Examining the Barriers to Sustainable Power at Duke Energy

The Non-Profit vs. Corporate Perspectives

By

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May 2009

Masters project submitted in partial fulfillment of the requirements for the Master of Environmental Management degree in the Nicholas School of the Environment of Duke University
2009

Abstract:

Electric utilities throughout the United States are under increasing pressure by the government, the public and environmental groups to make the transition to clean power as urgency over the need to address climate change grows. The Southeast will be particularly hard-pressed to find substitutes for its numerous coal plants even as its nuclear options face strong public opposition.

A perfect example of this struggle is embodied in the positions held by the North Carolina Waste Awareness Reduction Network (NC WARN), a non-profit environmental group located in the Durham area, and Duke Energy, a corporate electric utility provider with a generation mix comprised nearly entirely of coal and nuclear plants. In order to meet North Carolina's growing energy needs, NC WARN has promoted a combination of energy efficiency, demand-side management, and renewables while avoiding the need for new power plants. In contrast, Duke Energy has asserted that only new coal and nuclear plants are capable of reliably meeting this demand.

This project analyzes why the two groups' approaches differ and what barriers and disincentives prevent Duke Energy from adopting NC WARN's more "sustainable" energy plan. It also offers recommendations for research, regulation, and policy solutions that could be used to bridge this gap.

This project also provides a closer examination of the arguments surrounding Duke Energy's controversial on-going construction of a new coal-fired unit at Cliffside, North Carolina via analysis of Duke Energy's cumulative air emissions under various carbon scenarios. The results of this simulation demonstrate that carbon tax policy and renewable energy incentives will play a major role in determining whether a shift away from coal plants not involving nuclear will become a reality for energy generation in North Carolina as well as the United States as a whole.

TABLE OF CONTENTS

I. INTRODUCTION 1

Motivation 2

Organization 5

II. THE PLANS 5

III. DEMAND BEFORE/AFTER ADJUSTMENTS 8

IV. WHOLESALE AGREEMENTS 10

Wholesale Sales Agreements 10

Wholesale Purchase Agreements 15

V. LOAD CONTROL 17

VI. EFFICIENCY GAINS 20

VII. RENEWABLES 25

VIII. NEW COGENERATION 28

VIV. EXISTING PLANTS 29

X. NEW PLANTS 30

Cliffside 31

Cliffside Scenario Model 33

Dan River and Buck River Natural Gas Plants 39

Lee Nuclear Station 39

XI. CONCLUSIONS 42

XII. BIBLIOGRAPHY 44

I. Introduction

As a regulated electric utility, Duke Energy has been facing increasing criticism over its requests to the North Carolina Utilities Commission to meet new demand by building conventional coal and nuclear plants in North Carolina. Numerous non-profits and environmental groups, but specifically the non-profit North Carolina Waste Awareness Reduction Network (NC WARN), have tried to prevent Duke Energy from receiving the permits to do this, claiming that North Carolina can better reduce carbon emissions and electricity costs by forcing Duke Energy to invest in energy efficiency and renewables rather than costly new power plants.[1] Over the past few years, NC WARN has invested resources to legally oppose nearly every major project Duke Energy has proposed to the Commission,[2] basing much of its opposition on studies from climate experts warning about the dire need to quickly reduce carbon emissions.[3] It believes that drastic greenhouse gas reduction is achievable based on state-commissioned and corporate studies predicting the massive potential for cost-effective energy efficiency in North Carolina, and the belief that investing the billions of dollars Duke Energy proposes for its conventional plants into renewables instead will lead to a feasible, sustainable energy future for North Carolina.[4]

Meanwhile, Duke Energy contests that these new power plants are the only economical and reliable way to meet the energy needs of a growing population, basing its position on economic analyses, industry practice, and other business variables not publicly available.

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[1] Jim Warren, "SAW Update," NC WARN Alert, 15 August 2008. <http://www.ncwarn.org/docs/Alert%208-15-08%20SAW%20update%20&%20alternative.pdf>

[2] North Carolina Utilities Commission Docket List, Generic Proceeding (E-100), accessed 26 September 2008. <http://ncuc.commerce.state.nc.us/cgi-bin/docksrch.ndm/INPUT?COMPNUM=E100&COMPSUB=&PROC=Search&frmmnth=00&frmday=00&frmyear=****&numret=20>

[3] Jim Warren and Grant Smith, "Climate Expert Says Energy Chiefs Have Stolen Big Tobacco's Playbook," NC WARN News Release, 31 March 2008. <http://www.ncwarn.org/docs/news%20rel/nr-03-31-08HansenLtrToRogers.htm>

[4] GDS Associates, inc. (2006), "A Study of the Feasibility of Energy Efficiency as an Eligible Resource as Part of a Renewable Portfolio Standard for the State of North Carolina," December 2006.

Clearly these groups have two very different ideas about the best way to meet North Carolina's energy needs fueled by two very different sets of assumptions. The purpose of this project is to examine these assumptions from a neutral perspective in the light of scientific research and mainstream projections of technological advancement, consumer behavior, and fuel and pollutant costs. The goal is to understand the nature of the obstacles that prevent Duke Energy from adopting the energy plan NC WARN has called for. Understanding the barriers to sustainable energy as well as understanding the policy or research solutions needed in order to overcome them will be critically important in determining NC WARN's legal actions as well as Duke Energy's future success as a business. Both sides may find the comparison between their proposed energy plans useful in advancing the discussion over North Carolina's energy future and determining what steps are needed to ensure that sustainable, feasible, and economically sound energy resources are recognized and utilized efficiently. Additionally, groups engaged in litigation against Duke Energy may find this beneficial in understanding what makes their suggestions unappealing from an economic or business standpoint. This might be useful for strengthening their arguments, or even redirecting the focus of their efforts towards a more comprehensive energy policy at the state or national level that creates the right incentives for clean power. Similarly, Duke Energy may wish to re-examine some of the alternatives proposed by NC WARN that were previously dismissed or overlooked, particularly if those resources are economically feasible in addition to sustainable.

Motivation

Duke Energy (as a corporation presumably motivated by profit maximization) and NC WARN (as an environmental group) have very different proposals for meeting North Carolina's power needs. These differences stem in part from this disparity in goals but also from different

assumptions and information about the key variables that affect the requirements, costs, and performance of different energy sources. This project examines the impact of the latter, focusing on how these assumptions and information sources differ and why- if there was only one source of indisputable information then the only reasons for this disagreement over what needs to be done would be the goals. The project also explores the role of policy makers in implementing the mechanisms that would realign Duke Energy's goals so that they match those of society (as embodied in NC WARN's environmental aims).

NC WARN advocates for the promotion of energy efficiency, DSM and more renewable energy capacity while Duke wants to increase coal and nuclear generating capacity. NC WARN's goal is to reduce the share of nuclear and coal involved in electricity generation in North Carolina while Duke Energy's is to determine the best method of maximizing profits. Policy makers face the difficult task of assessing the resources proposed by both parties while balancing the need for low rates, environmental protection, and reliable service. In the process of determining the best way of addressing all the interests of the parties involved while protecting the interests of North Carolina citizens, policy makers may face information gaps that limit their ability to understand the pros and cons of the energy resources suggested. They will also need to determine regulatory policy that will help North Carolina avoid looking into a future of high CO2 emissions or high reliance on nuclear.

One of the largest contributors to CO2 emissions as a sector is electric utilities. Duke Energy alone is the third-largest corporate emitter in the United States with a carbon dioxide contribution of 100 million tons annually.[5] From an environmental group like NC WARN's standpoint, one of the best ways to quickly and drastically reduce carbon impact is to prevent

[5] Clive Thompson, "A Green Coal Baron?" *The New York Times*, 22 June 2008. <http://www.nytimes.com/2008/06/22/magazine/22Rogers-t.html>

companies like Duke Energy from building more power plants that are fueled by carbon-emitting sources such as coal, and forcing them to invest in energy efficiency and renewables instead.

In the midst of these conflicts, environmental groups, which are often non-profits with limited funds, expend significant resources to achieve these "victories" and can lose just as often as they win. Meanwhile, Duke Energy loses a certain degree of credibility which often motivates management to spend resources on PR campaigns and lawyers to defend its reputation and can be penalized with significant monetary losses from delays or restrictions on their permits due to public pressure on the North Carolina Utilities Commission. For example, due to pressure from NC WARN and its allies, the North Carolina Utilities Commission only granted permission for one of the two coal-fired Cliffside units proposed by Duke Energy, potentially endangering the economic feasibility for the multi-billion dollar project as a whole.[6]

Despite these costly disagreements, both sides can seem to agree the electricity is a necessary commodity and that it should be reliable and affordable. However, these two groups are operating on very different assumptions about energy resources that influence the positions they've taken on what North Carolina's energy future should look like. Rather than continue conflicts based on erroneous assumptions about the environmental impacts, economics behind, and willingness of ratepayers to accept different ways of meeting energy need, it would be better for both sides to challenge their beliefs and engage in a search for detailed, accurate information on the key issues that affect energy efficiency, emissions, consumer behavior, and technological advances. By understanding the studies and economic analyses that provide context for these disparate positions, both groups can advance the discussion over acceptable energy resources and clarify any misunderstandings over the feasibility, benefits, and costs of certain types of energy.

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[6] Paige Sheehan, "North Carolina Utilities Commission Approves One Cliffside Unit," Duke Energy 2007 News Releases, 28 February 2007. < http://www.duke-energy.com/news/releases/2007022801.asp>

By exploring these commonalities and differences in assumptions, this project will hopefully help both sides come closer in advancing the discussion over the best way to develop a more sustainable, reliable, and economically feasible energy future, thereby avoiding wasted resources from conflicts due to positions based on erroneous or outdated information. This study will also help direct research priorities into addressing gaps in the body of knowledge influencing decision-making in energy policy. And in a larger context, this project will help highlight the economic, regulatory, and technical barriers preventing sustainable energy resources from being adopted within the energy industry as a whole.

Organization

This document is organized as follows: under a given energy resource, both NC WARN's and Duke Energy's stances on that resource and motivations for taking that position are presented and explained. Then an analysis of why these positions differ is presented which includes recommendations for resolving these differences. Of the energy resources analyzed, special attention is paid to the controversial ongoing construction of a new coal-fired unit being built at Cliffside, North Carolina. The analysis of Cliffside also includes an energy model that attempts to analyze the impact this project will have on future investment in renewables and overall CO2, SOx, NOx, and mercury emissions under various carbon tax scenarios.

II. THE PLANS

Both organizations' plans call for allowing existing plants to cover approximately 70% of demand. However, the way the remaining 30% or so of demand is met varies significantly between the two. To meet this remaining demand, NC WARN relies mostly on efficiency and renewables by 2025 whereas Duke Energy relies on new plants:

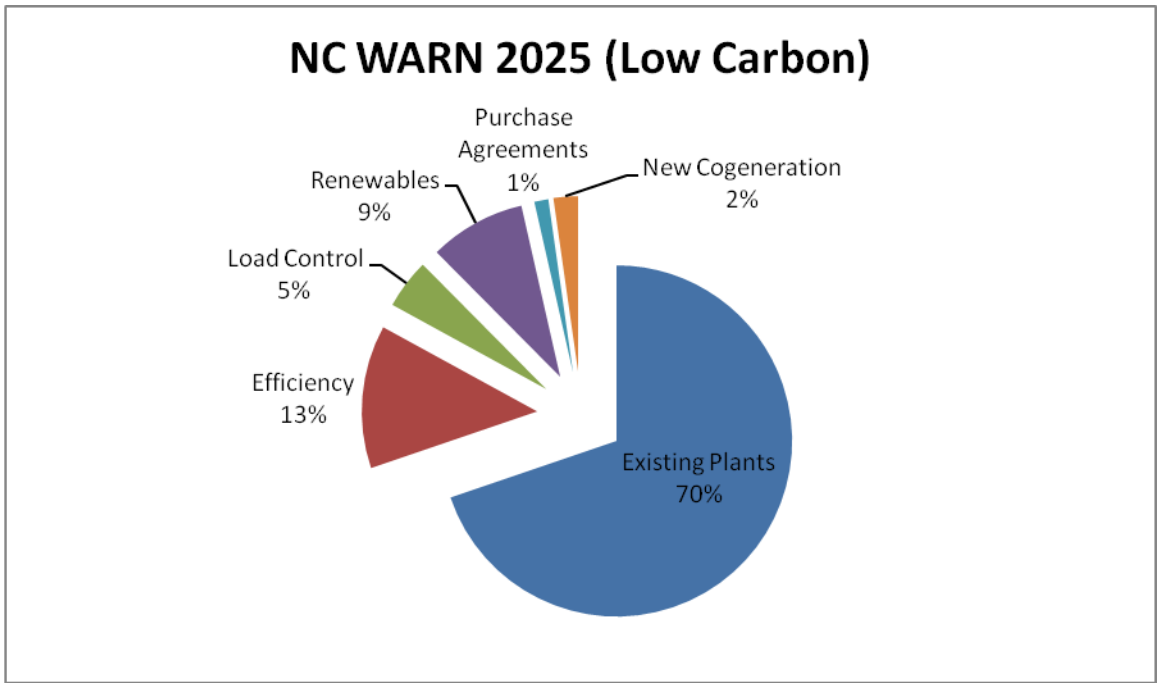

Figure 1 Resources used to supply demand by 2025 under NC WARN's plan in a low carbon taxes scenario

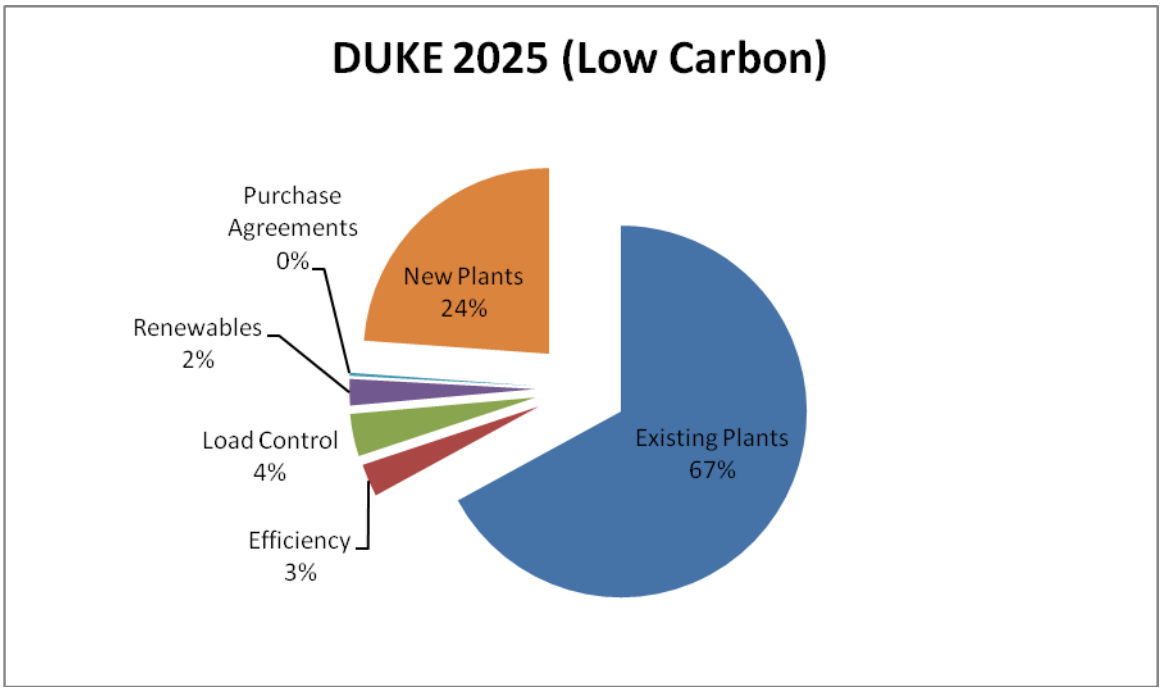

Figure 2 Resources used to supply demand by 2025 under Duke Energy's plan in a low carbon taxes scenario

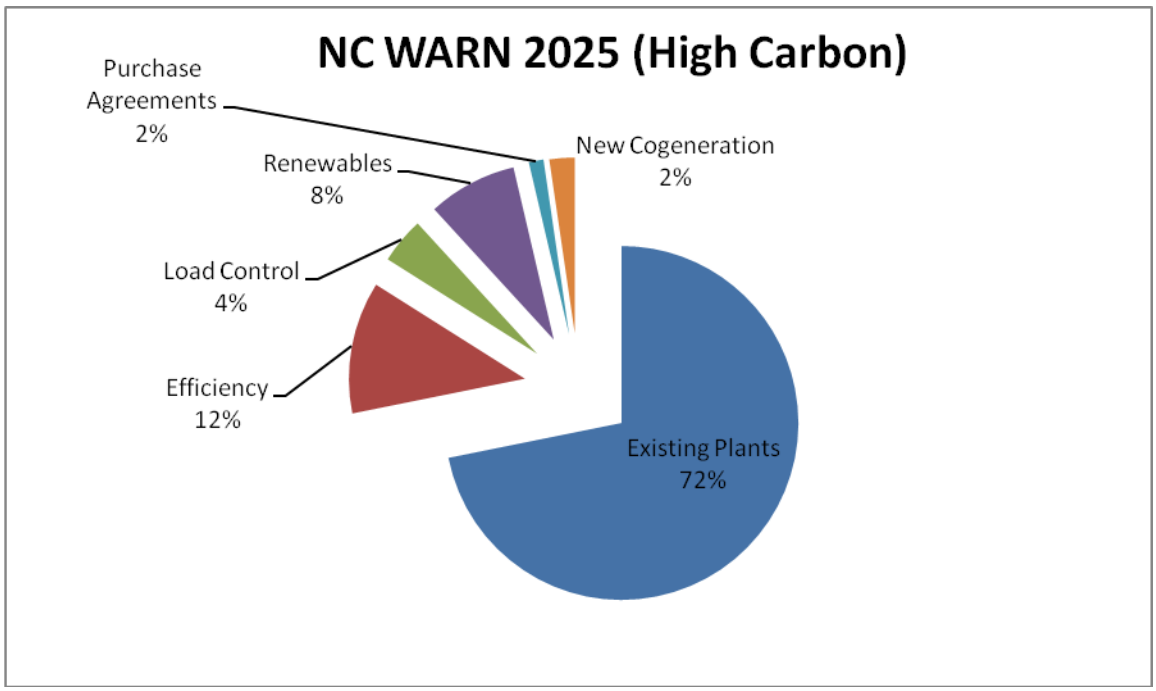

Figure 3 Resources used to supply demand by 2025 under NC WARN's plan in a high carbon taxes scenario

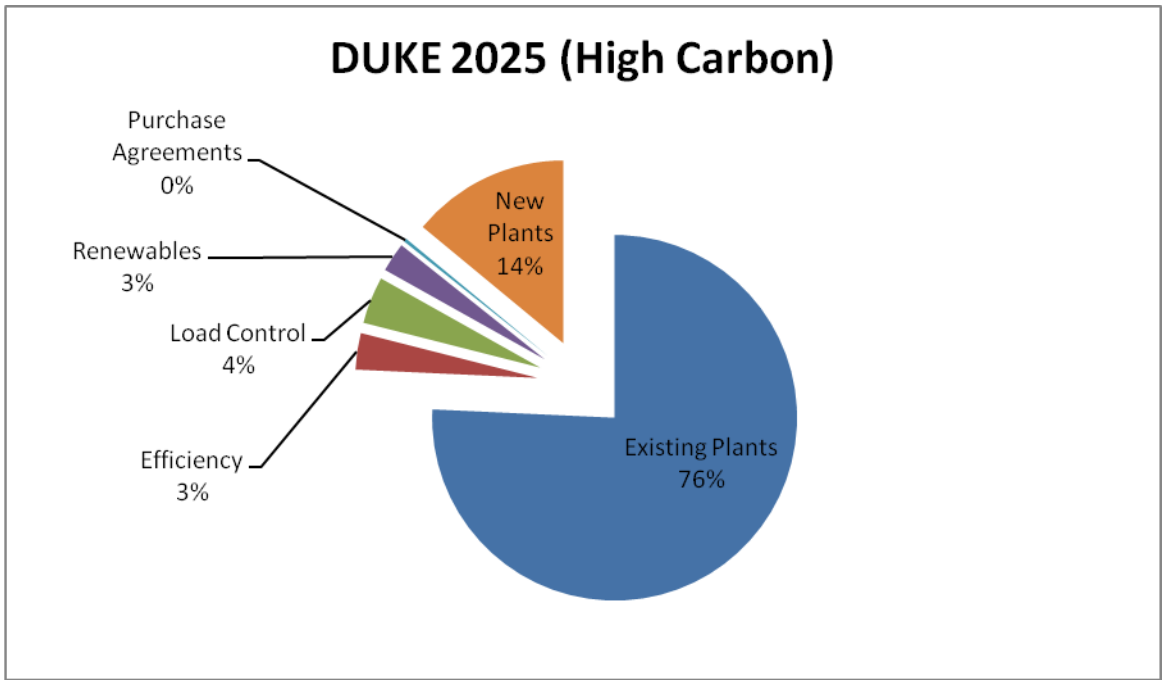

Figure 4 Resources used to supply demand by 2025 under Duke Energy's plan in a high carbon taxes scenario

III. DEMAND BEFORE/AFTER ADJUSTMENTS

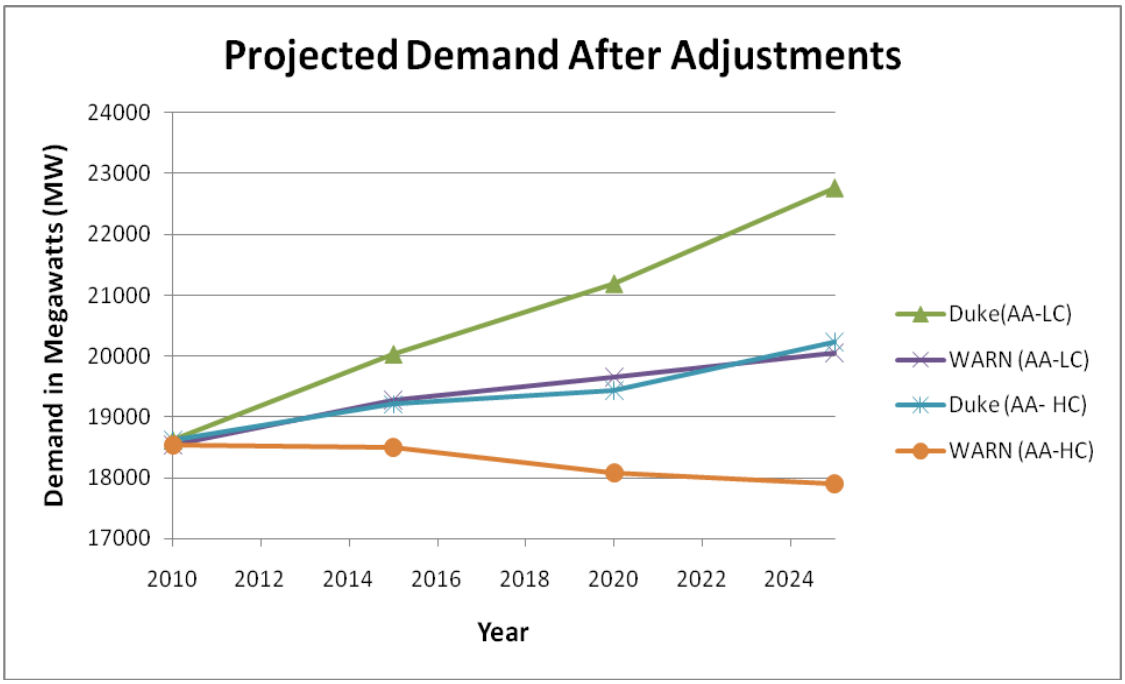

Figure 5 Demand expected after adjustments by NC WARN and Duke Energy (AA= after adjustments, HC= high carbon tax scenario, LC= low carbon tax scenario)

NC WARN has proposed a plan that contains the exact same projections Duke has made for future demand. Thus, both Duke Energy and NC WARN assume that a high carbon taxes scenario would reduce energy use, culminating in 2500 MW less demand by 2025. This expectation is likely the result of Duke Energy assuming that consumers will respond to the higher costs of electricity from higher carbon taxes by using less energy. However, high carbon prices might not only imply a higher electricity cost, but might also be correlated with extreme temperatures (if the high prices are a direct response to climate change) which might increase electricity demand, and therefore offset this assumption. Duke Energy would be well advised to conduct more extensive research on the relationship between price elasticity and increased

demand from extreme weather conditions before fully integrating this assumption into its planning.

After adjustments for renewable energy contributions, load control, and energy efficiency NC WARN clearly expects a much larger drop in demand than Duke Energy. In fact, NC WARN's demand in a low carbon tax scenario is nearly identical to Duke Energy's assumptions about demand in a high carbon tax scenario. Clearly, NC WARN believes that even with very low carbon taxes, demand can be lowered to a level that Duke Energy would only consider to be feasible under very high carbon taxes.

This would imply an apparent disconnect between the groups in terms of their projections for how carbon taxes would affect business as usual. While this probably reflects fundamental differences in the ultimate missions of these two groups, both might be advised to re-examine the existing literature on the ability of carbon taxes to impact electricity generation decisions. If NC WARN is being too optimistic about the ability of carbon taxes to promote energy efficiency and renewables, NC WARN's economic argument for promoting these changes may be somewhat overblown. However, this may also indicate that Duke Energy is underestimating the financial impact of carbon taxes on their operations, or that Duke Energy is counting on its existing coal plants being grandfathered into the carbon regulation system. If carbon regulations are more expensive than they predict (i.e. - credits are auctioned off rather than distributed) they may be more vulnerable economically than they realize. In that case, adopting more of NC WARN's initiatives would make them more stable financially as NC WARN's plan is less carbon intensive than the one Duke Energy is currently proposing. Further research clarifying the economic impacts of a carbon tax system would prove incredibly useful in determining whether Duke Energy could feasibly begin to adopt more of NC WARN's suggestions.

IV. WHOLESALE AGREEMENTS

Wholesale sales agreements refer to Duke Energy's "sales for resale" transactions which "refer to electricity sold by one electric utility or power marketer to other electric utilities for distribution." Its wholesale purchase agreements refer to contracts which "involve buying electricity from electric utilities and nonutility power producers," in order to maintain necessary capacity.[7]

Wholesale Sales Agreements

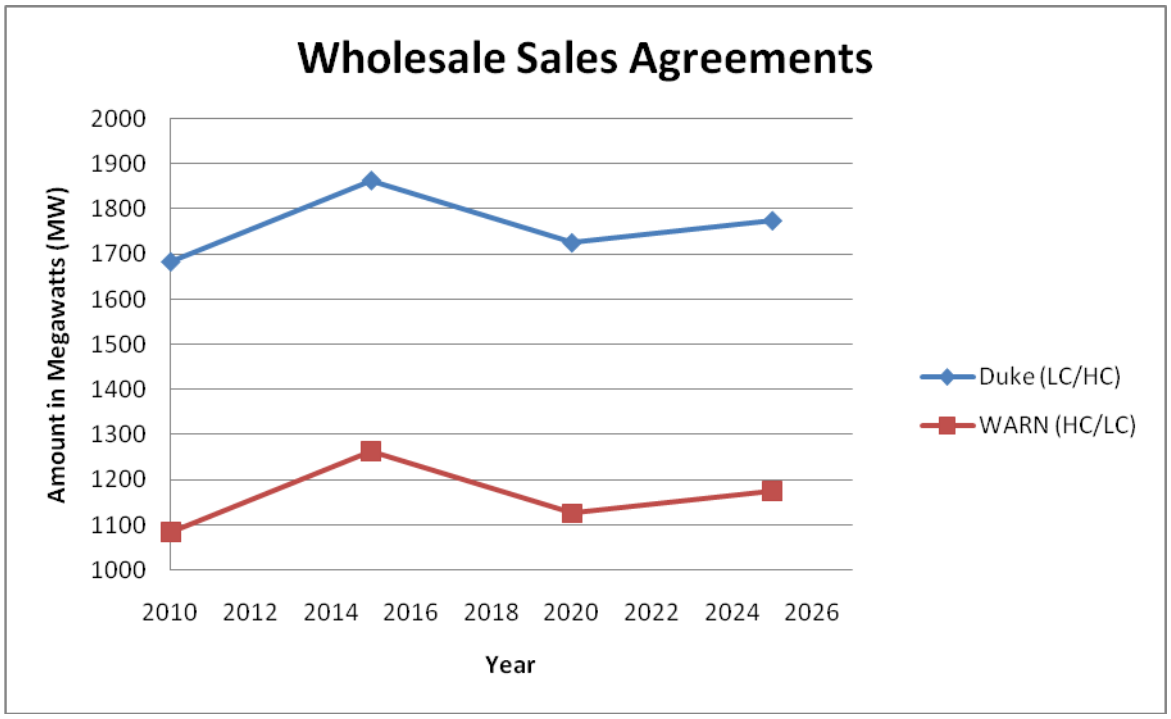

Figure 6 Projected wholesale sales agreements in NC WARN and Duke Energy's plans (LC/HC= low carbon and high carbon tax scenarios).

In NC WARN's plan, Duke would have to trim approximately 600 MW from its planned wholesale sales agreements and would not be able to make any significant additional capacity commitments or recruit new wholesale customers. Meanwhile Duke continues to actively recruit

[7] Robert Schnapp, "Overview- Power Transactions & Interconnected Networks" Energy Information Administration (EIA) website, accessed December 2008 <http://www.eia.doe.gov/cneaf/electricity/page/prim2/chapter7.html>

wholesale customers and expects to continue many of its existing contracts (see wholesale chart below):

Wholesale Customer

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Schedule 10A - Note 1 City of Concord, NC Town of Dallas, NC Town of Forest City, NC Town of Kings Mountain, NC Lockhart Power Company Town of Due West, SC Town of Prosperity, SC	275	275	276	277	277	278	278	279	280	280	281	281	282
NP&L Wholesale Western Carolina University Town of Highlands, NC	22	22	23	24	25	25	26	26	27	27	28	28	29
Orangeburg	203	205	208	210									
Blue Ridge EMC See Note 1	225	230	235	238	242	245	249	253	256	260	264	268	272
Piedmont EMC See Note 1	111	112	114	115	117	119	121	123	124	126	128	130	132
Rutherford EMC See Note 1	207	211	215	218	221	225	228	231	235	238	242	246	249
NCEMC See Note 2	687	687	687	687	687	687	687	687	687	687	687	687	687
Saluda River EC See Note 2													
NCEMPA1													
NCEMC	97	122	122	122	122	147	147	147	147	147	147	147	147

Figure 7 Chart of projected wholesale sales agreements, p.33 Duke IRP 2008 Report.

With the exception of Orangeburg, SC, Duke Energy has not planned to eliminate any of its wholesale customers from 2015-2025. As Orangeburg only takes approximately 210 MW of capacity, that dropped contract alone is not enough to meet NC WARN's plan where 600 MW of wholesale contracts are eliminated from 2010 onward. Many of the largest of these contract agreements are with other electric companies, mainly as an agreement to provide an additional peak load resource should these other companies need them. Considering these contracts are

already in effect it is unlikely that Duke Energy would want to revise these agreements to trim down the capacity, and in fact has made numerous plans to expand.

NC WARN has promoted this reduction in wholesale customer recruitment by Duke Energy because they are concerned about the rate impacts to North Carolina customers if Duke Energy continues to recruit outside its service area. They also argue that Duke Energy's new plants are being built in order to supply wholesale customers outside of the state (such as Orangeburg, SC) with artificially underpriced energy while North Carolina residents are forced to deal with the emissions, air pollutants, and additional costs from these plants. In fact, NC WARN believes that the Cliffside upgrade Duke Energy is building is merely a ploy to "build excess capacity so they can make money" by selling it to these outside customers.[8]

Duke Energy has admitted that there will be a cost to North Carolina customers due to the addition of Orangeburg on the level of $0.022/kWh for retail customers.[9] However, they argue that they need no additional capacity to supply Orangeburg and the rate impacts come from operation and maintenance and distribution costs rather than new plants and will be split between wholesale and retail customers, lowering that cost even further. Their rationale behind recruiting additional wholesale customers in general is that more customers can "help shoulder the burden of those capital costs which necessarily are going to be incurred by the Company as it builds this additional capacity," promote economies of scale, smooth out "lumpiness" in resource distribution, lower costs (rate and capital), and to encourage efficiency in operations through

[8] Jim Warren, e-mail correspondence, NC WARN, 11 February 2009.
[9] North Carolina Utilities Commission, "Transcript of Testimony- Volume 3 (Heard 11-6-08)," Docket E-7, Sub 858, 12 November 2008, p.18

competitive bidding- the justification being that to offer competitive prices for energy to wholesale customers, they need to be more efficient.[10]

In essence, Duke believes that the benefits to the company in terms of profitability, operational efficiency, and/or capital costs/savings outweigh the supposedly incremental costs to North Carolina retail customers which are "still pretty low in terms of net impact."[11] This economic trade-off is so favorable, in fact, they have plans to recruit 9 additional cities and forge agreements supplying up to 1500 MW of additional wholesale capacity.[12] They also argue the point that in terms of customers, "Their loads exist. Their loads will be serviced by somebody," with the belief that even if new power plants or additional wholesale customers are avoided by Duke Energy, other electric utilities will take their place.[13] NC WARN and other non-profits would be well-advised to clarify their stances in this, as restricting capacity in North Carolina may just lead to a shifting of the plants to other states, a move that would do little to alleviate climate change.

An additional point that NC WARN and other state-based non-profits must consider is that Duke Energy is a corporation with significant holdings in states ranging from South Carolina to Illinois. Thus, Duke Energy as an organization has no obligation to keep their service territory within state lines from an economic standpoint- as long as they believe they can increase the company's profitability and efficiency without jeopardizing obligations to their ratepayers they will continue to use wholesale sales agreements to bolster their energy portfolio. From a

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[10] North Carolina Utilities Commissions, "Transcript of Testimony- Volume 1 (Heard 11-5-08)," Docket E-7, Sub 858, 12 November 2008, p. 20-23

[11] North Carolina Utilities Commissions, "Transcript of Testimony- Volume 1 (Heard 11-5-08)," Docket E-7, Sub 858, 12 November 2008, p. 23

[12] Jim Warren, "The Case for Cliffside and New Nukes is Dead," News Release, NC WARN, 17 December 2008. <http://www.ncwarn.org/docs/news%20rel/nr%2012-17-08% 20Case%20is%20Dead%20for%20new% 20plants. pdf>

[13] North Carolina Utilities Commissions, "Transcript of Testimony- Volume 1 (Heard 11-5-08)," Docket E-7, Sub 858, 12 November 2008, p. 27

corporate standpoint, everything within their service territory is treated as a single system. Whether a plant is built or customers are recruited in South Carolina or North Carolina, it makes no difference to the company in terms of the system as a whole. Essentially, there are no real economic or regulatory drivers that would make Duke restrict its service territory, especially when it's more profitable to expand. Duke has even argued that attempts by the North Carolina Utilities Commission to prevent it from expanding defy federal laws encouraging healthy competition and impedes its overall ability to service customers. From a business standpoint there is nothing that obligates Duke Energy to consider the ratepayers of North Carolina alone, and Duke Energy representatives often find the opposition's fierce defense of North Carolinian customers somewhat bewildering.

However, NC WARN and North Carolina ratepayers do have protection in the form of the Public Staff Utilities Commission which has been quite proactive in preventing Duke Energy from using captive native load customers to bear the burden of non-native wholesale agreements. The PUC has also repeatedly foiled Duke Energy's legal attempts to avoid the Commission's oversight and authority over its wholesale deals.[14] If Duke Energy is indeed counting on wholesale customers to offset costs, it may need to reassess how much extra capacity they can afford to build, particularly since the PUC is unlikely to grant them the flexibility to offer the favorable sales agreements they desire. Based on Duke Energy's vehement threats to legally fight the Commission over its outside wholesale sales agreements, it appears that Duke Energy may have been counting overmuch on its ability to recruit wholesale customers to offset capital costs in its projects and its ability to avoid regulatory constraints.

[14] North Carolina Utilities Commissions, "Public Staff's Proposed Order," Docket E-7, Sub 858, 31 December 2008, p. 8

Even if all of NC WARN's accusations are true, and this is indeed a money-making "scheme," the NCUC is unlikely to ever allow Duke Energy to recruit wholesale customers at the expense of native load. As long as the NCUC continues to impose this restriction, Duke Energy has no choice but to only recruit wholesale customers if it *lowers* costs to customers through operations efficiency or volume sales. If this is the case, wholesale sales in and of itself would not be an important enough motivator for building new plants.

Wholesale Purchase Agreements

Duke has planned on dropping its contracts to buy wholesale (mostly peak natural gas) power from other electric utilities in North and South Carolina from 1212 MW in the summer and 1109 MW in the winter to just 72 MW by 2015.[15] NC WARN has suggested that Duke Energy follow the same timeline but only drop down to 345 MW instead.

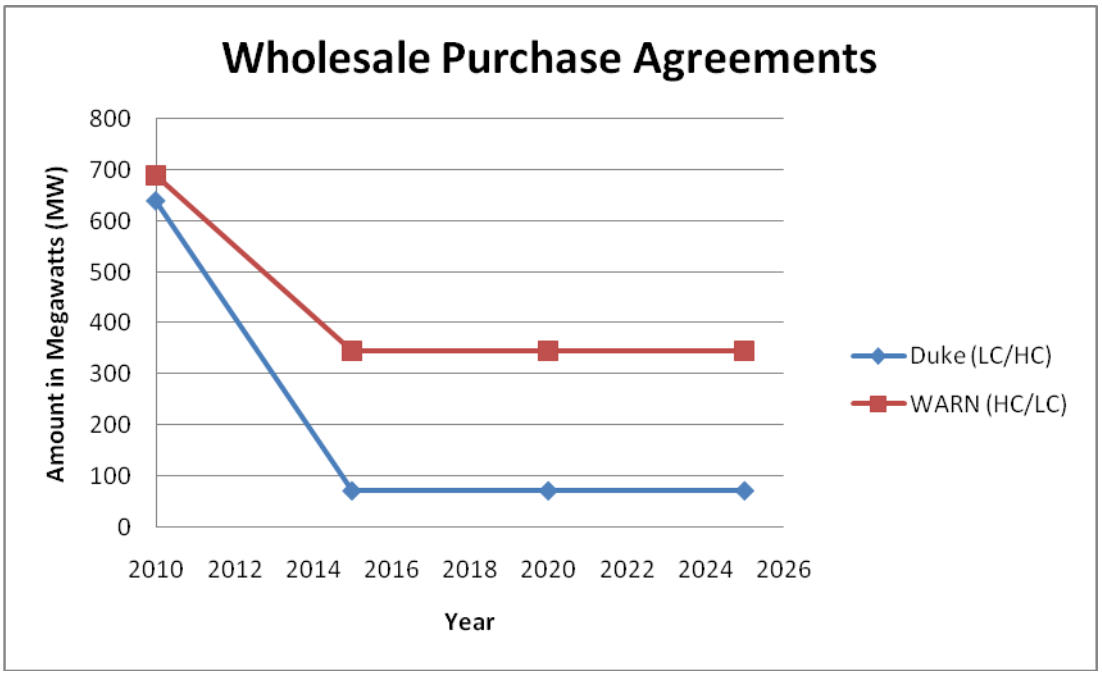

Figure 8 Projected wholesale purchase agreements in NC WARN and Duke Energy's plans (LC/HC= low carbon and high carbon tax scenarios).

[15] The Duke Energy Integrated Resource Plan: November 3, 2008. p. 35

NC WARN believes that Duke Energy can limit its plant construction by tapping into the "oversupply" of excess capacity reported by the Southeastern Reliability Corporation (SERC). Based on their interpretation of these numbers, oversupply in the Southeast could easily approach 50,000 MW of excess capacity. They also believe that using wholesale purchase agreements to capture some of this oversupply is more economical than building new capacity and that Duke Energy should be trying harder to forge bulk purchase agreements with other utility or merchant plants.[16]

However, Duke Energy may be limited by more than just the pure quantity of oversupply. NC WARN and Duke Energy would have to research whether there is enough transmission capacity (at affordable rates) before counting on this oversupply to lower peak load.

Additionally, even if the transmission costs make an agreement possible other considerations, such as the suppliers' market power might put Duke in a vulnerable position in the future. In the end, the cost of electricity might end up lower if Duke Energy uses assets they already own- a conclusion Duke Energy seems to have at least partially reached as they are tentatively planning significant natural gas peaking plant generation capacity in a low carbon taxes scenario. Relying on their own assets may also help Duke Energy reach reliability standards, particularly if no additional wholesale purchase contracts can be agreed upon.

In order to make a compelling argument for increased wholesale purchase agreements, NC WARN may first want to develop the SERC oversupply argument further. As the mere existence of this supply would not be enough to convince Duke Energy or the Commission that wholesale purchase agreements are a significant resource, research proving that no technical and

[16] North Carolina Utilities Commission, "Initial Comments of NC WARN," Docket E-100 Sub 114, 17 March 2008, p.10

economic constraints prevent Duke Energy from tapping into this supply would significantly improve this argument's relevance.

As an aside, Duke Energy can only plan for contracts it already has. Theoretically, Duke may already be thinking about expanding its wholesale purchase agreements and simply hasn't progressed enough to include them in its Integrated Resource Plan, so whether this will be a point of serious contention between Duke and NC WARN remains to be seen.

V. LOAD CONTROL

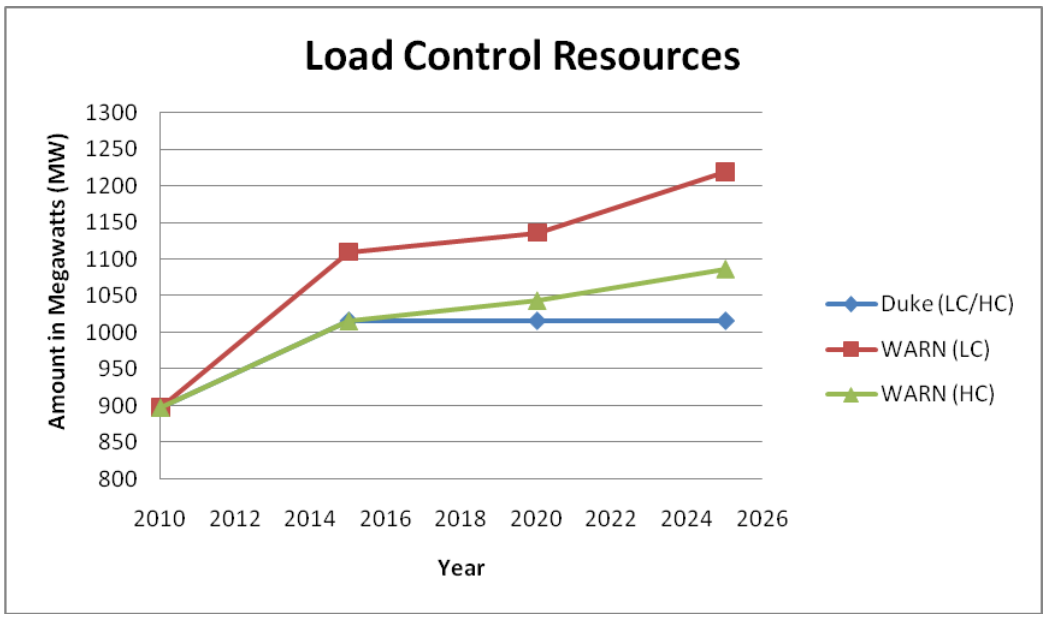

Figure 9 Projected load control resources in NC WARN and Duke Energy's plans (LC/HC= low carbon and high carbon tax scenarios).

Load control programs allow the utility to reduce peak demand by forming certain agreements with customers that reduce demand at peak times. Agreements can take several forms: the utility could exchange billing credits for the right to interrupt the customer's load, customers could be notified with a utility signal requesting curtailment, or be provided with economic incentives to reduce or shift load, mostly through attractive rates. This helps the utility by avoiding the need for peaking plants. Instead, when the utility is experiencing demand at peak

times that would exceed its generation capacity, they can simply send the signal to the pre-arranged customers or interrupt service to reduce that peak demand.

After 2011, Duke Energy's estimate of load control capacity peaks at 1016 MW and then remains constant for the remaining planning timeline (2028). In contrast, NC WARN believes that load control opportunities increase proportionately with demand and should be taken advantage of. While under a high carbon tax scenario this assumption only leads to a difference of 71 MW in load control capacity, it leads to a 203 MW difference under a low carbon tax scenario as NC WARN's estimates rise proportionately along with demand.

Duke Energy's 2008 IRP demonstrates that by 2010 they plan to limit their load control options to two programs, with exactly 771 MW supplied by the Power Share (non-residential curtailment) program and 244 MW by Power Manager (interrupting residential air conditioning) Duke also does not have any plans to expand these programs for the rest of the planning horizon.[17] However, this lack of expansion may be due to technical constraints not accounted for in NC WARN's plan. In order to be cost-effective, load control customers generally need to be larger volume which implies mostly commercial or industrial accounts. Residential can be recruited but again, these too need to be larger volume accounts such as apartment complexes and/or be residential customers with systems that allow Duke Energy to easily meter and affect distribution of the electricity supply.

Even if customers are able to meet these requirements, there is also the question of how large the potential customer base is. Since Duke Energy has a very limited pool of customers that meet the technical requirements mentioned previously, they cannot rely overmuch on recruiting new customers if its existing customers drop out of the program. While NC WARN argues that new growth should increase the pool of customers, much of this growth is anticipated in the

[17] The Duke Energy Integrated Resource Plan: November 3, 2008. p. 144

residential sector which will have far fewer potential customers that meet the requirements of this program than growth in the industrial or commercial sectors (both of which are sectors expected to decline in Duke's IRP). Additionally, demand alone is not an indicator of growth as much of the demand differences between the two carbon-tax scenarios result from changes in use, not from adding new customers.

For Duke Energy there is also the added question of reliability. In many ways, a load control contract acts like a peaking plant: both reduce peak load and thereby the need for additional baseload capacity. However, load control contracts are far more unreliable for several reasons. Duke Energy can only count on having that capacity for the length of the contract term which is often far shorter than the lifetime of a peaking or baseload plant. For planning purposes, it makes it very difficult to know over a 20 year planning period what your load control resource will look like long-term when customers in an already small potential customer base can drop out at nearly any time. As a result, Duke Energy views these contracts as having value "only in the year and not over a long period of time."[18]

However, Duke Energy has proposed a method for significantly widening the range of potential load control customers, a method that NC WARN may have initially dismissed. During the Save-a-Watt proceedings, (a Duke energy-efficiency proposal that will be examined in detail under the "Efficiency Gains" section) Duke Energy repeatedly mentioned its plans for a smart grid.[19] At the time, it was portrayed as an energy efficiency measure, an assessment NC WARN would vehemently deny. However, this technology does have the ability to significantly increase Duke Energy's load control options since it would allow easy distribution and metering to a

[18] North Carolina Utilities Commission, "Transcript of Testimony- Volume 10 (Heard 8-18-08)," Docket E-7, Sub 831, 27 August 2008, p. 90
[19]North Carolina Utilities Commission, "Transcript of Testimony- Volume 10 (Heard 8-18-08)," Docket E-7, Sub 831, 27 August 2008, p. 84

much larger proportion of its residential customer base, allowing them to participate in load control programs. Even though NC WARN would disagree with the way Duke Energy is portraying this technology, allowing Duke Energy to implement it would allow them to reach and perhaps exceed the load control goals NC WARN has set in its plans.

VI. EFFICIENCY GAINS

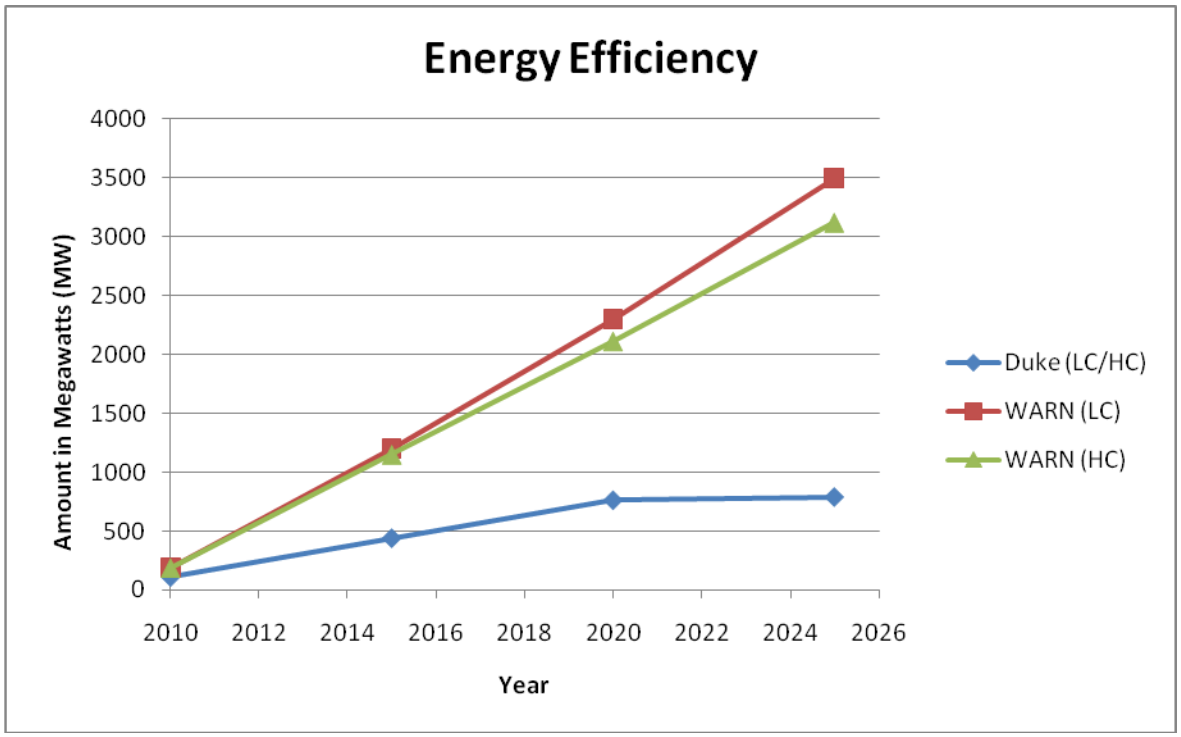

Figure 10 Projected load control resources in NC WARN and Duke Energy's plans (LC=low carbon tax scenario; HC=high carbon tax scenario).

When defining energy efficiency, it is important to distinguish between demand-side management, which shifts peak loads to non peak times, and energy conservation which actually reduces demand. In North Carolina, their legal definitions are as follows:[20]

[20] North Carolina Utilities Commission, "Testimony of J. Richard Hornby on Behalf of Environmental Defense Fund, Natural Resources et al," Docket E-7, Sub 831, 26 June 2008, p. 11

In North Carolina, in N.C. Gen. Stat. § 62-133.7(a) and Commission Rule R8-66, DSM is defined differently from energy efficiency:

> **Demand-side management** (also known as demand response) – activities, programs or initiatives undertaken by an electric power supplier or its customers to shift the timing of electricity use from peak to nonpeak demand periods
>
> **Energy efficiency** (also known as energy conservation) measure – an equipment, physical or program change that results in less energy used to perform the same function – includes combined heat and power but does not include demand-side management

One of the greatest differences between the NC WARN and Duke Energy plans is the reliance on energy efficiency gains to suppress demand. While Duke Energy only estimates a 787 MW cut in demand due to energy efficiency by 2028, NC WARN is suggesting a 1% reduction in demand from energy efficiency every year from 2010 onward. Under a low carbon tax scenario (with higher demand), this accumulates to 3498 MW while under a high carbon tax scenario it reaches 3122 MW.

Nowhere is this conflict in assumptions more clear than in the Save-a-Watt hearings. Save-a-Watt was proposed as an energy efficiency and demand-side management (which includes load control) program by Duke Energy in the latter half of 2008, and was immediately and vehemently opposed by the Public Staff and a wide-coalition of local government, businesses, and environmental/non-profit groups. These groups, including NC WARN, found several faults with this program, but mostly opposed its unprecedented repayment scheme and lack of proposed results.

Looking to anticipate energy efficiency regulation from the North Carolina Utilities Commission and North Carolina State Legislature, Duke Energy took the initiative and proposed that it be compensated with a rider of 90% of the avoided fixed and variable supply-side costs for its energy efficiency and DSM programs. Duke Energy has claimed that this unprecedented

repayment scheme represents a novel and bolder way of encouraging energy efficiency, potentially serving as a "model to other utilities to a new way of thinking about energy efficiency."[21] However, the Public Staff and opposition groups brought out several expert witnesses that agreed that it was simply excessive, citing as a real-world example that if Duke Energy installed a CFL bulb in someone's home, Duke would receive a 500% profit on the energy it would save.[22]

Many of the opposition groups also found fault with the programs themselves, claiming that Duke was simply repackaging DSM programs like load control rather than promoting energy efficiency programs in order to make a profit without doing any additional work. These groups and the Public Staff also were of the opinion that the amount of energy Duke Energy was proposing to save through this program was far below what could be achieved. The Public Staff even performed a comparison of the efficiency programs of several other utilities and municipalities and concluded that they were averaging an 11% cut in demand. [23] Meanwhile, Duke Energy only projected a savings of 1.1% by 2015 after which those savings would drop to 1.05% by 2025. In comparison, the Public Staff's expert witness testified that "the top twenty energy efficiency utilities are already saving 1% of annual kWh sales every year, over ten times higher per year than what Duke is proposing through its filed Energy Efficiency Plan.[24] NC WARN has based its 1% annual reduction projected on many expert witnesses who support this figure and the NC Legislature's study which supports a potential of 14% reduction over 10

[21]North Carolina Utilities Commission, "Transcript of Testimony- Volume 10 (Heard 8-18-08)," Docket E-7, Sub 831, 27 August 2008, p. 14
[22] North Carolina Utilities Commission, "NC WARN's Brief," Docket E-7, Sub 831, 7 October 2008, p. 7
[23] North Carolina Utilities Commission, "Public Staff's Late-Filed Exhibit Nos. 1and 2," Docket E-7, Sub 831, 01 August 2008
[24] North Carolina Utilities Commission, "Public Staff's Non-Confidential Testimony of Michael C. Maness & Richard F. Spellman," Docket E-7, Sub 831, 26 June 2008, p. 13-14

years.[25] Even Duke's own consultants estimated that a 19% reduction was feasible based on results from other states.[26]

In response to expert witnesses who testified to these numbers based on results from other states, Duke Energy countered these arguments by claiming that these studies are all theoretical because they cannot be applied to what will really happen in North Carolina. Many experts and opposing groups have argued that California has proved that energy efficiency programs can cut demand. However, Duke Energy has actually claimed that studies show that the energy savings resulted from driving industry out of state, not from the energy efficiency programs, and that 75% of the difference between the usage in California and North Carolina is tied to price and weather.[27] Later, they also took issue with the validity of any studies comparing results from other states as a whole, believing they were not comparable "given the differences in calculation methodologies, retail rates and definitions of energy efficiency measures."[28] They also dismissed the North Carolina Legislature's study into the potential of energy efficiency in North Carolina for this reason as it too aggregates data from other states. They also claim that their repayment scheme is necessary in order to be as aggressive with energy efficiency as other states since these states have deregulated generation markets where consumers do not pay for the construction of new power plants.[29]

Duke Energy also believes that historically low prices of electricity in North Carolina will lead to low customer participation rates in energy efficiency programs, a trend they say was

[25] GDS Associates, inc. (2006), "A Study of the Feasibility of Energy Efficiency as an Eligible Resource as Part of a Renewable Portfolio Standard for the State of North Carolina," December 2006.
[26] Forefront Economics Inc. (2007), "Duke Energy Carolinas DSM Action Plan: North Carolina Report," 31 August 2007.
[27] North Carolina Utilities Commission, "Transcript of Testimony- Volume 10 (Heard 8-18-08)," Docket E-7, Sub 831, 27 August 2008, p. 80
[28] North Carolina Utilities Commission, "Order Denying Motion," Docket E-100, Sub 120, 2 December 2008, p.6
[29] North Carolina Utilities Commission, "Transcript of Testimony- Volume 10 (Heard 8-18-08)," Docket E-7, Sub 831, 27 August 2008, p. 186

common in their experience with programs they implemented in their Midwest locations where prices were also low.[30] They also disagree with the potential cited by the opposing groups, arguing that these energy efficiency programs cannot realistically cut demand to the level argued by NC WARN and others. They state that to reach anywhere near these levels they require customer participation which requires a great deal of time and education to build, a program like Save-a-Watt in place, and a switch to a digital grid with Smart Meters all of which will take a long time to establish.[31]

Based on Duke Energy's reaction, it is clear that they do not believe that any studies incorporating results from other states can be applied to North Carolina. However, this leads to a fundamental chicken-and-egg problem: if there are no wide-spread energy efficiency programs in North Carolina, studies have to take results from other states. If studies take results from other states, Duke Energy will discount them as being non-applicable. Duke Energy also seems to be relying on its own experience with Midwest energy efficiency programs to assume that North Carolina will have low customer participation rates, leading to a push for non-customer-reliant measures such as a digital grid and smart metering. Duke Energy's proposed repayment scheme may also act as a security blanket for the risks they feel they are taking, namely the possibility that these programs might fail and/or customer participation will be low.[32]

However, Duke Energy simply cannot justify the use of an exceptional repayment scheme while planning for less than exceptional results without facing opposition, as evidenced by the strength of the coalition of groups that opposed them during the Save a Watt hearings.

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[30] North Carolina Utilities Commission, "Transcript of Testimony- Volume 10 (Heard 8-18-08)," Docket E-7, Sub 831, 27 August 2008, p. 39

[31] North Carolina Utilities Commission, "Transcript of Testimony- Volume 10 (Heard 8-18-08)," Docket E-7, Sub 831, 27 August 2008, p. 71

[32] North Carolina Utilities Commission, "Transcript of Testimony- Volume 10 (Heard 8-18-08)," Docket E-7, Sub 831, 27 August 2008, p. 247

Most expert witnesses and the Public Staff called for a push towards the more standard rate-making scheme where Duke would be compensated for the cost of the programs, not the cost of new power plants, a move Duke Energy would be well-advised to take. NC WARN and many of the same groups involved in the Save-a-Watt hearings have supported NC SAVE$, a motion to install an independently administrated energy efficiency program for North Carolina.[33] If this program succeeds in gaining the support of the State Legislature, Duke Energy may lose out on the energy efficiency market altogether- if Duke wants to avoid this scenario, it will need to have less conservative projections for results and/or a less outrageous repayment scheme. Even a compromise of slightly more optimistic numbers would go far in alleviating the opposition's scrutiny.

If NC WARN wants to see energy efficiency incorporated to the level seen in other states, either NC SAVE$ will have to pass or they will need to push for the regulatory frameworks seen in those other states. This will likely involve a repayment scheme that is results oriented and has higher goals than Duke Energy has projected; however, the most appropriate framework for North Carolina will need to be examined further through additional research should this become an option.

VII. RENEWABLES

Another major difference between the NC WARN and Duke plans is the reliance on renewable energy resources to offset peak load. In both cases, it appears that NC WARN and Duke do not place a great deal of confidence in renewables as a baseload resource, preferring to treat renewable energy plants as a method of load control or a category unto itself. As renewable energy is still considered a developing resource, both groups appear to be wary of relying on it

[33] North Carolina Utilities Commission, "Order Denying Motion," Docket E-100, Sub 120, 2 December 2008

overmuch during its initial development. Even NC WARN's projections are fairly modest to begin with as this resource is only expected to meet 1% of demand by 2010, 4% by 2015, and 10% thereafter.

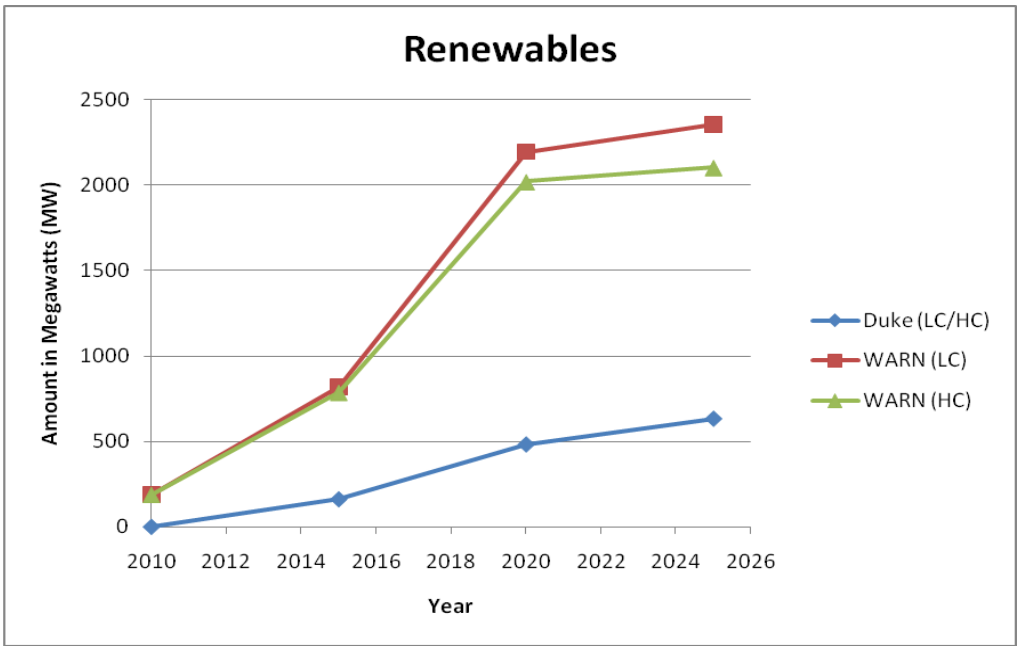

Figure 11 Projected renewable resources in NC WARN and Duke Energy's plans (LC=low carbon tax scenario; HC=high carbon tax scenario).

However, NC WARN's 10% figure appears optimistic in comparison to Duke Energy's projections. Duke Energy claims that it is enthusiastically planning to provide 12.5% of its electricity generation with "renewable energy resources" in compliance with North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard.[34] But under this REPS, Duke Energy's actual requirements for contributions from the generation of what is traditionally regarded as "renewable" energy is far lower as renewable energy credits, energy efficiency, hydro-power, and demand-side management can all be used to meet a significant portion of this standard. When these additional resources are removed, the amount of generation covered by

[34] The Duke Energy Integrated Resource Plan: November 3, 2008. p. 27

actual “renewable energy” sources only adds up to 3% in both high carbon and low carbon scenarios.

While Duke Energy has planned for just enough renewable capacity to meet the REPS, NC WARN believes that with economies of scale and over time, renewable resources will be able to supply a greater part of Duke Energy’s portfolio. They also believe that these economies of scale will eventually make renewable power competitive with kWh prices from nuclear by the time the Lee nuclear stations come online. However, as evidenced by Duke Energy’s approach to energy efficiency, Duke Energy is reluctant to incorporate new technologies and resources into its IRP, particularly when those resources currently cost more than its conventional sources such as coal and nuclear. NC WARN’s optimism about this resource, even if it’s well-founded in scientific studies and research, does not change the fact that renewables cost what they do *today*. Added to the fact that many of these renewable energy resources are outside of Duke Energy’s core competencies (coal, nuclear, natural gas, hydro, etc.), Duke Energy will be highly reluctant to count on renewables to supply 10% of its projected demand in 2025.

Even with a great deal of proof in the form of research and studies, Duke Energy is unlikely to act on this resource unless it has been proven to be successful commercially amongst other electric utilities, the more similar geographically and technologically the better. However, these lower costs and commercial viability from economies of scale that NC WARN envisions rely on initial investments or regulations that force renewable energy development. In order to force Duke Energy to take a leap into the renewable resource market that matches NC WARN’s projections, NC WARN may be better off taking its research and studies to the North Carolina Senate- the same lawmakers who created the REPS- and recommend a higher renewable standard. Without this regulatory impetus, Duke Energy is unlikely to invest in renewables to the

levels required by NC WARN on its own particularly because of uncertainty over its commercial viability and high cost.

VIII. NEW COGENERATION

Cogeneration, the process of harnessing waste heat at power plants for heating purposes, is a significant resource in NC WARN's plan but is non-existent in Duke Energy's. Duke Energy does not even mention this resource in its expansion plans, a significant departure from NC WARN's assumptions about the viability of the resource.

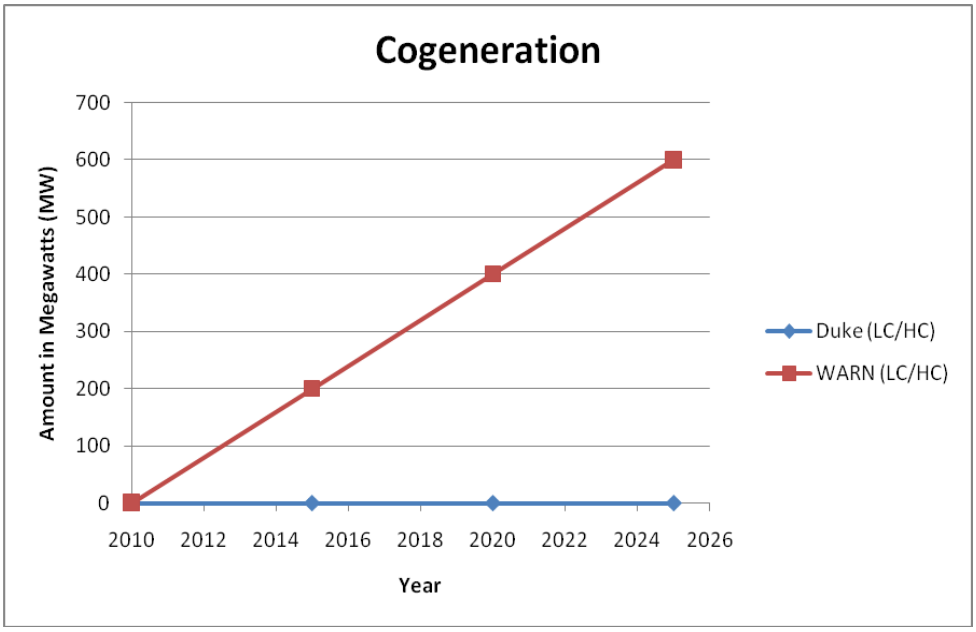

Figure 12 Projected cogeneration resources in NC WARN and Duke Energy's plans (LC=low carbon tax scenario; HC=high carbon tax scenario).

Unlike renewables, cogeneration is technologically simple and quite widespread. Duke Energy even has a non-regulated affiliate, Duke Energy Generation Services (DEGS), which offers cogeneration development services. However, because this technology is not being championed by the general public or environmental groups in the same way renewables are, virtually no financial or regulatory incentives exist in North Carolina to install it. The ability to

implement this technology is also very dependent on a wide range of environmental and technical factors, especially the plant's proximity to customers. In order to prove that this is a viable resource for Duke Energy, NC WARN or other promoters will have to go plant by plant to determine whether cogeneration technologies can be implemented there effectively.

Added to these challenges is the fact that cogeneration simply lacks the exposure and support renewable resources have managed to gain. While many environmental groups promote the use of renewable energy resources as part of its agenda, very few are aware of or promulgate cogeneration as an important resource in combating climate change.

More research directed into exploring the viability and benefits of this resource as they would apply to Duke Energy could help to bring this neglected technology to the attention of the same North Carolina policy makers creating regulations promoting renewables. If this resource can indeed be used to offset a great deal of energy load in North Carolina, this could be a great tool for reducing carbon impacts if electric utilities are forced and/or incentivized to adopt it by lawmakers who have been influenced by the scientists and environmental groups that promote it.

VIV. EXISTING PLANTS

NC WARN's plan follows the same unit retirement schedule as Duke's IRP. However, units 1-4 at Cliffside are still retired in NC WARN's plan even though the new 800 MW Cliffside upgrade is not built in this plan. Duke Energy has repeatedly stated that the retirement of units 1-4 are entirely dependent on the Cliffside upgrade being completed, which means that these units would remain online if the Cliffside upgrade were cancelled. Other than this difference, Duke Energy and NC WARN would assume the same retirement plan. Figure 13 shows Duke Energy's current generation resource mix.

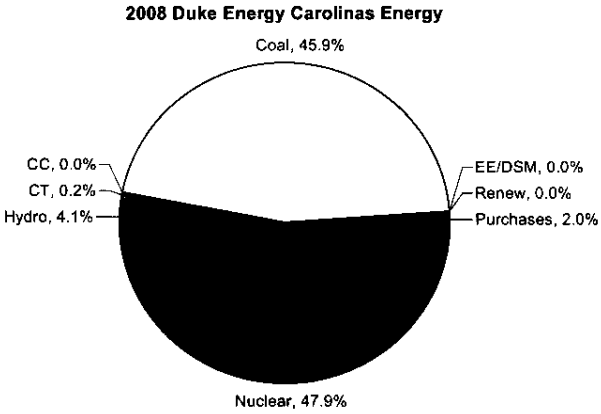

Figure 13 Existing 2008 energy resource distribution for Duke Energy.

X. NEW PLANTS

The fundamental difference between NC WARN's plans in comparison to Duke Energy's is the complete avoidance of new plants. In contrast, Duke Energy has projected they will build up to nearly 7000 MW of new capacity from new plants and upgrades by 2025 in a low carbon scenario.

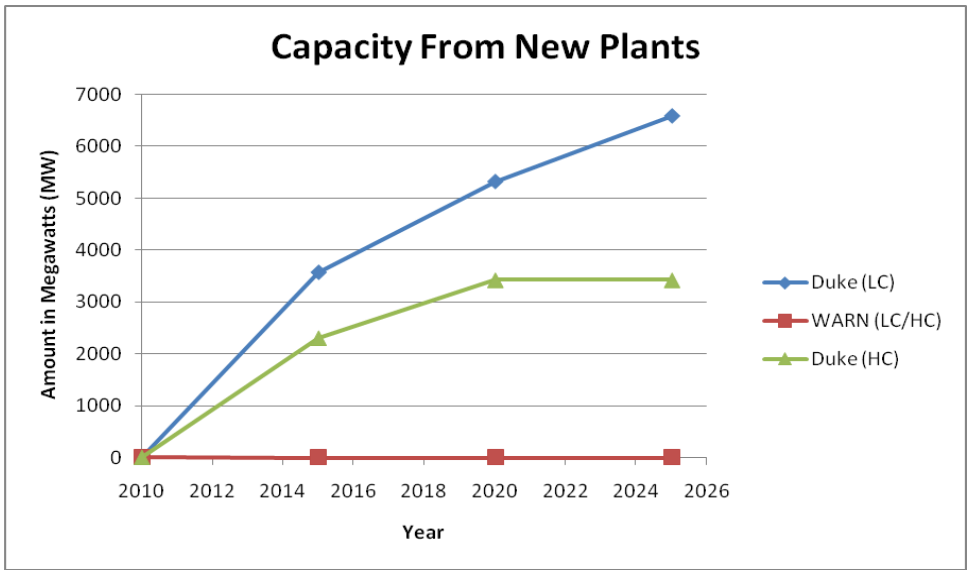

Figure 14 Projected capacity added by the construction of new plants in NC WARN and Duke Energy's plans (LC=low carbon tax scenario; HC=high carbon tax scenario).

Cliffside

Presently, Duke Energy is continuing construction on an 800 MW coal-fired unit (Cliffside Unit 6) at its existing Cliffside, NC location. As part of its permit agreement, this unit is being built in exchange for the retirement of four older coal-fired units at Cliffside, the retirement of 800 MW of coal-fired capacity elsewhere (subject to Duke Energy's reliability requirements), and Duke Energy's contribution of 1% of its annual retail revenue from electricity sales to energy efficiency and DSM programs.[35]

NC WARN and other non-profit groups initially demanded that the Cliffside unit be an Integrated Gasification Combined Cycle power plant (IGCC), a technology that would allow for eventual carbon capture if retrofitted for doing so. However, North Carolina and South Carolina have geologies that do not allow for direct carbon sequestration, so the North Carolina Division of Air Quality (NC DAQ) declared that this technology was not viable and would constitute a fundamental change to the project, so could not justify/mandate its use in the Cliffside permit.[36]

Since then, NC WARN and many of these same groups have lodged numerous lawsuits over the criteria and hazardous air pollutants projected to come out of the new unit; however, these are mostly designed to delay or stop the project in order to address the real problem these groups have with this plant: the carbon dioxide emissions. NC WARN believes that investment in the Cliffside plant is unnecessary considering the potential of efficiency, load control, and renewables to offset demand. In addition to being too expensive, they believe Cliffside slaves Duke Energy's captive customers to burning dirty coal instead of moving forward to cleaner sources of energy.

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[35] North Carolina Utilities Commission, "Order Granting Certificate of Public Convenience and Necessity with Conditions," Docket E-7 Sub 790, 21 March 2007.

[36] North Carolina Department of Environment and Natural Resources, Division of Air Quality. "Air Quality Permit No. 04044T28, Duke Energy Carolinas LLC, Cliffside Steam Station." Raleigh, NC. 29 January 2008. <http://daq.state.nc.us/permits/psd/docs/cliffside/Final_Permit-Final_Determ_App_A.pdf>

Duke Energy states the Cliffside upgrade is necessary to meet growing customer demand. However another incentive could make this investment attractive: there is a possibility that under a CO2 cap-and-trade system, emissions from existing generating capacity will be grandfathered which could hand a future windfall to firms that built substantial new capacity now.[37] Because the new unit can be expected to be more efficient and reliable than the coal units it is projected to replace, there might be substantial environmental benefits. The NC DAQ has projected that with the unit retirements and carbon offset agreements Duke Energy made in its Cliffside permit in order to build this unit, the net emissions of air pollutants would actually decrease and overall carbon impacts would be neutralized.[38]

Would carbon regulations alone deter Duke Energy from building the new Cliffside unit? It depends on the type and timing of regulation, and the time when such regulation takes place.[39] Even if NC WARN succeeded in completely stopping the new Cliffside unit, let us consider how Duke Energy would react. They have already stated that they won't retire Cliffside units 1-4 or the extra 800 MW of capacity from other older coal plants if this unit is stopped, and will not need to fulfill its promise to invest 1% of their profits in energy efficiency. More importantly, considering Duke Energy's significant doubts about the ability of renewables and energy efficiency to address demand, Duke Energy will be unlikely to turn to those resources to offset baseload generation instead (which is the basis of NC WARN's argument). Even though NC WARN claims that these resources will be more cost-effective than Duke Energy's existing resources, we have already examined why Duke Energy does not place much credit in NC WARN's studies/cost projections. Considering Duke Energy's skepticism, they are unlikely to

[37] Morgan, Granger. "Editorial: Don't Grandfather Coal Plants." Science. Vol 314. 17 November 2006
[38] Overcash, Keith. "Cliffside Power Plant, Remarks by Keith Overcash." Press release. Division of Air Quality. 01 April 2008
[39] Patiño-Echeverri, Dalia et al. "Should a Coal-Fired Plant be Replaced or Retrofitted?" Environmental Science & Technology. 41(23): 7890-7986. 2007

find the cost-effectiveness argument to be compelling, particularly after considering the dispatch-ability of those resources. Instead, they will most likely resort to pushing for more nuclear or burning more coal in their more inefficient existing coal units. So given these factors, what would building or not building the new Cliffside unit do to carbon emissions and the integration of more renewables into the energy mix?

Cliffside Scenario Model

In order to test NC WARN's claims that building the new Cliffside unit will be worse for carbon emissions and prevent investment in renewables, I created a spreadsheet model (in Excel) that would simulate Duke Energy's coal generation mix (and corresponding air emissions) for 50 years from 2010-2060, under four different scenarios that combine two different carbon tax prices and the two strategies of installing or not installing the new Cliffside plant.

Data and Assumptions:

For all of Duke Energy's existing coal units, the heat rate and emission rates for carbon dioxide, sulfur dioxide, nitrous oxide, and mercury by weight per kWh are based on the EPA's 2005 E-Grid data.[40] It is assumed that all these existing plants have an 85% maximum capacity factor when calculating maximum kWh output. Since the new Cliffside unit is still under construction, emission rates for this project are estimated via existing literature and by entering specification data collected from Duke Energy's air quality permits into the Carnegie Mellon/NETL Integrated Environmental Control Model and assumed a maximum capacity factor

[40] "US EPA: e-GRID," US Environmental Protection Agency, 12 February 2009, 25 March 2009 <http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html>

of 95%.[41,42] Current coal, SO2, and seasonal NOx prices were also collected from various sources.[43,44,45]

Energy demand was based on Duke Energy's IRP until 2023 which was the last year for which Duke Energy supplied demand forecasts.[46] Thereafter I assumed a 1% growth in annual demand until 2055 where it then remains stable until 2060. The amount of demand expected to be supplied by these coal-fired units also changed, dropping 0.65% per year from 45.9% until 2028 where it then falls to a .12% decrease annually until 2060.

It is assumed that starting in 2018 Duke has the option of supplying up to 30% of coal-energy demand with renewable sources at a cost of $0.06/kWh. The $0.06/kWh price for renewables is an optimistic estimate that allows an examination of whether renewables would be competitive with coal under various carbon tax situations. Considering current wind power costs are in the range $0.04-$0.06/kWh in certain states, $0.06/kWh was chosen to represent the renewable energy mix that might be achievable by 2018 given the aggressive investment NC WARN has proposed.[47] The model attempted to simulate emissions from 2010 until 2060.

Four Scenarios:

The four scenarios were designed to capture the emission impacts of either building Cliffside unit 6 and retiring 800 MW of the most expensive plants along with Cliffside units 1-4

[41] "Duke Energy Plans to Emit Six Million More Tons of CO2 per Year in NC," *New Raleigh*, 23 October 2007, 25 March 2009 <http://www.newraleigh.com/articles/archive/duke-energy-plans-to-emit-six-million-more-tons-of-co2-per-year-in-nc/>
[42] "Integrated Environmental Control Model," Carnegie Mellon University/National Energy Technology Laboratory, 28 January 2008, 18 March 2009 <http://www.iecm-online.com/iecm_dl.html>
[43] "Average Price of Coal Delivered to End Use Sector by Census Division and State," DOE/EIA, September 2008, 25 March 2009 <http://www.eia.doe.gov/cneaf/coal/page/acr/table34.html>
[44] Dave Ryan, "EPA Announces Results of Acid Rain Reduction Auction," US EPA, 28 March 2002, 25 March 2009 <http://yosemite.epa.gov/opa/admpress.nsf/b1ab9f485b098972852562e7004dc686/d91ed5d63106f4a385256b8a0079ff0c?OpenDocument>
[45] "SO2 market falls sharply in week, while NOX prices regain footing," Platts News, 4 March 2009, 25 March 2009 <http://www.platts.com/Electric%20Power/News/7696476.xml?S=printer&src=Electric%20Powerrssheadlines1>
[46] The Duke Energy Integrated Resource Plan: November 3, 2008. p. 95
[47] "What is Wind Energy in the States?" US Dept. of Energy, 20 June 2007, 31 March 2009 <http://apps1.eere.energy.gov/state_energy_program/topic_definition_detail.cfm/topic=208>

or not building Cliffside and retaining their current existing portfolio of coal units. These impacts were also placed under an additional factor of there either being no carbon taxes throughout the planning horizon or there being carbon taxes by 2018. These scenarios were chosen in order to answer the dual questions of whether building the new Cliffside unit would actually lead to more carbon emissions and if it would preclude Duke Energy from using cheap renewables were they to be available. A table summarizing these assumptions is included below:

	New Cliffside Built?	**Carbon taxes by 2018?**
Scenario I	no	no
Scenario II	yes	no
Scenario III	no	yes
Scenario IIV	yes	yes

Figure 15 Table illustrating assumptions under the energy model's four scenarios.

These four scenarios were run once under a $20/ton carbon tax price (when carbon taxes were applicable) and once under a $30/ton carbon tax price.

Simulating Duke Energy Operation of Coal-Fired Plants:

Tables 16 and 17 present power generation costs ($/MWh) based on fuel and emissions costs for each coal-fired plant in Duke Energy's generation mix. Assuming economic dispatch (where the cheapest $/MWh units would be dispatched to meet energy demand first) and the demand profile discussed above, it can be determined which plants will be running and how much emissions will they produce, under each scenario.

		MWh	Fuel	Nox cost	SO2 cost	CO2 cost	Hg cost	TOTAL (Cost/MWh)
Cumulative	COST/Ton		67.92	864.5833333	81.87	0	0	
6,865,650	Unit6	6,865,650	21.33	0.30	0.06	0	0	21.69127802
20,853,618	Marshall	13,987,968	22.78	0.79	0.53	0	0	24.10153466
35,992,300	Belews Creek	15,138,682	24.53	0.25	0.52	0	0	25.30487027
44,086,540	G G Allen	8,094,240	25.69	0.83	0.58	0	0	27.0950772

48,087,407	U5Cliffside	4,000,867	26.45	0.29	0.59	0	0	27.32715739
50,680,367	Buck	2,592,960	28.44	1.12	0.48	0	0	30.03307426
53,946,095	Riverbend	3,265,728	28.92	1.04	0.62	0	0	30.57747613

Figure 16 Power generation costs when Cliffside Unit 6 is built and 800 MW of the most expensive units are retired

		MWh	Fuel	Nox cost	SO2 cost	CO2 cost	Hg cost	TOTAL (Cost/MWh)
Cumulative			67.92	864.5833333	81.87	0	0	
13,987,968	Marshall	13,987,968	22.78	0.79	0.53	0	0	24.10153466
29,126,650	Belews Creek	15,138,682	24.53	0.25	0.52	0	0	25.30487027
37,220,890	G G Allen	8,094,240	25.69	0.83	0.58	0	0	27.0950772
42,693,437	Cliffside	5,472,547	27.87	0.53	0.62	0	0	29.02104142
45,286,397	Buck	2,592,960	28.44	1.12	0.48	0	0	30.03307426
48,552,125	Riverbend	3,265,728	28.92	1.04	0.62	0	0	30.57747613
51,369,341	W S Lee	2,817,216	29.46	1.40	0.64	0	0	31.49547758
53,401,661	Dan River	2,032,320	33.55	2.06	0.54	0	0	36.14601843

Figure 17 Power generation costs for existing coal-fired units in $/MWh

Results:

For brevity, only the CO2 impacts and renewables use are displayed in this section. The emissions of NOx, SO2, and mercury follow the exact same trends as the CO2 and are attached as appendices.

The results are displayed as the annual emissions by coal-fired units by 2060 and by the overall emissions from 2010 to 2060:

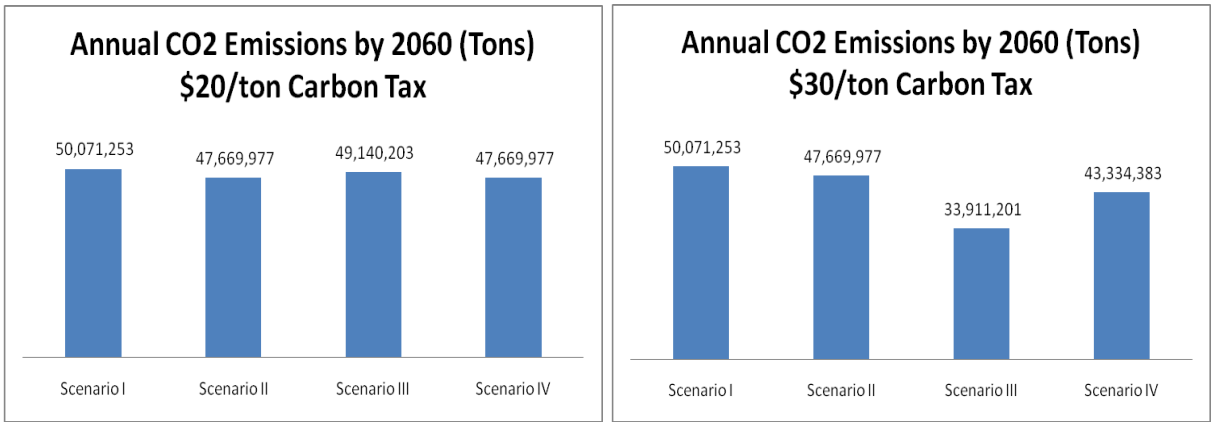

Figure 18 Projected annual CO2 emissions in tons by 2060 under $20/ton vs. $30/ton CO2 taxes

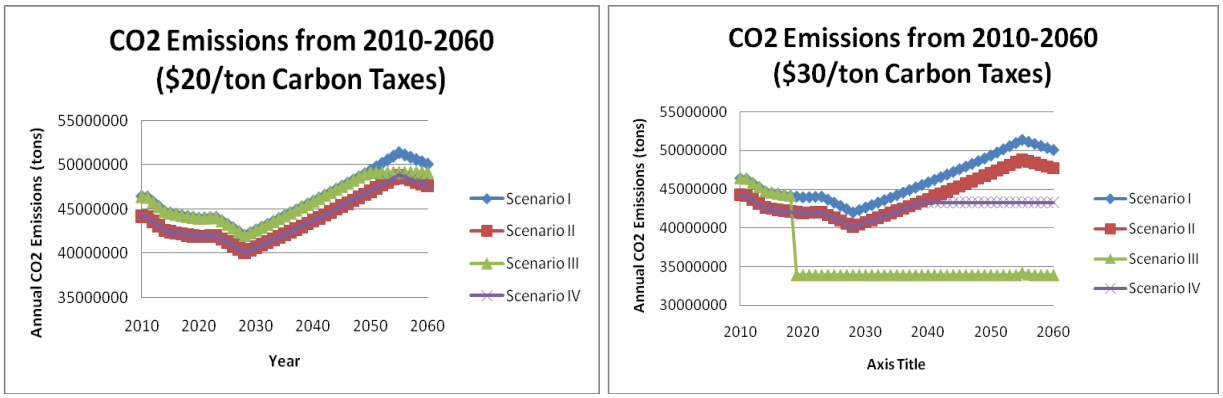

Figure 19 Projected annual CO2 emissions in tons from 2010-2060 under $20/ton vs. $30/ton CO2 taxes

The results show that $20/ton carbon taxes do not have a significant impact on carbon emissions. In fact, it demonstrates that building the new Cliffside unit would actually be better for carbon emissions as the units under this mix would be emitting 2.4-1.5 million tons less annually overall. However, under $30/ton carbon taxes, $0.06 renewables become significantly more competitive with coal, leading to far larger cuts in carbon emissions under carbon taxes. In this situation, over 16 million tons are avoided annually by not building Cliffside when carbon taxes are present and renewables are an option. In comparison, allowing Cliffside to be built would only lead to a 4.3 million ton reduction under carbon taxes.

This $10/ton difference in carbon taxes also has significant effects on the utilization of renewables under these scenarios:

Figure 20 Percent energy generation supplied by renewables as opposed to coal under $20/ton carbon taxes

Figure 21 Percent energy generation supplied by renewables as opposed to coal under $30/ton carbon taxes

From these results, it is clear that higher ($30/ton) carbon taxes will lead to more utilization of renewables. It is also apparent that renewables will be used to supply far more electricity if the new Cliffside unit is not built, reaching 29% of the assumed 30% generation shared allowed in this model.

The energy model shows that in a situation where carbon taxes are too low to make renewables competitive with coal, Duke Energy and the NC DAQ would be correct in asserting that air quality impacts will be slightly less detrimental if the new Cliffside unit is built and the agreed-upon retirements take place. It would also encourage 2% more generation from renewables as opposed to coal if the Cliffside unit is built.

However, in a situation where carbon taxes are high enough to make renewables competitive with most of the existing coal-fired units, NC WARN would be right in assuming the new Cliffside unit would be a step-backward in transitioning to a cleaner energy future. Not only would it lead to significantly more CO2 emissions, it would prevent a significant amount of energy demand from being supplied by competitively priced renewables.

In either case, it is clear that a great deal of research will need to be conducted into both determining a carbon tax price that will inspire actual changes in electricity generation decision-making and determining technological and regulatory methods of making renewables competitive with coal, either through economies of scale/technological breakthroughs or renewable energy subsidies.

Dan River and Buck River Natural Gas Plants

Of the new plants that Duke has proposed, the Dan and Buck River natural gas plants are the least controversial. While NC WARN has argued that under their plan, no new plants would be required, they believe natural gas plants are the best alternative out of the conventional resources proposed. In addition to burning the cleanest, and least carbon intensive of the non-nuclear conventional fuels, these natural gas plants are cheap to build and will only be used for peaking load.

Additionally, if a high carbon tax scenario is in place, these plants will not even be built under Duke's plan since they expect total consumer demand to be lowered by high energy prices. Thus, even if implemented, these projects would not be a source of significant conflict between the two groups.

Lee Nuclear Station

Although nuclear produces no carbon emissions from the combustion of fuel, NC WARN does not believe this is an acceptable resource for combating climate change. There are a number of potential threats to human health and the environment that need to be addressed when using nuclear which include issues with safety, remediation, radioactive waste disposal, and terrorist attacks. However, in addition to these traditional arguments, NC WARN claims that investing in nuclear is risky, costly, and a dangerous waste of investment when it comes to taking real action on climate change. From a cost perspective, NC WARN believes that charging ratepayers billions of dollars for nuclear plant projects that take many years to build is a missed opportunity to invest in faster, cheaper, more effective carbon cutting energy resources. They also believe that cost overruns and construction delays are inevitable with large nuclear projects, and have frequently cited studies claiming that by the time new nuclear plants come online, prices for kilowatt hours produced from renewables will be just as competitive or even cheaper. Citing the reluctance of Wall Street investors to finance these projects without 100% backing by federal taxpayers, NC WARN argues that the financial and physical risk to ratepayers is simply unacceptable considering the cheaper, quicker and more effective alternatives mentioned throughout their plan (energy efficiency, renewables, load control, purchase agreements, etc.).[48]

Considering Duke Energy already has a generation mix that is 47.9% nuclear and has made permit requests to add up to 1117 MW of new nuclear capacity, Duke Energy clearly does not share this opinion. In fact, of the factors that affect planning for new nuclear, the largest concern appears to be cost, not environmental or community impacts. More specifically, Duke Energy was concerned about the factors that would affect the cost of these projects such as capital cost, greenhouse gas legislation impacts, and the ability to gain favorable financing. They also describe two "favorable" financing options, federal loan guarantees and traditional

[48] Jim Warren, News Release: "Nuclear Plant Proposals Challenged by Southeast, National Groups" Nov 13 2008

financing, which both lower the ultimate cost of the project, making nuclear even more attractive. Depending on these assumptions, they believe they can lower the overall cost by 13% to 32% which acts as a powerful pull.[49]

In addition to these existing financial incentives, the impact of greenhouse gas legislation may be acting as a significant impetus for the desire to de-carbonize the energy supply. For a company that has a fuel supply that is 45.9% coal and 47.9% nuclear, Duke Energy understandably will want to act to just increase the proportion of nuclear in relation to its significant coal assets. Looking at the issue in terms of core competency, nuclear is a resource Duke Energy is very familiar with- they understand the requirements, are well-versed in the reliability and technical constraints of the resource, and can trust it to act as a baseload resource. If you compare that to the major resources NC WARN is calling for, namely renewables and energy efficiency, Duke Energy would consider nuclear to be far more familiar and "reliable" in comparison.

Considering the rising costs of construction for all plants, not just nuclear, NC WARN and other organizations opposed to nuclear might consider pushing for changes to existing regulations that currently incentivize nuclear projects such as the Energy Policy Act of 2005.[50] Without those incentives, the naturally high capital costs of these projects might be enough to financially deter companies like Duke Energy from pursuing such expensive plants. This, coupled with regulation that encourages the other resources NC WARN has called for will hopefully be enough incentive for Duke Energy to at least consider other, more cost-effective methods of cutting greenhouse gases.

[49] The Duke Energy Integrated Resource Plan: November 3, 2008. p. 56
[50] The Duke Energy Integrated Resource Plan: November 3, 2008. p. 56

XI. CONCLUSIONS

By examining the conflicts between NC WARN and Duke Energy, we can identify many of the general obstacles that prevent them from coming to a consensus over North Carolina's energy future.

Duke Energy is reluctant to adopt "new" energy resources that are not price-competitive with conventional resources such as coal and nuclear. This reluctance may be motivated by the start-up costs associated with integrating new resources, a lack of significant in-depth expertise and firsthand knowledge about these resources (as compared to coal and nuclear), and no apparent mechanism for profit that would motivate them to adopt these resources. Without favorable first-hand experience in these resources, Duke Energy will likely be very skeptical of any studies that would encourage the use of these resources without follow-up by regulatory or financial incentives that would shift them away from established energy resources to these more "risky" ones.

Because Duke Energy is not a non-profit and does not have environmental protection as one of its motivating missions, it will be very difficult for NC WARN to convince Duke Energy to adopt a cleaner energy grid based solely on a platform of environmental protectionism or ratepayer protection. While NC WARN has gathered a body of legitimate research that encourages the belief that energy efficiency, DSM, cogeneration, and renewables can supply North Carolina's energy needs *economically*, more attention could be focused on researching how this could be achieved *technically*. By proving Duke Energy has the technical capability to adopt more wholesale purchase contracts, encourage more DSM, and install cogeneration NC WARN will have greater weight behind its arguments to the NCUC that these are resources Duke Energy should be investing in. As for arguments encouraging resources such as renewables

that lack current economic feasibility but have a great deal of potential, NC WARN will need to propose them to policy-makers whose interests are also aligned with protecting North Carolina residents and ratepayers as profit-oriented companies such as Duke Energy will be reluctant to take those risks for the sake of societal and environmental gains.

Energy Resource	Course of Action
Overall Plans/Cliffside (Coal)	Research impact of carbon taxes
Wholesale Sales	Maintaining regulation (continued protection by PUC)
Wholesale Purchase	Technical feasibility study
Load Growth	Technical study proving customer base
Energy Efficiency	Regulation encouraging reasonable payback scheme
Renewables	Regulation bolstering the REPS
Cogeneration	Technical feasibility study
Lee (Nuclear)	Regulation taking away financing incentives

Figure 22 Summary table of suggested courses of action

The Cliffside analysis shows that when carbon prices are too low to make renewables competitive with coal, building the new, more efficient unit is slightly better for air emissions. In this case, building the Cliffside unit under $20-$0/ton carbon prices leads to a slight reduction in carbon dioxide emissions (~3 million tons annually). However, when carbon prices are high enough to make renewables a competitive option with coal, building the new Cliffside unit is significantly worse for both renewable investment and emissions. In the $30/ton carbon price scenario, building Cliffside adds approximately 11 million tons of annual CO2 emissions and two-thirds less utilization of renewable resources.

To inform energy policy, more research in the fields of carbon economics and renewable technologies as well as case-specific research related to feasibility studies are needed in order to set a carbon price that will actually force investment in greener energy. Well-thought out policies regarding carbon taxes and the encouragement of less carbon-intensive energy will also be critical in ensuring the transition to a cleaner energy future for both North Carolina and the United States as a whole.

XII. Bibliography

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APPENDIX:

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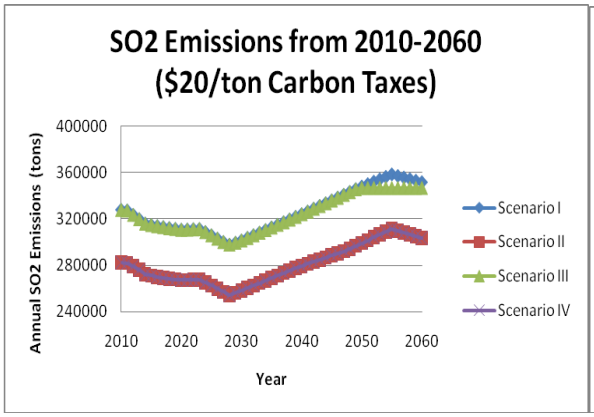

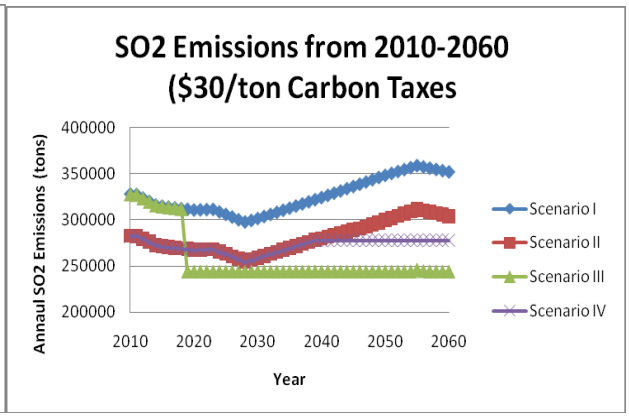

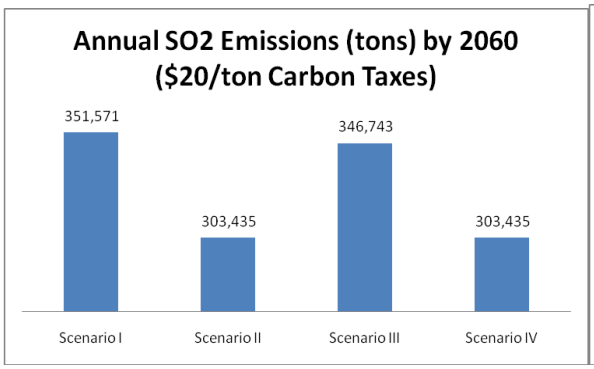

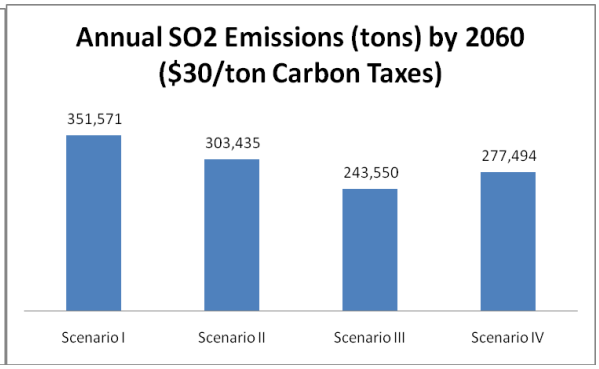

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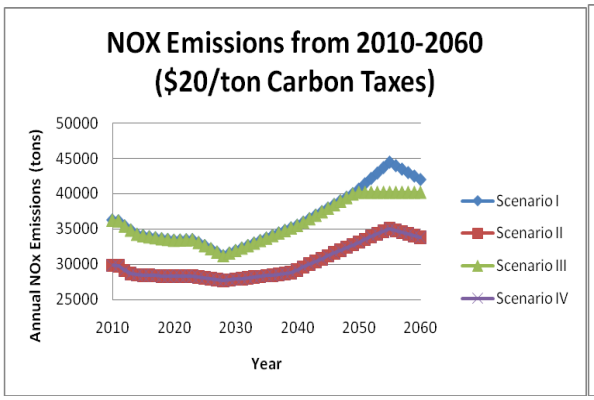

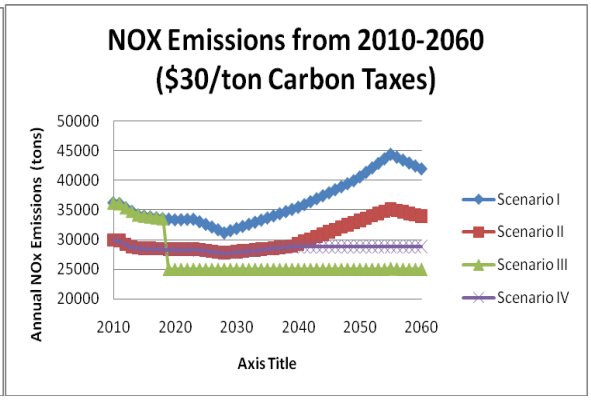

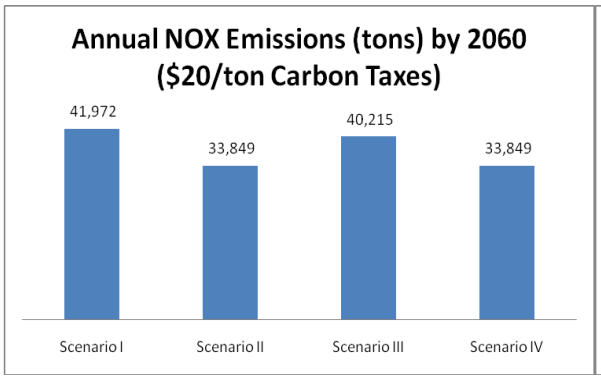
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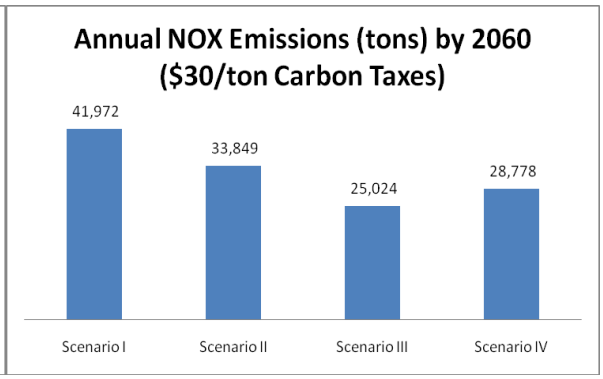
Scenario II
Scenario III
Scenario IV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Scenario IV

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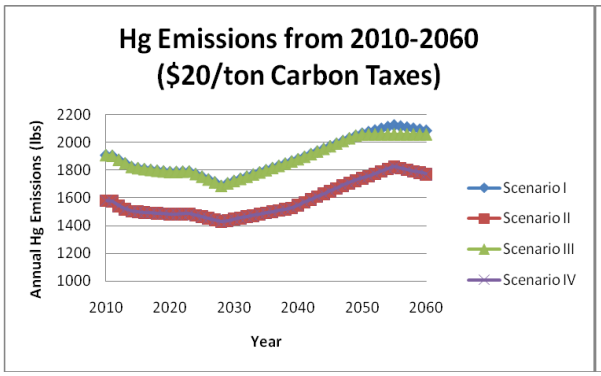
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Scenario II
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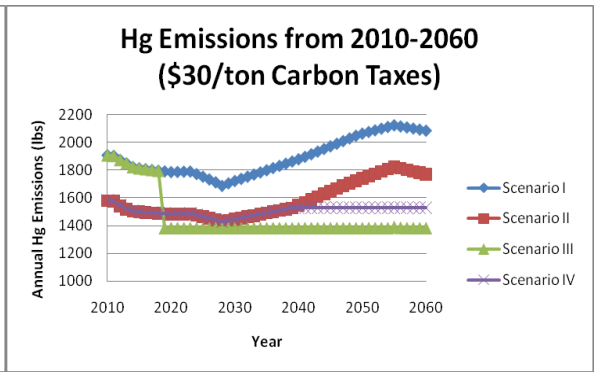
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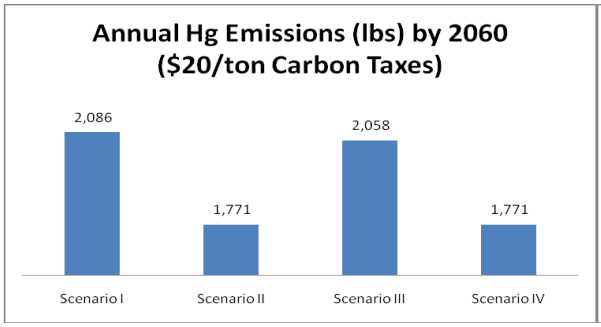
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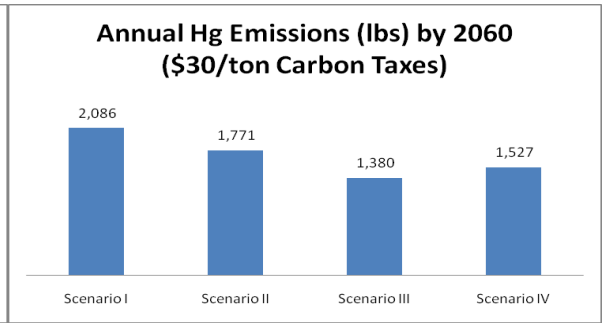
Scenario IV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