

# Solar 101 for NH Municipal Officials

## Facilitating the installation of residential and municipal solar PV systems

**by Lakes Region Community College**  
with support from the U.S. Department of Energy  
SunShot Initiative Rooftop Solar Challenge II  
in partnership with New Hampshire Office of Energy  
and Planning and Clean Energy States Alliance






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## Why a Solar 101 for Municipal Officials?

- Accommodating huge increases in grid-tied residential solar PV systems in New Hampshire
  - *If your town is not moving forward to facilitate solar PV, it is falling behind...*
- Part of U.S. Dept. of Energy's SunShot Initiative
  - A national effort to make solar energy fully cost-competitive with traditional energy sources by the end of the decade
  - Targeting the reduction of non-hardware "soft" costs for solar photovoltaic (PV) systems
- Companion presentation:
  - "NH Residential PV Solar 101"



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## Presentation Outline

- A. Solar PV Essentials**
- B. Municipal Planning and Zoning for Solar PV**
- C. Facilitating Solar with Municipal Permitting**
- D. Codes and Inspections**
- E. Assessments and Property Taxes**
- F. Solar PV Installations on Municipal Property**

*Disclaimer: Lakes Region Community College makes no guarantee as to the accuracy, completeness, usefulness or currency of the information in this presentation. Neither LRCC nor its sponsors shall be responsible for any errors or omissions herein.*

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## A. SOLAR PV ESSENTIALS

- Solar PV growth in New Hampshire
- Why go solar?
- Anatomy of a residential PV system
- Net metering
- Solar PV output
- Typical residential PV costs and incentives
- Residential PV roles

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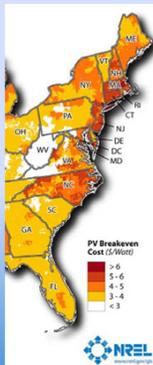
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## The Solar Revolution

- Solar PV at grid parity now in NH
- Consumer demand for solar is skyrocketing
- In 2030:
  - Electric more important than ever: cars, heat pumps, etc.
  - Microgrids
  - Advanced storage
  - Smart metering and smart buildings
- Is your municipality prepared?



Source: NREL, 2009

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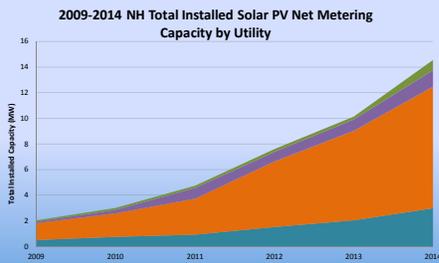
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## Solar PV Growth in New Hampshire



Data from NH Public Utilities Commission Annual Renewable Energy Fund Reports  
<http://www.puc.state.nh.us/Sustainable/2012EnergyRenewableEnergyFund.html>

Source: NH OEP, 2016

2015: ~29 installed PV megawatts (DC) (SEIA & ISO-NE)

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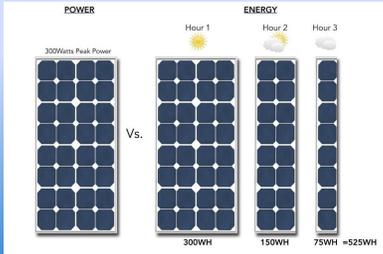
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### Anatomy of PV: Solar Panel *Power* Rating vs. *Energy* Production

- NH fixed mount PV rule of thumb:
  - 1 watt of solar panels  $\approx$  1.2 kilowatt-hours electricity / year



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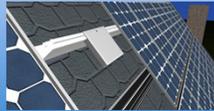
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### Anatomy of a PV System: Inverters

- Inverters convert DC current from the panels to usable AC current
- String (central) inverters*
  - Larger and centrally located near meter or electrical panel
  - Most cost-effective if few shading issues
  - Approx. 15 year life
- Micro-inverters*
  - Smaller and numerous, located behind the solar panels
  - Reduces the impact of shading
  - May have a longer life
- Another option: *power optimizers* with central inverters



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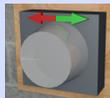
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### Connecting to the Grid and Net Metering

- Net meter- special electricity meter*
  - Runs forwards: consuming electricity from grid
  - Runs backwards: producing electricity into grid
- Utility disconnect*
  - Immediately shuts off solar power when grid goes down
  - Most grid-tied PV systems don't work during a power outage
- Separate RECs watt-meter*
  - If selling renewable energy credits
- Off-grid PV systems*
  - No connection to the electrical grid
  - Uses batteries to store solar energy
  - Hybrid systems: can do both -- expensive



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### Net Metering and Utility Interconnections

- Net metering allows small producers to send electricity into the grid
  - And use electricity when not producing
  - “Distributed generation”
- Utility net metering cap
  - NH net metering law amended May 2016
  - Expands the cap from 50 to 100 megawatts
  - 80% of new capacity for small (under 100 kW) projects
- What rate structure to credit solar producers?
  - ~14¢/kWh 2016 average residential consumer retail rate
  - NHEC 2016 resid.: 8.6 ¢/kWh produced vs. 12.1 ¢/kWh consumed
  - Different commercial rates
  - NH PUC net metering rate study – due in early 2017
- “Grid Modernization” – current NH PUC docket



Source: ConEd

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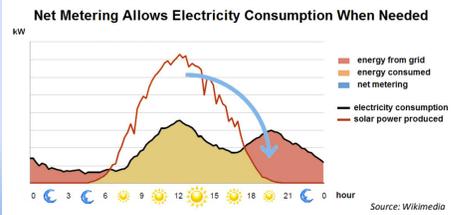
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### Net Metering Over a Day

Net Metering Allows Electricity Consumption When Needed



- Red area: electricity consumed from the electrical grid
- Tan area: solar-generated electricity consumed “behind the meter”
- White area: “Net excess generation”
  - Net metering credit towards later consumption
  - Day vs. night, and summer vs. winter

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### Summer and Winter Sun



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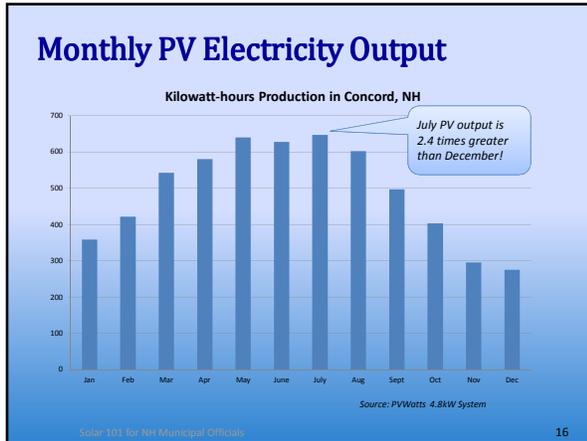
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### Shading, Orientation and Tilt

- “Solar Pathfinder” and similar shading analysis tools
  - Estimates shading by time of year and time of day
- Orientation (azimuth): true south (solar south: 180°) best
  - Orientations between 140° to 220° usually acceptable
- Tilt (angle): ideally sun at a right-angle to the panels
  - A 35° angle works well in NH (15° to 55° still provide 95+% output)
  - Want sufficient tilt for snow and ice to slide off

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### Typical Residential PV Costs and Incentives

- 6 kilowatt roof-mounted, grid-tied PV system
  - Hypothetical 2016 costs and incentives

| 6 kW Residential PV -- Components  | \$\$                |
|--|---------------------|
| Hardware: 20 solar panels, inverter, cabling, etc.                                 | \$14,700            |
| Balance of system costs- labor, permitting, etc.                                   | \$9,300             |
| <i>(approx. \$4 / watt)</i> <b>Subtotal:</b>                                       | <b>\$24,000</b>     |
| Less: NH PUC rebate (50¢/watt; \$2,500 max)  | (\$2,500)           |
| Less: 30% IRS tax credit (after rebate*)   | (\$6,450)           |
| <i>(approx. \$2.5 / watt)</i> <b>Net cost:</b>                                     | <b>\$15,050</b>     |
| Solar electricity production:<br>7,200 kilowatt-hours/year @ 14¢/kW-hour           | \$1,008/year        |
| Renewable Energy Credits revenue<br>7 RECs @ \$45 each, less \$65 monitoring costs | \$250/year          |
| <i>(~8.4% return on investment)</i> <b>Total revenue</b>                           | <b>\$1,258/year</b> |

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### Steps in a Solar PV Installation

- 1 Determine potential for a solar PV project and meet with installer(s). \*
- 2 Contact administrative staff in your city or town to understand the permitting process.
- 3 Complete the simplified interconnection application process with your utility and understand if any transformer upgrades are necessary.
- 4 Submit Part 1 of the NH State Residential Solar Rebate application.
- 5 Receive approval from your city or town for installation of solar PV system.  
Receive approval from your local utility for electrical interconnection.
- 6 Install solar PV system. Complete PV system and electrical interconnection inspections.
- 7 Complete and submit Part 2 of NH State Solar PV Rebate application.  
File for Federal tax credits (completed with Form 1040).

Source: NH Residential Rooftop Solar PV Permitting, Zoning and Interconnection Guide

- Many steps, many roles...

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### Residential PV Roles

- Property owner
  - Usually also electricity consumer
- Solar developer / installer
- **Municipality**
  - **Planning, permits and inspections**
- Electric utility
- State and federal government
- Possibly: lenders, investors, consultants and lawyers



Source: www.lumoxart.com

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## B. MUNICIPAL PLANNING AND ZONING FOR SOLAR PV

- Enabling State statutes
- Incorporating solar into master plans
- Zoning for solar
- Zoning and planning resources

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### Enabling State Statutes for Smart Solar PV Planning



Source: Picaserver

- NH solar-friendly enabling statutes for municipal plans, zoning and ordinances:
  - RSA 477 Encourages use of solar skyspace easements
  - RSA 672:1 Encourages planning and zoning that allow access to sunlight for solar energy
  - RSA 674:2 Enables an energy section in municipal master plans
  - RSA 674:17 Enables zoning ordinances to encourage and protect solar access (setbacks, vegetation height, street orientation, etc.) [RSA 674:36 for subdivisions]
  - RSA 674:51 Allows municipalities to reduce or waive fees for renewable energy systems

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### Incorporating Solar into Municipal Master Plans: Best Practices

- Include an energy chapter in the master plan
  - 27% of responding NH towns already do (2015)
- Utilize enabling State legislation to declare solar PV a municipal planning goal
  - And sunlight a valuable resource
- Make connections with regional, state and federal solar initiatives
  - Nashua RPC: Renewable Tool Belt initiative
  - SNHPC, UVLSRPC, Vital Communities & NHSEA: Solar Up and Solarize community solar campaigns
  - State of NH Renewable Portfolio Standard
  - Federal SunShot initiative – to drive down the cost of solar PV

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### Examples of Smart Solar Planning

- Durham – Energy Chapter
  - Energy chapter “presents a vision ... of a resilient, efficient, and environmentally responsible municipality”
- Claremont – 2016 Master Plan revisions
  - Will include a new Energy chapter
  - Extensive public involvement activities
- Hollis – Zoning Ordinance
  - SECTION 24: SOLAR ENERGY SYSTEMS- Includes definitions, conditional use permits conditions and standards of review
- Lebanon – Zoning Ordinance
  - SECTION 612 RENEWABLE ENERGY FACILITIES- “...to accommodate and encourage renewable energy facilities ... while protecting the public’s health, safety and welfare.”

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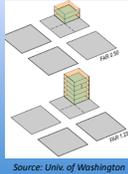
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### Zoning for Solar: Overall Best Practices

- Establish clear definitions
  - Do your zoning codes define: *solar photovoltaic (PV) system, roof-mounted vs. free-standing solar energy system, solar farm or garden, building-integrated solar PV system, etc.?*
- Consider exempting small solar energy systems from floor area ratio (FAR) and lot coverage requirements
- Provide checklists for zoning and site plan review



Source: Univ. of Washington

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### Zoning for Roof-Mounted PV: Best Practices

- Consider exempting roof-mounted solar from all zoning and site plan review regulations
  - Or at least classify roof-mounted solar in the same category as building HVAC/mechanical equipment
- Exclude roof-mounted solar PV systems from impervious surface regulations
- Consider exempting all roof-mounted PV systems from building setback requirements
  - Unless the panels extend beyond the building footprint



Source: City of Keene

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### Zoning for Ground-Mounted PV: Best Practices

- Exclude or minimize free standing (ground-mounted) solar PV systems from impervious surface regulations
  - Other than footings, free-standing solar systems do not prevent water absorption
- Balance the benefits of solar with reasonable dimensional and lot coverage requirements
  - Consider more flexible height restrictions and setback requirements for ground-mounted PV systems
  - Also balance potential aesthetic concerns
- Consider zoning restrictions for large-scale solar facilities in rural areas
  - Potential beneficial use on marginal lands
  - Concern about loss of productive farmland
  - Aesthetics and security issues



Source: City of Nashua

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### Other Zoning Issues



Source: City of Portsmouth

- Historic districts
  - Revise zoning restrictions to allow roof-top solar if not impairing historic character
  - See Clean Air Cool Planet document as a model
- Subdivision and site plan regulations
  - Encourage use of solar resources through street and lot layouts, building orientation, and plantings
  - Allow for solar access rights and solar sky space easements
- Homeowner and condo associations
  - In addition to municipal zoning and planning regulations
  - Association bylaws can be changed to accommodate solar

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### Zoning and Planning Resources

1. *Solar Friendly Best Planning Practices for NH Communities*, by Southern NH Planning Commission, 2015.  
[www.snhpc.org/pdf/FinalSolarResourceGuide2015.pdf](http://www.snhpc.org/pdf/FinalSolarResourceGuide2015.pdf)
2. *NH Residential Rooftop Solar PV Permitting, Zoning and Interconnection Guide*, by NH Office of Energy & Planning, GDS Associates and Resilience Planning & Design, 2015.  
[www.nh.gov/oepl/energy/saving-energy/documents/solar-permitting-guide-no-appendices.pdf](http://www.nh.gov/oepl/energy/saving-energy/documents/solar-permitting-guide-no-appendices.pdf)
3. *Energy Efficiency, Renewable Energy and Historic Preservation: A Guide for Historic District Commissions*. Clean Air Cool Planet, 2009.  
[www.nh.gov/nhdhr/publications/documents/hdc\\_guide\\_cacp.pdf](http://www.nh.gov/nhdhr/publications/documents/hdc_guide_cacp.pdf)

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### C. FACILITATING SOLAR WITH MUNICIPAL PERMITTING

- A tale of two towns
- PV installers' example of permitting costs
- Solar permitting best practices
- Permit applications and fees
- Structural review best practices
- Permitting resources

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### Solar Permitting: A Tale of Two Towns...

- Town X
  - No information about solar on town web site
  - Requires costly electrical and building permits
  - Licensed professionals must file for permits in-person
  - Required structural review for all roof-top installations
  - Stipulates a 4-hour window for inspections
- Town Z
  - Town web site has a how-to page on solar permitting
  - One staff member serves as point of contact
  - Streamlined solar permit form, including structural review
  - Permit can be filed and paid for online, with licensed professional verification
  - Provides a specific appointment time for inspections

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### PV Permitting Costs: An Installer's Example

**Example of Project Soft Costs:**

An example of the soft costs incurred for one professional installation -- provided by a NH solar PV installer. They show how the permitting and inspection costs may play out in a New Hampshire community with value-based permitting -- they are not meant to be representative of typical permitting costs for residential solar PV systems in the State.

Sample Permit Costs for a \$20,000 residential rooftop array:

- \$200 Building Permit (\$10 per \$1,000)
- \$100 Electrical Permit (\$5 per \$1,000)
- \$500 Structural Analysis and Professional Engineer's (PE) stamp
- \$150 Installer Office Labor (compiling and submitting permit materials)
- \$300 Installer Labor Costs (licensed professional required to pick up permit in person, and return for final inspection)

**\$1,250 in associated permitting costs = 6.25% of project cost.**

Source: NH Residential Rooftop Solar PV Permitting, Zoning and Interconnection Guide, 2015

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### Status of NH Municipal Solar PV Permitting

#### Permitting and Ordinances for Solar PV in New Hampshire

Solar PV systems in these towns or cities require the following permits:

- Solar and electrical permits
- Building permit only
- Electrical permits only
- Building and electrical permits
- No permit required
- No information from municipality
- Solar PV Ordinance

Towns in white: permitting information not known

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### Solar PV Permitting: Overall Best Practices

- Transparency
  - Municipal offices and web site publish solar permitting information
  - How-to guides and checklists
  - See: “Sample Permit Checklist” (NH OEP)
- Consistency
  - Permitting language has enough detail for consistent implementation of regulations
  - Avoiding arbitrary interpretations
- Standardization
  - Applying model language, standard forms and common codes

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### Solar Permit Applications and Fees: Best Practices



- Permit applications available online
- One-stop solar permit
  - See *Sample NH Standardized Residential Solar PV Permit Application* (NH OEP web site)
  - Addresses permitting issues unique to solar
  - Avoids non-relevant paperwork
- Single point of contact for most solar projects
- Reasonable solar permit fees
  - Nominal flat fees preferable over ad valorem % fees
- Easy permit application and fee payment processes
  - Online applications and fee payment
  - Confirm work is done by licensed professionals through contractor-friendly methods

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### Solar Permitting: Rooftop Structural Review Best Practices

- Do all rooftop PV projects need a registered design professional (RDP) evaluation and stamp?
  - *NO!* Unnecessary expense
- Do some rooftop projects need a structural review?
  - *YES!* Building safety hazard
- Adopt the *NH Residential Solar PV Structural Review Worksheet*
  - Delineates when a structural review is needed or not
  - Modern code-built home may not need a structural review
  - Always need a structural review: pre-1930 homes, metal roofs, hidden roof framing

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**Permitting Resources**

1. *NH Residential Rooftop Solar PV Permitting, Zoning and Interconnection Guide*- see Zoning resources
2. *NH Sample PV Permit Checklist, Permit Application, and Rooftop Structural Review Worksheet*  
[www.nh.gov/oep/energy/saving-energy/](http://www.nh.gov/oep/energy/saving-energy/)
3. *Expedited Permit Process for PV Systems*, Solar America Board for Codes and Standards, 2012  
[www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Expermitprocess.pdf](http://www.solarabcs.org/about/publications/reports/expedited-permit/pdfs/Expermitprocess.pdf)
4. *Sharing Success: Emerging Approaches to Efficient Rooftop Solar Permitting*, IREC, 2012.  
[www.irecusa.org/publications/sharing-success/](http://www.irecusa.org/publications/sharing-success/)

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**D. CODES AND INSPECTIONS**

- Building codes in New Hampshire
- State building codes and PV language
- PV system inspections: best practices
- Codes and inspections resources

*(PV for firefighters and first responders separate training also available)*

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**Residential Building Codes in New Hampshire**

- State Building Code includes these residential PV-relevant codes:  
*(most have NH-specific amendments)*
  - 2014 National Electrical Code (NEC)
  - 2009 International Residential Code (IRC)
  - 2009 NH State Fire Code (Saf-C 60000)
- The 2009 International Energy Conservation Code is indirectly relevant
  - Code-built homes will use less energy, and need a smaller PV array
- Enforcement of the State Building Code varies widely
  - Contractors are expected to comply with codes
  - Some municipalities have no code enforcement officer
  - Code awareness and education very important



Source: Wikimedia

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### State Building Codes and PV Language

- NH State Fire Code (Saf-C 60000) incorporates NFPA 1 2009 Uniform Fire Code by reference
  - Does NOT include newer NFPA 1 2012+ language requiring PV rooftop access pathways, ridge clearances, etc.
- International Residential Code 2009 also older
  - Does NOT include newer M2302 Photovoltaic Energy Systems section found in IRC 2012+
  - IRC 2012+ has rack-mounted PV roof load structural, flashing and fire classification requirements, etc.
- NH's National Electric Code 2014 is newer
  - With Article 690: PV Power Systems, etc.
  - Licensed electricians must install solar panels and electrical components (Electricians' Board May 2016 clarification)

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### PV System Inspections: Best Practices

- Use a standard permit application form
- Have a single point of contact for permits and inspections
- Issue pre-approvals for solar-ready new homes as part of building code review
- Schedule a single comprehensive inspection
- Schedule inspections at specific times
- If possible, coordinate municipal and utility inspections
- Use standard PV inspection checklists

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### Codes and Inspections Resources

1. **Current NH State Building Code**  
[www.nh.gov/safety/boardsandcommissions/bldgcode/nhstatebldgcode.html](http://www.nh.gov/safety/boardsandcommissions/bldgcode/nhstatebldgcode.html)
2. **NH Residential Rooftop Solar PV Permitting, Zoning and Interconnection Guide**- see Zoning resources
3. **Field Inspection Guidelines for PV Systems**, IREC, 2010  
[www.irecusa.org/publications/field-inspection-guidelines-for-pv-systems-2010/](http://www.irecusa.org/publications/field-inspection-guidelines-for-pv-systems-2010/)
4. **Model Inspection Checklist for Rooftop PV**, IREC, 2013  
[www.irecusa.org/publications/model-inspection-checklist-for-rooftop-pv-systems/](http://www.irecusa.org/publications/model-inspection-checklist-for-rooftop-pv-systems/)
5. **Solar Codes & Standards**, Solar America Board for Codes and Standards  
[www.solarabcs.org/codes-standards/index.html](http://www.solarabcs.org/codes-standards/index.html)

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## E. ASSESSMENTS AND PROPERTY TAXES

- NH local property tax exemption
- PV assessment valuation process
- Tools for PV assessments and appraisals

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### Local Property Tax Exemption

**LOCAL OPTIONAL EXEMPTIONS (if adopted by city/town)**

|      |  |
|------|--|
| 7)   | <input type="checkbox"/> Solar Energy Systems Exemption (RSA 72:62)          |
| 1-6) | <input type="checkbox"/> Wind-Powered Energy Systems Exemption (RSA 72:37-6) |
|      | <input type="checkbox"/> Woodheating Energy Systems Exemption (RSA 72:37-4)  |

- **What it is:**
  - Per RSA 72:62 NH municipalities “may adopt under RSA 72:27-a an exemption from the assessed value, for property tax purposes, for persons owning real property which is equipped with a solar energy system”
- **Implementation:**
  - 103 NH municipalities have partial or full exemptions (Some municipal assessors consider solar PV “personal property” – neither assessable nor taxable)
- **Application process:** through municipal assessor
  - Property owners use NH Dept. of Revenue Administration Form PA-29
- **Timing:** application by April 15 in year preceding tax year
- **Go to:** [www.nh.gov/oeep/energy/saving-energy/documents/dra-solar-exemption-report.pdf](http://www.nh.gov/oeep/energy/saving-energy/documents/dra-solar-exemption-report.pdf)

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### Property Tax Exemptions Map

- Must be enacted by the municipality
  - Assumes PV systems are locally taxable as real property
- If a portion of assessed value is exempted – methodology varies widely
  - Dollar value exemption cap, such as \$10,000
  - Predetermined tax deduction regardless of value
  - % of assessed value of the PV system

**Municipalities with Solar Property Tax Exemptions in New Hampshire**  
November 2015  
Source: NH Dept. of Revenue Administration

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### PV Assessment Valuation Process

- No specific assessor valuation method is mandated
  - Wide variations in PV valuation methodologies per NH OEP survey
  - Or not even assessed as real property
    - NH DRA Manual: “If the value of the [solar] improvement is not added, there is nothing to subtract out.”
  - Taxation issues with third-party-owned solar PV systems...
- Municipal assessors and appraisers use commonly accepted solar property valuation methods
  - Comparable sales approach
    - Few comparable sales with PV
  - Discounted cost approach
    - May exclude rebates and credits from initial cost
    - How to depreciate?
  - Income approach
    - Can use solar revenue stream such as “PV Value” methodology

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### Tools for PV Assessments and Appraisals

- “PV Value”
  - Free web tool
  - Uses income approach to provide a current value for PV systems
- 2016 *Appraisal Journal* article:
  - Examined 43 qualifying homes with PV in 6 states
  - Used all three valuation approaches: paired sales, replacement cost and net income
  - Found increases in home value from a PV system ~\$2.50 - \$3.75 per watt
  - Income approach was the most conservative valuation

**Subject Property Data**

|                      |             |                         |
|----------------------|-------------|-------------------------|
| Solar Resource       |             | O & I                   |
| System Size:         | 16000 watts | Inverter Size:          |
| Module Warranty Yrs: | 25          | Inverter Warranty:      |
| System Age Yrs:      | 5           | Inverter Age Yrs:       |
| Remaining Yrs:       | 20          | Inverter Replacement:   |
| Derate Factor:       | 0.84        | Replacement Cycle:      |
| Depreciation Rate:   | 0.5         | Replacement Cost:       |
| Array Tilt:          | 30.3        | User Replacement:       |
| Array Azimuth:       | 160         | O & I Expense (\$):     |
| kWh Produced/Year:   | 20,302      | O & I Expense (\$/kWh): |

**Estimated Value of Energy**

Low Estimated Value: \$25,685.93  
Avg Estimated Value: \$27,622.13  
High Estimated Value: \$29,578.24

Source: PV Value

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### Assessments and Property Taxes Resources

1. NH OEP, Renewable Energy Incentives- including renewable energy property tax exemption listings  
[www.nh.gov/oep/energy/saving-energy/incentives.htm](http://www.nh.gov/oep/energy/saving-energy/incentives.htm)
2. *Property Taxes and Solar PV Systems: Policies, Practices, and Issues*. North Carolina Solar Center, 2013  
[nccleanetech.ncsu.edu/wp-content/uploads/Property-Taxes-and-Solar-PV-Systems-2013.pdf](http://nccleanetech.ncsu.edu/wp-content/uploads/Property-Taxes-and-Solar-PV-Systems-2013.pdf)
3. Understanding NH Property Taxes: The Official NH Assessing Reference Manual, 2014  
[revenue.nh.gov/mun-prop/property/documents/asb-manual.pdf](http://revenue.nh.gov/mun-prop/property/documents/asb-manual.pdf)
4. PV Value- free PV system valuation tool  
[www.pvvalue.com/](http://www.pvvalue.com/)
5. “An Analysis of Solar Home Paired Sales across Six States,” *Appraisal Journal*, Winter 2016  
[emp.lbl.gov/sites/all/files/lbnl-1005058.pdf](http://emp.lbl.gov/sites/all/files/lbnl-1005058.pdf)

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## F. SOLAR PV INSTALLATIONS ON MUNICIPAL PROPERTY

- Town meeting 2016
- NH municipal PV projects
- Financing municipal-owned PV
- Municipal PV through PPAs
- Costs and incentives for municipal PV
- The electricity rates wild card
- Municipal PV resources

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### Town Meeting 2016: For and Against Solar

- Solar projects and 2016 town meeting results
  - Lancaster: home run with 113 yeas, 8 nays
  - Warner: failed by 3 votes
- Town meeting *proponents* for municipal solar PV
  - Financial benefits- reduced electricity cost
  - Long-term financial security of power supply
  - Environmental benefits -- green power
  - Local economic benefits
- Town meeting *opponents* to solar projects
  - Financial concerns about legitimacy of savings
  - Worries about long 20+ year contract terms
  - Loss of productive land and aesthetic concerns

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### A Sampling of NH Municipal PV Projects

| Location     | Size (kW DC) | Financing | Site            | Vendor           | Status     |
|--------------|--------------|-----------|-----------------|------------------|------------|
| Bristol      | 15           | Owned     | Public Library  | Frase Electric   | Operating  |
| Concord      | 1,000        | PPA       | Wastewater T.P. | SolarCity        | Approved   |
| Durham       | 99           | PPA       | Ice Rink        | ReVision Energy  | Operating  |
| Lancaster    | 118          | Owned     | 3 locations     | TBD              | Approved   |
| Milton       | 994          | PPA       | Old landfill    | NH Solar Garden  | Constructn |
| North Conway | 167          | Owned     | Wastewater T.P. | Waterline Indus. | Operating  |
| Peterborough | 947          | PPA       | Wastewater T.P. | Borrego Solar    | Operating  |
| Rochester    | 87           | PPA       | School          | ReVision Energy  | Operating  |

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**Bristol Library:  
Small Owned System**



- Minot-Sleeper Public Library in Bristol
  - Rooftop 15 kW system in service July 2013
  - \$36k net cost funded by library capital fund
  - \$2.35/watt net
  - 8.7% ROI with RECs revenue and electricity net metering
- See [www.nhenergy.org](http://www.nhenergy.org) for this and other municipal solar case studies

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**Peterborough Large  
Municipal PV Case Study**



- Town of Peterborough array
  - Large 947 kW system
  - Power purchase agreement
    - 8 ¢/kilowatt-hour
    - 20 year term with 1% annual escalator
  - \$1.2 million NH PUC REF grant in 2013
  - Developer: Borrego Solar Systems, Inc.
  - Brownfield redevelopment- old wastewater lagoon
- *Peterborough solar tour- Wed., May 18, 5:00 pm*  
 – *And Durham 640 kW solar tour- Tue., May 24, 5:00 pm*  
 – *Before Residential Solar 101s -- [www.lrcc.edu/solar101](http://www.lrcc.edu/solar101)*

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**Financing Municipal-Owned PV**

- NH PUC Renewable Energy Rebate (as of May 2016)
  - Up to 100kW: 70¢/watt AC (65¢/watt AC after 9/1/16)
  - 100 – 500 kW: 55¢/watt AC
  - May be waitlisted, lottery or temporarily closed
- Potential municipal funding sources
  - Capital funds
  - Bonding and borrowing
  - USDA Rural Development loans and grants
  - Community Development Finance Authority (CDFA)
- Other possibilities
  - Commercial Property Assessed Clean Energy (CPACE)
  - New England Grassroots Environment Fund (NEGEF)
  - Check with regional planning commission for other opps.

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### Municipal PV through Power Purchase Agreements (PPAs)

- *What it is:* Municipality purchases PV electricity produced by a third-party-owned system
  - Long-term PPA contract: 7 – 25 years
  - Municipality pays only for the electricity produced by PV system
  - Possible buyout options
- *Power purchase agreement advantages:*
  - No up-front costs
  - Cost of PV-produced electricity typically less than utility/supplier electricity
  - PV owner typically pays property taxes or payments in lieu of taxes
  - Installer responsible for performance and maintenance
- *Watch out for:*
  - PPA terms and escalation clauses, unrealistic electricity rate projections, varying monthly payments, long PPA term, no govt. incentives, reroofing costs

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### PPAs Can Be Complex

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    graph TD
      Developer[Developer] -- "51-100%" --> Owner[Owner/Lessor]
      Owner -- "0-49%" --> PC[Project Company (Lessee)]
      Host[Host Agency] -- "Assign PPA and LUA" --> PC
      Investors[Investors] -- "Pass through of the Tax credit" --> PC
      PC --> Owner
    
```

Source: Federal Energy Management Program

- Not just solar developer and host (municipality)
  - Also: special purpose entities, investors, lawyers, etc.
- Example: PPA with an inverted lease
  - Separates tax credits from accelerated depreciation benefits

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### Community Solar Options

Source: Vital Communities

- Solarize community projects
  - Encouraging widespread PV installations throughout a municipality or small region
  - Usually a pre-selected solar installer
  - More solar installations = lower costs for all
  - Municipality can help publicize and participate
- Community group net metering
  - Multiple electricity users share in solar project electricity
  - May be a private developer: NH Solar Garden projects in Milton, Franklin, etc.
  - Or a locally-owned project: Monadnock Food Co-op in Keene
    - See MSN's "NH Community Supported Solar Guide"

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**REVIEW**

- The solar revolution
- Residential and municipal PV roles
- Planning and zoning for solar
- Solar permitting best practices
- PV codes and inspections
- Assessments and property taxes
- Municipal PV installations

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**THANK YOU!**

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For more information about the  
NH Solar 101 series:  
[www.lrcc.edu/solar101](http://www.lrcc.edu/solar101)

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