the screening of potential resources?

Mostly. NIPSCO's 2018 IRP provides an explanation of the assessment of demand-side and supple-side resources—including how cost, risk and uncertainty were taken into consideration—and describes its resource screening analysis. NIPSCO's 2018 IRP does not discuss how information from distributed generation, advanced metering, or smart grids could be used.

Table 7. Evaluation of selected Indiana IRP requirements regarding screening of potential resources

	Requirement	Findings	Citation
5	Screening of potential resources	[illegible]	[illegible]
5-1	A detailed explanation of the assessment of demand-side and supply-side resources considered to meet future customer electricity service needs	Met	170 IAC 4-7-4(31)
5-2	A resource screening analysis, including screening to eliminate nonviable resource alternatives, and resource summary table	Met	170 IAC 4-7-4(7); 4-7-7(a)
5-3	Potential resources must include supply-side and demand-side resources that safely, reliably, efficiently, and cost-effectively meet the electric system demand and take cost, risk, and uncertainty into consideration	Met	170 IAC 4-7-8(c)(5)
5-4	Discussions detailing how information from advanced metering infrastructure and smart grid will be used; contemporary issues; and distributed generation and potential effects	Partial	170 IAC 4-7-4 (16)(17)(18) (A-D)
5-5	An analysis of resource alternatives including: rate design, demand-side resources, supply-side resources, and transmission resources	Met	170 IAC 4-7-6(b)(1-4)

5-1. Does the IRP include a detailed explanation of the assessment of demand-side and supply-side resources considered to meet future customer electricity service needs?

Yes. Section 4.9 in NIPSCO's IRP describes future supply-side resource options and the process for selecting them, including the data review that NIPSCO used to determine feasible technology options and the all-source RFP. Section 5.2 in the IRP describes NIPSCO's modeling framework, potential impacts, assumptions, and detailed findings regarding demand-side potential and recommended DSM programs and bundles. Appendix B of NIPSCO's IRP provides a DSM Savings Update and the results of the 2016 DSM Market Potential Study.

5-2. Does the IRP include a resource screening analysis, including screening to eliminate nonviable resource alternatives, and a resource summary table?

Yes. Section 4.9.1 in NIPSCO's IRP describes its resource screening analysis where the Company screened outside data sources to identify a list of feasible technology options. IRP Figures 4-6 and 4-7 show a summary of capital costs by technology, as identified in the third-party screening. We found this information to be complete.

5-3. Does the IRP consider potential resources that include supply-side and demand-side resources that safely, reliably, efficiently, and cost-effectively meet the electric system demand and take cost, risk, and uncertainty into consideration?

Yes. Section 5 in NIPSCO's IRP reviews its demand-side resources, including: existing energy efficiency and demand response resources, DSM electric savings update, energy efficiency and demand response bundles used in IRP modeling, energy efficiency potential impacts, energy efficiency measures and savings potential, future demand-side resource options, and consistency between the IRP and NIPSCO's energy efficiency plans. We found this information to be complete though, as we discussed in Section 3, we do have some concerns about the formulation of the market potential study that was the basis for the modeled energy efficiency bundles.

5-4. Does the IRP include discussions detailing (1) how information from advanced metering infrastructure and smart grid will be used, (2) contemporary issues, and (3) distributed generation and potential effects?

Partially; however, NIPSCO currently has automatic meter reading ("AMR"), not advanced metering infrastructure ("AMI") installed. Further, we would not recommend the installation of AMI simply for the sake of providing information, rather the choice to upgrade AMR meters to AMI should be predicated on a clear program design to bring cost-effective benefits to customers. NIPSCO states that customers can "integrate their own distributed generation resources into NIPSCO's electric distribution systems"[15] and notes the Company does not consider distributed generation resources to be reliable in the same manner that traditional generation resources are. The discussion of distributed generation is limited to its status as a resource "that can be utilized in supplementing customer electric energy needs".[16]

The IRP does include a breakdown of the distributed generation resources in their service territory under the Net Metering and the Feed-In Tariff programs. NIPSCO mentions its observation of "voltage related operating impacts on its electric system due to customer-owned generation," but does not discuss how this may impact planning and forecasting for its system.

[15] 2018 IRP Submission, p. 100.
[16] 2018 IRP Submission, p. 101.

The primary improvement NIPSCO could make to benefit customers in this area is to establish a process for consideration of non-wires alternatives to traditional distribution upgrades. To our knowledge, such a process is not a component of NIPSCO's Transmission Distribution System Improvement Charge ("TDSIC") plan. A non-wires alternatives analysis considers the costs and benefits of deploying one or more distributed energy, storage, demand response, and energy efficiency projects to meet capacity needs on distribution feeders. Because these projects serve load, they can then be incorporated into the IRP as an explicit reduction in demand or modeled in the aggregate as supply-side resources.

5-5. Does the IRP include an analysis of resource alternatives including demand-side resources, supply-side resources, and transmission resources?

Yes. NIPSCO's IRP includes an analysis of demand-side and supply-side resources. Transmission resources are mentioned,[17] but not considered as an alternative resource. However, this is not an area of particular concern because MISO, not NIPSCO, is largely responsible for determining where to construct new transmission through its Transmission Expansion Planning process.

Section 4.9 in NIPSCO's IRP provides an analysis of future supply-side resource options, including a discussion of their all-source RFP. Section 5.2 in NIPSCO's IRP provides a description of its analysis of future demand-side resource options, while subsequent sections describe potential impacts, assumptions, and detailed findings regarding demand-side potential and recommended programs and bundles.

[17] 2018 IRP Submission, p. 98.

6. *Does the IRP include a description of model structure and assumptions?*

Partially. NIPSCO, in the text of its IRP, alludes to resource constraints its modelers placed on Aurora in formulating the replacement portfolios. Through discovery, NIPSCO clarified the constraints in place on the retirement portfolios, as well. Having these specific constraints spelled out in the IRP text would be preferable and seems necessary to the provision of a complete description of the IRP model structure and assumptions.

NIPSCO's IRP in Section 6.1 also included a brief discussion of its transmission system planning and attached its FERC Form 715 Annual Transmission Planning and Evaluation Report as part of its confidential appendix. The IRP fails, however, to provide any description of the power flow model used to develop NIPSCO's transmission analysis.

NIPSCO summarized some of its 2016 IRP feedback and how its 2018 update intended to improve upon its prior submission. Having reviewed both NIPSCO 2016 and 2018 IRPs, we can definitively say that the 2018 IRP is a vast improvement over the 2016 IRP. NIPSCO's 2018 IRP does not, however, provide avoided cost calculations for each year of the preferred portfolio.

Table 8. Evaluation of selected Indiana IRP requirements regarding a description of model structure and assumptions

	Requirement	Findings	Citation
6	[illegible]	Partial	[illegible]
6-1	A description of the structure and applicability of the models used in the IRP and the general expansion criteria	Partial	170 IAC 4-7-4(19),(22)
6-2	A brief description of the models' transmission analysis	Partial	170 IAC 4-7-4(27) (A-C)
6-3	A discussion of how the utility's compliance costs for existing or reasonably anticipated air, land, or water environmental regulations have been taken into account	Met	170 IAC 4-7-4 (20),(21),(23)
6-4	An explanation, with supporting documentation, of an avoided cost calculation for each year in the forecasted period of the preferred resource portfolio	Not Met	170 IAC 4-7-4(29) (A-D)
6-5	A discussion of efforts to develop and improve modeling methodology and inputs	Met	170 IAC 4-7-4 (10),(13),(15), (28),(30); 4-7-8(c)(9); 4-7-9(a-c)

6-1. Does the IRP include a description of the structure and applicability of the models used in the IRP and the general expansion criteria?

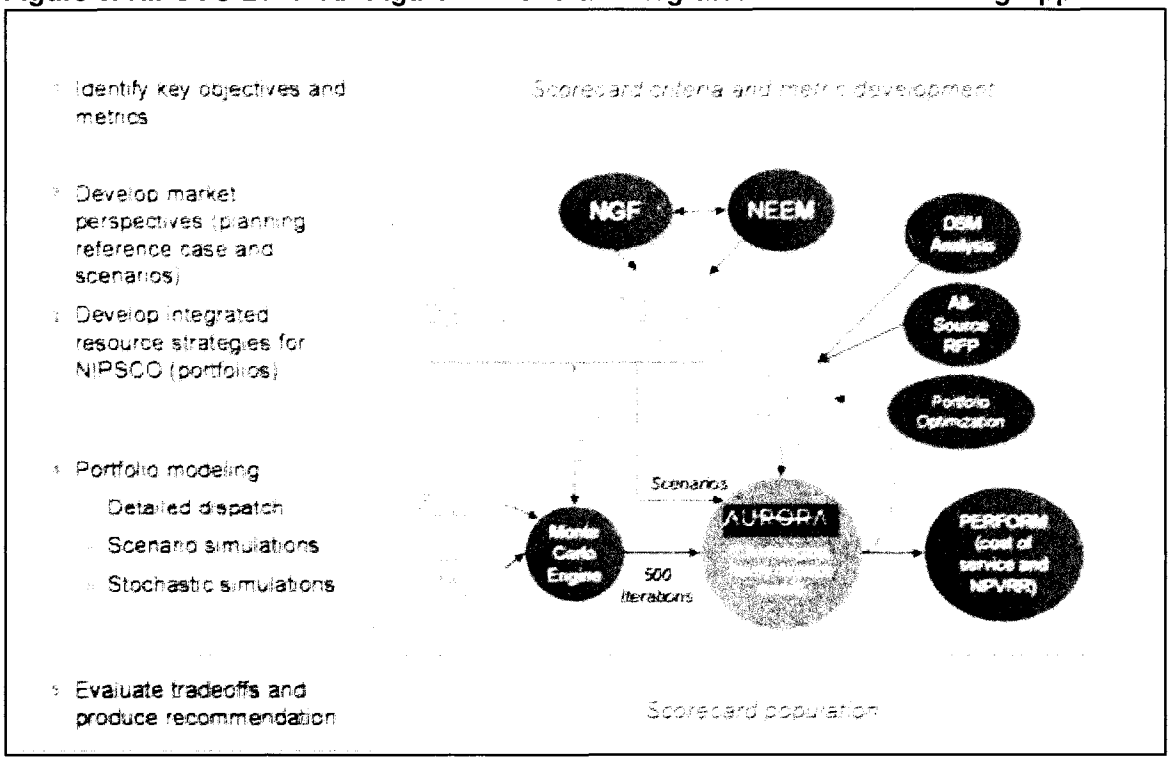
Partially. The IRP text alludes to resource constraints its modelers placed on Aurora in formulating the replacement portfolios but only clarified these constraints in discovery.

NIPSCO said that new resources "were only available for selection in specific online years as per the RFP bids, in years where a retirement occurred, or where a previously selected contract ended."[18] In addition, "In the retirement analysis, all candidate request for proposal ("RFP") resources were available for selection. In the replacement analysis, different portfolios were established with specific eligible resources from the RFP in the following resource categories: renewables, natural gas plants, long duration options (ownership and long-term purchase power agreements, or PPAs), and short duration options (short-term PPAs)."[19] While we appreciated their candor and responsiveness in this data request, we recommend utilities include such information in the actual IRP text, including a complete description of the structure and applicability of models, as well as constraints on modeling.

Section 2.3 in NIPSCO's IRP presents its resource planning approach (see Figure 3), including a description of the model structure and applicability. IRP Section 2.3 shows the steps NIPSCO undertook for their resource planning approach. The Company first conducted a retirement analysis and then developed its replacement portfolios. NIPSCO used Aurora's portfolio optimization tool to develop least-cost portfolios to replace retiring units in its modeling of retirement portfolios. After constructing portfolios, CRA would use Aurora to simulate hourly dispatch of the portfolios within the MISO market. The output from the Aurora dispatch is then used as an input to the PERFORM model in order to help construct the stream of annual revenue requirements of each portfolio.

[18] NIPSCO Response to CAC Request 1-001.
[19] Ibid.

Figure 3. NIPSCO 2018 IRP Figure 2-1: Overall Integrated Resource Planning Approach



Source: Reproduced from NIPSCO 2018 IRP Submission, p. 11.

IRP Section 9.2.4 presents the evaluation criteria for each replacement portfolio, which occurs according to six metrics that were defined prior to the commencement of analysis:

1. Cost to consumer
2. Cost certainty
3. Cost risk
4. Fuel security
5. Environmental
6. Local economy

6-2. Does the IRP include a brief description of the models' transmission analysis?

Partially. It is not clear if any transmission within NIPSCO's service territory was modeled in Aurora. IRP Section 6.1 and Confidential Appendix F discuss NIPSCO's recent power flow modeling, but this modeling was almost certainly performed in some model other than Aurora and independent of the resource optimization performed by CRA. To our knowledge, Aurora has no power flow capabilities.

6-3. Does the IRP include a discussion of how the utility's compliance costs for existing or reasonably anticipated air, land, or water environmental regulations have been taken into account?

Yes. NIPSCO assumed different carbon dioxide ("CO_2") prices across their four identified scenarios. NIPSCO assumes a new federal rule or law establishing a CO_2 price in both the Base and Booming Economy/Abundant Natural Gas scenarios. The Aggressive Environmental Regulation scenario carries the highest CO_2 price under the assumption that a stricter federal rule will be in effect by the mid-2020s. The Challenged Economy scenario assumes no CO_2 price throughout the planning period as this scenario is predicated on an alternative approach for carbon reduction that focuses on heat rate efficiency improvements without a specific tax or emission cap requirement. All scenarios with a CO_2 price assume that it goes into effect in 2026.

In their retirement analysis, NIPSCO evaluated all five of its remaining coal-fired units for retirement. The costs for each unit include environmental compliance capital and operating costs, specifically those costs necessary for compliance with the Effluent Limitation Guidelines ("ELG") rule. IRP Section 7.3.3 provides a discussion of the ELG rule and the potential for the compliance date to be pushed back pending a decision by the EPA. The current ELG requires state permitting agencies to set a date for compliance that they find to be "as soon as possible" between 2018 and 2023 (or after the Postponement Rule, between 2020 and 2023). As a practical matter, the rule provides the Indiana Department of Environmental Management discretion to set December 31, 2023 as the compliance date if it makes appropriate findings.; Four ELG rule compliance pathways were identified by NIPSCO: (1) Zero Liquid Discharge ("ZLD"), (2) Non-ZLD, (3) retirement, and (4) extended compliance date. The ZLD pathway had a higher estimated cost of compliance than the Non-ZLD pathway. Under the retirement pathway, there is no concern for compliance costs as the units would be retired by the assumed 2023 compliance date. The last pathway assumes the potential for a further extension of the compliance date once the EPA completes its reconsideration of the ELG rule.

NIPSCO includes environmental compliance costs as a component of the total generation costs for their units. Included in the compliance costs are the necessary controls to bring units into compliance with the limits contained in the ELG rule. The environmental capital and O&M spending schedule includes the retrofits necessary for both the coal combustion residuals ("CCR") and ELG rules. NIPSCO's Base case assumes the ELG requirement that is in effect today. Portfolios 1, 2, and 3 have a non-ZLD compliance pathway whereas Portfolios 5, 6, 7, and 8 retired the coal units. NIPSCO also modeled Portfolio 4, with 15 percent coal in 2028 without ELG – which includes Schahfer Units 14 and 15 running until 2028 without additional spending to bring those units into compliance with the ELG rule – even though Portfolio 4 is not currently viable from an ELG compliance standpoint.

6-4. Does the IRP include an explanation, with supporting documentation, of an avoided cost calculation for each year in the forecasted period of the preferred resource portfolio?

No. Section 5.2 in NIPSCO's IRP states that avoided costs were provided by NIPSCO to GDS for purposes of its DSM market potential study update, but no detail is given about how those

costs were derived or what they were. Avoided costs that are predicated on wholesale market price forecasts and the capacity cost of a combustion turbine are likely to understate contributions of generation and capacity to avoided cost. For this reason, we continue to recommend that quarter percentage decrements to load be modeled with wide latitude to allow the IRP model to select resources. That way, an avoided cost that was derived from the resource decisions that a utility is likely to make can be developed and used for DSM program design and cost-effectiveness analysis. A truncated version of this recommendation was presented in a NIPSCO stakeholder workshop, but was not part of the filed IRP.

6-5. Does the IRP include a discussion of efforts to develop and improve modeling methodology and inputs?

Yes. Section 2.2.2 in NIPSCO's IRP discusses 2016 IRP feedback and how the 2018 process was improved as a result. IRP Section 3.2 addresses the development of the model, including forecasting methods and data sources, and how these processes were improved or are continuing to be improved, as applicable. As mentioned previously, the 2018 IRP is a vast improvement over the 2016 IRP, and we appreciate NIPSCO's consideration of stakeholder feedback on its IRP processes and methodologies that was both constructive and thorough.

7. Does the IRP include a description of the development of retirement portfolios?

Yes. IRP Section 9.1 describes the manner in which the coal retirement portfolios were created. Our primary concern with the retirement portfolios is the selection of Portfolio 6 over the lower cost Portfolio 8 due to unspecified reliability issues. Those concerns are discussed in more detail in Section 10.

Table 9. Evaluation of selected Indiana IRP requirements regarding description of the development of retirement portfolios

	Requirement	Findings	Citation
7	[illegible]	[illegible]	[illegible]
7-1	The IRP must include information about expected changes to capacity over the next 20 years, including retirements	Met	170 IAC 4-7-6(a)(2)
7-2	The IRP must include a description of the utility's analysis of reliability in the context of choosing preferred retirement and capacity expansion plans	Met	170 IAC 4-7-8(c)
7-3	The IRP must include a description of the utility's analysis of rate impacts in the context of choosing preferred retirement and capacity expansion plans	Met	170 IAC 4-7-4(24); 4-7-8(c)(4)(E)

7-1. Does the IRP include information about expected changes to capacity over the next 20 years, including retirements?

Yes. Section 9.1 in NIPSCO's IRP includes a discussion of its retirement analysis, including the retirement of all remaining coal generators over the next 10 years, while IRP Section 9.2 includes a discussion of its replacement analysis. Section 9.1.7 discusses the possible conversion of two retiring coal units to gas-fired generators.

7-2. Does the IRP include a description of the utility's analysis of reliability in the context of choosing preferred retirement and capacity expansion plans?

Yes. Section 9.1.6 in NIPSCO's IRP highlights the different metrics used by NIPSCO as one of the metrics for the scorecard methodology utilized to evaluate the retirement portfolios. Cost certainty, cost risk, reliability risk, and other factors such as the loss of work for employees were also considered in evaluating the different retirement portfolios. NIPSCO defines the reliability risk as an assessment of the ability to confidently transition the resources and maintain customer and system reliability. NIPSCO discusses that this metric is based on a qualitative assessment made by NIPSCO regarding "how orderly the transition would be from its current portfolio."[20] While the Company does highlight that this assessment is based on NIPSCO's

[20] 2018 IRP Submission, p. 149.

ability to plan for and implement necessary system upgrades and/or equipment to ensure reliability, they only report this as either "acceptable" or "unacceptable" in the report card evaluations without details about why certain portfolios, such as Portfolios 7 and 8, were deemed unacceptable. We would presume that these acceptability ratings are based on specific reliability concerns and, as such, should be backed up with the basis for those concerns so that all stakeholders can assess the reasonableness of the analysis.

7-3. Does the IRP include information regarding rate impacts in retirement portfolios?

Yes. It is likely to be very cumbersome to translate revenue requirements in an IRP into specific rate impacts by rate class because of the complexity of cost allocation. Therefore, the focus is normally on the net present value of differing portfolios as a proxy for rate impacts. One may also look at near-term annual revenue requirements in order to determine whether there are likely to be system average rate increases. Those revenue requirements projections are contained in NIPSCO's Confidential Appendix D and show that the lower cost portfolios also lead to lower near-term revenue requirements.

8. Is the development of the candidate resource portfolios described?

Mostly. NIPSCO's 2018 IRP describes the candidate resource portfolios and the process for developing them, including the selection of both supply-side and demand-side resources conducted on a consistent and comparable basis. The selection of NIPSCO's candidate resource portfolios, however, did not evaluate the impact of targeted DSM programs, nor did NIPSCO consider risk and uncertainty factors when developing its list of candidate resource portfolios.

Table 10. Evaluation of selected Indiana IRP requirements regarding development of the candidate resource portfolios

	Requirement	Finding	Citation
8)	Development of [sets of] replacement portfolios	[Mostly]	
8-1	A description of the candidate resource portfolios and the process for developing them (with a forecast period of at least 20 years)	Met	170 IAC 4-7-4 (1),(8)
8-2	Candidate resource portfolios must include supply-side and demand-side resources that safely, reliably, efficiently, and cost-effectively meet the electric system demand and take cost, risk, and uncertainty into consideration	Met	170 IAC 4-7-8 (c)(5)
8-3	Candidate resource portfolios must evaluate supply-side and demand-side resource alternatives on a consistent and comparable basis	Mostly	170 IAC 4-7-8 (c)(4)
8-4	Candidate resource portfolios must evaluate targeted DSM programs, including impacts on the utility's transmission and distribution system	Not Met	170 IAC 4-7-8 (c)(6)
8-5	The selection of candidate resource portfolios must consider risk and uncertainty in general, and load growth uncertainty in specific	Mostly	170 IAC 4-7-8 (a)

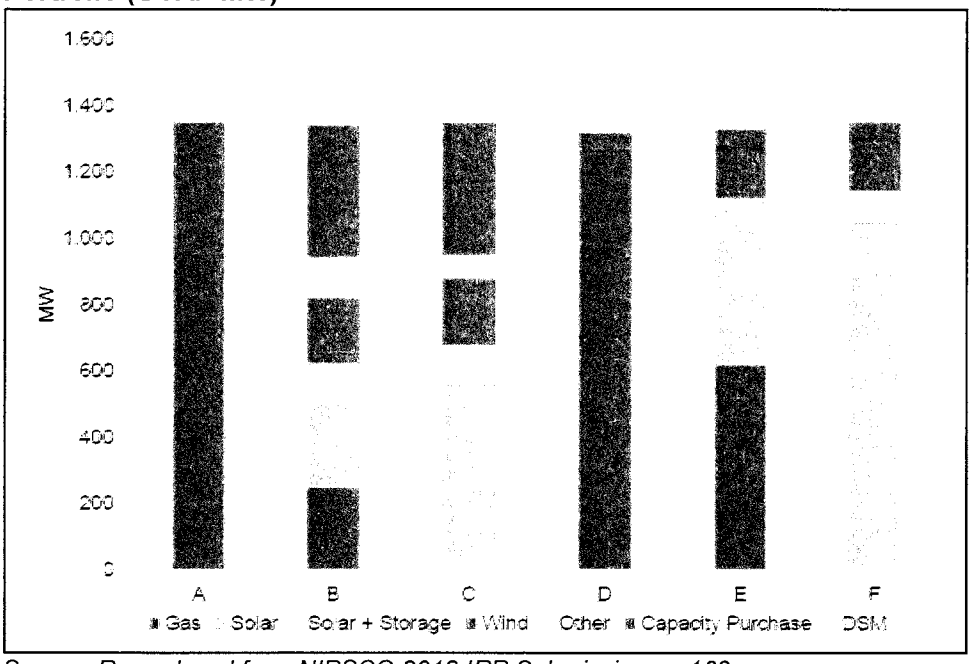
8-1. Does the IRP include a description of the candidate resource portfolios and the process for developing them (with a forecast period of at least 20 years)?

Yes. Section 9.2 in NIPSCO's IRP describes the process for developing replacement portfolios with a forecast period of 20 years and evaluates each replacement portfolio in turn. Fixed portfolio combinations have an important role in candidate resource analysis, but it is also important to allow the model to optimize resource choices. By definition, an optimized portfolio would be the lowest cost and is an important point of comparison even if it is not chosen as the preferred plan for other, legitimate reasons. While new resources were optimized as part of the retirement analysis, they were not in the replacement portfolio analysis.

8-2. Do the candidate resource portfolios include supply-side and demand-side resources that safely, reliably, efficiently, and cost-effectively meet the electric system demand and take cost, risk, and uncertainty into consideration?

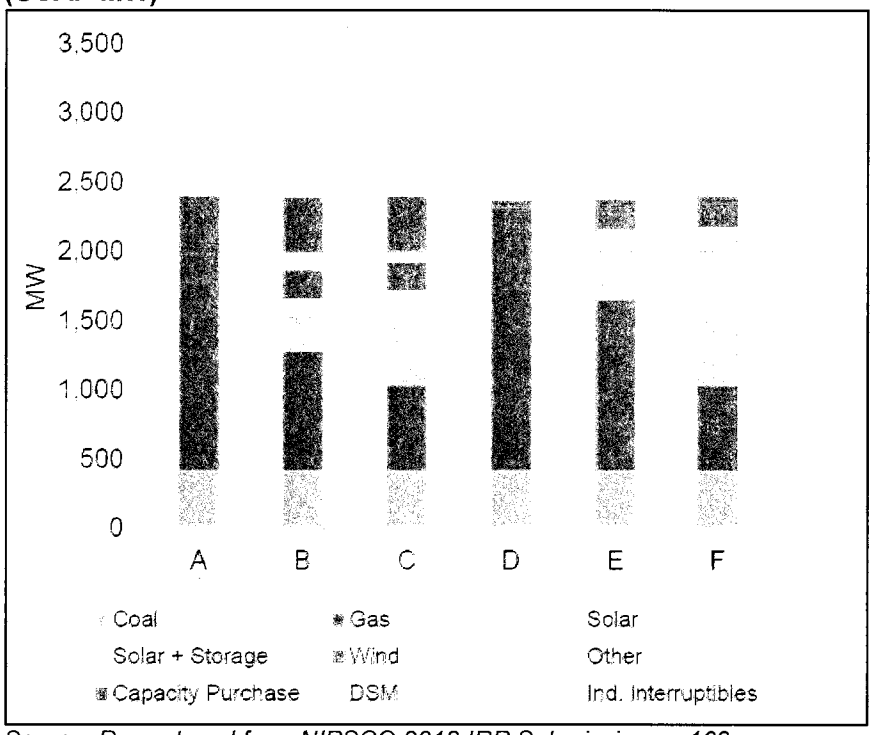
Yes. Section 9.2 in NIPSCO's IRP discusses its replacement analysis, and each portfolio under the analysis contains both supply-side and demand-side resources (see Figure 4 and Figure 5) and were analyzed according to six metrics that were defined prior to the commencement of analysis: cost to consumer, cost certainty, cost risk, fuel security, environmental, and local economy (see Figure 6).

Figure 4. NIPSCO 2018 IRP Figure 9-17: 2023 Incremental Replacement Resources by Portfolio (UCAP MW)



Source: Reproduced from NIPSCO 2018 IRP Submission, p. 163.

Figure 5. NIPSCO 2018 IRP Figure 9-18: 2023 Total Projected Capacity Mix by Portfolio (UCAP MW)



Source: Reproduced from NIPSCO 2018 IRP Submission, p. 163.

Figure 6. NIPSCO 2018 IRP Figure 9-19: Scorecard Metrics for Replacement Analysis

2018 Replacement Scorecard

Criteria	Description
Cost to Customer	• Impact to customer bills 30-year NPV of revenue requirement (Base scenario deterministic results)
Cost Certainty	• Certainty that revenue requirement falls within the most likely range of distribution of outcomes (75% certainty that cost will be at or below this level) 75th percentile of cost to customer
Cost Risk	• Risk of extreme, high-cost outcomes 95th percentile of cost to customer
Fuel Security	• Power plants with reduced exposure to short-term fuel supply and/or deliverability issues (e.g., ability to store fuel on-site and/or requires no fuel) Percentage of capacity sourced from resources other than natural gas (2025 ICAP MW sourced from non-gas resources)
Environmental	• Annual carbon emissions from the generation portfolio Total annual carbon emissions (2030 metric tons of CO_2) from the generation portfolio
Employees	• Net impact on NiSource jobs Approximate number of permanent NiSource jobs added
Local Economy	• Property tax amount from entire portfolio 30-year NPV of estimated modeled property taxes from the entire portfolio

Source: Reproduced from NIPSCO 2018 IRP Submission, p.164.

8-3. Do the candidate resource portfolios evaluate supply-side and demand-side resource alternatives on a consistent and comparable basis?

Mostly. We have concerns about how energy efficiency was characterized and, therefore, optimized. With regards to supply-side resources, Section 8.2 in NIPSCO's IRP describes the analysis that was applied to each portfolio (and its component resources).

Further, in response to CAC Request 1-001, NIPSCO stated, "In the retirement analysis, all candidate request for proposal ("RFP") resources were available for selection. In the replacement analysis, different portfolios were established with specific eligible resources from the RFP in the following resource categories: renewables, natural gas plants, long duration options (ownership and long-term purchase power agreements, or PPAs), and short duration options (short-term PPAs)."

The names used for energy efficiency (as contained in Confidential Appendix D) are also inconsistent with the IRP narrative, which makes it unclear how bundles were assessed and optimized in Aurora. For instance, there are three "EE_Base_1" bundles named in Appendix D. One is listed as "EE_Base_1", one is "EE_Base_1(after 2021)" and one is named "EE_Base_1(flat)." It is likely EE_Base_1 refers to some portion of NIPSCO's DSM plan currently underway through 2021. But the distinction between the "after 2021" and "flat" bundles is unclear as is the impact this had on resource optimization.

8-4. Do the candidate resource portfolios evaluate targeted DSM programs, including impacts on the utility's transmission and distribution system?

No. NIPSCO did not evaluate the impact of targeted DSM programs. In other words, NIPSCO did not look at DSM specifically to evaluate how DSM investments can substitute for transmission and distribution upgrades to alleviate congestion. Such programs often go by the name "geo-targeted DSM programs." NIPSCO should take steps to identify areas where targeted DSM could be deployed within the system through the utilization of a non-wires alternative analysis. This evaluation of specific locations to deploy DSM programs will help inform NIPSCO's DSM plans and the development of programs.

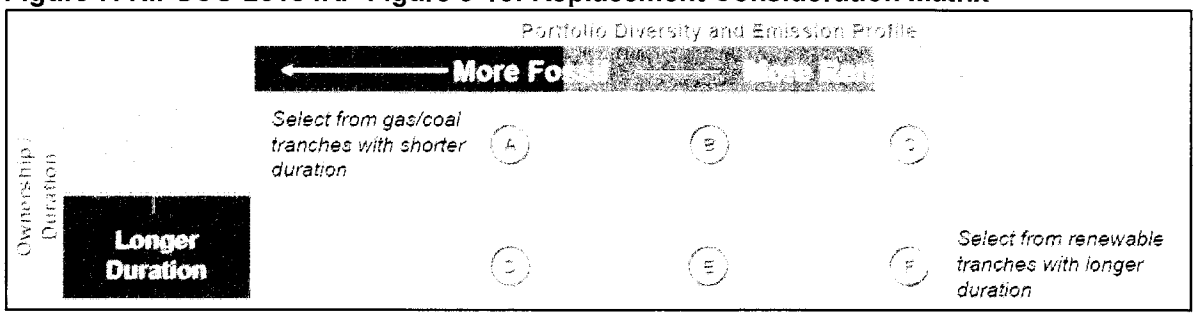
8-5. Does the selection of candidate resource portfolios consider risk and uncertainty in general, and load growth uncertainty specifically?

Mostly. It is difficult to draw a broad and bright line between selecting candidate resource portfolios considering risk and uncertainty and subjecting portfolios to risk and uncertainty testing. Allowing the model to optimize replacement portfolios under differing sensitivities would be one way to address this IRP rule requirement. However, the construction of fixed portfolios, as NIPSCO has done, is also a useful thing because it provides a point of comparison between materially distinct portfolios.

Candidate portfolios are selected on the basis of Figure 9-13: ownership duration and emission profile (see Figure 7 below, which reproduces IRP Figure 9-13). NIPSCO does not specifically discuss risk or uncertainty in relation to its design or selection of these replacement portfolios.

But one could reasonably argue that some accounting of risk is inherent in these portfolio choices because they have materially different risk profiles.

Figure 7. NIPSCO 2018 IRP Figure 9-13: Replacement Consideration Matrix



Source: Reproduced from NIPSCO 2018 IRP Submission, p. 159.

9. Is the development of future scenarios described?

Mostly. NIPSCO's IRP includes a thorough description of its base case and alternative scenarios and includes Base, Booming and Challenged forecasts of energy demand and peak that are comparable to MISO's forecasts. In its analysis of the resources required for its Base, Booming and Challenged scenarios, however, NIPSCO's modeling parameters seem to include some inconsistencies.

Our review also questions the meaning and import of NIPSCO's alternative scenarios and finds them to conflate unrelated characteristics into irrelevant storylines, an issue common to other Indiana IRPs that we have reviewed. Overall, however, NIPSCO's development of future scenarios allows for an unbiased assessment of coal unit retirements.

Table 11. Evaluation of selected Indiana IRP requirements regarding development of future scenarios

	Requirement	Findings	Citation
9	Detailed review of future scenarios	Mostly	
9-1	A description and analysis of the utility's base case scenario and alternative scenarios, including comparison of the alternative scenarios to the base case scenario	Met	170 IAC 4-7-4 (25)(A-D); (26)
9-2	A description of the utility's best estimate of its forecasted load requirements	Met	170 IAC 4-7-8(a); 4-7-4(25)
9-3	An objective analysis of the resources required for its base and alternative scenarios?	Mostly	170 IAC 4-7-4 (28)

While we would strongly prefer to see utilities model scenarios based on explicit risks to their systems rather than storylines, e.g., fuel price risks, loss of load risks, regulatory risks, etc.,[21] the absence of such scenario modeling in this IRP is largely mollified by five factors. First, NIPSCO conducted an all-source RFP that garnered a significant response and allowed it to characterize supply-side resources of many types with a highly accurate dataset. Second, the model selected renewables and other fuel-free resources to entirely make up the capacity and energy lost when existing units retire, which completely eliminates fuel risk associated with those new resources. Third, the size in which renewables are typically contracted and/or purchased allows NIPSCO significantly more optionality to right size its resources in the face of potential loss of load than is normally possible with most thermal units. Fourth, we would expect that "right-sizing" to take place as NIPSCO adds new resources because it is adding them in stages. Some of the bids from the 2018 RFP will be presented to the IURC for approval, but the rest of NIPSCO's projected need will be filled out following a second RFP issued prior to 2023.

[21] NIPSCO also performed stochastic analysis of natural gas and power prices. This analysis helps to address some of the risks to NIPSCO, but doesn't capture the full range. However, that is not to say that additional stochastics would have been appropriate; stochastics are appropriate to test volatility, not uncertainty.

And finally, the savings from acquiring new resources over the continued operation of existing coal units is overwhelmingly in favor of the choice to retire and replace those existing coal units.

It is not uncommon for us to see differences of 1 or 2 percent in net present value ("NPV") amongst different resource plans. However, all of the portfolios containing at least some retirement of coal units had savings of *16 – 29 percent* in NPV over continued operation. It is extremely difficult to imagine a scenario in which retiring significant amounts of coal would *not* be beneficial in the extreme to customers. Instead, the concerns we are raising throughout these comments have more to do with the choice of replacement resources, e.g., should NIPSCO acquire more energy efficiency and fewer renewables.

9-1. Does the IRP include a description, analysis, and comparison of the utility's Base case scenario and alternative scenarios?

Yes. NIPSCO's IRP includes a thorough description of its Base case and alternative scenarios including the scenarios' differing assumptions regarding: NIPSCO load, CO_2 prices, natural gas prices, coal prices and power prices.

However, NIPSCO's scenario selection suffers from a common problem in integrated resource planning: Unrelated characteristics are conflated into meaningless storylines. Combining multiple, unrelated forecasts into a single scenario makes it impossible to examine the sensitivity of model outcomes to changes in a single parameter (ceteris paribus), for example, CO_2 price or load. Scenarios designed to change either (1) a single parameter as a test of the model's sensitivity to changes in that input or (2) several parameters where the reasons that these parameters should change in concert are made explicit will produce results that are easier to interpret and provide more transparent information to utilities, stakeholders, and the Commission. In the case of NIPSCO's current IRP, it appears, however, that the Company's design of alternate scenarios has not had an important effect on its choice of a preferred portfolio.

9-2. Does the IRP include the utility's best estimate of its forecasted electrical requirements?

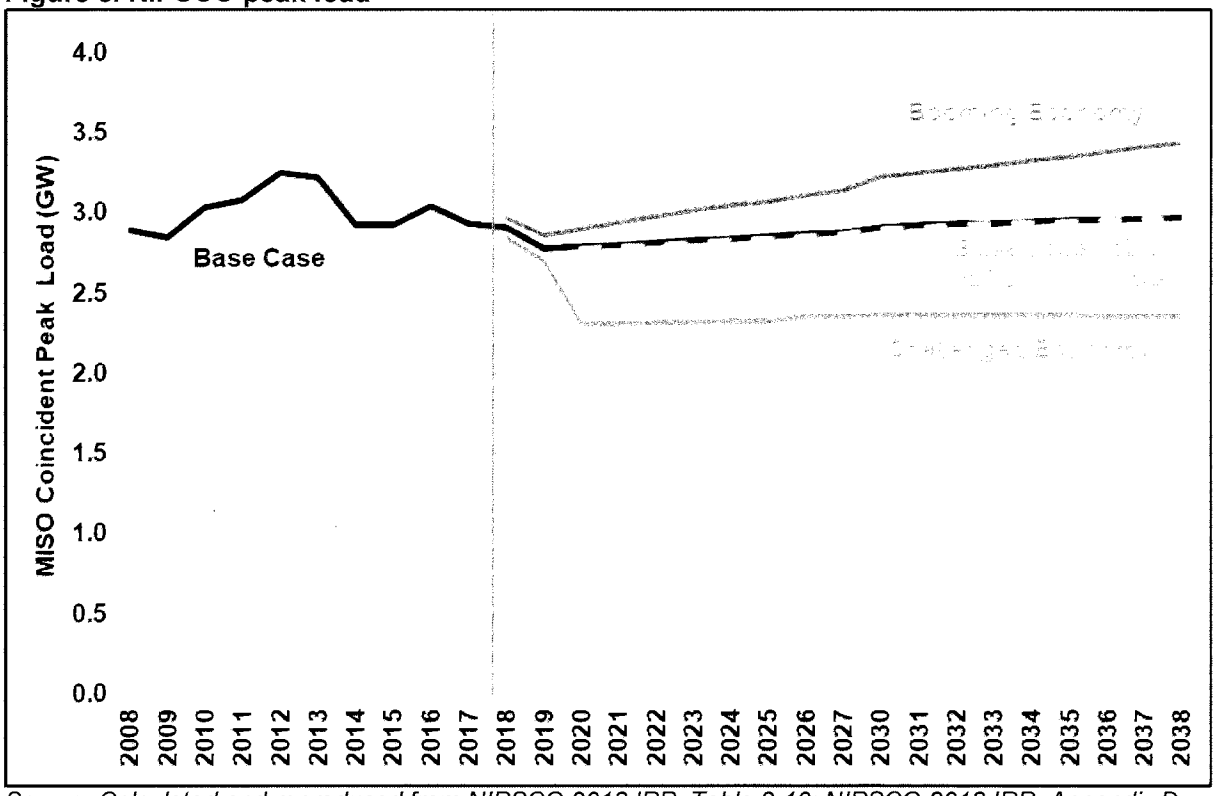
Yes. NIPSCO's IRP includes Baseline, Booming and Challenged forecasts of peak load and energy demand that are comparable to MISO's forecasts (see Table 12, Figure 8, and Figure 9). NIPSCO models a loss of industrial load in its Challenged scenario, but not in its Baseline scenario. While, ultimately, these alternative scenarios do not appear to have had an important effect on the choice of the preferred portfolio, more complete information should be included in the IRP regarding the assumptions behind these choices.

Table 12. MISO coincident peak load and total energy demand average growth rate (2021-2030)

	0.43%	0.38%
	0.24%	0.17%
	1.08%	1.02%
	0.24%	1.00%

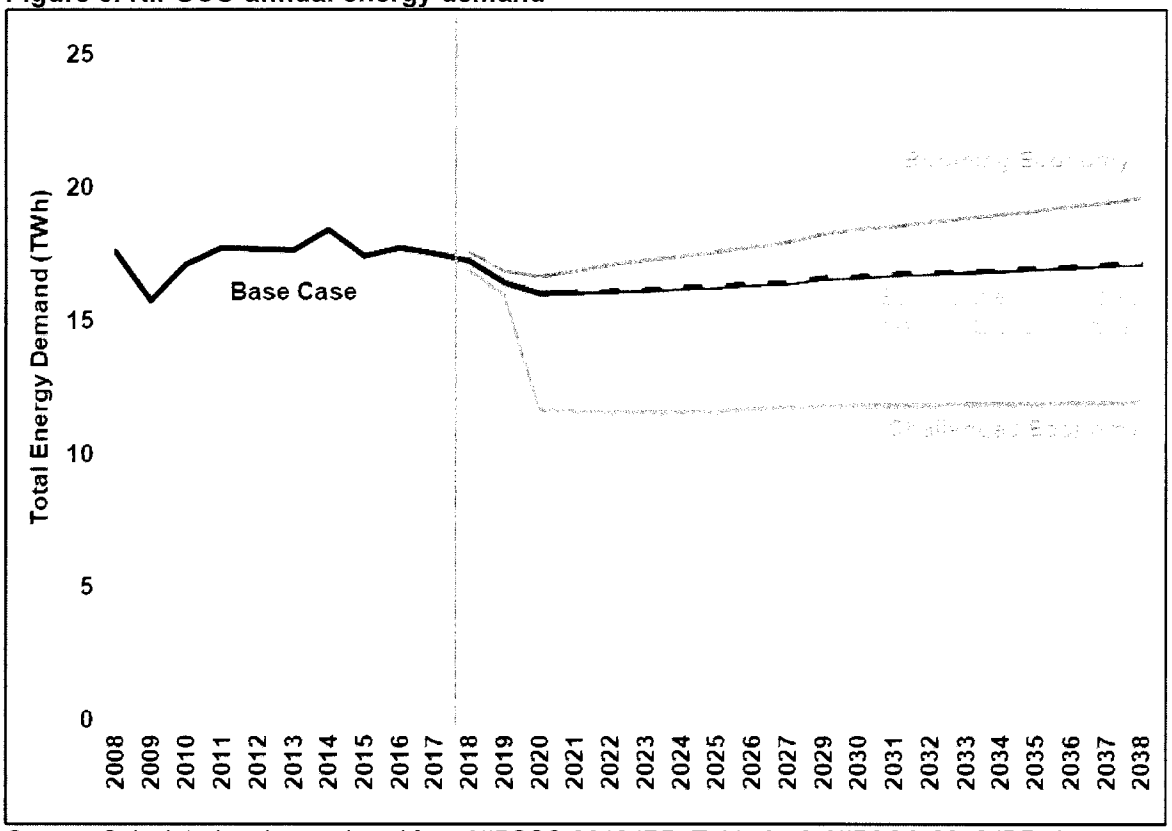
Source: Author calculations. Note: Numbers were calculated using peak load and energy demand values as opposed to growth rates. MISO had a constant growth rate.

Figure 8. NIPSCO peak load



Source: Calculated and reproduced from NIPSCO 2018 IRP, Table 3-10; NIPSCO 2018 IRP, Appendix D (MISO Coincident Peak Load Forecast (MW)), p. 172.

Figure 9. NIPSCO annual energy demand



Source: Calculated and reproduced from NIPSCO 2018 IRP, Table 3-10; NIPSCO 2018 IRP, Appendix D (NIPSCO Sales Forecast—Monthly; Pessimistic Case—Used in the Challenged Economy Scenario and Optimistic Case—Used in the Booming Economy/ Abundant Natural Gas Scenario), pp. 169-171.

9-3. Does the IRP provide an objective analysis of the resource required for its base and alternative scenarios?

Mostly. NIPSCO includes modeling of expected loss of industrial load in its Challenged Economy case but does not make this part of its Baseline, although this scenario design choice does not appear to have had an important effect on NIPSCO's selection of a preferred portfolio.

As discussed at the top of Section 9, it would be our preference to have loss of load explicitly modeled rather than rolled into a storyline scenario. But the lack of this modeling is largely mollified by:

1. NIPSCO's all-source RFP, which allowed it to characterize supply-side resources of many types with a highly accurate dataset.
2. The selection of renewables and other fuel-free resources to entirely make up the capacity and energy lost when existing units retire which completely eliminates fuel risk associated with those new resources.
3. The size in which renewables are typically contracted and/or purchased allows NIPSCO significantly more optionality to right size its resources in face of potential loss of load.

4. The expectation that "right-sizing" will take place as NIPSCO adds new resources because it is adding them in stages.
5. And fifth and finally, the savings from acquiring new resources over the continued operation of existing coal units is overwhelming in favor of the choice to retire and replace those existing coal units.

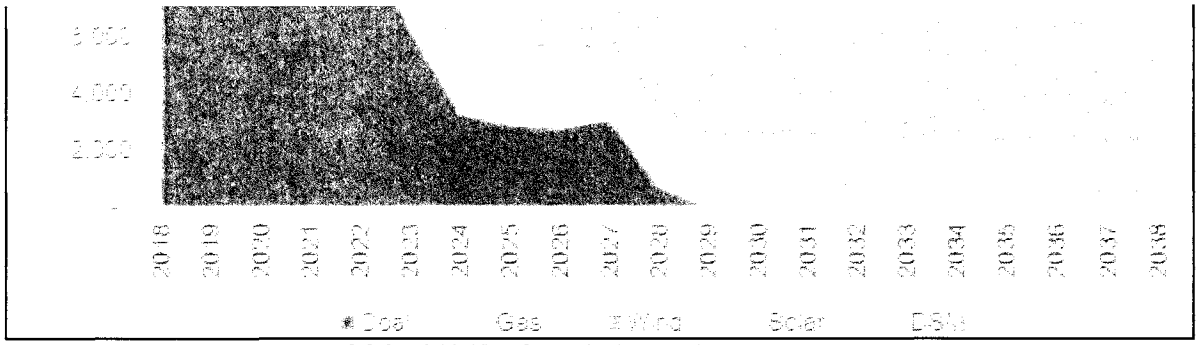
As NIPSCO comes to the IURC to seek approval for new resources, however, we would like to see a robust evaluation of the impacts of potential lost industrial load.

10. Is the selection of the preferred portfolio described?

Mostly. NIPSCO's 2018 IRP includes a forecast period of 20 years, performs an analysis of candidate resource portfolios across a range of future scenarios and selects a preferred resource portfolio that considers risk and uncertainty. More transparency would be beneficial in several areas including: details about specific capacity additions and retirements by year and size; the reasoning behind selecting retirement Portfolio 6 instead of Portfolio 8, which was less risky and less costly; and when and how sensitivity analyses versus stochastics analyses were used.

Table 13. Evaluation of selected Indiana IRP requirements regarding selection of preferred portfolio

	Requirement	Findings	Citation
[illegible]	[illegible]	Mostly	
10-1	A detailed description of the preferred resource portfolio	Mostly	170 IAC 4-7-4(1),(8),(9)
10-2	A forecast period of at least 20 years	Met	170 IAC 4-7-4(1),(8),(9)
10-3	A discussion of how the utility's resource planning objectives were balanced in selecting its preferred resource portfolio	Mostly	170 IAC 4-7-4(24)(A-D)
10-4	An analysis of candidate resource portfolios' performance across a wide range of future scenarios, which must be considered in selecting the preferred resource portfolio	Met	170 IAC 4-7-8 (a),(b),(c)
10-5	Preferred resource portfolio must include supply-side and demand-side resources that safely, reliably, efficiently, and cost-effectively meet the electric system demand and take cost, risk, and uncertainty into consideration	Mostly	170 IAC 4-7-8(c)(5)
10-6	Preferred resource portfolio must include supply-side and demand-side resource alternatives that were evaluated on a consistent and comparable basis	Mostly	170 IAC 4-7-8(c)(4)
10-7	Preferred resource portfolio must include an evaluation of DSM program impacts on the utility's transmission and distribution system	Not Met	170 IAC 4-7-8(c)(6)
10-8	Preferred resource portfolio must balance cost effectiveness, reliability, risk and uncertainty	Partial	170 IAC 4-7-8(c)
10-9	The selection of preferred resource portfolios must consider risk and uncertainty	Met	170 IAC 4-7-4(24)



Source: Reproduced from NIPSCO 2018 IRP Submission, p. 173.

10-2. Does the IRP include a forecast period of at least 20 years?

Yes. Section 9.3 in NIPSCO's IRP provides a description of their Preferred Replacement Portfolio over a forecast period of 20 years.

10-3. Does the IRP include a discussion of how the utility's resource planning objectives were balanced in selecting its preferred resource portfolio?

Mostly. Section 9.1 in NIPSCO's IRP details its retirement analysis, and Section 9.3 in NIPSCO's IRP provides a description of their Preferred Replacement Portfolio. While NIPSCO clearly presents its modeling approach and how different assumptions regarding various market outcomes were accounted for, it fails to adequately explain the reasoning behind selecting retirement Portfolio 6 instead of Portfolio 8 (see Figure 11). NIPSCO states that "[c]ombination 6

was selected because it was the lowest cost option that held acceptable reliability risk for customers and the system" because it "provides enough time to reasonably erect the necessary transmission upgrades that are critical for system and customer reliability."[22] NIPSCO fails to explain the ways in which these particular transmission upgrades are "critical for system and customer reliability" or what transmission upgrades have been deemed "necessary" to this end.

The difference in retirements between retirement Portfolios 6 and 8 is the date by which Michigan City 12 is retired: 2023 versus 2028. As such, there should be a clearer and more explicit rationale as to why the date of retirement matters for reliability and why the retirement of Michigan City 12 cannot be accelerated from 2028. This lack of information does not undermine the choice to retire any coal units at all—rather it is a question of when is retirement most appropriate because it clearly provides significant value to customers.

Figure 11. NIPSCO 2018 IRP Figure 9-9: Retirement Portfolio Scorecard

						Preferred Retirement Path		
	1	2	3	4	5	6	7	8
Portfolio Transition Target:	**65% Coal through 2035**	**40% Coal in 2023**	**15% Coal by 2028 w/ ELG**	**15% Coal by 2028 w/o ELG**	**15% Coal in 2023**	**15% Coal in 2023**	**15% Coal by 2023**	**0% Coal in 2023**
Retire:	None							
Retain beyond 2023:								None
Env. Compliance	CCR ELG non-CLO	CCR ELG non-CLO	CCR ELG non-CLO	CCR ELG Entered Retirement	CCR ELG Retirement	CCR ELG Retirement	CCR ELG Retirement	CCR ELG Retirement
Cost To Customer	$15,400	$12,911	$12,455	$12,336	$11,454	$11,943	$11,197	$10,974
Cost Certainty	$15,840	$13,155	$12,622	$12,502	$11,634	$11,504	$11,296	$11,132
Cost Risk	$17,406	$14,123	$13,225	$13,105	$12,252	$12,045	$11,750	$11,656
Reliability Risk	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable
Employees	0	125	125	125	276	276	276	426
Local Economy	+$118M	$0M	($23M)	($31M)	($65M)	($74M)	($74M)	($84M)

Source: Reproduced from NIPSCO 2018 IRP Submission, p. 155.

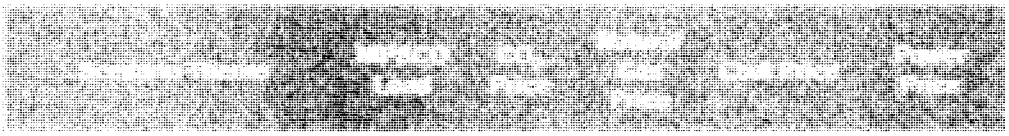
10-4. Does the IRP include an analysis of candidate resource portfolios' performance across a wide range of future scenarios, which were considered in selecting the preferred resource portfolio?

Yes. Section 8 in NIPSCO's IRP describes the four scenarios across which it analyzed its candidate resource portfolios: Base case, Aggressive Environmental Regulation, Challenged Economy, and Booming Economy and Abundant Natural Gas (see Figure 12). Detailed information about varying assumptions and projections across the scenarios is presented

[22] 2018 IRP Submission, p. 157.

throughout IRP Section 8. NIPSCO reports that each retirement portfolio—"including its associated least-cost capacity replacement"—was evaluated for each scenario and "across the full stochastic distribution of major market inputs."[23]

Figure 12. NIPSCO 2018 IRP Figure 8-20: Summary of Four Major Scenarios



Base	Base	Base	Base	Base	Base
Aggressive Environmental Regulation	Base	**High**	**High (CO_2)**	**Low (CO_2)**	**High (CO_2)**
Challenged Economy	**Low**	**Low**	**Low (No CO_2)**	**High (No CO_2)**	**Low (No CO_2)**
Booming Economy & Abundant Natural Gas	**High**	Base	**Low**	**Low (Low Gas)**	**Low (Low Gas)**

Source: Reproduced from NIPSCO 2018 IRP Submission, p. 124.

10-5. Does the preferred resource portfolio include supply-side and demand-side resources that safely, reliably, efficiently, and cost-effectively meet the electric system demand and take cost, risk, and uncertainty into consideration?

Mostly. Section 9.2.3 in NIPSCO's IRP presents the development of specific replacement portfolios, while IRP Section 9.3.2 presents its preferred plan. All replacement portfolios included demand-side resources (see Figure 4 and Figure 5 above), as did NIPSCO's preferred portfolio (see Figure 10 above). All replacement portfolios were analyzed according to six metrics that were defined prior to the commencement of analysis: cost to consumer, cost certainty, cost risk, fuel security, environmental, and local economy (see Figure 6 above).

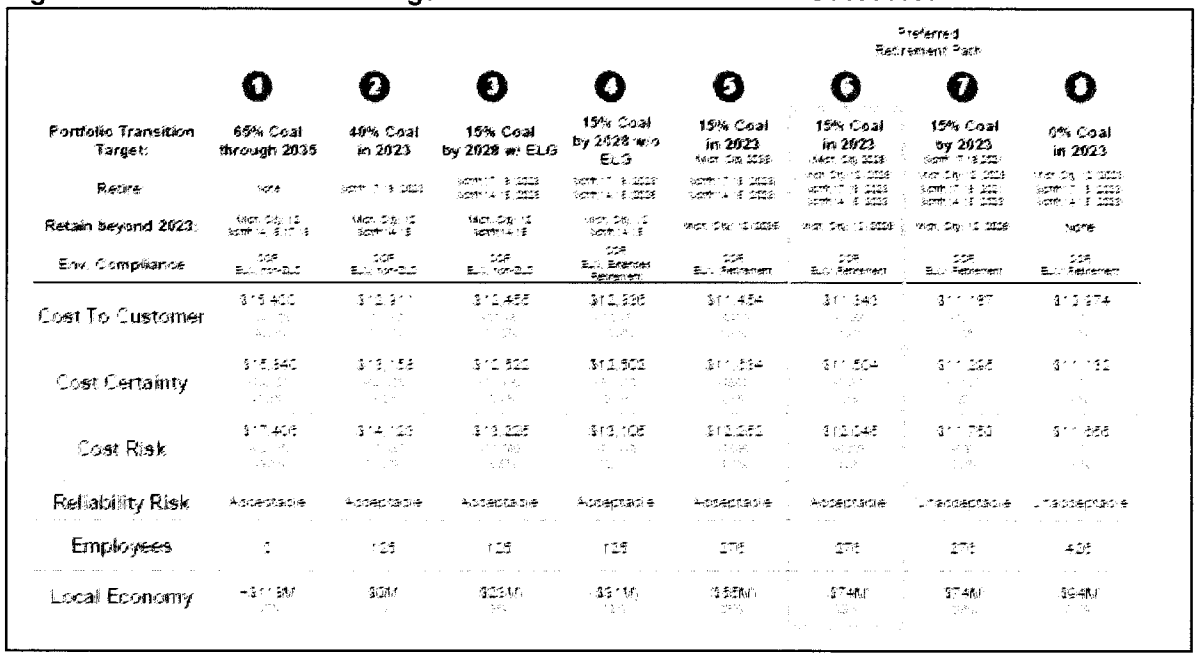
The selection of NIPSCO's preferred resource portfolio does take cost, risk, and uncertainty into consideration (see Figure 13). NIPSCO's explanation of its choice of when to use a sensitivity analysis versus when to use stochastics should be clearer and more detailed, and NIPSCO's explanation of its stochastic analysis should be more approachable to non-technical readers. We would encourage NIPSCO to provide more information that can better allow stakeholders and the Commission the ability to assess whether its analysis of risk and uncertainty produces useful results.

NIPSCO's scorecard grading system is a distinct improvement on the scorecard presented in its 2016 IRP. The Company has moved towards much greater transparency by abandoning color coding and qualitative grading. NIPSCO's 2018 IRP has also left out the "portfolio diversity" grade category used in its 2016 IRP, which biased overall portfolio grades against those with

[23] 2018 IRP Submission, p. 145.

more renewable resources.[24] Other Indiana utilities would do well to adopt these same improvements.

Figure 13. NIPSCO 2018 IRP Figure 9-9: Retirement Portfolio Scorecard



	Preferred Retirement Path							
	❶	❷	❸	❹	❺	❻	❼	❽
Portfolio Transition Target:	65% Coal through 2035	40% Coal in 2023	15% Coal by 2028 w/ ELG	15% Coal by 2028 w/o ELG	15% Coal in 2023	15% Coal in 2023	15% Coal by 2023	0% Coal in 2023
Retire	None	North 1 & 2023	North 1 & 2023 North 4 & 2028	North 1 & 2023 North 4 & 2028	North 1 & 2023 North 4 & 2028	North 1 & 2023 North 4 & 2028	North 1 & 2023 North 4 & 2023	North 1 & 2023 North 4 & 2023
Retain beyond 2023:	Mich. City 12 North 4 & 5	Mich. City 12 North 4 & 5	Mich. City 12 North 4 & 5	Mich. City 12 North 4 & 5	Mich. City 12	Mich. City 12	Mich. City 12	None
Env. Compliance	SCR Bucl. non-ELG	SCR Bucl. non-ELG	SCR Bucl. non-ELG	SCR Bucl. Extended Retirement	SCR Bucl. Retirement	SCR Bucl. Retirement	SCR Bucl. Retirement	SCR Bucl. Retirement
Cost To Customer	$15,400	$12,911	$12,455	$12,595	$11,454	$11,343	$11,187	$13,874
Cost Certainty	$15,540	$13,158	$12,822	$12,903	$11,534	$11,504	$11,285	$11,132
Cost Risk	$17,406	$14,123	$13,225	$13,105	$13,261	$13,045	$11,750	$11,656
Reliability Risk	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable
Employees	0	125	125	125	275	275	275	425
Local Economy	+$11.5M	$0M	$23M	$3.1M	$55.5M	$74M	$74M	$94M

Source: Reproduced from NIPSCO 2018 IRP Submission, p. 155.

10-6. Does the preferred resource portfolio include supply-side and demand-side resource alternatives that were evaluated on a consistent and comparable basis?

Mostly. The use of its all-source RFP data to characterize potential near-term resource additions gives us a unique level of confidence that NIPSCO has appropriately characterized supply-side additions. Our main concern has to do with the limitations of the market potential study update and the fact that it forms the basis for the energy efficiency bundles. In that respect, NIPSCO's analysis is not consistent and comparable.

10-7. Does the preferred resource portfolio include an evaluation of DSM program impacts on the utility's transmission and distribution system?

No. As we recommend in Section 5.4 above, we would encourage NIPSCO to develop a process for a non-wires alternatives analysis to traditional distribution system upgrades that includes consideration of targeted energy efficiency programs. We also recommend that a specific level of energy efficiency not be chosen in the IRP precisely because most IRP models

[24] *See* CAC *et al.*'s Report on NIPSCO 2016 IRP, March 16, 2017, p. 46, available here: https://www.in.gov/iurc/files/CAC%20EJ%20IDEA%20SC%20WP%20Comments%20on%20NIPSCO%20IRP%20PUBLIC--3-16-17.pdf

ignore potential transmission and distribution benefits, but those benefits are ultimately captured in the DSM screening phase.

10-8. Does the preferred resource portfolio balance cost effectiveness, reliability, risk and uncertainty?

Partially. Using its improved scorecard method, NIPSCO balances cost effectiveness, reliability, risk and uncertainty throughout its presentation and comparison of candidate portfolios. NIPSCO's choice of Portfolio 6 over Portfolio 8 balances costs against reliability issues, choosing the least costly portfolio for which reliability risks are found to be acceptable by NIPSCO.

However, NIPSCO does not provide compelling evidence of its reliability concerns, but rather asserts that these unsubstantiated concerns trump other metrics. If reliability is placed at risk by less costly scenarios, NIPSCO should demonstrate this by presenting specific evidence to support that contention. If the nature of the risk is more nebulous, it would be more appropriate to plan to achieve the least-cost scenario, i.e., advancing retirement of Michigan City 12, as rapidly as reliability allows with a backstop of NIPSCO's proposed preferred resource portfolio.

10-9. Does the selection of the preferred resource portfolio consider risk and uncertainty?

Yes. NIPSCO's IRP considers risk and uncertainty in peak load, CO_2 price and commodity prices (see Section 9 of this Report above).

It should be noted, however, that only the modeler-selected retirement and replacement portfolios are subject to a risk and uncertainty analysis. For future IRPs, it would be helpful to have not just modeler-selected retirement and replacement portfolios subjected to the risk and uncertainty analysis, but also to have the optimized portfolios undergo some level of risk and uncertainty analysis before the portfolios are selected. This would allow stakeholders and Commission staff the ability to understand the tradeoffs between optimal retirement dates and the Company's preferred retirement dates, if different, as well as the ability to understand how the optimal portfolio might differ from the preferred portfolio, again, assuming they are different.

11. Are the impacts of the preferred portfolio described?

Yes. NIPSCO's 2018 IRP describes: a workable strategy to adapt the preferred resource portfolio to unexpected changes; the financial impact of the preferred resource portfolio; and its short-term action plan for 2019-2021 that focuses on retiring its Schahfer units and procuring replacement resources.

Table 14. Evaluation of selected Indiana IRP requirements regarding impacts of the preferred portfolio

	Requirement	Findings	Citation
11-1	IRP must incorporate a workable strategy to adapt the preferred resource portfolio in reaction to unexpected changes in circumstances	Met	170 IAC 4-7-8 (c)(10)
11-2	Financial impact to the utility of acquiring the future resources identified in the preferred resource portfolio must be assessed	Met	170 IAC 4-7-8 (c)(7)(A-C)
11-3	IRP must include a short-term action plan for the next three year period to implement the utility's preferred resource portfolio and its workable strategy	Met	170 IAC 4-7-9 (a),(b),(c)

11-1. Does the IRP incorporate a workable strategy to adapt the preferred resource portfolio in reaction to unexpected changes in circumstances?

Yes. Section 9.4 in NIPSCO's IRP describes the strategy to adapt the preferred resource portfolio to unexpected changes: "To fill any short term capacity needs during this period, NIPSCO will rely on MISO market purchases or short term PPA(s)."[25] This is likely to be a reasonable approach to the issue of any short-term deficits in capacity.

11-2. Does the IRP include an assessment of the financial impact to the utility of acquiring the future resources identified in the preferred resource portfolio?

Yes. Section 9.3.3 in NIPSCO's IRP describes the financial impact of the preferred resource portfolio, and the information is summarized in IRP Figure 9-31 (see Figure 14).

[25] 2018 IRP Submission, p. 178.

Figure 14. NIPSCO 2018 IRP Figure 9-31: Financial Impact Summary

Financial Impact Summary	
Operating Costs ($000)	7,357,588
Capital Costs ($000)	4,405,775
Total Revenue Requirement ($000)	11,763,363
Total Energy Requirement (GWh)	263,994
Cents/kWh	5.77

Note that Total Energy Requirement is the cumulative amount for years in analysis forecasts, rather than a total sum. This is done to allow for the cents per kWh summary to be reflective of a levelized net present value calculation.

Source: Reproduced from NIPSCO 2018 IRP Submission, p. 175.

11-3. Does the IRP include a short-term action plan for the next three-year period to implement the utility's preferred resource portfolio and its workable strategy?

Yes. Section 9.4 in NIPSCO's IRP details its short-term action plan for 2019-2021, summarized in IRP Figure 9-32 (see Table 15), that focuses "mainly on initiating the planning process for the retirement of the Schahfer 14,15,17,18 units and beginning the procurement of replacement resources."[26]

[26] 2018 IRP Submission, p. 178.

Table 15. NIPSCO 2018 IRP Figure 9-32: Short-Term Action Plan Summary

Initiate retirement of Schahfer units 14,15,17,18 by making required notifications to MISO, NERC and other organizations
Identify and implement required reliability and transmission upgrades resulting from retirement of the units
Select replacement projects identified from the 2018 All-Source RFP evaluation process, prioritizing resources that have expiring federal tax incentives to achieve lowest customer cost
File CPCN(s) and other necessary approvals for selected replacement projects
Procure short-term capacity as needed from the MISO market or through short-term PPA
Continue to actively monitor technology and MISO market trends, while staying engaged with project developers and asset owners to understand landscape
Conduct a subsequent All-Source RFP to identify preferred resources to fill remainder of 2023 capacity need (likely renewables and storage)
Continue implementation of filed DSM Plan for 2019 to 2021
Comply with NERC, EPA and other regulations
Continue planned investments in infrastructure modernization to maintain the safe and reliable delivery of energy services

Source: Reproduced from NIPSCO 2018 IRP Submission, p. 179.

12. Did the IRP process include adequate consultation with stakeholders?

Yes. NIPSCO's IRP process included adequate consultation with stakeholders. NIPSCO was responsive to our requests for information and requests for meetings and discussions. NIPSCO provided opportunities to review and solicited feedback on its RFP and was responsive to our suggested changes to such. Generally, we are pleased with NIPSCO's great strides since its 2016 IRP submission. However, there is always room for further improvement. For example, as we previously discussed, the absence of the model manual and other critical data from Aurora does not align with the goals of the IRP stakeholder process. We would also suggest NIPSCO's IRP narrative could have better captured specific stakeholder comments on the RFP and on the IRP scenario construction, or highlighted the stakeholder-led development of the decrement load analysis.

Table 16. Evaluation of selected Indiana IRP requirements regarding consultation with stakeholders

	Requirement	Findings	Citation
[illegible]	[illegible]	[illegible]	[illegible]
12-1	A discussion of the most recent public advisory process, including key issues discussed	Met	170 IAC 4-7-4(30)
12-2	A discussion of how the utility responded to the issues raised during the public advisory process	Met	170 IAC 4-7-4(30)
12-3	A description of how stakeholder input was used in developing the IRP	Met	170 IAC 4-7-4(30)

12-1. Does the IRP include a discussion of the most recent public advisory process, including key issues discussed?

Yes. Section 2.1 in NIPSCO's IRP describes its IRP Public Advisory Process, and includes a summary of each stakeholder meeting, the issues discussed, and how NIPSCO took account of stakeholder feedback. We appreciate that NIPSCO made constructive efforts to address stakeholder feedback.

12-2. Does the IRP include a discussion of how the utility responded to issues raised during the public advisory process?

Yes. In addition to Section 2.1 in NIPSCO's IRP that describes its IRP Public Advisory Process (detailed above), NIPSCO's IRP also includes stakeholder materials in Appendix A. NIPSCO did a thorough job of capturing stakeholder questions and comments and providing written answers as part of those meeting summaries.

12-3. Does the IRP include a description of how stakeholder input was used in developing the IRP?

Yes. Section 4.9.2 in NIPSCO's IRP describes its all-source RFP and acknowledges that stakeholder input was used to develop the RFP. However, there is room for improvement. NIPSCO should describe in more detail how stakeholder input is used in the IRP and how it influenced the development of the IRP. While NIPSCO's attempt at the decrement load analysis was presented at a stakeholder workshop (as shown in Appendix A), it is not described in the main narrative of the IRP itself.