The Role of State Policy in Furthering Industrial Decarbonization through Energy Management and Industrial Assessments

Andrew Hoffmeister, American Council for an Energy-Efficient Economy

ABSTRACT

A recent state assessment, *How Energy Efficiency Can Help Rebuild North Carolina's Economy: Analysis of Energy, Cost, and Greenhouse Gas Impacts*, examines the potential of continued and expanded industrial energy efficiency (IEE) policies and programs to reduce North Carolina's annual energy demand and help reach state-level climate goals in the electric power sector (Gold et al. 2020). This paper expands upon and details the sections pertaining to industrial efficiency published in that report and relates the ideas to other states' perspectives. The role that industrial assessments and strategic energy management can play in states' strategies for mitigating emissions from the industrial sector is provided, along with policy choices for maximizing that potential, and how existing federal, state, and local infrastructure can be leveraged.

Introduction

The United States is facing significant challenges in delivering a clean energy future. States around the country are confronting not only the economic recession and the continued public health emergency created by COVID-19, but also the increasing impacts of climate change on shorelines, the power grid, and vulnerable communities. To address impending crises, 33 states have either released climate action plans or are in the process of developing them (C2ES 2020). These plans include approaches such as resilience strategies, economic goals (including recovery and job creation), social goals, and clean energy targets. North Carolina is one such state, having developed its Clean Energy Plan in 2019. The plan details strategies to reach a greenhouse gas (GHG) reduction target of 40 percent by 2025 by decarbonizing the electric power sector, ensuring access to clean energy, modernizing the grid, and increasing energy efficiency. Within the electric power sector, North Carolina is seeking to reduce its GHG emissions by 70 percent in 2030 relative to 2005 levels and reach carbon neutrality in the sector by 2050 (NCDEQ 2019). Figure 1 depicts the emissions at a 2005 baseline, the GHG reductions from the continuation of existing efforts in the reference case, and the potential for new EE measures to help North Carolina reach its emissions targets.

Figure 1. North Carolina Electric Sector GHG Emissions Scenario Projections. Source: Gold et. al 2020

In developing the steps to help reach this ambitious goal, North Carolina plans to leverage and build upon existing policy paths and other measures taken in past years to develop a cleaner energy economy through energy efficiency (Weiss 2019). There is significant opportunity for North Carolina to invest further in efficiency as a means to pursue economic recovery while simultaneously ensuring a long-term, supported, and sustainable clean energy future. The industrial sector represents a critical portion of that opportunity, and the policies and programs that extend new and existing energy efficiency to industry will help achieve savings from an underserved, carbon intensive sector that would otherwise be out of reach.

Improving energy efficiency in industry, including in manufacturing, is an essential way to advance decarbonization, reduce electricity demand, and provide cost savings to integral parts of state economies. This is especially important in light of the relatively cheap cost of saved energy in the industrial and commercial sectors, and the energy intensity of those sectors. North Carolina manufacturing accounted for 10.6% of the state's workforce and $103.6 billion in total output in 2018 (NAM 2020) and industrial customers as a whole were responsible for over 27,000 GWh, or about 20%, of North Carolina's electricity consumption in 2018. Those numbers are represented in Figure 2. Using state and federal funding to leverage existing programs and to reinforce existing offerings of technical assistance, energy audits, assessments, and energy management is essential in maximizing the potential of industrial savings in terms of helping North Carolina, and other states, reach climate goals. By examining the potential of North Carolina to reach such GHG and energy savings, it is possible to better understand other states' perspectives, and the potential of similar policies and programs that can complement federal

initiatives to set goals and achieve deeper energy and cost savings in the industrial sector across the country.

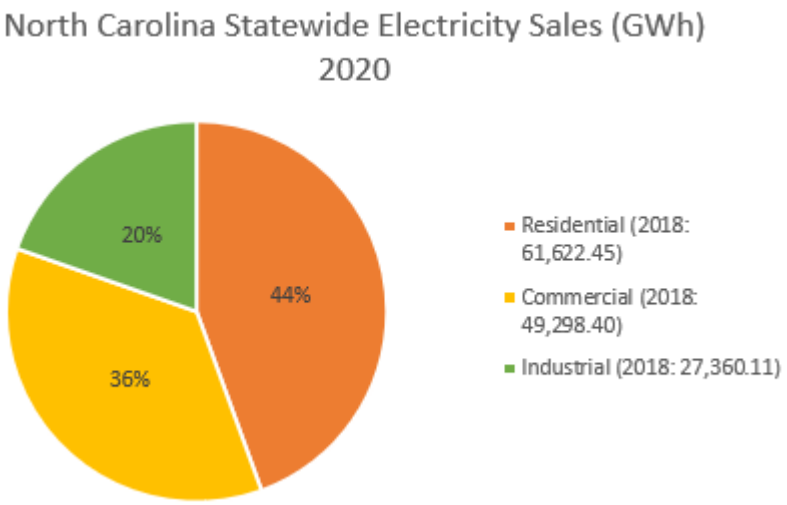

Figure 2. North Carolina Statewide Electricity Sales (GWh) 2020. Source: EIA 2020

Industrial Assessments:

North Carolina utilizes several university, government, and nonprofit programs to provide energy assessments and technical assistance to the industrial sector. This includes the local Industrial Assessment Center (IAC) at North Carolina State University, non-profits such as Advanced Energy, and governmental entities including Waste Reduction Partners (WRP), and the North Carolina Clean Technology Center.

The Department of Energy (DOE) funded IACs perform energy use assessments for industrial customers and are critical to expanding industrial EE. These centers and their assessments provide industry-specific expertise and help to create a knowledgeable workforce ready to accommodate and facilitate industrial transitions to more efficient technologies. IACs play a key role in connecting small and medium industrial customers with information on available low-cost, high-return on investment energy-saving opportunities for their facilities as well as quantifying their potential energy and cost savings. There are opportunities to leverage the many benefits of industrial energy assessments through additional state and federal funding on top of the funding that the Department of Energy already provides. IACs are viewed as a relatively bipartisan measure, with support for additional federal funding for IACs and centers of excellence being supported by policymakers on both sides of the aisle in such past legislation as the Energy Savings and Industrial Competitiveness Act of 2019 (S. 2137).

The North Carolina State University (NCSU) IAC is one of 31 IACs supported by DOE at large engineering universities across the United States. Through the university and the IAC program, teams of faculty members and engineering students run assessments of industrial plants

at no cost to eligible manufacturers. Since its inception in 1992, the NCSU IAC has conducted over 500 assessments and helped manufacturers in implementing 1,808 cost-effective, voluntary EE measures that have resulted in savings of $24,876,714. Since 2012, approximately 67 recommendations have been implemented annually, with average savings of 124 MWh per recommendation since 2012 (DOE 2020), although savings are highly variable year to year. These savings would result in approximately 36 GWh of saved energy in 2030, and 50 GWh of saved energy in 2040. In addition to these assessments, WRP, a program of the Land of Sky Regional Council in partnership with NCDEQ, conducts about 50 energy assessments per year by utilizing retired engineers across North Carolina.

Providing supplemental state funding could increase the electricity and cost savings made possible through the NCSU IAC. Mature centers, such as the NCSU IAC, can typically find additional assessments to perform. If North Carolina were to double current IAC funding (currently estimated at $310,000), the number of implemented recommendations and resultant savings could also double, reaching 100,000 MWh in savings in 2040 (Gold et al. 2020). These savings would add to the existing efforts of WRP's industrial audit program for combined savings of 176 GWh in 2030 and 208 GWh in 2040, or 0.1 percent of the total electricity load in 2040. It is estimated that net bill electricity savings through the supplemented IAC could reach $3 million in 2030 and $2.9 million in 2040 based on average retail rates.

The NCSU IAC could also deliver significant peak savings by helping industrial customers change rate schedules, reduce loads, and shift plant operational schedules. Additionally, there is also the potential for further investment in audit and implementation based industrial savings through a new IAC at another major engineering university in North Carolina or another nearby state. Complementary policies that would operate to reduce industrial energy consumption include support for smart manufacturing and intelligent efficiency, through which technologies, including multiple speed and adjustable frequency drive motors, upgraded controls on compressors, occupancy sensors, and others could deliver significant efficiency improvements. Any training and grants to that end could help further systems optimization, increase flexibility and data coordination to reduce waste materials and energy losses to complement industrial assessments.

An industrial initiative that includes IAC and smart manufacturing funding could use capital from a statewide, nonprofit clean energy fund. Federal legislation, including future COVID-19 recovery stimulus bills, that would increase funding to IACs, create new IACs or centers of excellence, expand scope for assessments, increase the size of centers, or incentivize implementation of recommendations would significantly contribute to new savings.

Energy Management:

Strategic Energy Management (SEM) achieves systematic energy performance improvements by empowering organizations to manage energy use consistently and effectively. Continuous energy-saving improvements are furthered through technical assistance geared towards identifying and prioritizing energy-saving methods and supplying hands-on support. SEM involves a commitment to energy management planning and implementation, supported by

a framework of measuring, reporting, and verification. Statewide SEM programs have significant potential for energy savings. In fact, such programs often report savings as high as 10% of annual energy spending for participants (Bernath and Buffum 2017).

Several programs and approaches support SEM and similar practices in North Carolina. State offices, including the Department of Environmental Quality (DEQ), as well as third-party organizations, federal offerings, and industrial customers that have established and report on their own energy savings goals have helped the industrial sector make significant strides towards EE improvements through energy management. These savings are essential to fully capture the potential of industrial EE to help North Carolina reach its climate goals. Since 2002, North Carolina's DEQ has operated an Environmental Stewardship Initiative, a voluntary program that provides technical assistance and encourages superior environmental performance and management for large industrial and commercial customers. All members self-report their savings and set individual energy goals. From 2012 to 2018, the program reported more than 432 GWh of electricity savings. The continuation of these activities would yield approximately 666 GWh of savings in 2040 (Gold et al 2020; NCDEQ 2020). Combining the energy-saving potential of the ESI program with the technical assistance efforts of other state programs could yield significant additional savings.

In addition to state programs, some of North Carolina's industrial facilities participate in federally administered energy management programs, or state offerings that build off of federal offerings. Ten facilities in the state are currently using the 50001 Ready Navigator tool to track the progress of their energy management systems (EnMS), or continual improvement of energy performance. However, to date none of these companies has completed the program. Three facilities have been certified under the DOE's Superior Energy Performance program. (DOE 2015; DOE 2016). Advanced Energy, a nonprofit energy consulting firm, is currently hosting an industry cohort using the ISO 50001 Ready program. Additionally, the Utility Savings Initiative works with the UNC system, community colleges, and state agencies to educate and communicate the need for SEP and other management programs (NCDEQ 2017).

Despite progress in voluntary state and federal programs, additional cost-effective industrial and large commercial energy management potential remains in North Carolina. Approximately 99 percent of the estimated eligible industrial and commercial demand for 2020 has not participated in these voluntary programs (Gold et al. 2020). If North Carolina's DEQ were to launch a statewide SEM program targeting medium and large industrial and commercial customers that have the ability to opt out of their IOU service provider's EE rider (companies must meet one million kWh in annual energy consumption to opt out), savings could be captured that would otherwise be unattainable by existing entities or measures. Opt-outs in 2019 accounted for approximately 32 million MWh from commercial and industrial customers, or about 52 percent of the total sales to those sectors. The SEM program would aim to capture savings from those customers as well as support programs that cater to small and medium sized companies, the efforts of DOE (through their IACs, SEP certification, ISO 50001 Ready), DEQ's programs, and third-party and other utility offerings in the state. The statewide SEM program would also include options for technical assistance and funding.

Such a statewide SEM program has the potential to enable average annual electricity savings of 420 GWh from 2022 to 2040 in North Carolina, reaching annual savings of 500 GWh in 2030 and 591 GWh in 2040. Of those savings, 31% would be commercial and 69% would be industrial. These values would account for 0.78% of the IOU nonresidential load in 2030 and 0.87% of the IOU nonresidential load in 2040. These savings would add to the existing efforts of DEQ's ESI program for combined savings of 1,116 GWh in 2030 and 1,257 GWh in 2040. (Gold et al. 2020)

Additional potential savings are available through the cohort model, such as the one being developed by Advanced Energy, or through SEM continuation after the program's first year. Additionally, participants may opt to add new sites from their organization participate, expanding potential savings. There are further savings possible beyond the scope of analysis if participants establish standalone internal energy-saving procedures after they participate in SEM programs, or if participants adopt SEM practices at other nonparticipating sites (DNV GL 2016). Additional potential savings could come from customers of co-ops and municipal utilities who could participate in a statewide SEM program, which were not captured as part of the North Carolina analysis. Savings from the statewide SEM program in North Carolina could likely be replicated in other states, especially those with robust energy management infrastructures. It can also operate to inform state perspectives and approaches to reaching climate goals via improvements to industrial EE.

State Perspectives on IEE Beyond North Carolina:

Together the industrial assessment and strategic energy management approaches in North Carolina have the potential to help save 1,465 GWh of electricity in 2040, or about one percent of total forecasted electricity sales and over two percent of forecasted IOU C&I sales in 2040. These savings would account for approximately 480,000 Metric tons CO_2e, or 0.6 percent of the 2005 baseline North Carolina electric sector GHG emissions. (Gold et al. 2020) With both approaches, there is opportunity to pursue even more aggressive savings by increasing funding to the mature NCSU IAC, creating a new IAC in North Carolina, and funding additional SEM cohorts, in addition to further savings beyond the scope of analysis. In other states, not only in the southeast region but across the United States, there is a similar landscape of opportunity within reach. Existing programs, especially SEM and industrial energy audits, can be leveraged, funded, and expanded to reach new targets in the industrial sector and provide enhanced EE possibilities to help states reach their climate goals via savings in the electric power sector.

For example, in Colorado, the Colorado Energy Office's (CEO) Industrial Strategic Energy Management Program (I-SEM) offers direct organizational and technical support from experienced energy managers and coaches to industrial customers free of charge. Experts help companies establish energy management plans, energy reduction goals, and low-cost energy efficiency improvement measures (CEO 2021) In New York, the New York State Energy Research and Development Authority (NYSERDA) offers training options to teach businesses how to establish and implement SEM, through continuous measurement and improvements to energy performance and workforce engagement. NYSERDA also offers SEM on Demand, a

remote learning training program that provides guidance and technical support to facilitate SEM adoption. The program focuses on flexible, practical, time-based solutions for reducing energy use and costs within the framework of continuous improvement. (NYSERDA 2020) Finally in Vermont, participation in the Self-Managed Energy Efficiency Program (SMEEP) is dependent on demonstrating a comprehensive energy management program, complete with energy savings objectives (Berg et. al 2019).

Leveraging these approaches, as in North Carolina, examining opportunities for expansion, and enabling connection with peers is needed to move the needle on industrial energy efficiency and savings in industrial electricity consumption across the U.S. Continuing to support the cohort approach, peer exchanges, experience sharing, and other initiatives as suggested in the 2017 report, Industrial Energy Efficiency and Distributed Generation Opportunities in Colorado, will be essential to furthering the potential of SEM (CEO 2017). SEM should be considered an essential strategy in state and local industrial energy efficiency portfolios as it has the potential to integrate EE policies, such as benchmarking and disclosure, and practices, including voluntary commitments to GHG reductions, under a single framework (DOE 2012) Strengthening funding to help implement recommendations and reach more industrial customers will likely help industrial organizations increase savings as well as support states in reaching their climate and power sector decarbonization commitments.

Industrial assessments and IACs also have the potential to be leveraged further at federal, state, and local levels to affect more meaningful decarbonization. As the North Carolina case demonstrates, any opportunities to combine federal funding to IACs with state and/or local funding should be explored, as mature centers can typically find more assessments to perform with additional financial support. IAC funding could also be paired with other decarbonization measures, including a carbon pricing or cap and trade program in order to both reduce industrial emissions and motivate clients to seek out savings accessed through industrial energy assessments. Industrial assessments should be considered a low-risk, low-cost, relatively bipartisan method of reducing industrial electricity consumption with an existing EM&V framework that can start enabling more savings in the immediate term, especially paired with a policy emphasis on smart manufacturing. Support for IACs can be bolstered by other state programs that deliver industrial energy audits in order to provide wide-reaching, technical assistance to as many customers as possible. These programs should be continued where possible to operate in parallel with additional IAC infrastructure to deepen savings, especially where they can reach small businesses outside of the scope of the IAC audits. Examples include utility programs such as Dominion Virginia Energy’s Small Business Improvement Program, which offers on site energy audits performed by contractors, as well as state programs like the Massachusetts Energy Efficiency Partnership (MAEEP) which works with the IAC program to support industrial plants with technical assistance in implementing efficiency measures (Virginia DMME 2015 ; Mass.gov 2021)

Conclusions:

The industrial sector in the United States is currently underserved by energy efficiency programs and is responsible for over 30 percent of energy consumption and 28 percent of CO2

emissions (EPA 2019). Industrial decarbonization can therefore play a significant role in mitigating the worst effects of climate change. Industrial energy efficiency is a potential significant driver to that end, and individual states can play a critical role in leveraging existing structures at both the state and federal level, as well as creating new infrastructure that helps realize opportunities to reach as much of the sector as possible. Industrial assessments and strategic energy management are industrial energy efficiency strategies that can do both. There are many existing structures of energy management and audits. DOE's IAC program, for example, has delivered significant savings to the industrial sector for decades. States like North Carolina have the opportunity to leverage such existing infrastructure, increase funding, create new programs, and increase collaboration to fully access the potential of industrial energy efficiency in reaching state based climate goals.

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