



Template Solar Energy Development Ordinance for North Carolina

Executive Summary

North Carolina is rapidly becoming a leader in solar energy development not only in the southeast, but also in the US. Before the template, there was statewide discussion about how to regulate and permit solar energy systems, and no clear guide to creating one that does not overly burden industry or irresponsibly manage land use. Most local governments in NC, both at the municipal and county levels, provide some regulation on land use within their jurisdiction, yet most have yet to institute regulation for solar development. This template ordinance provides consensus input on a best practice model for how solar development can be regulated.

Template Solar Ordinance Meets a Growing Need

The rapid growth in solar development in NC makes this a very opportune time for development of the template ordinance, particularly because there is significant experience across the state with solar projects of all sizes, yet the industry is still at the early stages of its ongoing growth.

Template Approach Affords Flexibility

It is important to understand that the solar ordinance is a template rather than an enforceable rule or one-size-fits-all law. It is designed to be adapted and then adopted by jurisdictions across the state and to serve as the basis for local development ordinances in their respective communities. In this way the template solar ordinance provides valuable guidance while still allowing flexibility that local governments may want to help them best address local interests.

Broad Stakeholder Working Group Enhances Template's Value

The North Carolina Clean Energy Technology Center (NCCETEC), known as the North Carolina Solar Center (NCSC) at the time of publication, and the North Carolina Sustainable Energy Association (NCSEA) managed the development of the template ordinance and the organization of the drafting working group. The working group consisted of representatives of the solar industry, local NC planners, State Farm Bureau, NC Department of Agriculture, NC Department of Environment and Natural Resources (DENR), NC Association of County Commissioners, NC League of Municipalities, military, University of North Carolina School of Government, NC Conservation Network, Duke Energy Progress, North Carolina State University Forestry, Federal Aviation Administration (FAA), and many others. The initial draft was developed by NCCETEC and NCSEA in May 2013 based on a study of current NC solar ordinances and available state model ordinances. Throughout the summer and fall the working group, often in the form of smaller topic-specific focus groups, worked to improve and update the existing drafts. Additionally NCCETEC and NCSEA hosted five public forums across the state on the development of the template ordinance. At these forums, NCCETEC and NCSEA convened a group of experts to inform interested stakeholders in the area about solar development and its regulation. The final three forums walked through the draft template and received valuable public feedback to assist with its development.

Template Ordinance Overview and Important Features

The ordinance covers photovoltaic as well as solar hot water projects, and classifies projects into one of three levels.

- Level 1 System:
 - Roof-mounted, building integrated, mounted over a parking lot, or ground-mounted and no more than half the footprint of the primary structure on the lot
 - A permitted use provided it meets applicable height, setback, aviation notification, and related district standards
- Level 2 System:
 - Ground-mounted system with a footprint of no more than ½ an acre in residential districts, no more than 10 acres in commercial/business districts or of any size in industrial districts
 - Subject to additional solar development standards (administrative approval)
- Level 3 System:
 - Systems that do not meet the requirements of Level 1 or 2 systems. Most solar farms are Level 3 systems.
 - Subject to the same solar development standards as Level 2
 - Require a public permit hearing (conditional/special use permit)

The template ordinance addresses some of the most common considerations that arise in the permitting of solar energy facilities. Some of the important topics covered in the ordinance include:

- Parcel Line Setbacks
- Height Limitations
- Aviation Notification (requires airport or FAA notification if project is within 5 nautical miles of an airport)
- Visibility (requirements regarding visual buffering, public signage, and lighting)
- Decommissioning (requires a decommissioning plan for the project)

There are other topics and resources that may be important to communities and other solar facility stakeholders but which were not deemed appropriate to include in the body of the template ordinance itself. Examples of those topics include wildlife habitat mapping and land lease considerations. These and other topics are nevertheless included in the form of appendices to the template ordinance document.

Implementation and Support

The template is designed to be used by jurisdictions across the state as a starting point for developing or updating their specific solar energy development regulations. However, there are natural limitations on the amount of information that can be included in the ordinance, even within multiple appendices. In order to facilitate local governments' access to the template ordinance and its contributors, the ordinance includes contact information for 30 individuals involved in the development of the template and who possess knowledge concerning various aspects of the ordinance. These organizations and individuals have agreed to share their contact information and serve as resources for fielding questions about the ordinance.

The Template Solar Energy Development Ordinance for North Carolina is available here:

[DSIRE website](#)

[NCCETC website](#)

[NCSEA website](#)

Historical Document and information related to the template ordinance are available here:

[NCCETC website](#)

[NCSEA website](#)

Introduction

Over the last few years, the state of North Carolina has experienced a massive increase in solar energy development. This can be attributed to many factors, including dramatic reduction in the price of solar modules, a state investment tax credit, the state's renewable energy portfolio standard (REPS), and the long-term standard offer contracts offered by utilities for projects below five megawatts (MW) in capacity. According to SNL Financial's latest industry data, the state has an installed capacity of 245 MW as of June 3, 2013.¹ This positions North Carolina as fifth nationally in cumulative installed capacity.² Thus, the North Carolina Sustainable Energy Association (NCSEA) and the North Carolina Solar Center organized this collaborative effort to construct a template ordinance. This ordinance facilitates the adoption of local regulation backed by industry, government, and citizen input.

Constructing solar energy projects requires numerous considerations and entails a thorough process of siting, permitting, and construction. These projects represent valuable assets in the community – creating local construction jobs, workforce training, economic development, increased property tax base, and ongoing educational opportunities. The permitting process generates discussion in communities with respect to the size and location of projects. Larger systems are often sited on farmland, forestland, or other open spaces, which can impact multiple residents. Responsible development of solar resources in North Carolina requires careful and consistent regulation in order to preserve important existing resources while facilitating the growth of this valuable new industry.

North Carolina's land use planning and regulation is handled by local governments. Cities, towns, and counties may delineate zoning districts within their jurisdiction and regulate various types of development within those local zoning districts. As of 2012, 87% of the state's 550 cities and 79% of the state's 100 counties have adopted zoning ordinances.³ Of these, only 24 cities and 18 counties have incorporated solar development ordinances into their codes; each on a case-by-case basis. This inconsistent approach to solar development regulation has created a patchwork of disparate and often undefined approaches, potentially creating unnecessary barriers to investment and development.

This discontinuity of policy prompted NCSEA and the NC Solar Center to lead in the drafting of a template solar ordinance that will not only provide guidance on effective language for responsible regulation of solar development, but also educate the public about this technology and its application. The wider public input process included five forums located throughout the state and a six-week period of open comments on nine key development issue areas using the Institute for Emerging Issues "IEI Commons" online tool. The drafting process included four months of working group meetings and several rounds of revisions. The drafting Working Group consisted of key stakeholders from planning, local government, agriculture, forestry, economic development, environment, wildlife, utilities, solar industry, and other specialties. Consensus on each aspect of this template ordinance was the goal throughout the drafting process.

The template ordinance set forth in this document attempts to organize and harmonize the language for regulating solar at the county and city level while incorporating some best practices. It divides solar energy systems into three different levels. Level 1 addresses all rooftop, parking lot, small ground mount associated with a building, and building-integrated solar systems. Level 2 applies to all mid-sized ground mounted systems and requires the systems meet development standards set by the ordinance before approval. The applicant must submit the required documents to the Zoning Administrator who reviews them and may then

¹ www.snl.com/InteractiveX/Article.aspx?cdid=A-17930699-11303

² Solar Energy Industries Association and GTM Research. (2011 & 2012). U.S.Solar Market Insight Report 2011 & 2012 in Review

³ David Owens and Dayne Battem, "2012 Zoning Survey Report: Zoning Adoption, Administration, and Provisions for Design Standards and Alternative Energy Facilities," *Planning and Zoning Law Bulletin: UNC School of Government* no. 20 (July 2012), 1

approve the application as meeting the development standards. Level 3 systems are generally larger scale ground-mounted solar systems, often referred to as solar farms. Level 3 systems must obtain a special/conditional use permit and conform to the development standards in this solar development ordinance. The ordinance suggests development limitations based upon trends in North Carolina in order to maximize legitimacy and relevancy of the requirements.

This template is not law, rather a carefully crafted guideline for cities and counties to consider when adopting ordinances specific to solar energy development in their jurisdiction. The authors of this template emphasize that the standards must be tailored to fit the existing local land development ordinances and suggest that ordinances treat solar similarly to other uses with similar attributes and land/community impacts. The zoning districts included in this template ordinance are generic districts which will need to be replaced with the existing zoning districts of the jurisdiction. The template ordinance may also be applied in non-zoned jurisdictions upon the modification and approval of the authorizing agency. Furthermore, the adoption of an ordinance will not supersede any existing federal, state, or local rules pertaining to the development of the project. There are many important aspects of solar development that are out of the jurisdiction of the city or county yet should be considered by the property owner, such as doing a title search to find out if there are any use restrictions of the parcel, such as would exist with an enhanced farm district or some easements. Additional guidance for landowners outside of the scope of this ordinance is provided in Appendix A. There are several other appendices that provide related information but that are not part of the template ordinance regulations, such as the appendix on Sustainable Development (Appendix B) with information for planners and policy makers on additional options related to solar to consider in other development ordinances.

Stakeholders Available for Contact

The following selected members of the template ordinance working group have agreed to make themselves available for questions regarding the ordinance or issues related to solar development.

<p>NC Clean Energy Technology Center (NCCETC) (formerly the NC Solar Center) Tommy Cleveland (919) 515-9432 Tommy_Cleveland@ncsu.edu</p>	<p>NC Sustainable Energy Association (NCSEA) Daniel Brookshire (919) 832-7601 ext 120 daniel@energync.org</p>
<p>Duke Energy Bruce Barkley (919) 546-2814 Bruce.Barkley@duke-energy.com</p>	<p>Duke University Nicholas Institute Larry Shirley (919) 613-8745 Larry.Shirley@duke.edu</p>
<p>Federal Aviation Administration (FAA) Dana Perkins at Atlanta ADO in Working Group Aaron Braswell at Memphis ADO is current contact (901) 322-8192 Aaron.Braswell@faa.gov</p>	<p>Mathis Consulting Ben Edwards (828) 351-9631 ben@mathiscounseling.com</p>
<p>NC Association of County Commissioners Casandra Skinner 919-715-7665 Casandra.Skinner@ncacc.org</p>	<p>NC Conservation Network Nadia Luhr (919) 857-4699 ext.107 nadia@ncconservationnetwork.org</p>
<p>NC Department of Agriculture – Ag. Development & Farmland Preservation Dewitt Hardee (919) 707-3069 Dewitt.Hardee@ncagr.gov</p>	<p>NC Department of Agriculture – Agribusiness Development Ron Fish (919) 707-3119 Ron.Fish@ncagr.gov</p>
<p>NC Depart. of Commerce – Div. of Community Assistance - Community Planning, Central Region Oliver Bass (919) 571-4900 obass@nccommerce.com</p>	<p>NC DEQ (formerly NC DENR) – State Energy Program Bob Leker (919) 733-1907 bleker@nccommerce.com</p>
<p>NC DEQ (formerly NC DENR) – Division of Water Quality (DWQ) Bill Diuguid (919) 807-6369 Bill.Diuguid@ncdenr.gov</p>	<p>NC DEQ (formerly NC DENR) – Military Affairs and Strategic Planning Chris Russo (919) 707-3128 Chris.Russo@ncdenr.gov</p>
<p>NC Department of Revenue (Tax) Michael Brown (919) 814-1142 Michael.Brown@dornc.com</p>	<p>NC Farm Bureau Paul Sherman (919) 719-7292 Paul.Sherman@ncfb.org</p>
<p>NC League of Municipalities Kim Hibbard (919) 715-3936 khibbard@nclm.org</p>	<p>NC State University Forestry Department Mark Megalos (919) 513-1202 mamegalo@ncsu.edu</p>

<p>NC Wildlife Resources Commission Kacy Cook (910) 638-4887 Kacy.Cook@ncwildlife.org</p>	<p>Planner – Catawba County Susan Ballbach (828) 465-8381 sballbach@catawbacountync.gov</p>
<p>Planner – Cleveland County Chris Martin 704-484-4975 Chris.Martin@clevelandcounty.com</p>	<p>Planner – Granville County Dervin Spell (919) 603-1333 Dervin.Spell@granvillecounty.org</p>
<p>Planner – Guilford County Les Eger (336) 641-3635 leger@co.guilford.nc.us</p>	<p>Planner – Warren County Ken Krulik (252) 257-7027 ext.30 kkrulik@co.warren.nc.us</p>
<p>Solar Industry - Carolina Solar Energy Richard Harkrader (919) 682-6822 rharkrader@carolinasolarenergy.com</p>	<p>Solar Industry - Parker Poe Adams & Bernstein, LLP Katherine Ross (919) 835-4671 katherineross@parkerpoe.com</p>
<p>Solar Industry - PCG Solar/Green Guys Mike Whitson (704) 497-0367 mike@pcgsolar.com</p>	<p>Solar Industry - O₂Energies, Inc. Logan Stephens (336) 708-5161 logan@o2energies.com</p>
<p>Solar Industry - Spilman Thomas & Battle, PLLC Nathan Atkinson (363) 725-4496 natkinson@spilmanlaw.com</p>	<p>Solar Industry - Southern Energy Management Bob Kingery (919) 836-0330 ext 101 bkingery@southern-energy.com</p>
<p>Solar Industry - Strata Solar Lance Williams (919) 960-6015 ext 306 lwilliams@stratasolar.com</p>	<p>Solar Industry - QF Solutions Donna Robichaud (513) 659-1178 drobichaud@qf-solutions-llc.com</p>
<p>UNC School of Government Adam Lovelady (919) 962-6712 adamlovelady@sog.unc.edu</p>	<p>NCSEA/Duke University Graduate Student Michael Fucci (302) 584-4152 fucci@energync.org</p>

Local government planning support resources:

- **NC Department of Commerce – Division of Community Assistance – Office of Community Planning:** To request services please contact the office nearest you. Contact information is available at www.nccommerce.com/rd/community-assistance/economic-advancement-and-planning/regional-office-services
- **Solar Outreach Partnership (SolarOPs) — a US Department of Energy funded project:** Designed to help accelerate solar energy adoption on the local level by providing best practices, resources, and technical assistance to local governments. www.solaroutreach.org (the term of this project has expired and is no longer provides services, but their website provides many valuable resources, check with NREL and SunShot for current programs offering services to local governments)

Contents of Template Ordinance

1. Purpose.....	6
2. Definitions	6
3. Applicability.....	7
4. Permits Required.....	7
5. Parcel Line Setbacks.....	8
6. Height Limitations.....	9
7. Aviation Notification (see Appendix F for additional information)	9
8. Level 1 Solar Energy System Requirements	10
9. Levels 2 & 3 Solar Energy System Requirements.....	10
APPENDIX A: Landowner Guidance.....	12
APPENDIX B: Sustainable Energy Options and Resources	13
APPENDIX C: NC Resource Mapping and Information	15
APPENDIX D: Water Infiltration and Soil Conservation at SES.....	16
APPENDIX E: Conditional Use Permits and Special Use Permits	17
APPENDIX F: Airports.....	18
APPENDIX G: Example Decommissioning Plan.....	20
APPENDIX H: Abandonment & Decommissioning	21
APPENDIX I: Solar PV and Fire Safety.....	22
APPENDIX J: Visual Buffering: Example NC Requirements	23
APPENDIX K: Construction Waste Management Plan (CWMP).....	27
APPENDIX L: Template Solar Ordinance Working Group Participants.....	29
APPENDIX M: Document Revision History	30

Template Solar Energy Development Ordinance

1. Purpose

The purpose of this ordinance is to facilitate the construction, installation, and operation of Solar Energy Systems (SESs) in the County/City of _____ in a manner that promotes economic development and ensures the protection of health, safety, and welfare while also avoiding adverse impacts to important areas such as agricultural lands, endangered species habitats, conservation lands, and other sensitive lands⁴. It is the intent of this ordinance to encourage the development of SESs that reduce reliance on foreign and out-of-state energy resources, bolster local economic development and job creation, support the diversification of the state's energy portfolio, strengthen energy and grid security, reduce greenhouse gas emissions, reduce local air and water pollution, and aid North Carolina in meeting its Renewable Portfolio Standard. This ordinance is not intended to abridge safety, health or environmental requirements contained in other applicable codes, standards, or ordinances. The provisions of this ordinance shall not be deemed to nullify any provisions of local, state or federal law.

2. Definitions

Solar Energy System (SES) - the components and subsystems required to convert solar energy into electric or thermal energy suitable for use. The area of the system includes all the land inside the perimeter of the system, which extends to any fencing. The term applies, but is not limited to, solar photovoltaic (PV) systems, solar thermal systems, and solar hot water systems. A system fits into one of three system types: Level 1 SES, Level 2 SES, and Level 3 SES.

Level 1 Solar Energy System - Level 1 SESs include the following:

- i.* Roof-mounted on any code-compliant structure.
- ii.* Ground-mounted on an area of up to 50% of the footprint of the primary structure on the parcel but no more than 1 acre.
- iii.* Covering permanent parking lot and other hardscape areas.
- iv.* Building integrated solar (i.e., shingle, hanging solar, canopy, etc.).

Level 2 Solar Energy System - Level 2 SESs are ground-mounted systems not included in Level 1 that meet the area restriction listed below:

- v.* Agricultural/Residential: SES \leq 1/2 acres
- vi.* Residential Low Density: SES \leq 1/2 acre
- vii.* Residential Medium Density: SES \leq 1/2 acre
- viii.* Residential High Density: SES \leq 1/2 acre
- ix.* General Commercial/Business: SES \leq 10 acres
- x.* Light Industrial: SES of any size
- xi.* Heavy Industrial: SES of any size
- xii.* Office-Institutional: SES \leq 10 acres

Level 3 Solar Energy System – Level 3 SESs are systems that do not satisfy the parameters for a Level 1 or Level 2 Solar Energy System.

⁴ See Appendix C for information on the NC resources

3. Applicability

- a. This ordinance applies to the construction of any new SES within the jurisdiction of the County/City.
- b. An SES established prior to the effective date of this ordinance shall remain exempt:
 - i. Exception: Modifications to an existing SES that increases the SES area by more than 5% of the original footprint or changes the solar panel type (e.g. photovoltaic to solar thermal) shall be subjected to this ordinance.
- c. Maintenance and repair are not subject to this ordinance.
- d. This ordinance does not supersede regulations from local, state, or federal agencies. Some important examples of such regulations include, but are not limited to:
 - i. **Building/Electrical Permits Required**
Nothing in this ordinance modifies already established building standards required to construct a SES.
 - ii. **Onsite Wastewater System Avoidance**
Nothing in this ordinance modifies already established Department of Health and Human Services requirements. A SES shall not be constructed over onsite waste water systems (e.g. septic systems) unless approved by the Department of Health and Human Services.
 - iii. **Stormwater Permit Required⁵**
Nothing in this ordinance modifies the requirements or exempts any SES of complying with the various stormwater jurisdictions⁶ and regulations established by the Department of Environment and Natural Resources. North Carolina statute requires the acquisition of stormwater permits for construction projects that impact stormwater runoff.
 - iv. **Historic Districts**
Nothing in this ordinance modifies already established State Historic Preservation Office requirements. May require additional permitting (certificates of appropriateness) to install solar in Historic Districts⁷

4. Permits Required

The type of permit required for an SES is displayed in Table 1: Permit Requirements.

⁵ See Appendix D: Water Infiltration and Soil Conservation for information on their relationship with ground-mounted solar energy systems

⁶ <http://deq.nc.gov/about/divisions/energy-mineral-land-resources/energy-mineral-land-data/stormwater-maps-gis-resources/Stormwater-Permitting-Interactive-Map>

⁷ www.hpo.ncdcr.gov (see also: www.nrel.gov/docs/fy11osti/51297.pdf and https://nccleantech.ncsu.edu/wp-content/uploads/Installing-Solar-Panels-on-Historic-Buildings_FINAL_2012.pdf)

Table 1: Permit Requirements

Types of Permits Required: P= Permitted Use; D= Development Standards ⁸ ; SUP= Special Use Permit or Conditional Use Permit (see Appendix E)								
Zoning District	Agricultural/ Residential	Residential Low Density	Residential Med. Density	Residential High Density	Commercial/ Business	Light Industrial	Heavy Industrial	Office/ Institutional
Solar Energy Facilities								
Roof-mounted, parking lot cover, or building integrated (Level 1)	P	P	P	P	P	P	P	P
Ground-mounted:								
up to 50% of the footprint of the primary structure (Level 1)	P	P	P	P	P	P	P	P
≤1/2 acre (Level 2)	D	D	D	D	D	D	D	D
≤10 acres (Level 2 or 3)	SUP	SUP	SUP	SUP	D	D	D	D
>10 acres (Level 2 or 3)	SUP	SUP	SUP	SUP	SUP	D	D	SUP

5. Parcel Line Setbacks

The following table provides the Parcel Line setback to ground mounted SES equipment, excluding any security fencing, poles, and wires necessary to connect to facilities of the electric utility.

Table 2: Parcel Line Setbacks

Zoning District	Level 1	Level 2	Level 3		
			Front	Side	Rear
Agricultural/Residential	Per Zoning District****	Per Zoning District* **	30’*	15’*	25’*
Residential, low density			50’*	50’*	50’*
Residential Medium Density			Per Zoning District*		
Residential High Density			30’*	15’*	25’*
Commercial/Business			30’*	15’*	25’*
Light Industrial			30’*	15’*	25’*
Heavy Industrial			30’*	15’*	25’*
Office/Institutional			30’*	15’*	25’*
* 100’ setback for SES equipment, excluding any security fencing, to any residential dwelling unit. If the SES is on a working farm where the primary residential structure of the farm is on an adjacent lot then this 100’ setback will not apply to this primary residential structure.					
** Ground-mounted SES must comply with district front yard limitations and setbacks, or otherwise not impair sight distance for safe access to or from the property or other properties in the vicinity					
*** Level 1 SESs are not subject to screening requirements typically applied to accessory utility systems (HVAC, dumpsters, etc.).					

⁸ Referred to as “Limited Use” in some jurisdictions

6. Height Limitations

The height of systems will be measured from the highest natural grade below each solar panel.

Table 3: Height Limitations*

Zoning Districts	Level 1 ⁹	Level 2	Level 3
Agricultural/Residential	Roof-mounted: Per zoning district Ground-mounted: 20'	20'	20'
Residential, low density		20'	20'
Residential Medium Density		20'	20'
Residential High Density		20'	20'
Commercial/Business		20'	20'
Light Industrial		20'	20'
Heavy Industrial		20'	20'
Office/Institutional		20'	20'
* This excludes utility poles and any antennas constructed for the project.			

7. Aviation Notification (see Appendix F for additional information)

The requirements below apply only to Level 1, 2, & 3 systems over half (½) an acre in size:

- a. A map analysis showing a radius of five (5) nautical miles from the center of the SES with any airport operations within this area highlighted shall be submitted with permit application.
- b. For consideration of potential impacts to low altitude military flight paths, notification of intent to construct the SES shall be sent to the NC Commanders Council¹⁰ at least 30 days before the CUP/SUP hearing for Level 3 SESs and at least 45 days before starting construction for applicable Level 1 & Level 2 SESs. Proof of delivery of notification and date of delivery shall be submitted with permit application. Notification shall include:
 - i. Location of SES (i.e. map, coordinates, address, or parcel ID)
 - ii. Solar technology (i.e. polycrystalline PV, monocrystalline PV, Cadmium Telluride PV, evacuated tube solar thermal, flat plate solar thermal, etc.)
 - iii. Approximate number of solar modules/panels
 - iv. System mounting (i.e. fixed-tilt on flat roof, fixed-tilt ground-mount, 1-axis tracking ground-mount, etc.)
 - v. The maximum height of the array from the ground or roof surface
 - vi. The maximum height of any new utility poles
 - vii. Power capacity of the system, in both DC and AC Watts where applicable
 - viii. Acreage of array and acreage of total project
 - ix. How will the project connect? (i.e. net meter, to existing distribution line, to new distribution line, to transmission line)
 - x. Will a substation be constructed? If so, provide location and size
 - xi. Is the site with five nautical miles of aviation operations? If so, provide the required SGHAT analysis results

⁹ An alternative for roof mounted systems would be to exempt roof mounted systems from building height restrictions.

¹⁰ Mail: Commanding General MCIEAST; Attn: Mr. Bill Meier (NC Commanders Council); Marine Corps Installations East G-7 (MCIEAST); PSC Box 20005; Camp Lejeune, NC 28542

Email: Subject: NC Commanders' Council Notification of Solar Development Project in "*Town or County Name*"
Address: Meier CIV William A [William.meier@mcw.usmc.mil] , Ayers CIV Bryan C [bryan.ayers@usmc.mil]

- c. The latest version of the Solar Glare Hazard Analysis Tool (SGHAT) or equivalent¹¹ shall be used per its user’s manual to evaluate the solar glare aviation hazard. The full report for each flight path and observation point, as well as the contact information for the zoning administrator, shall be sent to the authority indicated below at least 30 days before the CUP/SUP hearing for Level 3 SESs and at least 45 days before starting construction for Level 1 & Level 2 SESs. Proof of delivery of notification and date of delivery shall be submitted with permit application.
 - i. Airport operations at airport in the National Plan of Integrated Airport Systems (NPIAS)¹² within 5 nautical miles of the center of SES: provide required information to the Federal Aviation Administration’s (FAA) Airport District Office (ADO) with oversight of North Carolina¹³
 - ii. Airport operations at airport *not* in the NPIAS, including military airports, within 5 nautical miles of the center of SES: provide required information to the NC Commanders Council for military airports and to the management of the airport for non-military airports

Any applicable SES design changes (e.g. module tilt, module reflectivity, etc.) after initial submittal shall be rerun in the SGHAT tool and the new full report shall be sent without undue delay to the contact specified in 7.b.i and 7.b.ii above for accurate records of the as-built system.

8. Level 1 Solar Energy System Requirements

Level 1 SESs are a permitted use provided they meet the applicable height, setback, aviation notification, and related district standards.

9. Levels 2 & 3 Solar Energy System Requirements

These requirements are in addition to height, setback, aviation notification, and applicable district standards.

a. Site Plan

- i. A site plan¹⁴ shall be submitted to the Zoning Administrator demonstrating compliance with:
 - 1. Setback and height limitations established in Tables 2 and 3,
 - 2. Applicable zoning district requirements such as lot coverage,
 - 3. Applicable solar requirements per this ordinance.

b. Visibility

- i. SESs shall be constructed with buffering as required by the applicable zoning district or development standards (see Appendix J for solar visual buffering example standards).
- ii. Public signage (i.e. advertising, educational, etc.) as permitted by local signage ordinance, including appropriate or required security and safety signage.
- iii. If lighting is provided at site, lighting shall be shielded and downcast such that the light does not spill onto the adjacent parcel or the night sky. Motion sensor control is preferred.

¹¹ <http://sandia.gov/glare> (as of May 2016 Sandia licensed the technology of the SGHAT to Forge Solar (www.SolarForge.com) who offers a subscription-based software called GlareGauge based on the same technology used in SGHAT. This software offers one free trial to new users then charges over \$100/month to use the software. As of October 2016, the free SGHAT is available at the Sandia glare website. It is not known how long it will remain available. GlareGauge analysis should be accepted anywhere this ordinance requires use of the SGHAT.)

¹² www.faa.gov/airports/planning_capacity/npias/reports/

¹³ as of October 2016 this is the Memphis ADO

¹⁴ Applicants may choose to provide a sketch plan to the Planning Administrator ahead of a site plan, as sketch plans do not require much investment and are an opportunity for the Planning Administrator to point out design changes ahead of more expensive site planning.

- c. Decommissioning** (see Appendix G for a sample decommissioning plan and Appendix H for example abandonment clause and information on decommissioning)
- i. A decommissioning plan signed by the party responsible for decommissioning and the landowner (if different) addressing the following shall be submitted with permit application.
 1. Defined conditions upon which decommissioning will be initiated (i.e. end of land lease, no power production for 12 months, etc.)
 2. Removal of all non-utility owned equipment, conduit, structures, fencing, roads, and foundations
 3. Restoration of property to condition prior to development of the SES.
 4. Timeframe for completion of decommissioning activities, not to exceed one year.
 5. Description and copy of any lease or any other agreement with landowner regarding decommissioning.
 6. Name and address of person or party responsible for decommissioning..
 7. Plans and schedule for updating this decommissioning plan.
 - ii. Before final electrical inspection, provide evidence that the decommissioning plan was recorded with the Register of Deeds.

APPENDIX A: Landowner Guidance

There are many aspects of solar energy system development that impact the land, the landowner, the community, and the solar owner that are not regulated by the local government, or other regulatory bodies. Below is a list of issues developed in early 2013 in consultation with staff at the State Energy Office, the NC Solar Center, and the NC Attorney General's office to help identify *some* issues landowners should investigate when considering a lease offered for land used for a solar farm. Please be advised that the list is not meant to be a comprehensive list of all issues. It is recommended that landowners complete item #1 - get a land-lease lawyer.

1. It is highly recommended that you retain a lawyer with land lease experience to help you evaluate a lease. You can reach the NC Bar Association at 1-800-662-7660 and they can give you a list of lawyers in your area.
2. An option or feasibility period may be proposed by a developer while they are investigating whether a parcel of land is appropriate for a project – before they offer a long term lease. This is a due diligence period a developer will use to examine if the right conditions exist for a solar farm and possibly to secure agreements for the sale of power from the project.
3. Make sure conservation easement conditions or agricultural designation for tax purposes are consistent with the new lease. Taking land out of agricultural designation may result in additional taxes owed. The contract should state who is responsible for increased taxes due to the Solar Energy System development.
4. Evaluate any potential conflicts that the solar lease may have w/ any existing mortgage terms.
5. Evaluate any potential conflicts that the solar lease may have w/ any existing land use agreements, such as easements or an enhanced farm district.(A title search may be used to identify potential conflicts)
6. Make sure there is compensation for timber removal (if appropriate).
7. Make sure all conditions of a lease or options in advance of a lease are received in writing.
8. Have detailed decommissioning (removal) and restoration terms for the solar equipment at the end of lease so the land can be used for other purposes.
9. The developer should be responsible for managing storm water on the site. The installation of the arrays will impact storm water on the site and may require changes to storm water management or increase maintenance of storm water system (i.e. erosion control and keeping drainage ditches/pipes free flowing).
10. Make sure the lease identifies all work to be done and exact locations for equipment, also make sure there is proper notification of landowner in advance of any work to be done.
11. Take time to review lease documents before signing them.
12. It may be useful to check w/ neighbors to assess compensation rates being offered for land leases in your area.

Another resource that individuals as well as local governments may wish to consult is a document that the Solar Foundation prepared with funding from the U.S. Department of Energy as part of the US Department of Energy SunShot Program. It discusses a number of background requirements for solar farms as well as major elements of lease documents. You can find the document at the following link

http://thesolarfoundation.org/sites/thesolarfoundation.org/files/TSF_Leasing%20Fact%20Sheet.pdf

Landowner guidance information from the North Carolina State University Cooperative Extension Service published in 2016 can be found at: www.ces.ncsu.edu/search-results/?q=solar (Pubs & Factsheets) and include:

- [Threshold Issue for Landowner Solar Leasing](#) (covers what makes a site good for solar development)
- [Landowner Solar Leasing: Contract Terms Explained](#)

APPENDIX B: Sustainable Energy Options and Resources

This appendix is provided to supply planners and policy makers with inspiration and information about concepts and policies that in one way or another relate to solar energy, but do not appear within the scope of a solar development ordinance. None of the policies in this appendix are included in the template solar ordinance.

Project Permit – Solar Permitting map, database, and ratings, by Vote Solar

A project of the Vote Solar Initiative, Project Permit is an interactive website that scores municipal solar permitting practices nationwide. It is designed to help permitting staff, solar advocates, and municipal leaders understand how their city or town compares to permitting best practices. Project Permit includes tools and resources to help more municipalities achieve permitting best practices. Project Permit is funded by Solar 3.0, a DOE Sunshot Initiative grant recipient.

<http://projectpermit.org/>

Model Inspection Checklist for Rooftop PV Systems, from Interstate Renewable Energy Council (IREC), September 2013

For municipalities, an inspection checklist can serve a variety of important functions. First, it can serve as a supplementary educational tool for new or experienced inspectors to ensure they are aware of the host of code requirements that must be verified on-site during the inspection. It can also increase the consistency of inspections, by both a single inspector, as well as different inspectors working for the jurisdiction. Consistent inspections ensure high-quality, safe installations and also reduce conflict with installers, who may complain when they perceive that inspectors provide different results. A checklist could contain a section for “common mistakes” which could highlight particular issues for both installers and inspectors to verify. IREC incorporated the best components of each of leading checklists and then worked with Don Hughes, Senior Electrical Inspector with Santa Clara County, California, to identify the relevant code requirements and add the citations. Finally, this document was peer-reviewed by qualified inspectors and building code officials from across the country, and by UL representatives.

www.irecusa.org/wp-content/uploads/2013/09/Model-Inspection-Checklist.pdf

Expedited Permit Process, from Solar American Board for Codes and Standards (Solar ABCs)

This report presents an Expedited Permit Process for PV Systems. The permit process in this report was created to meet the needs of the growing, small-scale photovoltaic (PV) market in the U.S. and is applicable nationwide. It takes advantage of the many common characteristics inherent in most of the small-scale PV systems installed today to streamline both the application and award of permits. The term “expedited permit process” refers to an organized permitting process by which a majority of small PV systems can be permitted (structural & electric) quickly and easily. It is not intended to apply to all types of PV systems. The primary need and use for this process is for systems of less than 15kW maximum power output. The expedited permit process is intended to simplify the structural and electrical review of a small PV system project and minimize the need for detailed engineering studies and unnecessary delays.

www.solarabcs.org/about/publications/reports/expedited-permit/

Solar Powering Your Community: A Guide for Local Governments, from U.S. Department of Energy

The U.S. Department of Energy developed this comprehensive resource to assist local governments and stakeholders in building sustainable local solar markets. This second edition of the guide was updated to include new market developments and innovations for advancing local solar markets that have emerged since the first edition was released in 2009. The guide introduces a range of policy and program options that have been successfully field tested in cities and counties around the country.

This guide can help stimulate ideas or provide a framework for a comprehensive solar plan for a community. DOE recognizes that there is no one path to solar market development.

www4.eere.energy.gov/solar/sunshot/resource_center/resources/solar_powering_your_community_guide_local_governments

NC Solar Access Law:

North Carolina has a Solar Access Law, which among other things, states that Cities and counties in North Carolina generally may not adopt ordinances prohibiting the installation of "a solar collector that gathers solar radiation as a substitute for traditional energy for water heating, active space heating and cooling, passive heating, or generating electricity for residential property. For more information visit:

www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NC08R

Renewable Energy Ready Homes

Local governments can encourage construction of more capacity for rooftop solar installations on industrial, commercial and residential rooftops. The American Planning Association recommends that for this purpose local governments require the installation of solar 'stub-ins' on rooftops of appropriate new construction and building renovation. Stub-ins and their installation are very affordable and can significantly reduce the cost of installing a solar system in the future. Energy Star has Renewable Energy Ready Homes specifications:

www.energystar.gov/index.cfm?c=rerh.rerh_index

Design for Solar Access

New developments can be designed to maximize solar access for each property, greatly increasing the ability of the buildings in the development to make use of solar energy.

Some resources:

- Site Design strategies for Solar Access in model Sustainable Community Development Code: www.law.du.edu/documents/rmlui/sustainable-development/SolarAccess.pdf and www.law.du.edu/images/uploads/rmlui/rmlui-sustainable-siteDesignStrategiesSolarAccess.pdf
- Solar Ready Development: www.solarsimplified.org/zoning/solar-zoning-toolbox/solar-ready-zoning
- APA Planning and Zoning for Solar Energy information packet: www.planning.org/pas/infopackets/open/pdf/30part1.pdf

Wildlife Friendly Power Lines

The U.S. Fish & Wildlife Service provides guidelines on how to minimize the impacts of distribution and transmission lines to wildlife at www.fws.gov/birds/documents/powerlines.pdf.

Pollinator Friendly Solar (added to Appendix October 2016)

Gabriela Garrison (gabriela.garrison@ncwildlife.org) with North Carolina Wildlife Resources Commission (NCWRC), is coordinating a pollinator-friendly solar farm program for NC.

Solar Permitting (Building/Electrical) Best Practices (added to Appendix October 2016)

The Interstate Renewable Energy Council (IREC) published a [permitting best practices guide](#) and a [report explaining the best practices](#).

Solar Power Purchase Agreements (PPA): a Toolkit for Local Governments (added October 2016)

IREC published [this guide](#) and associated templates to support local governments and other public entities seeking to install and finance rooftop solar systems.

Minimizing Overlap in PV System Approval Processes: Case Studies and Analysis (added October 2016)

Published by IREC in October 2014, [this report](#) seeks to help improve efficiency of review and approval

Property Taxes and Solar PV Systems: Policies, Practices, and Issues, by NC Solar Center and Meister Consultants in July 2013 (added to Appendix October 2016)

Property taxes represent a potentially significant cost for solar PV system owners. [This report](#) presents state-by-state landscape of current property taxes as applied to PV systems.

APPENDIX C: NC Resource Mapping and Information

The **Biodiversity and Wildlife Habitat Assessment map** can be obtained from the **N.C. Conservation Planning Tool** at www.conservationtool.nc.gov and displays the location of high priority habitats and natural resources. Also included in the N.C. Conservation Planning tool are maps of Open Space and Conservation Lands, Agricultural Lands, and Forestry Lands.

- The NC Wildlife Resources Commission recommends that Solar Energy System developers address how they will minimize impacts as much as is practical to forests and sensitive lands mapped in the Biodiversity and Wildlife Habitat Assessment.

Maps of Managed Areas (lands managed at least partially for wildlife habitat) and Smoke Awareness Areas (areas adjacent to lands managed with prescribed burning) are available from the **Green Growth Toolbox** website at www.ncwildlife.org/greengrowth (see below).

- The NC Wildlife Resources Commission recommends that Solar Energy System developers address how they will minimize impacts as much as is practical to forests and sensitive lands mapped in Managed Areas and impacts to the ability to conduct prescribed burning on adjacent lands. The NC Wildlife Resources Commission also recommends that sites should not be located immediately adjacent to Managed Areas.

NC OneMap (www.nconemap.org/) is a public service providing comprehensive discovery and access to North Carolina's geospatial data resources. NC OneMap, the State's Clearinghouse for geospatial information, relies on data sharing and partnerships. Information available is extensive and includes wetlands, soil types, streams, and airports.

NC DENR Watershed Plan Map: <http://deq.nc.gov/document/water-supply-watershed-map>

NC Green Growth Toolbox: Wildlife & Natural Resource Stewardship in Planning, from North Carolina Wildlife Resources Commission

The NC Green Growth Toolbox is a guide to provide North Carolina's counties, towns, and cities with tools for growth that conserves wildlife and natural resources. The Toolbox includes a Green Growth Handbook, Wildlife Action Plan, Conservation Data, Habitat Conservation Recommendations, Training Workshops, and more.

www.ncwildlife.org/Conserving/Programs/GreenGrowthToolbox.aspx

APPENDIX D: Water Infiltration and Soil Conservation at SES

The prevailing interpretation of ground-mounted solar energy systems is that the solar arrays do *not* count towards the impervious allowance. In other words, the solar arrays are pervious. The State definition of built-upon area states built-upon area does not include a wooden slatted deck or pervious or partially pervious paving material to the extent that the paving material absorbs water or allows water to infiltrate through the paving material.¹⁵ Therefore, if the solar panels can be constructed in such a manner as to promote the effective infiltration of rainfall then they could be considered pervious, similar to a slatted deck or pervious pavement. Other structures such as transformers, buildings, entrance roads, etc. would still be considered impervious. The following criteria could be used at a minimum in establishing a solar panel as pervious cover:

1. Panels must be positioned to allow water to run off their surfaces.
2. Soil with adequate vegetative cover must be maintained under and around the panels.
3. The area around the panels must be adequate to ensure proper vegetative growth under and between the panels.

It is suggested that the solar farm designer/developer design the ground cover as pervious to the maximum extent practicable, so that the stormwater infiltrates or is cleaned by sheetflow across the solar farm before exiting the property or reaching the waters of the State.

Information on soil conservation:

- North Carolina Division of Water Quality Best Management Practices (BMP) Design Manual (<http://deq.nc.gov/sw-bmp-manual>) details how to design various stormwater BMPs effectively.
- North Carolina Association of Soil & Water Conservation Districts (<http://ncaswcd.org/>)
- A sample (soil) conservation plan: www.dec.ny.gov/docs/water_pdf/appendixf1.pdf

¹⁵ State's model Phase II post-construction ordinance, Section 6: Definitions, Built-upon area (BUA) available at <http://deq.nc.gov/about/divisions/energy-mineral-land-resources/energy-mineral-land-permits/stormwater-permits/npdes-ms4>

APPENDIX E: Conditional Use Permits and Special Use Permits

Special Use Permits (aka Conditional Use Permits) require a quasi-judicial hearing where the application must be found to meet several general standards and any special conditions required by the board. In general, decisions of a quasi-judicial body require findings of facts to reach conclusions of law that justify the decision. Decisions of a quasi-judicial body are often legally enforceable under the laws of a jurisdiction; they can be challenged in a court of law which is the final decisive authority

Most NC jurisdiction use the following four general standards: 1) Does not materially endanger the public health or safety; 2) Meets all required conditions and specifications; 3) Would not substantially injure the value of adjoining property or be a public necessity, and 4) Will be in harmony with the area in which it is located and be in general conformity with the comprehensive plan. More information on SUP/CUP in NC is available from the UNC School of Government: www.sog.unc.edu/sites/www.sog.unc.edu/files/SS_22_v4b.pdf

APPENDIX F: Airports

Experience and research has shown that there is a possibility for today's solar energy systems to cause a glare hazard for pilots and/or air traffic controllers. The Department of Energy's Sandia National Laboratories developed a 3-D modeling based online hazard assessment tool to determine if a solar project is likely to create a Solar Glare Aviation Hazard. The tool is free (as of October 2016) and recommended by the Federal Aviation Association (FAA). <https://share.sandia.gov/phlux>. Contact the FAA's local Airport District Office (ADO) for help with the tool or to get input data for tool variables that must come from the airport. As of May 2016 Sandia announced that they licensed the technology behind the SGHAT to www.SolarForge.com who is offering a paid monthly software subscription to access their GlareGauge online software based on the SGHAT technology. Sandia says the free SGHAT will not always be available, but it is not known when it will be removed from public access. It is recommended that either SGHAT or GlareGauge analysis be accepted.

A new FAA interim policy¹⁶ (published 10-23-2013) for on-airport solar development requires the use of this glare assessment tool and defines the below criteria to assess acceptable risk of glare.

The proposed solar energy system meets the following standards:

1. No potential for glint or glare in the existing or planned Airport Traffic Control Tower (ATCT) cab, and
2. No potential for glare or "low potential for after-image" (shown in green in [reports]) along the final approach path for any existing landing threshold or future landing thresholds (including any planned interim phases of the landing thresholds) as shown on the current FAA-approved Airport Layout Plan (ALP)¹⁷. The final approach path is defined as two (2) miles from fifty (50) feet above the landing threshold using a standard three (3) degree glidepath.

As of October 2016 the FAA website still says "**Note:** The FAA is reviewing Section 3.1.2 ("Reflectivity") of this guidance [[2010 FAA report on solar glare](#)] based on new information and field experience. All users of this guidance are hereby notified that significant content in this section may be subject to change, and the FAA cautions users against relying solely on this section at this time." A note on the front of the 2010 publication directs readers to the October 2013 FAA interim policy for on-airport solar development.

The following are recommended steps required to complete the aviation notification requirement in the template solar ordinance for NC for SESs near an airport.

- 1) OFF AIRPORT solar project-
 - a) Determine if the site is so close to an airport that it falls under FAA authority to require a filing with the Federal Aviation Administration (FAA) in accordance with CFR Title 14 Part 77.9 & follow instructions. If a filing is required steps b-f are not required, otherwise continue with the step below. (<https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showNoNoticeRequiredToolForm>)
 - b) Use internet/software mapping tool (such Google Earth or Google Map) to identify airports within 5 nautical miles of the center of the proposed solar project site.
 - c) If search results indicate no airport within 5 nautical miles of the project site, append research results to the permit application.
 - d) If search results indicate airport(s) within 5 nautical miles of the project site, go to http://www.faa.gov/airports/planning_capacity/npias/ to determine if it is in the National Plan of Integrated Airport Systems (NPIAS), i.e. an FAA "obligated" airport. If you are unable to determine if the airport is in the NPIAS or require assistance, contact the FAA's local ADO.
 - i) Notification of airports in the NPIAS should be sent to the local ADO.
 - ii) Notification of military airports should be sent to the NC Commander's Council via mail or email

¹⁶ www.gpo.gov/fdsys/pkg/FR-2013-10-23/pdf/2013-24729.pdf

¹⁷ FAA airport GIS maps and eALPs at <https://airports-gis.faa.gov/public/>

- iii) Notification of all other airports should be sent to the management of the airport¹⁸
- e) Run the latest version of the SGAHT according to the user manual. Unless otherwise directed in the user's manual, use the tool to assess for glare hazards at¹⁹:
 - i) the Airport Traffic Control Tower (ATCT) cab, and
 - ii) the final approach path for any existing landing threshold or future landing thresholds (including any planned interim phases of the landing thresholds) as shown on the current FAA-approved Airport Layout Plan (ALP). The final approach path is defined as two (2) miles from fifty (50) feet above the landing threshold using a standard three (3) degree glidepath.
- f) Review and send the results summary as well as the results of the glare analysis tool for each flight path and the ATCT.

On-airport solar projects at FAA obligated airports must follow FAA requirements. The following are recommended steps to facilitate meeting the FAA requirements.

2) ON AIRPORT Solar Projects

- a) Contact the ADO to discuss big picture concept (type of system, siting, size, environmental requirements, FAA Form 7460, etc.). This way FAA can give the proponent a general "roadmap" for the way forward (General FAA areas of concern, introduce the SGHAT Tool, if an on-airport project: give a feel for which areas ON AIRPORT can be considered for siting (per FAA safety & design standards); lease requirements on obligated airports, etc. Also, the ADO can facilitate contact between the solar proponent, the sponsor (& NCDOA if project location is on or near a State Block airport. In this case the ADO will be available to support NCDOA as requested.
- b) If after preliminary discussion, the solar proponent is still interested, collaborate with the FAA (or NCDOA) until conceptual agreement by all parties with the FAA's lease requirements.
- c) Develop National Environmental Policy Act (NEPA) documentation to support siting alternatives & run the SGHAT Tool for all site alternatives carried forward for analysis.
- d) Submit 7460 with Proposed Lease, NEPA analysis & SGHAT Tool Results attached to FAA ADO Review & acceptance via Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) filing.

Limited information on low altitude flight paths in North Carolina.

Information about military airports and low altitude flight paths may be found in a 2012 report on military presence and land compatibility: 2012 NC Military Land Compatibility Report
http://portal.ncdenr.org/c/document_library/get_file?p_1_id=1169848&folderId=8979146&name=DLFE-57386.pdf. Local planning departments may have or be able to request maps of local low altitude flight paths.

¹⁸ NC airports in NC contact information at www.faa.gov:

www.faa.gov/airports/airport_safety/airportdata_5010/menu/contacts.cfm?Region=ASO&District=&State=NC&County=&City=&Use=&Certification=

¹⁹ Sources of NC airport data: Unofficial Airport information available under *Maps and Diagram* at

<http://flightaware.com/resources/airport/browse/NC> and official GIS maps at <https://airports-gis.faa.gov/public/>

APPENDIX G: Example Decommissioning Plan

This is a simple example decommissioning plan:

Decommission Plan for Big Bright Solar Farm, located at
123 Edge-of-Town Rd.
Piedmont-ville, NC 21234

September 10, 2013

Prepared and Submitted by Solar Developer ABC, the owner of Big Bright Solar Farm

As required by the Town/County of _____, Solar Developer ABC presents this decommissioning plan for Big Bright Solar Farm (the "Facility").

Decommissioning will occur as a result of any of the following conditions:

1. The land lease ends
2. The system does not produce power for 12 months
3. The system is damaged and will not be repaired or replaced

The owner of the Facility, as provided for in its lease with the landowner, will do the following as a minimum to decommission the project.

1. Remove all non-utility owned equipment, conduits, structures, fencing, and foundations to a depth of at least three feet below grade.
2. Remove all graveled areas and access roads unless the owner of the leased real estate requests in writing for it to stay in place.
3. Restore the land to a condition reasonably similar to its condition before SES development, including replacement of top soil removed or eroded.
4. Revegetate any cleared areas with warm season grasses that are native to the region (~~Mountains, Piedmont, Sandhills or Coastal Plain~~ regions), unless requested in writing by the owner of the real estate to not revegetate due to plans for agricultural planting.

All said removal and decommissioning shall occur within 12 months of the facility ceasing to produce power for sale.

The owner of the Facility, currently Solar Developer ABC, is responsible for this decommissioning. Nothing in this plan relieves any obligation that the real estate property owner may have to remove the facility as outlined in the Special Use Permit in the event the operator of the farm does not fulfill this obligation.

The owner of the Facility will provide Town/County planning department and the Register of Deeds with an updated signed decommissioning plan within 30 days of change in the Facility Owner.

This plan may be modified from time to time and a copy of any modified plans will be provided to the planning staff and filed with the Register of Deeds by the party responsible for decommissioning.

SES Owner Signature: _____ Date: _____

Landowner (if different from SES Owner) Signature: _____ Date: _____

APPENDIX H: Abandonment & Decommissioning

This sample abandonment clause is provided for any jurisdiction who would like to consider including a clause on abandonment in their solar ordinance.

Abandonment

A SES that ceases to produce energy on a continuous basis for 12 months will be considered abandoned unless the current responsible party (or parties) with ownership interest in the SES provides substantial evidence (updated every 6 months after 12 months of no energy production) to the Zoning Administrator of the intent to maintain and reinstate the operation of that facility. It is the responsibility of the responsible party (or parties) to remove all equipment and facilities and restore the Parcel to its condition prior to development of the SES ²⁰

1. Upon determination of abandonment, the Zoning Administrator shall notify the party (or parties) responsible they must remove the SES and restore the site to its condition prior to development of the SES within three hundred and sixty (360) days of notice by the Zoning Administrator.
2. If the responsible party (or parties) fails to comply, the Zoning Administrator may remove the SES, sell any removed materials, and initiate judicial proceedings or take any other steps legally authorized against the responsible parties to recover the costs required to remove the SES and restore the site to a non-hazardous condition.

Some resources regarding decommissioning of SES

- Question and Answers about Ground-Mounted Solar Photovoltaic Systems by the state of Massachusetts, June 2015 update: www.mass.gov/eea/docs/doer/renewables/solar/solar-pv-guide.pdf
- First Solar (leading manufacturer of Cadmium Telluride PV modules) has a pre-funded recycling program for all of their modules: www.firstsolar.com/Sustainability/Environmental/Recycling-Service
- PV Cycle (www.pvcycle.org/) European PV recycling program. A good source for an example of a large scale PV module recycling program and for information on PV recycling.
- Solar Energy Industries Association (SEIA) information on PV recycling: www.seia.org/policy/environment/pv-recycling
- NC DENR information on electronics recycling in NC
- Silicon Valley Toxics Coalition (SVTC) Solar Scorecard: www.solarscorecard.com
- Green Guys, company in NC offering recycling services to the solar industry greenguys@pcgsolar.com
- Solar Energy Industries Association (SEIA) announced a National PV Recycling Program in September 2016. www.seia.org/seia-national-pv-recycling-program

Current US PV Module Recycling Regulation:

End-of-life disposal of solar products in the US is governed by the Federal Resource Conservation and Recovery Act (RCRA), and state policies that govern waste. To be governed by RCRA, panels must be classified as hazardous waste. To be classified as hazardous, panels must fail to pass the Toxicity Characteristics Leach Procedure test (TCLP test). Most panels pass the TCLP test, and thus are classified as non-hazardous and are not regulated.

²⁰ Anywhere reference is made to restoring the parcel to condition prior to development of the SES (including removal of gravel, roads, and fencing), less restoration is acceptable when it is requested in writing by the parcel owner.

APPENDIX I: Solar PV and Fire Safety

Information on firefighter safety and emergency response needs

- Solar Energy Industries Association (SEIA) information on fire safety and solar: www.seia.org/policy/health-safety/fire-safety-solar
- Underwriters Laboratory (UL) information and studies on fire safety and solar: www.ul.com/global/eng/pages/offerings/industries/buildingmaterials/fire/fireservice/pvsystems/
- California Office of the State Fire Marshal information for firefighters on solar PV: www.gosolarcalifornia.ca.gov/solar_basics/fire_safety.php
- The Solar America Board for Codes and Standards (Solar ABCs) reports and information on fire and flammability for the solar PV industry and code officials: www.solarabcs.org/current-issues/fire.html
- Detailed Fire Protection Plan for solar farm in San Diego County, CA: www.sdcounty.ca.gov/pds/regulatory/docs/3300-11-029_CEQA_REVIEW_120503/3300-11-029-FPP.pdf
- Online training on Solar for the fire and rescue community, provided by the North Carolina Office of State Fire Marshal: www.ncdoi.com/OSFM/RPD/pt/Student_Review.aspx
- The 2012 version of the International Fire Code added requirements regarding roof-mounted and ground-mounted PV systems, including:
 - Marking: required on interior and exterior of direct-current (DC) conduit, enclosures, etc.
 - Locations of DC conductors: requirements regarding the location and pathway of DC wiring on and under a roof
 - Access and pathways: Module location restrictions designed to allow safe walkways and access for roof venting
 - Ground-mounted photovoltaic arrays: States that the access and pathway rules do not apply to ground-mounted systems, but they are required to provide a clear, brush-free area of 10 feet around the array.This is section 605.11: Solar photovoltaic power systems in the International Fire Code, the exact language is available here: http://publicecodes.cyberregs.com/icod/ifc/2012/icod_ifc_2012_6_par132.htm
- Online Solar PV Safety Training for Firefighters (free) by the International Association of Fire Fighters and IREC, September 2016 www.iaff.org/pvsafetytraining/ Quality training educating firefighters on the identification, operation, and hazards associated with rooftop solar electric (PV) systems through the use of engaging videos, 3-D simulations, and quizzes.

APPENDIX J: Visual Buffering: Example NC Requirements

Visual buffering and screening is not specific to solar and has applicability to many other forms of development. However, solar has been subject to various screening/buffering standards of varying specificity throughout the state. The following are examples of buffering requirements in two jurisdictions (Brunswick and Guilford Counties) in the state at the time of publication of this template solar ordinance. In both cases there is a simple solar specific buffering requirement that refers to existing generic buffering specifications/requirements. Significant portions of the applicable county buffering specifications are included in this appendix to facilitate understanding the solar buffering requirement in each example.

Brunswick County

(UDO- Section 5.3.4.P)

Solar Farm (Rev. 01-Nov-10)

A Solar Farm developed as a principal use shall be permitted in accordance with Section 5.2., subject to the following:

...

3) Visibility

- (a) Solar farms with panels located at least 150 feet from an adjacent public street right-of-way, residentially-zoned property, or residential use shall not require screening.
- (b) Solar farms with panels located less than 150 feet from an adjacent public street right-of-way must meet the requirements of Section 7.2.8.B. Street Buffers and Section 7.2.9. Project Boundary Buffers.

(Section 7.2.8.B. Street Buffers and Section 7.2.9. Project Boundary Buffers.)

7.2.8. Street Buffers

Street buffers shall be required and existing vegetation should be used to satisfy these planting requirements where possible (see Section 7.1.5, Existing Vegetation). No vegetation or fence shall interfere with a required clear sight triangle at a driveway or intersection (See Section 6.2.4). Berms constructed in accordance with Section 7.2.10.B, Berms with Vegetation, are encouraged as a component of any street buffer and the Planning Director may allow up to 25% reduction in the required buffer depth with a berm.

....

B. Collector or Thoroughfare Street Buffers

All development located along either a collector or thoroughfare street shall be required to provide one of the following buffers along the entire street frontage.

1. One canopy tree per 100 linear feet of property frontage, located within a twenty-foot landscape buffer; OR
2. Two understory trees per 100 linear feet of property frontage, located within a twenty-foot landscape buffer; OR
3. Under utility lines only, two understory trees per 100 linear feet of property frontage, located within a 20-foot landscape buffer. No trees under utility lines shall have a natural height over 25 feet.

7.2.9. Project Boundary Buffers

Commentary: Project Boundary Buffers ensure a landscaped transition between different types of uses and/or zoning districts. At first glance, the following method may seem complicated. In reality, this is a fairly easy approach to implement. A few simple steps will provide the total amount of plants that are required to be in a buffer as well as the buffer depth.

A. Required Project Boundary Buffer Table

1. Description

- i. The buffer standards in the table below address the opacity of the buffer that is required on the property boundary between zoning districts, and in some instances within a zoning district.
- ii. An opacity of 0.2 screens 20% of an object, and an opacity of 1.0 would fully screen the adjoining development during summer months after five years of growth.

2. Measurements: Project boundary buffers shall be measured along a perpendicular line from the lot line.

3. How to Read the Buffer Table

- i. The required opacity of project boundary buffers is represented in the Table below by two numbers (for example, .2/.6).
- ii. The second number represents the total required buffer opacity between any two properties.
- iii. Where the proposed project adjoins vacant property, the first number represents the applicant’s required buffer opacity.
- iv. Where the adjoining property is already developed with no buffer, the proposed project is responsible for providing the total required opacity (the second number).
- v. Where the adjoining property is already developed with a partial buffer, the proposed project is responsible for providing the remaining opacity required.
- vi. A zero means no project boundary buffer is required.

		ZONING DISTRICT of ADJOINING PROPERTY					
		Rural Low Density Residential	R-7500, R-6000, and SBR-6000	MR-3200 and N-C	C-I	C-LD and RU-I	I-G
ZONING DISTRICT of SUBJECT PROPERTY	Rural Residential	0 ¹ /0 ²	.2/.2	.4/.6	.2/.8	.2/.8	.2/1.0
	R-7500, R-6000, and SBR-6000	.2/.2	0 ¹ /0 ²	.2/.4	.2/.6	.2/.6	.2/1.0
	MR-3200 and N-C	.4/.6	.2/.4	0 ¹ /0 ²	.2/.6	.2/.6	.2/1.0
	C-I	.6/.8	.4/.6	.4/.6	0/0	.2/.4	.2/1.0
	C-LD and RU-I	.6/.8	.4/.6	.4/.6	.2/.4	0/0 ²	.2/1.0
	I-G	.8/1.0	.8/1.0	.6/1.0	.6/1.0	.4/.6	0/0
	¹ Non-residential uses locating next to vacant property shall be required to provide a 0.2 buffer. ² When locating a non-residential use in a Rural Residential, R-7500, R-6000, SBR-6000, MR-3200, NC, C-LD, or RU-I Zoning District next to an existing residential developed property, a 0.4 buffer shall be required. Non-residential uses locating next to other non-residential uses are not required to provide a buffer.						

4. Buffer Alternatives

The table below shows the required buffer depth (average) and plantings required for a project boundary buffer to satisfy the required opacity. Existing vegetation should be used to satisfy these planting requirements where possible (see Section 7.1.5, Existing Vegetation).

MINIMUM REQUIRED PROJECT BOUNDARY BUFFER Buffer Depth and Plants Required Per 100 Linear Feet				
Required Opacity[1]	Alternative 1 Plantings	Alternative 2 Plantings	Alternative 3 Plantings + 6-Foot (Height) Fence[2]	Alternative 4 Plantings + 6-Foot (Height) Wall[3]
0.2	10 feet 1 canopy 1 understory 7 shrubs	10 feet 1 canopy 2 understory 3 shrubs	Not available	Not available
0.4	20 feet 2 canopy 4 understory 25 shrubs	20 feet 2 canopy 6 understory 9 shrubs	Not available	Not available
0.6	30 feet 3 canopy 6 understory 34 shrubs	30 feet 3 canopy 8 understory 13 shrubs	20 feet width 0 canopy 3 understory 3 shrubs	15 feet width 0 canopy 3 understory 3 shrubs
0.8	50 feet 5 canopy 7 understory 43 shrubs	50 feet 4 canopy 10 understory 17 shrubs	35 feet width 0 canopy 5 understory 7 shrubs	25 feet width 0 canopy 5 understory 7 shrubs
1.0	80 feet 5 canopy 8 understory 49 shrubs	80 feet 4 canopy 11 understory 19 shrubs	60 feet width 0 canopy 5 understory 7 shrubs	40 feet width 0 canopy 5 understory 7 shrubs
<p>Note: [1] Required Opacity x 100 = % Required Opacity (e.g., .2 times 100 = 20% Required Opacity). [2] When Alternative 3 is selected, the fence type must be 100% opaque and comprised of either wooden or vinyl material. [3] When Alternative 4 is selected, the wall must be designed in conformance with Section 6.8.5, Walls, and Section 7.2.10, Walls, Berms, and Fences within Buffers.</p>				

Commentary: Suppose you are required to install a buffer with opacity of 0.6 and you elect to use Alternative 1. Your buffer would have to be 30 feet deep (on average) and you would have to plant 3 canopy trees, 6 understory trees, and 34 shrubs for every 100 feet of buffer length.

For full requirements: www.brunswickcountync.gov/Portals/0/BC/files/Planning/UDO_Final.pdf

Guilford County

6.4-84 - Solar Collectors (Principal)

- (D) *Screening:* Solar collectors and associated outside storage shall be completely screened with a vegetative buffer from view from all streets and adjacent residential uses. Required screening shall be at a type B Planting Yard Rate, except understory-trees may be substituted for canopy tree requirements.”

6-3.2. - Planting Yards.

(B) *Planting Area Descriptions:*

- (4) Type B Planting Yard: A medium density screen intended to partially block visual contact between uses and create spatial separation. See Figure 6-G.

Planting Yard Rates						
Yard Type	Minimum Width (ft.)	Min. Avg. Width (ft.)	Maximum Width (ft.)	Canopy Tree Rate	Understory Tree Rate	Shrub Rate
Street Yard	8	8	25	$\frac{2}{100}$ lf; ^{sup} ; ^{sup} ;	NA ^c	17/100 lf
Type A Yard	40 ^a	50 ^a	75	$\frac{4}{100}$ lf/oc	10/100 lf/oc	33/100 lf/oc
Type B Yard	25 ^a	30 ^a	50	$\frac{3}{100}$ lf	5/100 lf	25/100 lf
Type C Yard	15 ^a	20 ^a	40	$\frac{2}{100}$ lf; ^{sup} ; ^{sup} ;	$\frac{3}{100}$ lf	17/100 lf
Type D Yard	5	5	10	-	$\frac{2}{100}$ lf	18/100 lf

Notes:

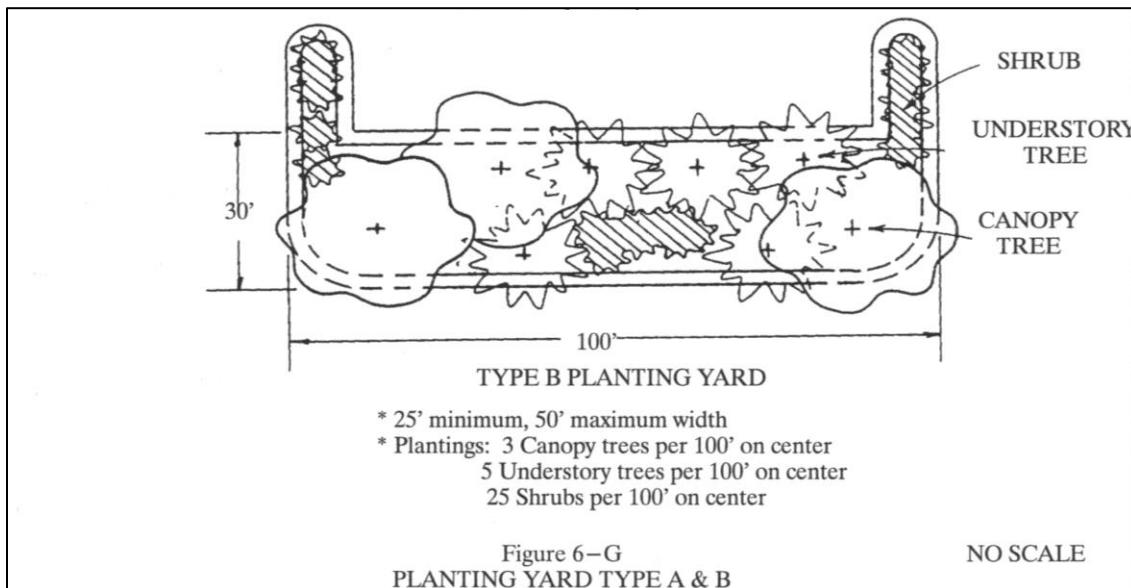
If: linear fee oc: on center

^a Walls, a minimum of five (5) feet in height, constructed of masonry, stone, or pressure treated lumber or an opaque fence, a minimum of five (5) feet in height, may be used to reduce the widths of the planting yards by ten (10) feet.

[;]^{sup};^{sup}; In streetyards, Type C and Type D planting yards, and parking lots understory trees may be substituted for canopy trees at the rate of two (2) understory trees for each required canopy tree.

^c One (1) understory tree may be substituted for each required canopy tree if the Technical Review Committee determines that there would be a major conflict with overhead utility lines.

NOTE: On Lots of Record less than fifty-five thousand (55,000) square feet in area, no development shall be required to place required landscaping on greater than fifteen (15) percent of the site.



6-3.7. - Provisions for Preservation of Existing Trees.

(A) *General:* Any existing tree or group of trees which stands within or near a required planting area and meets or exceeds the standards of this Ordinance may be used to satisfy the tree requirements of the planting area. The protection of tree stands, rather than individual trees, is strongly encouraged.

For Full requirements go to Guilford Co. at www.municode.com/Library

These are two representative buffering requirements for solar found within North Carolina. As is evident, there are variances in descriptiveness and the level of intensity for each jurisdiction. This template ordinance does not favor these over any other alternatives. Appropriate requirements should be discussed and agreed upon by each jurisdiction.

APPENDIX K: Construction Waste Management Plan (CWMP)

Solar energy is generally considered an environmentally beneficial industry; however, its initial construction can produce large quantities of cardboard, wood, scrap metal, scrap wire, and clearing and grading wastes. Often the waste produced is sent to local landfills or burned on site. For level 2 and 3 SESs, these additional waste streams can place a burden on existing waste management and landfill resources at a local municipal and county level. A large percentage of this waste can be diverted from landfills to private recycling businesses with net costs approximating landfill disposal. According to a report published in 2010 by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Environmental Assistance and Outreach and the Recycling Business Assistance Center, the recycling industry in North Carolina consisted of over 630 private sector recycling businesses employing over 15,200 people and has been growing at 4.8% since 2008 (See Resources for link). In addition, NCDENR has launched a web based NC Recycling Markets Directory (see Resources below) to help identify local recyclers. As a result, developing a CWMP and finding a private recycling entity for construction waste(s) is arguably easier than ever before. Counties/municipalities that choose to adopt CWMP requirements can not only avoid straining their existing landfill and waste management resources, but can also help contribute to the growth of their local recycling industries. Similar ordinances requiring CWMPs for new construction have been ratified in California as well as Cook County, Illinois and King County, Washington (See below for further information)

CWMP Examples

- CALGREEN CWMP
 - www.hcd.ca.gov/codes/calgreen/CW-1.pdf
- Sandia National Laboratories CWMP Template
 - www.sandia.gov/engstds/ConstSpecs/Div_01/01505C_CWM_Waste_Mgt_Plan_Template-archived.pdf
- King County, Washington
 - <http://your.kingcounty.gov/solidwaste/greenbuilding/specifications-plans.asp>

Successful Construction Waste Management Ordinances

- State of California's California Building Standard Code
 - www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf
- Cook County, Illinois - Ordinance requiring management of construction and demolition waste consistent with Cook County's existing Solid Waste Management Plan.
 - <http://blog.cookcountyil.gov/sustainability/wp-content/uploads/2012/07/Substitute-Demolition-Debris-Diversion-Ordinance-July-23.pdf>

Level 3 SES Anticipated Waste - 20 MW SES in Halifax County

- Project goal to recycle 80% of all construction and demolition waste. Contact greenguys@pcgsolar.com for more information.
 - 140,000 lbs - cardboard waste
 - 32,000 lbs - scrap wire waste
 - 3,500 - wooden slatted pallets
 - 16 acres - Clearing and grading waste

Resources

- NC Recycling Market Directory
 - www.p2pays.org/dmrm/start.aspx
- California Department of Housing and Community Development- Construction Waste Management Forms
 - www.hcd.ca.gov/calgreen.html
- Green Guys - Waste Management and Site Services greenguys@pcgsolar.com
- Employment Trends in NC Recycling Industry - 2010
 - www.container-recycling.org/assets/pdfs/jobs/EmploymentTrendsInNC.pdf

General Template for Rules and Regulations

1. A developer of a Solar Plant in North Carolina shall be required to develop a Waste Stream Management Plan (WSMP) for the construction waste and debris at the site of the said Solar Energy System.
2. A developer of a Solar Plant in North Carolina shall be required to file the WSMP with the department of _____ in the County/Town/City wherein the Solar Energy System shall be erected and operated.
3. A WSMP shall only be acceptable if it contains a proper and adequate plan for the recycling of _____ (____%) percent of all of the waste, including but not limited to cardboard, wood, scrap metal, scrap wire, and clearing and grading wastes, from the construction site.
4. A developer shall be required to file with the department of _____ in the County/Town/City wherein the Solar Energy System shall be erected a Construction and Demolition Debris Summary Report (CDSR) within fifteen (15) days of the end of the construction of the solar plant.

General Template for Enforcement

1. Developer's failure to meet or exceed the provisions of the developer's CWMP shall constitute a violation of this Ordinance.
2. Developer shall have fifteen (15) days in which to cure this violation and make property notice to the County/Town/City.
3. Developer's failure to cure and notify the County/Town/City within the said fifteen-day (15) period shall result in a fine of _____ (\$ insert dollar amount here) dollars to be paid by Developer within thirty (30) days of the issuance of said fine or a lien will be placed on the property upon which the solar energy system has been constructed.

APPENDIX L: Template Solar Ordinance Working Group Participants

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Duke Energy Progress, Bruce Barkley
Federal Aviation Association, Peter Hughes
Federal Aviation Association, Dana Perkins
Governor's office military affairs, John Nicholson
Granville County Planning Department, Dervin Spell
Guilford County Planning Department, Les Eger
HelioSage LLC, Kyle West
Institute for Emerging Issues, Diane Cherry
Keyes, Fox, Weidman, Laurel Passera
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National Renewable Energy Corporation (Narenc), Dennis Richter
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NC Association of County Commissioners, Johanna Reese
NC Association of County Commissioners, Casandra Skinner
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NC Commerce Dept. - Community Planning, Oliver Bass
NC Conservation Network, Nadia Luhr
NC DENR - Military Affairs and Strategic Planning, Chris Russo
NC Dept. of Agriculture - Agribusiness Development, Ron Fish
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APPENDIX M: Document Revision History

Date	Version	Revision Author	Revision Details
12/18/2013	Version 1.0	Tommy Cleveland, NCSC Miriam Makhyoun, NCSEA	n/a, original publication date
5/22/2014	Version 1.1	Tommy Cleveland, NCSC	Updated NCSEA contact to be Maggie Clark, moved Michael Fucci down in contact lists and added affiliation as Duke Grad Student.
11/24/2014	Version 1.2	Tommy Cleveland, NCCETC	Replaced NCSC logo with NCCETC logo, updated the Center's name in contact list
01/26/2016	Version 1.3	Tommy Cleveland, NCCETC	Edits for clarity in Appendix F: Airports, Off Airport recommended steps
01/26/2016	Version 1.3	Tommy Cleveland, NCCETC	Clarifying improvements to Section 9.C: Decommissioning. Subsections 4,5,6, and 7
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	NCSEA contact in stakeholder list, changed DENR to DEQ (formerly DENR).
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Updated URLs in footnotes 6 and 7 on stormwater maps and historic buildings
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Updated military notice in 7.b at request of USMC. Expanded list of information to include in notification and updated contact information
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Update footnote 11 on SGHAT regarding additional software option and potential loss of access to free software
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Appendix A, added links to new resources by NCSU Cooperative Extension
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Appendix B: added five additional resources at end of the list. Edited existing descriptions slightly to limit to two pages
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Appendix F, updated information on SGHAT software and notes on the status of reports on solar glare from FAA
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Appendix H, added link to Q&A on ground mounted solar that does a great job of addressing common impact questions, added link to SEIA's new national PV recycling program
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Appendix I: added new online solar safety training for firefighters
10/06/2016	Version 1.4	Tommy Cleveland, NCCETC	Throughout, updated DENR urls to proper new DEQ url