Quarterly Interim Report on the Activities Conducted to Establish a Regulatory Program for the Management and Decommissioning of Renewable Energy Equipment

Citation of Law or Resolution: Section 2.(d) of S.L. 2019-132 (H329)
Due Date: December 1, 2020 Quarterly

Receiving Entities:
The Environmental Review Commission
The General Assembly

Submitting Entity:
Department of Environmental Quality

Quarterly Interim Report of the Department of Environmental Quality

Executive Summary and Transmittal

Pursuant to Section 2.(d) of S.L. 2019-132 (H329/Renewable Energy Amends), the North Carolina Department of Environmental Quality (Department or DEQ) and the Environmental Management Commission (Commission), must submit quarterly interim reports as to the activities conducted, including updates on the stakeholder process and the work to adopt rules governing the management of end-of-life (EOL) photovoltaic modules and energy storage battery systems and the decommissioning of utility-scale solar projects and wind energy facilities, to the Environmental Review Commission and the General Assembly. This is the fifth and final such quarterly report and covers the activities undertaken to implement this Section since the submission of the previous quarterly interim report, from September 1, 2020, through November 30, 2020.

Quarterly Interim Report of Activities

In accordance with Section 2.(c) of S.L. 2019-132, the Department established a stakeholder process and has incorporated comments and feedback from the stakeholders to inform the preparation of the final report due on December 31, 2020. To follow is a brief summary of the work undertaken by the Department and the stakeholders to implement this Section of the Act since the previous report was submitted.

DEQ Resources

Due to the multi-disciplinary scope of the legislative directive to adopt rules governing the management of end-of-life (EOL) photovoltaic (PV) modules and energy storage battery systems and the decommissioning of utility-scale solar projects and wind energy facilities, staff from three DEQ units are assigned to support this effort. The Division of Waste Management, the Division of Environmental Assistance and Customer Service, and the State Energy Office are each represented and this team's work is coordinated by the Office of Governmental Affairs and Policy. Pursuant to Section 2.(d) of S.L. 2019-132, the Department submitted its recommendations regarding resources necessary to implement this Section in its April 1, 2020 interim report. The Department will provide recommendations for resources in the final report submitted at the end of this year.

Stakeholder Organizations

The following public, private, or not-for-profit organizations have joined the stakeholder process since the last quarter. In addition to these entities, DEQ solicited stakeholder's feedback to broaden and include participation from all potentially interested Parties. A comprehensive list of all participating stakeholders to-date is included in the Appendix of this report.

PV Cycle
Illinois Sustainable Technology Center

Matters Under Consideration

Pursuant to Section 2.(a), DEQ must consider nine matters in its development of the rules governing the management of EOL PV modules and energy storage battery systems and the decommissioning of utility-scale solar projects and wind energy facilities. The following table lists the matters DEQ, with assistance from stakeholders, has considered through the date on which this report was submitted.

S.L. 2019-132 / HB 329	Photovoltaic (PV) Modules	Wind Energy Facilities (WEF)	Energy Storage System Batteries	Status
§2.(a)(1): Characteristics of hazardous waste identified	• Presentations on classifications of solar waste • TCLP methodology, results, and potential hazardous characteristics of modules has been thoroughly discussed • DEQ drafted a literature review on the hazardous characteristics of modules and TCLP methodology[1]	DEQ conducted literature review of the potential hazardous characteristics of turbines and related facility equipment	DEQ presented on hazardous characteristics in common types of energy storage system batteries	• DEQ to evaluate rulemaking to amend Universal Waste Rules to add PV modules • DEQ coordinating with ASTM for publication of a TCLP guidance for PV modules.
§2.(a)(2): Preferred methods to responsibly manage end-of-life (EOL) products	Presentations on methods to manage EOL PV modules. Reuse, refurbish, recycle, and landfill disposal options have been researched by DEQ	DEQ conducted literature review on the preferred methods to manage EOL wind turbines.	DEQ and stakeholder presentations on different EOL management options for several energy storage system battery technologies. Reuse, refurbish, recycle, and landfill disposal options have been researched by DEQ	• EOL for PV modules, WEFs, and energy storage system batteries has been thoroughly researched and discussed. • Recycling or reuse is determined to be optimal EOL method, but if disposal into a landfill is needed there is available capacity in NC.
§2.(a)(3): Economic and environmental costs and benefits	• Stakeholder discussions on environmental costs / benefits • EOL management methods and associated costs and benefits for PV modules has been researched by DEQ	DEQ evaluated economic and environmental costs / benefits to the extent practicable based on limited available information	• Stakeholder discussions on environmental costs/benefits • EOL management methods and associated costs and benefits for energy storage system batteries has been researched by DEQ	Conducted research review of environmental costs/benefits of recycling, reusing, and disposing of PV modules, WEFs, and energy storage system batteries
§2.(a)(4): Expected economically productive life	• Stakeholders have submitted resources on the economically productive life cycle of PV modules • Data on current NC PV module lifespan has been collected and presented[2]	Presentation on Amazon Wind, U.S. East, the State's only operational WEF, included this information	Stakeholders provided applicable resources for energy storage system batteries.	• NC solar facility lifespan data obtained and presented[3] • Limited data on energy storage system batteries received

[1] Executive Summary of the Literature Review of Hazardous Characteristics of Solar PV Equipment is included in Appendix B of the Quarterly Report submitted on March 1, 2020.

[2] Data on the number of modules, weight in tons, and estimated timeframes for decommissioning is included in the January 22, 2020 meeting materials in Appendix A2 of the Quarterly Report submitted on March 1, 2020.

S.L. 2019-132 / HB 329	Photovoltaic (PV) Modules	Wind Energy Facilities (WEF)	Energy Storage System Batteries	Status
§2.(a)(5): The volume of photovoltaic modules, wind turbines, and energy storage system batteries currently in use in the State, and projections	• The volume of PV modules currently installed in NC facilities was compiled by DEQ and presented in graphs[3] • DEQ compiled the capacity, panel type, and estimated volume of PV modules currently installed in NC solar facilities and the results were illustrated in graphs presented to the stakeholders in January 2020	The volume of turbines currently installed in NC has been researched and presented[3]	DEQ completed research to determine the best estimated capacity of energy storage system batteries currently installed as limited datasets and information are available at this time.	• DEQ has finalized the analysis of volume of utility-scale solar facilities, wind turbines, and energy storage systems batteries that are currently installed in NC. • DEQ has finalized the analysis on landfill capacity if current PV modules, wind turbines, and energy storage system batteries are disposed in landfills and concluded that the capacity is sufficient. DEQ recalculates a landfill capacity study annually in reporting due to the legislature on April 15 per GS 130A-309.06
§2.(a)(6): A survey of federal and other states' and countries' regulatory requirements	• Federal, state, county, and EU regulatory requirements, including financial assurance (FA) requirements, researched and presented to stakeholders • Discussions of solar ordinances adopted in NC counties • Stakeholders provided list of solar decommissioning requirements in other states • DEQ completed summary of current decommissioning requirements in NC counties	• Stakeholders provided list of WEF decommissioning requirements in other states • Federal and NC requirements for WEFs presented and discussed[4]	• Stakeholders provided list of battery decommissioning requirements in other states • Federal and state regulatory requirements for battery technologies used in energy storage systems has been collected.	Completed evaluation of regulatory requirements at federal-, state-, NC county-, and international-level for management of EOL PV modules, WEFs, and energy storage system batteries.
§2.(a)(7): Financial assurance requirements	• FA requirements for PV modules in NC counties (per ordinance) have been collected and presented to stakeholders • Stakeholders have discussed the need for and implementation of FA for PV modules	*Not required per S.L. 2019-132*	*Not required per S.L. 2019-132*	The Department finds that existing local government regulatory structures for EOL management and decommissioning are in effect in the majority of the counties where utility-scale solar projects are installed. At this time, mandated financial assurance requirements are not necessary to ensure proper decommissioning of utility-scale solar projects.

[3] See February 10, 2020 presentation on WEF in North Carolina in Appendix A3 of the Quarterly Report submitted on March 1, 2020.

[4] See April 14, 2020 presentation on States with WEF Regulations in Appendix A of the Quarterly Report submitted on June 1, 2020.

S.L. 2019-132 / HB 329	Photovoltaic (PV) Modules	Wind Energy Facilities (WEF)	Energy Storage System Batteries	Status
§2.(a)(8): Infrastructure that may be needed to collect and transport EOL products	DEQ conducted research and corresponded with appropriate stakeholders	DEQ conducted research and corresponded with appropriate stakeholders	DEQ conducted research and corresponded with appropriate stakeholders	DEQ staff has conducted research and had conversations with stakeholders to consider and evaluate infrastructure needs.
§2.(a)(9): Manufacturer stewardship programs	Examples of existing manufacturer stewardship programs for recycling PV modules have been presented and discussed	*Not required per S.L. 2019-132*	*Not required per S.L. 2019-132*	DEQ staff solicited feedback from stakeholders on EOL equipment stewardship programs.

Materials Received from Stakeholders and Activities to Date

To support the completion of the scope of work directed by the Session Law, DEQ continues to solicit assistance from the stakeholders to fill knowledge and data gaps. During this reporting quarter, DEQ staff met with several stakeholder organizations to inform our work and research of discrete topics under evaluation. To follow is a brief description of the meetings/conversations held:

Synergy: Synergy recycling has never processed solar panels on a large scale, but has received a few from being involved in the stakeholder process. The company is not interested in recycling solar panels on a large scale because of the significant cost to refurbish or recycle them and the lack of an established market. A company representative informed DEQ that Synergy has talked with multiple North Carolina recyclers about solar panels and the general consensus is that they do not want that material for recycling.

Minnesota Pollution Control Agency: Minnesota is not currently characterizing EOL solar panels as universal waste, but staff thinks that the state is headed in that direction. The state has adopted federal hazardous waste and universal waste rules with a few exceptions. Agency staff considers energy storage batteries to be universal waste. In a recent survey the Agency sent out, product stewardship was the highest rated option among participating respondents wherein a person buys the panels and pays a surcharge at purchase. However, in the scenario presented, it would be the manufacturer's responsibility for implementing the EOL program. The Agency thinks that a mandate has to precede a product stewardship program because a mandate will guarantee materials primed for recycling which should attract private recycling investment. The alternative, voluntary recycling, would not necessarily yield a reliable materials supply to attract the private investment required.

Regency: Regency, a recycling company, is not actively collecting EOL solar panels and it is not something that the company has managed in the past. Regency could participate in a broader solar panel recycling effort, but that engagement would require changes to properly handle the materials, which is not currently the company's primary focus. Regency does not think that most items from solar panels would be hazardous.

Metech Recycling: Metech recycles PV modules at their California facility, but not at the North Carolina facility. The company does not have plans to expand PV module recycling to other facilities at this time. While Metech is open to discussing recycling opportunities with North Carolina waste generators, the transportation could be cost-prohibitive. Metech believes that planning for the logistics and financing of EOL panels should occur now as opposed to when modules come out of service.

Dynamic Lifecycle Innovations: Dynamic is one of the Solar Energy Industry Association's (SEIA) recycling partners. Although the company has a facility in Tennessee, all PV module recycling is done in Wisconsin. Dynamic specializes in electronics recycling but can process solar panels in batches using existing shredders and equipment. Customers pay a fee for PV module recycling, with some variation based on the volume of modules. Dynamic partners with other U.S. recyclers to manage the glass portion since they do not have equipment in-house to effectively remove contaminants.

Electronics Recyclers International (ERI): ERI does not currently process solar panels. ERI first evaluated solar panels roughly five years ago and worked with a couple manufacturers to gauge their recyclability with two of their staff travelling through Europe and Asia to look at different types of technology for processing solar panels. ERI did not identify any technology at that time that would remove the need for an individual to do some sort of manual labor like breaking glass. The company has three large shredders across the country and has tested solar panels through the shredders. However, difficulties emerged because the majority of solar panels have a very strong adhesive in the panels to hold them together. When solar panels are run through the shredders they come out in a giant ball of material because of the adhesive. When talking with manufacturers, ERI considers a five to seven year time frame before the volume of EOL solar panels will create enough interest to invest in a recycling infrastructure. ERI is willing to invest in this infrastructure as the volume increases and is willing to bring solar panels in and recycle them.

Washington State Department of Ecology: In Washington, new legislation was enacted in 2020 that changed and delayed the implementation of a stewardship program for solar panels. The 2020 legislation now covers large-scale utility installations. Currently, panels that are sold in or into the state after July 1, 2017 would be subject to the stewardship program, but not anything before.

Around the time that COVID impacted the state, the Governor was supposed to sign the law – he vetoed the section of the bill that allowed the Department of Ecology to work with Washington State University to conduct a stakeholder process on end-of-life management of solar panels. The law provides that the plan should be financed with no cost to the consumer. The industry overwhelming does not want this model, rather it prefers a fee levied at retail, but the Department does not want this model to change.

Solar Energy Industry Association (SEIA): The infrastructure needed to collect and transport end-of-life PV modules will depend on how solar is deployed. Utility-scale solutions will be very different from rooftop or small scale commercial solar. Typically, utility-scale replacements or decommissions have enough volume to justify direct transportation from the solar facility to the end-of-life management destination. Collection and consolidation points will be most useful for rooftop and small-scale solar. SEIA anticipates that solar installers and maintenance companies will play a key role in this network as the removers of PV modules, since it is highly recommended that modules be removed by industry professionals to safely disconnect electrical components. End-of-life wind energy equipment will also likely be transported directly to the end-of-life management destination, so intermediate collection points are not needed.

Upcoming Activities

On December 9th, staff from the Division of Waste Management will brief the full EMC on the status of DEQ's work to implement this Act as well as findings and recommendations prepared for the final report to be submitted at the end of 2020.

DEQ will provide the draft final report to both the EMC and the stakeholders for review and comment through December 14, 2020.

APPENDIX—LIST OF PARTICIPATING STAKEHOLDERS

Duke Energy
Dominion Energy
NC Electric Membership Cooperatives
NC Sustainable Energy Association
First Solar
Cypress Creek Renewables
NC Clean Energy Business Alliance
NC Farm Bureau
Energy & Environment Innovation Foundation
Ecoplexus
Smith Gardner Inc.
Sierra Club
NC Conservation Network
Southern Environmental Law Center
Recycling Association of NC
NC State University Extension
Solar Energy Industries Association
Electronics Recyclers International
Law Office of Robert W. Kaylor
Smith Anderson
Capitol Advantage Associates
Brooks Pierce & Recycling
NC Association of County Commissioners
Alamance County
Solterra Partners Invenergy
Minnesota Pollution Control Agency
Stevens Lobby and Consulting
Southern Power Companies
SunnKing
Energy Intelligence Partners
Synergy Recycling
Metech Recycling
Powerhouse Recycling Inc.
Institute of Scrap Recycling Industries, Inc
NC Clean Energy Technology Center
GEEP Global (Global Electric Electronic Processing)
PV Cycle
Illinois Sustainable Technology Center
Dynamic Lifecycle Innovations
TT&E Iron and Metal Foils Inc.
Regional Materials Recovery, Inc.
NC Utilities Commission-Public Staff
Advanced Energy
EQ Research
Umicore
Carolina Recycling Association
ecycleSecure
NC Department of Public Safety
Caldwell County Government
Cabarrus County Government
Chatham County Government
Cherokee County Government
Columbus County Government
Cumberland County Government
Currituck County Government
Davidson County Government
Davie County Government
Gaston County Government
Granville County Government
Hoke County Government
Iredell County Government
Jones County Government
Northampton County Government
Onslow County Government
Orange County Government
Perquimans County Government
Randolph County Government
Rowan County Government
Transylvania County Government
Wilson County Government
Stanly County Government
Warren County Government
Yadkin County Government