Comments on Entergy Louisiana's 2015 Integrated Resource Plan

Strengths, Weaknesses, and Implications

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CONTENTS

INTRODUCTION....................1

1. MODEL STRUCTURE....................1

1.1. Prescribed Retirements....................3

1.2. Regulatory Risk....................4

1.3. Scenarios....................6

2. INPUT ASSUMPTIONS....................8

2.1. Load Forecasts....................8

2.2. CO_2 Price....................10

2.3. Cost and Availability of Wind Resources....................12

2.4. Demand-Side Management Potential....................13

2.5. Changes to Inputs....................15

3. RESULTS AND ACTION PLAN....................16

4. CONCLUSION....................18

INTRODUCTION

Synapse Energy Economics was retained by Sierra Club to review the results of Entergy Louisiana's 2015 Integrated Resource Plan (IRP) in order to provide feedback on the Company's modeling inputs and methodology, and provide recommendations to improve future planning documents. Our comments are based on the limited information Entergy has made publicly available during the stakeholder engagement process. Synapse has identified nine major concerns that we believe skew the results of the current IRP and will require improvement in future IRPs. In particular, Entergy:

1) Appears to have forced the Aurora model to retire some units while preventing it from retiring others;
2) Presents no thoughtful discussion on regulatory risks associated with continued operation of its coal fleet;
3) Designed the structure of the IRP to focus on a limited set of unrealistic scenarios;
4) Used unrealistically high forecast for load growth;
5) Failed to properly incorporate realistic costs associated with forthcoming regulations of carbon dioxide (CO_2) emissions;
6) Assumes unreasonably high costs associated with procuring wind resources;
7) Underestimated the potential for and benefits of demand-side management (DSM);
8) Altered key input assumptions without providing justification or details of these changes to the public; and,
9) Produced results that are so unintuitive that it calls into question the entire modeling methodology.

1. MODEL STRUCTURE

Preparing for long-term, least-cost planning involves modeling the economics of existing and potential resources to find an optimal plan that minimizes the costs of providing power to ratepayers. These resources typically include supply- and demand-side resources, market purchases, and power purchase agreements (PPAs). Existing resources should be dispatched in the order of ascending cost of operation (given load levels and other constraints). When existing plants are no longer economic, cannot economically meet regulatory constraints, or there is a need for new capacity or energy, the model should select new resources, either from construction of new resources or market purchases.

With a suite of environmental regulations either in effect today or due to come into effect in the near future, a significant part of modeling the future economics of available resources should involve consideration of the costs of compliance with these regulations.

In addition, to ensure that the Company is appropriately accounting for future uncertainties, the system must also be tested under reasonable ranges of variables that will influence the outcome of the modeling. At the very least, resource planning should be conducted under a range of variables including, but not limited to: fuel prices, energy prices, capacity prices (where applicable), environmental regulations, and demand.[1]

Entergy appears to have deviated from these best practices in three ways. First, it chose to limit the model's ability to select the optimal resource mix by preventing the model from retiring certain units, regardless of the units' economic viability. Second, Entergy failed to consider the costs of environmental compliance—a critical factor in the future economic viability of the Company's coal plants, considering the number and scope of the impending environmental regulations that Company's coal fleet will be subject to. And finally, the Company chose not to run true sensitivities. In a true sensitivity test, a reference case is first developed and then each variable is changed (independently or in certain combinations) so that the variable's impact on the reference case can be determined. Instead, as demonstrated in Table 1 below, Entergy groups these variables into futures termed "scenarios."

Table 1. Summary of scenario descriptions and assumptions

Name of scenario	Description of assumptions that underline the scenario
Industrial Renaissance	Labeled as a reference case, this scenario envisions a world with a reference case fuel price, "considerable" load growth, and no CO_2 costs.
Business Boom	This scenario assumes that low gas and low coal prices will drive very high load growth; this worldview incorporates a "modest" CO_2 price.
Distributed Disruption	This scenario envisions a world in which customers continue to conserve energy or self-generate which suppresses load growth (as compared to the other three scenarios). It assumes a reference case CO_2 price and a reference case natural gas price.
Generation Shift	Under an assumption of continued support for clean energy and renewables, this worldview assumes a slightly higher CO_2 price and high fuel prices.

Entergy Gulf States Louisiana and Entergy Louisiana. "2015 Draft Integrated Resource Plan," page 18.

Notably, there is no "business-as-usual" or reference case with which to compare the results from these scenarios. Moreover, it is difficult to observe the impact of individual variables given the Company's structure.

We discuss the ways in which Entergy has deviated from these best practices in further detail below.

[1] Wilson, R., B. Biewald. 2013. B*est Practices in Electric Utility Integrated Resource Planning: Examples of State Regulations and Recent Utility Plans*. Synapse Energy Economics for Regulatory Assistance Project.

1.1. Prescribed Retirements

Utilities across the country are planning for a number of environmental regulations that will result in significant costs to the continued operation of coal plants. Prudent planning requires any company that owns a coal-fired power plant to rigorously and thoroughly investigate the risk its coal plants pose to its ratepayers. An IRP process is the appropriate time to perform such an analysis and investigate the economic viability of continuing to operate these units. Decisions surrounding the continued operation or retirement of existing plants are fundamentally the same as those surrounding new asset procurement: the need for capital investments, variable costs, fuel costs, fixed costs, and regulatory costs should influence the decision to build new units or shut down old units. However, in its 2015 Draft IRP, Entergy seems to have ignored even the potential for idling or retiring any of its coal units.

Decisions on procurement and retirement of resources can be made using a capacity expansion (or optimization) model that selects new and existing units for operation. In the 2015 IRP, the Company uses the $Aurora_{XMP}$ model, which offers a platform to review economic additions and retirements from the Entergy system. However, in the IRP results document, Entergy states that retirement of non-Entergy units will retire at 50, 60, or 70 years old, depending on the model scenario.[2] For Entergy-owned resources, "the Companies have assumptions regarding the deactivation of approximately 5,950 MW of older gas fired steam generators over the planning period."[3] And in response to stakeholder comments, the Company states that, "throughout the planning period all Entergy coal units are assumed to continue to operate. These units will continue to operate as long as it is economic to do so."[4] These statements suggest that retirement/deactivation dates are based on assumptions made by the Company that are then fed into the Aurora model. If that is the case, the Aurora model was not allowed to choose optimal resources additions or retirements. Instead, the Company is pre-selecting the resources rather than using the model's full capabilities for optimizing its resources. As a result, even if existing coal units were to become uneconomic in the future, they would still be allowed to continue to operate.

The Aurora model is more than capable of handling complex assumptions about when new costs will be incurred, how those costs will impact dispatch of the units, and the resulting economic viability of individual units. The Company should optimize the build-out of new resources while accounting for the changes in load and the possible retirement of existing resources. This means that coal retirements should be optimized compared to other options in the modeling (such as MISO market purchases), not pre-defined or "hardwired" into the model. While hardwiring resources in a model to meet state and federal regulatory requirements may be reasonable for certain circumstances (e.g., to comply with an existing or proposed Energy Efficiency or Renewable Portfolio Standard), by assuming the continued operation of all coal units, Entergy denies its ratepayers the opportunity to find cost-effective

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[2] Entergy Gulf States Louisiana and Entergy Louisiana. 2015. *2015 Draft Integrated Resource Plan*. Appendix C, Page 6. LPSC Docket No. I-33014.

[3] Ibid, page 35.

[4] Ibid, Appendix C, page 1.

alternatives to those resources. Ultimately, Entergy's failure to allow for uneconomic coal plants to retire likely places upward pressure on rates over the long term.

1.2. Regulatory Risk

In order to continue operations, Entergy's coal units will face significant environmental compliance costs from regulations such as National Ambient Air Quality Standards (NAAQS), Acid Rain Program, the Cross-State Air Pollution Rule (CSAPR), Mercury and Air Toxics Standards (MATS), the Regional Haze Rule, Clean Water Act section 316(b), Effluent Limitation Guidelines (ELG), and Coal Combustion Residuals (CCR), in addition to potential greenhouse gas regulations. Although the Commission's IRP rules explicitly require Entergy to account for environmental impacts and discuss plans to meet environmental regulatory requirements at its affected facilities, the public documents presented in support of Entergy's IRP fail to disclose, let alone evaluate, any of these impending regulations.[5]

In response to stakeholder questions, the Company has stated that "[t]he IRP does consider all known and expected environmental cost of resources including carbon," and that "[t]he IRP does evaluate a range of environmental compliance costs in regards to CO_2, SO_2, and NO_X."[6] However, it appears that the costs associated with forthcoming environmental compliance obligations that the IRP considers only pertain to emission allowances associated with CO_2, SO_2, and NO_X.

The Company makes no apparent effort to incorporate the impact of future environmental regulations on existing units, particularly with respect to how those units may incur additional capital and operating costs from installing new environmental controls.[7] However, Entergy is well aware of the regulatory risks associated with continued operation of its coal units; the Company discusses each one of those regulations, and the risks associated with compliance, in its annual reports filed to the U.S. Securities and Exchange Commission (SEC).[8] In the Company's 2014 SEC 10-k Form, Entergy states that it has developed or is in the process of developing a compliance plan for each of these regulations. Such plans go unmentioned in the IRP and its supporting documents.

As Entergy has recognized, several of these regulations explicitly implicate Entergy's Louisiana and Arkansas coal-fired electric generating units. For example:

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[5] Louisiana Public Service Commission. 2012. *Integrated Resource Planning Rules for Electric Utilities in Louisiana* at ¶ 7(d). LPSC Docket No. R-30021.

[6] Entergy Gulf States Louisiana and Entergy Louisiana. 2015. *2015 Draft Integrated Resource Plan*. Appendix C, page 6. LPSC Docket No. I-33014.

[7] Also omitted from the IRP discussion are the ongoing LDEQ negotiations regarding past "deviations" in their carbon monoxide emission limits at Nelson Unit 6. These negotiations may result in any number of outcomes that could materially affect the future operations of Entergy owned units. Entergy 2014 10-k, page 266-267.

[8] Entergy Corporation. 2015. Form 10-K, 2014 Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. Page 262-272.

- In April of 2012, EPA designated Baton Rouge, Louisiana—which falls within Entergy's utility service area—as being in "marginal" nonattainment for ozone under NAAQS and that "Entergy facilities in these areas may be subject to installation of NOx controls."[9] Depending on which facilities are required to install retrofits, Entergy may be required to construct low NO_X burners, Selective Non-Catalytic Converters (SNCR) or Selective Catalytic Converters (SCR) at one or more of the Company's facilities.

- In July of 2013, EPA issued final nonattainment designations for (sulfur dioxide) SO_2 1-hour NAAQS, which included St. Bernard Parish, Louisiana, in Entergy's service territory. Further, on March 2, 2015, the United States District Court for the Northern District of California entered a consent decree that will require EPA to make additional SO_2 NAAQS nonattainment designations for areas that contain a stationary source that emitted more than 2,600 tons of SO_2 and had an annual average emission rate of 0.45 lbs of SO_2 per Mmbtu or higher in 2012.[10] As Entergy has recognized in shareholder and SEC disclosures, "[a]dditional capital projects or operational changes may be required for Entergy facilities in these areas."[11] Indeed, to control for SO_2, Entergy may be required to construct either wet or dry flue-gas desulfurization systems at one or more of the Company's electric generating units.

- The Mercury and Air Toxics Standard (MATS) rule was finalized in December 2011 with a compliance deadline of 2015. According to the Company, "Entergy has applied for and received a one-year extension, as allowed by the Clean Air Act, for its affected facilities in Arkansas and Louisiana." Yet the Company makes no mention of these compliance plans in its IRP or how they might impact its existing fleet in Louisiana.

- On March 6, 2015, in response to Arkansas's failure to promulgate an approvable State Implementation Plan (SIP) for Regional Haze and as required under the Clean Air Act, EPA proposed a Federal Implementation Plan (FIP) that will require Entergy to install and operate dry flue-gas desulfurization technology to control SO_2 at both the White Bluff and Independence power plants.[12] The EPA Regional Haze FIP will further require the installation of best available retrofit technology (BART) for nitrogen oxides at both facilities. Despite knowledge of EPA's March 12, 2012 disapproved Arkansas' Regional Haze SIP,[13] which necessitated a revised SIP or FIP within two years, Entergy's IRP fails to acknowledge the significant environmental compliance costs associated with continuing to operated either of those facilities.

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[9] Ibid, page 263.

[10] See Sierra Club v. McCarthy, No. 3:13-cv-3953-SI (N.D. Cal. Mar. 2, 2015) (Consent Decree).

[11] Entergy Corporation. 2015. Form 10-K, 2014 Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934, page 264.

[12] EPA. 2015. Promulgation of Air Quality Implementation Plans; State of Arkansas; Regional Haze and Interstate Visibility Transport Federal Implementation Plan at 93-94, 99-101, 160-61, 167-69 (pre-publication version signed Mar. 6, 2015). Available at: http://www.epa.gov/region6/6xa/pdf/log_633_ar_rh_fip_proposed_frn_signed_030615.pdf.

[13] 77 Fed. Reg. 14604 (Mar. 12, 2012).

- Similarly, Entergy's IRP fails to evaluate, let alone acknowledge in the public draft of the IRP, the potential costs associated with a revised Regional Haze rule for its Louisiana facilities. On July 3, 2012, EPA partially disapproved Louisiana's Regional Haze SIP based in part on the state's failure to impose SO_2 BART emission limits for eligible facilities.[14] That finding triggered a "mandatory FIP clock" under which the state (or EPA, if the state fails to act) must promulgate legally defensible, source-by-source BART determinations for Louisiana sources. Although both Big Cajun 2 and R.S. Nelson are BART-eligible, and therefore could require additional controls under any Regional Haze plan, Entergy's IRP fails to account for, or even mention, these potentially significant environmental compliance risks.

Complying with these regulations will cost Entergy's ratepayers significantly, and it would be detrimental to ratepayers for Entergy to ignore these costs. The Company's IRP is an opportunity to evaluate alternative plans that could save ratepayers money in the long run. This process should include the costs associated with environmental compliance. Unfortunately, Entergy has not provided information on these costs. If these costs are being included in the background, then the Company is not being transparent. If these costs are not being included, then the Company is being negligent. In either case, Entergy must re-evaluate and disclose the environmental regulatory risk associated with the continued operation of its coal-fired electric generating unit fleet.

1.3. Scenarios

For the 2015 IRP, Entergy created four scenarios (or futures) to develop alternative resource portfolios. These four scenarios represent combinations of assumptions simplified into just the four independent "worldviews." Table 3 of the Draft IRP outlines the key assumptions of each of these worldviews.[15] Rather than test sensitivities of these assumptions against a reference case, the Company developed fixed assumptions regarding emissions prices, load growth, energy efficiency, and renewable energy requirements within each worldview in an unsystematic way.

[14] 77 Fed. Reg. 39425 (July 3, 2012).

[15] Entergy Gulf States Louisiana and Entergy Louisiana. 2015. *2015 Draft Integrated Resource Plan*. Page 19. LPSC Docket No. I-33014.

Table 2. Summary of scenario assumptions in each worldview

Summary of Key Scenario Assumptions				
	Industrial Renaissance (Ref. Case)	**Business Boom**	**Distributed Disruption**	**Generation Shift**
Electricity CAGR (Energy GWh)[23]	~1.45%	~1.70%	~0.90%	~1.20%
Peak Load Growth CAGR	~1.05%	~1.10%	~0.75%	~0.85%
Henry Hub Natural Gas Price ($/MMBtu)	Reference Case ($4.87 levelized 2014$)	Low Case ($3.84 levelized 2014$)	Reference Case ($4.87 levelized 2014$)	High Case ($8.17 levelized 2014$)
CO_2 Price ($/short ton)	Low Case: None	Reference Case: Cap and trade starts in 2023 $6.83 levelized 2014$	Cap and trade starts in 2023 $6.83 levelized 2014$	Cap and trade starts in 2023 $14.61 levelized 2014$

Source: Entergy Gulf States Louisiana and Entergy Louisiana. "2015 Draft Integrated Resource Plan," page 19.

For example, in none of the scenarios are the reference case Henry Hub natural gas price, coal price, load projection, and CO_2 price simultaneously used. Thus, at no point does the Company actually run a true reference case scenario. The "Industrial Renaissance" case is reported as the reference case; however, it uses the no CO_2 price (which is the Company's "low case") and includes "considerable load growth," neither of which are appropriate to use in a reference case.[16]

It is also unreasonable to assume that variations in commodity prices, such as natural gas and coal prices, are as highly correlated as the Company assumes them to be. In at least three of the four scenarios, the Company explicitly assumes that high, reference, or low coal prices will be accompanied by high, reference, or low natural gas prices (respectively).[17] In fact, because the Company assumes that all of these variables must be highly correlated, it is extremely unlikely that any of the scenarios run by the Company will actually transpire. Changes in the regulatory environment, developments in technology, and global demand push and pull the market price of coal and natural gas; these prices do not necessarily move in lockstep. By forcing these four artificial worldviews, the Company denies the Commission and stakeholders the opportunity to review the real risks entailed in uncertain commodity price futures.

[16] Ibid.

[17] Ibid.

Where Entergy has developed high, mid, and low forecasts for variables, it should run true sensitivities with those projections that are independent of the other variables and in combination with other variables. Regrettably, Entergy has chosen to employ a mechanism that systematically biases modeling results and confuses reasonable decision-making.[18] Because Entergy never developed a reference case, the sensitivities the Company does run only tell a partial story. And because the Company never ran sensitivities regarding capacity prices, environmental regulations, or demand, it hasn't evaluated a reasonable range of possible outcomes. Given the scale of the planning decisions and sizeable investments that depend on this IRP, the marginal effort required to set up and run additional scenarios is truly *de minimis*. Moreover, additional sensitivity runs around a true reference case would provide valuable information to the Company, Commission, and stakeholders on the many inherent risks associated with the Company's portfolio. It should be noted that it appears that during the IRP stakeholder process, Entergy was developing a true reference case (see below); however, it appears the Company abandoned that by the time the 2015 Draft IRP was released.

2. INPUT ASSUMPTIONS

Entergy's assumptions will have a dramatic impact on what resources are considered optimal on a forward-going basis in the modeling. In this section, we discuss Entergy's assumptions regarding load forecasts, CO_2 prices, cost of renewable resources, and demand-side management potential. While no forecast is perfect, there are often estimates that either represent an industry consensus, or are at least based on public methodologies that have undergone vetting and critique. This section will also discuss changes to inputs that Entergy appears to have made without justification or public disclosure.

2.1. Load Forecasts

Testing resource plans against different load forecasts, both high and low, is a critical sensitivity since it determines how much supply and demand resources are needed. However, the value of exploring alternative load forecasts is reduced when those forecasts are not meaningfully different from the reference case forecast. In its 2015 Draft IRP, Entergy assumes an unrealistically high load growth in both its reference case and in its lowest forecast—especially as compared to the Company's previous load forecasts, as shown in Table 3. In its 2013 Data Assumptions filing, Entergy forecasted a compound annual growth rate (CAGR) of 0.95 percent across the 10-year period. In February 2014, Entergy

[18] The Company eventually does run sensitivities but uses the Industrial Renaissance Scenario as the base. However, as noted above, the Industrial Renaissance does not accurately represent a reference case. And several important variables, including load, are never tested.

assumed a 20-year CAGR in the reference case of 0.8 percent.[19] These reference case forecasts seem to have been abandoned at the same time the Company decided to label the Industrial Renaissance as a reference case. In the 2015 Draft IRP, Entergy increased load growth, using a 20-year CAGR of 1.45 percent for the Industrial Renaissance—a 45 percent increase over the 2014 Industrial Renaissance forecast and a 81 percent increase over the original reference case forecast. Entergy's other scenarios use a range of annual growth forecasts of 0.9 percent to 1.7 percent in the other three scenarios—significantly higher growth rates than assumed by the Company previously.

Table 3. Differences between current and previous growth rates used for load growth

Date of Forecast	Reference Case	Industrial Renaissance	Distributed Disruption	Generation Shift	Business Boom
2013	0.95%*				
2014	0.80%	1.00%	0.10%	0.40%	
2015	1.45%+	1.45%	0.90%	1.20%	1.70%

**The December 2013 Forecast provided a 10-year CAGR, as opposed to a 20-year CAGR.*
+In the 2015 Draft IRP, the Industrial Renaissance Case becomes the new Reference Case.

For the high and low forecasts, the Company only presents the compound average growth rate (CAGR). This means we do not know if most of the load growth is occurring over a short period or growing steadily over the planning period. The high and low forecasts are only slight deviations from the reference case. The Company's lowest load forecast (modeled in the "Distributed Disruption" scenario) includes a 0.75 percent annual peak load growth and a 0.9 percent growth rate for energy.[20] These forecasts are unrealistic for a low bound; even Entergy seemed to agree less than a year ago, when the Company used a CAGR of 0.1 percent for the low bound in its May 2014 IRP Update.[21] Yet, the Company offers no explanation for its significantly revised forecast.

Entergy should consider a low growth scenario that sees little to no growth in peak load. Several other utilities provide load forecasts that include no growth in peak load over their respective study periods.

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[19] Entergy Corporation. 2014. "ELL's and EGSL's Responses to January 22, 2014 Informal Stakeholder Questions." LPSC Docket No. I-33014.. Available at: http://www.entergy-louisiana.com/content/irp/2014_0228_Informal_Response_Stakeholder_Mtg.pdf

[20] Entergy Gulf States Louisiana and Entergy Louisiana. 2015. *2015 Draft Integrated Resource Plan*. Page 19. LPSC Docket No. I-33014.

[21] Entergy Corporation. 2014. "Portfolio Design Analytics (Scenarios & Sensitivities); AURORA Documentation: 2015 EGSL & ELL Integrated Resource Plans." Page 5. LPSC Docket No. I-33014. Available at: http://www.entergy-louisiana.com/content/irp/2014-05-05_Transm_Ltr_and_Updates.pdf

Just a few public examples of this are SWEPCO's 2015 IRP proposed assumptions, Minnesota Power's 2009 Electric forecast, Nova Scotia's 2010, 2011, and 2012 IRPs, and Alaska Railbelt Regional IRP.[22]

The impact of slight variations in the peak load forecast CAGR can be significant in selecting a long-term plan. It is important to capture the full range of potential capacity requirements by considering a wider range of peak load forecasts. The Company only considers peak load growth within the range of 0.75 percent and 1.1 percent. For illustration, Table 4 displays the amount of capacity Entergy would be required to have at the end of the 20-year planning period under a range of peak load compound annual growth rates (ranging from 0 to 1.1 percent).

Table 4. Impact of increasing the peak load CAGR on capacity need

Peak load CAGR	20-year impact on capacity requirements (MW)
0.0%	-
0.1%	220
0.2%	444
0.3%	672
0.4%	905
0.5%	1,142
0.6%	1,384
0.7%	1,631
0.8%	1,882
0.9%	2,137
1.0%	2,398
1.1%	2,664

Source: Author's calculation, includes 12 percent MISO Reserve Margin.

2.2. CO_2 Price

The inclusion of a CO_2 cost in utility resource modeling is critical to protecting Entergy and its ratepayers from exposure to the costs of greenhouse gas regulations. However, in the 2015 Draft IRP, the Company has not included a CO_2 price in its chosen reference case. Confusingly, the Company has designated a "reference case" CO_2 price beginning at $7.54 per ton and growing to about $17.50 per ton in 2034, but this is only applied to the "Business Boom" scenario, not the "Industrial Renaissance" scenario, which is described as the reference case.[23] The Company does not actually use its reference case CO_2 price

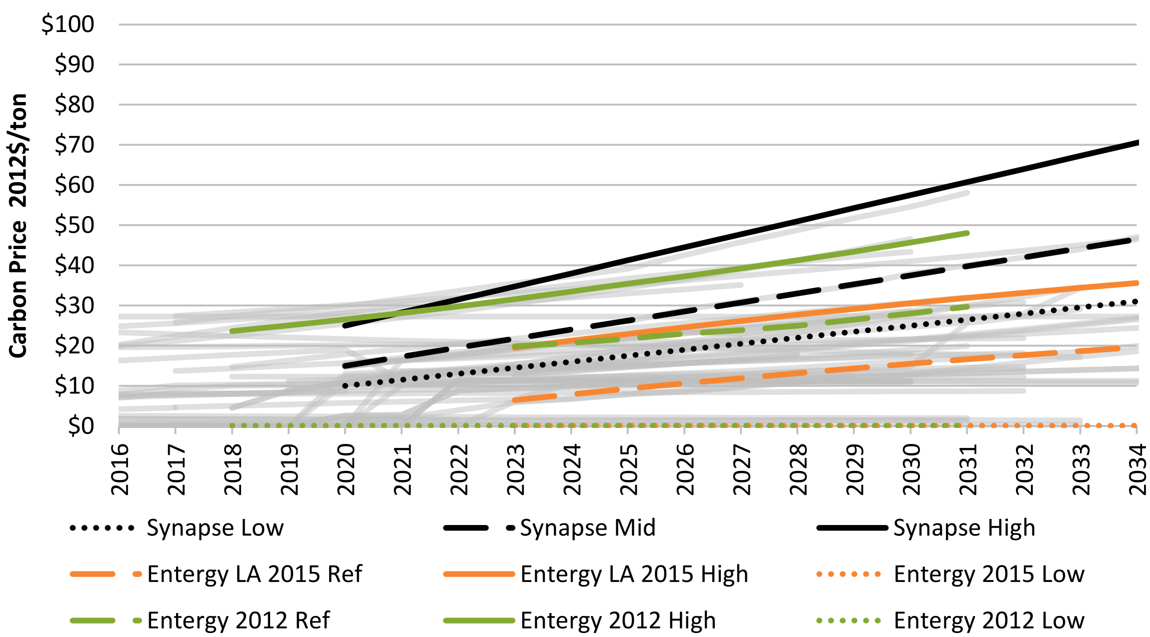
[22] Synapse Energy Economics. 2013. "Synapse 2013 Technical Training, Session 2: Best and Worst Practices in IRP and CPCN."

[23] Entergy Gulf States Louisiana and Entergy Louisiana. 2015. "2015 Draft Integrated Resource Plan." Page 19. LPSC Docket No. I-33014. Available at: http://www.entergy-louisiana.com/content/irp/2015_Louisiana_Draft_IRP.pdf.

forecast for its “reference case” and therefore the Company has no real reference case. The Company should have used a non-zero, reference case CO_2 price projection in its reference case scenario.

As show in Figure 1, Entergy’s CO_2 price forecasts have decreased over time. The 2015 high case is now as low as the Company’s reference case in 2012. Also shown in Figure 1 are various utilities’ CO_2 price forecasts from across the country. Entergy’s reference case 2015 forecast is far below that of most utilities in most years. Entergy also assumes that the CO_2 price will take effect in 2023. In light of EPA’s proposed Clean Power Plan (due to be finalized in the summer of 2015), Synapse suggests that 2020 is a reasonable timeframe for the start of CO_2 prices for planning purposes.[24] Most importantly, however, Entergy should—at the very least—include a non-zero price in its reference case scenario rather than applying its “low” price, which is equal to zero. Several papers discuss the critical and fundamental role of the assessment of CO_2 prices in long-term utility planning.[25]

Figure 1: Recent utility CO_2 forecasts with current and past Entergy forecasts highlighted



Source: Synapse, only select years shown.

[24] Luckow, P., et al. 2015. *2015 Carbon Dioxide Price Forecast*. Synapse Energy Economics.

[25] See: (1) Luckow, P., J. Daniel, S. Fields, E. A. Stanton, B. Biewald. 2014. “CO2 Price Forecast: Planning for Future Environmental Regulations.” EM Magazine, June 2014, 57-59. (2) Wilson, R., Biewald, B., 2013. “Best Practices in Electric Utility Integrated Resource Planning.” Regulatory Assistance Program, “Addressing the Effects of Environmental Regulations: Market Factors, Integrated Analysis, and Administrative Processes” http://www.raponline.org/featured-work/resource-planning. (3) Barbose, G., et al. 2008. “Reading the Tea Leaves: How Utilities in the West Are Managing Carbon Regulatory Risk in their Resource Plans.”

The drop in CO_2 price forecasts from Entergy's 2012 IRP compared to the 2015 Draft IRP implies that Entergy now believes the cost of compliance with carbon regulations will be less burdensome than previously forecasted. It is worth noting that, in his comments to the EPA on the draft Clean Power Plan, Chuck Barlow, Vice President of Environmental Strategy & Policy at Entergy, claims that Entergy "must implement additional measures to further reduce CO_2, and these measures likely will have a higher marginal cost than the actions already taken."[26] Similarly, in comments the Company filed with the LPSC regarding the potential economic impact of the Clean Power Plan, Entergy admitted that complying with the rule's heat rate improvements at R.S. Nelson alone would cost more than $60 million.[27] The Company's use of a zero carbon price in the reference case scenario is belied by the significant compliance risk identified by the Company in other contexts.

A CO_2 cost greater than zero would favor dispatch of less carbon-intensive resources over coal generation than what the Company's reference case would select, as the analysis currently stands. If the Company fails to properly apply a reasonable CO_2 price forecast, the result will be a carbon-intensive fleet more vulnerable to escalating costs under the Clean Power Plan or any other carbon legislation and/or regulations.

2.3. Cost and Availability of Wind Resources

The Company overestimates the costs associated with delivering wind energy to its footprint and by doing so may be denying its ratepayers access to an energy resource that is likely to be least cost and least risk. Current long-term wind PPAs are being offered by developers at prices much lower than the levelized cost assumed by the Company, which is $109 per MWh.[28] The most recent wind technologies report by the U.S. Department of Energy shows that new wind PPAs have reached "all-time lows" costing "around $25/MWh nationwide," or over 77 percent less than what the Company assumes to be the cost.[29] Even after accounting for wheeling charges or the cost of building new transmission, which might be required to deliver the wind energy, the Company has severely overestimated the cost of wind. Wind PPAs have been signed to deliver energy from states west of Louisiana to states east of Louisiana at prices below what the Company has modeled. Alabama Power has signed long-term PPA contracts for wind in Oklahoma and Kansas at $32 per MWh, over 70 percent less than what the Company

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[26] Barlow, Chuck D. 2014. "Comments of Entergy Corporation to the United States Environmental Protection Agency's Proposed Carbon Pollution Emission Guidelines for Existing Stationary Sources." Page 27. Docket No. EPA-HQ-OAR-2013-0602. Available at: http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2013-0602-22874.

[27] See LPSC Docket No. R-33253, In Re: U.S. Environmental Protection Agency's Proposed Rule on Carbon Dioxide Emissions from Existing Fossil-Fuel Fired Electric Generating Units Under Section 111(d) of the Clean Air Act, Entergy Louisiana Comments at page 3 (filed Aug. 26, 2014).

[28] Entergy Gulf States Louisiana and Entergy Louisiana. 2015. *2015 Draft Integrated Resource Plan*. Page 14. LPSC Docket No. I-33014.

[29] U.S. Department of Energy (DOE). 2013. *2013 Wind Technologies Report*. Page ix.

modeled.[30,31] Georgia Power has also signed contracts to deliver wind from Oklahoma at prices estimated to be at most $59 per MWh, 45 percent less than what the Company modeled. Even under assumptions of low fuel costs and no CO_2 price, wind at $59 per MWh would be as low as or lower than any of the resources evaluated in the 2014 Technology Sensitivity Assessment (as presented in Table 1 of the IRP).[32] In addition to being a contending least-cost resource, wind acts as an effective hedge against fuel price volatility and future air or water pollution regulations. There should be little doubt that Entergy should be able to procure long-term contracts to deliver wind energy to its service territory—if not in Louisiana than certainly to its footprint in Texas or Arkansas—for prices far below what it chose to assume for modeling.

2.4. Demand-Side Management Potential

Demand-side management (DSM) measures reduce peak load through demand response, which is only called upon during peak hours, and through energy efficiency, which is spread among hours throughout the day. Thus, demand response directly reduces peak load but has little effect on energy sales, while energy efficiency reduces sales and also reduces peak load as it coincides with peak hours. Additional DSM directly reduces the Company's capacity and energy requirements, avoiding the need to build or retrofit supply resources and generation to meet load. The potential DSM used in this IRP underestimated potential and performed limited cost-effectiveness testing, as described in further detail below.

In the course of the IRP process, Entergy commissioned a "demand side management potential study" (DSM Potential Study) from ICF International. The study found that for modest costs—i.e., four to eight cents per kilowatt hour—Entergy could procure in the range of 3.9 percent to 9.9 percent cumulative energy savings over 20 years, or 5.8 percent to 14.4 percent peak demand reductions from energy efficiency.[33] In the 2015 Draft IRP, however, DSM additions fall between the Low and the Reference Cases outlined in the ICF report, reaching cumulative peak demand savings of 7.6 percent in 2034.[34] Despite this apparent inconsistency between the findings of the potential study and the IRP's

[30] Inda, A., J. Wu, and D. Zhou. 2014. "Assessing the Hedging Value of Wind Against Natural Gas Price Volatility." Page 34. Available at: http://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/8582/Inda_Wu_Zhoupercent20-percent20Assessingpercent20thepercent20Hedgingpercent20Valuepercent20ofpercent20Wind.pdf?sequence=1.

[31] Alabama Power. "Chisholm View, Buffalo Dunes projects provide cost-effective power." Available at: http://www.alabamapower.com/environment/news/chisholm-view-project-provides-low-cost-power.asp. Retrieved 2015.

[32] Entergy Gulf States Louisiana and Entergy Louisiana. 2015. *2015 Draft Integrated Resource Plan*. Page 14. LPSC Docket No. I-33014.

[33] ICF International. 2014. *Long-Term Demand Side Management Potential in the Entergy Louisiana and Entergy Gulf States Louisiana Service Areas.* Page iv. Available at: http://www.entergy-louisiana.com/content/irp/2014_1103_ELL_EGSL_DSM_Potential_Study_Report.pdf

[34] Entergy Gulf States Louisiana and Entergy Louisiana. 2015. *2015 Draft Integrated Resource Plan*. Table 19. LPSC Docket No. I-33014.

recommendations for DSM additions, the 2015 Draft IRP clearly relies on the results of the potential study.[35] However, the potential study has several major flaws that lead it to significantly underestimate the potential for cost effective energy efficiency resources.

The DSM Potential Study only includes avoided costs associated with electricity, capacity, and gas savings but should at a minimum include avoided transmission and distribution (T&D) investments and avoided environmental compliance costs.[36] Just a few of the other efficiency program benefits that should be considered in cost-effectiveness testing include reduced arrearages, risk benefits, participant non-energy benefits (e.g. health and safety, productivity, comfort, property value), and environmental externalities not anticipated to be addressed by regulation or legislation over the life of the measures.

The DSM Potential Study used the Total Resource Cost test (TRC) to screen for cost-effectiveness.[37] The TRC, as applied by the study, is skewed because it includes participant costs but not all participant benefits. The TRC should always include reduced energy bills as a benefit to participants. Other, more difficult to quantify participant benefits, such as health and safety, productivity, comfort, and property value improvements, can also have a large impact on cost-effectiveness under the TRC, and should be considered—if not quantitatively, then qualitatively. The LPSC rules governing energy efficiency plans make it clear that the TRC test should not be considered in isolation—other tests, including the Societal Cost Test (SCT) and Utility Cost Test (UCT), must also be considered.[38] In general, the SCT and UCT will show much higher cost-effectiveness ratios than the TRC, because the SCT includes all relevant benefits, and the UCT does not include participant costs.

The DSM Potential Study only considered commercially available measures.[39] However, it is highly likely that technologies will become more efficient and more cost-effective, and new technologies will emerge during the timeframe for the study (2015-2034). The study also screened the cost-effectiveness of measures, rather than programs or portfolios.[40] Evaluating cost-effectiveness at the measure level is highly restrictive and can create a barrier to greater savings levels.[41] Thus, programs or portfolios, rather

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[35] Ibid, Appendix C, page 5.

[36] ICF International. 2014. *Long-Term Demand Side Management Potential in the Entergy Louisiana and Entergy Gulf States Louisiana Service Areas*. Page 26.

[37] Ibid, page 1.

[38] Louisiana Public Service Commission. 2013. Docket No. R-32206, Energy Efficiency Rule Applicable to LPSC Jurisdictional Investor-Owned Electric and Group I Gas Utilities at 3-5, Sept. 20, 2013.

[39] ICF International. 2014. Long-Term Demand Side Management Potential in the Entergy Louisiana and Entergy Gulf States Louisiana Service Areas. Page 1.

[40] After measure screening, "in most cases only measures with a TRC of 1.0 or higher" were put into programs. Exceptions were made for low income measures. ICF International. 2014. *Long-Term Demand Side Management Potential in the Entergy Louisiana and Entergy Gulf States Louisiana Service Areas*. Page 9.

[41] Kushler, M. S. Nowak, and P. White. 2008. National Action Plan for Energy Efficiency. *Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices Technical Methods, and Emerging Issues for Policy-Makers*. Available at: http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf.

than measures, should be screened for cost-effectiveness.[42] The majority of states (70 percent) screen at the portfolio level and the program level, although many of these states also grant waivers for some programs (e.g., low-income programs, pilot programs).[43]

Even with its significant limitations, the DSM Potential Study suggests that Entergy should pursue more DSM—somewhere between the Reference and High cases. Given the assumed low potential and a lack of rigorous cost-effectiveness testing, the 2015 IRP is likely leaving tens or even hundreds of millions of dollars of benefits attributable to DSM on the table.

2.5. Changes to Inputs

During the stakeholder process, input assumptions may change frequently and perhaps even substantially. Often these changes reflect new evidence unearthed in the stakeholder process or suggestions from relevant parties and, as such, represent sound planning and decision-making. However, to make these changes without justification or void of stakeholder input is uncooperative and misleading.

Between the initial draft input assumptions presented in December 2013 and the 2015 Draft IRP, Entergy significantly adjusted the load growth forecasts without any justification, acknowledgement, or disclosure of details on what the new forecast would be, except in confidential documents. For instance, and as detailed above, as of May 2014, the 20-year CAGR of energy in the reference case was 0.8 percent. However, in the 2015 Draft IRP, the 20-year CAGR of energy in the Industrial Renaissance "reference case" is 1.45 percent—a substantial increase with substantial ramifications for future resource need. The assumptions for peak load growth in the reference case increased modestly as well, from a CAGR of 0.8 percent in May of 2014 to a CAGR of 1.05 percent in the 2015 Draft IRP.

Further, between the second IRP Update materials provided in May 2014 and the 2015 Draft IRP, Entergy switched the scenario it considered to be the "reference case." As a result, the CO_2 price assumed in the "Industrial Renaissance" case, which is the new reference case scenario, shifts from the *Reference* trajectory assumed for a CO_2 price to no future price at all. As discussed, this unfairly biases the results in the chosen reference case to be more carbon-intensive, failing to protect ratepayers from any regulatory costs associated with CO_2 emissions. Put simply, this represents unreasonable and imprudent planning.

To alter not only individual assumptions but also which scenario is considered the "reference case" after months of stakeholder input and development of robust scenarios is improper planning. And to make these alterations in a fully redacted document, as Entergy did in the third IRP Update released in

[42] Ibid.

[43] American Council for an Energy-Efficient Economy. 2012. "A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs." Report No. U122. Available at: http://www.aceee.org/research-report/u122.

November 2014, is uncooperative at best, and misleading at worst.[44] Additionally, these eleventh-hour alterations to key assumptions are only those that we were able to find after a review of all of the planning documents. As such, there may be other inputs and assumptions that we do not have access to that have changed as well.

3. Results and Action Plan

The Company bases its action plan off of the resource portfolio selected under results of the Industrial Renaissance, inaccurately called the "reference case." As pointed out in Section 1, the Industrial Renaissance neither uses a reasonable reference case load forecast nor uses the Company's reference case CO_2 price forecast. The Distributed Disruption scenario, on the other hand, has the load forecast that most closely reflects the original reference case load forecast. It is also the only portfolio developed under reasonable assumptions regarding natural gas price that also includes a (albeit it low) CO_2 price. It performs best under nearly all the sensitivities, and has the same or lower PVRR than Entergy's plan portfolio (the "Industrial Renaissance Portfolio") in all but one scenario (see Table 5 and Table 6). Yet curiously, Entergy Louisiana opts to pursue a different resource portfolio.

Table 5. Present value of forward revenue requirements by scenario

PV of Forward Revenue Requirements ($B) (2015-2034)				
	IR Scenario	BB Scenario	DD Scenario	GS Scenario
Industrial Renaissance Portfolio	35.5	31.9	35.6	45.9
Business Boom Portfolio	35.7	31.7	35.9	45.8
Distributed Disruption Portfolio	35.5	31.7	35.7	45.7
Generation Shift Portfolio	37.3	34.5	36.9	42.5

Source: Recreation of Table 11 from Draft IRP.

[44] Entergy Corporation. 2014. "2015 LA IRP Macro Inputs," Docket No. I-33014. Available at: http://www.entergy-louisiana.com/content/irp/2014_1103_ELL_EGSL_DSM_Potential_Study_Report.pdf

Entergy chooses the "Industrial Renaissance" portfolio since "the industrial renaissance [is] underway in Louisiana."[45] However, the Distributed Disruption portfolio, despite its negative connotation, performed just as well in the Industrial Renaissance scenario.[46] So if these two portfolios perform equally as well under the "reference case," how do they fair under the sensitivities? As it turns out, the Distributed Disruption portfolio actually outperforms, that is to say, is less affected by, the select few sensitivities Entergy does run. And as Entergy points out, the Distributed Disruption portfolio has lower variable costs as compared to the Industrial Renaissance.[47] A close comparison of the two portfolio's present value of revenue requirements (PVRR) reveals that the Distributed Disruption (DD) portfolio has a lower PVRR than the industrial renaissance portfolio by $200 million in both the Business Boom (BB) and Generation Shift (GS) scenarios. From this information, one could conclude that the Distributed Disruption portfolio is both lower cost and lower risk (see Table 5).

In addition, Entergy's IRP modeling produces results that are unintuitive. Each resource portfolio was presumably optimized under a given scenario. It would therefore be reasonable to assume that that resource portfolio would be the optimal choice for that scenario. That is curiously not the outcome that Entergy presents. As shown in Table 6, half of the portfolios developed by the Company, presumably as the optimal resource mix under a given scenario, were not the optimal portfolio under that given scenario. For example, the Distributed Disruption portfolio, which was developed under the lowest load forecast and the reference natural gas price, would not be expected to outperform all other resource portfolios in the Business Boom (BB) scenario which has the highest load forecast and lowest natural gas price.

Table 6. Portfolios with the lowest revenue requirements under a range of scenarios, expected vs. actual

		IR Scenario	BB Scenario	DD Scenario	GS Scenario
Expected	IR Portfolio	1			
	BB Portfolio		1		
	DD Portfolio			1	
	GS Portfolio				1
Actual	IR Portfolio	1	3	1	4
	BB Portfolio	3	2	3	3
	DD Portfolio	1*	1	2	2
	GS Portfolio	4	4	4	1

Source: Entergy. 2015. 2015 Draft Integrated Resource Plan. LPSC Docket No. I-33014, January 30, 2015. Table 13. page 31.
**Entergy labels the DD portfolio as ranked 2nd in the IR Scenario, however, all of the data provided in the IRP indicates that the DD portfolio performed equally with, or better than, the IR portfolio.*

45 Entergy Gulf States Louisiana and Entergy Louisiana. 2015. *2015 Draft Integrated Resource* Plan. Page 35. LPSC Docket No. I-33014.

46 Ibid, page 31.

47 Ibid, page 31.

These results strongly indicate that resources portfolios where not properly optimized and calls all of the model results into question. How did Entergy manage to arrive at these results? Unfortunately, without additional information, it is nearly impossible to conclusively answer that question. Given that Entergy inappropriately prevented the model from retiring resources (see Section 1), it is entirely plausible that the Company made similar errors that prevented the model from selecting optimal resource portfolios.

4. CONCLUSION

Long-term planning through the IRP process is a critical part of the Company's responsibility to ratepayers, and provides a mechanism by which the Commission, stakeholders and the Company may engage with one another in an informed, deliberative, and collaborative process. This process should take into account the Company's interests and requirements, stakeholder concerns, and the best interest of Louisiana's ratepayers. To that end, Entergy should consider the following:

- The company should develop a true "reference case" that includes the original load growth rate of 0.9 percent as well as the Company's reference case price forecast for coal, natural gas, and CO_2.
- Entergy should consider a low growth scenario that sees little to no growth in peak load.
- Entergy should seriously pursue opportunities to develop long term wind contracts. This could include sending out a request for information (RFI) or request for quote (RFQ) regarding delivery of wind energy to the Entergy Louisiana service territory. Responses to such RFIs or RFQs can be incorporated into future IRP proceedings.
- At the very least, the Company should rerun the preselected scenarios, and a newly formed true reference case, under conditions where existing electric generating units are retired based on economic criteria rather than be hardcoded based on arbitrary boundaries regarding the age or ownership of the units.
- Any model runs should incorporate all the costs associated with complying with the environmental regulations outlined in the above report and should assume wind price in the $32-59/MWh range.
- The Company should consider running sensitivities of key variables (such as carbon price and natural gas price) around the true reference case.
- Based on the results of the ICF EE potential study, which underestimated the benefits and overestimate the costs of energy efficiency, the company should pursue additional energy efficiency, which is more in line with the reference to high case as outlined by the ICF study.

Incorporating these key recommendations, and taking into account the other issues outlined in this report in future long-term planning processes, will help ensure that the ratepayers of Louisiana continue to enjoy the reliability and affordability that Entergy has provided in the past. Revising the Company's input assumptions will aid the Company in accounting for the increased risk and variability that currently exists in the utility planning landscape.