2024-2025

PART C

RENEWABLE ENERGY COSTS

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Section C – Renewable Energy Facilities

The purpose of this section is to provide information and guidance regarding the valuation of utility-scale and distributed generation renewable energy facilities and is meant as an assistance in identifying and understanding different components of renewable energy facilities, not as the only source of information.

Common Elements

Land

The BLM estimates that photovoltaic facilities require about 10 acres per MW. By comparison, the amount of land necessary for a wind project is location sensitive and depends on the distance needed between wind turbines to avoid interference of one wind turbine on the wind experienced by a downwind turbine ("array effect"), as well as the terrain characteristics. In general, a project's facilities occupy only about 5 percent of the total project area as referenced in https://www.nrel.gov/docs/fy09osti/45834.pdf

Land value for property included in a BLM Right-of-Way program for renewable energy may be determined by capitalizing the rental payments made to BLM at an appropriate capitalization rate as authorized by NAC 336.1198 as an alternate approach to value. The BLM Linear Rent Schedule may be used to calculate the rent. The rent depends on the "zone" where the operation is located. The Linear Rate Schedule is adjusted annually based on inflation (the Implicit Price Deflator Index). The BLM has developed separate calculations for contract rent for wind and solar rights-of-way. Their Linear Rate Schedule, right-of-way lease valuation and Mw fee forms can be found at: BLM Renewable Energy Lease Forms (2016-2021)

Improvements

In order to use the appropriate valuation methodology for locally assessed property, it is first necessary to determine whether an item of property is real property or personal property provided in NRS 361.030 and 361.035. The fixture test, as outlined in Appendix E of the Personal Property Manual, can provide further guidance on this determination. The taxable value of real property must be based on the full cash value of the land plus the replacement cost new less depreciation of the improvements required by NRS 361.227. The statutory rate of depreciation for improvements is 1-1/2% per year with a 25% residual at the end of 50 years, plus all applicable obsolescence (NRS 361.227(1)(b). NAC 361.128(4) allows for the permission of alternative recognized cost manuals cost determinations or subscription services if appropriate costs cannot be found within the Marshall and Swift Valuation Services.

Personal Property

The Personal Property Manual published by the Department and approved by the Nevada Tax Commission provides service lives for various kinds of property as well as tables showing cost-index factors and depreciation by year for each year of the service life. Depreciation for personal property is calculated by first trending up acquisition cost with cost index factors, then applying a double-declining rate of depreciation, with a five percent residual. The depreciation for personal property associated with electric generation facilities is based on a service life of 30 years pursuant to the Personal Property Manual, Special Properties Section, Valuation Guidelines, 22-Utilities, Section 2211, Electric generation, transmission, and distribution systems.

Access Roads

There are generally five road types that may be part a renewable energy project. They are:
- existing paved roads
- existing gravel roads
- existing roads that need to be improved
- temporary roads
- permanent roads

Construction of the access road would require removing vegetative cover, if needed and may have all-weather capability but would not be paved.

Transmission Lines and Substations

Common to each type of renewable energy generation facility is the transmission system. Transmission lines may range in length from less than 1 mile to 50 miles or more with a corridor width of approximately 40 feet. Wooden poles most likely support them, and about 5 acres could be disturbed per mile of transmission line. The Solar EIS provides more information and can be obtained at: http://solareis.anl.gov/documents/docs/APT_61117_EVS_TM_08_4.pdf and https://solareis.anl.gov/guide/transmission/index.cfm

Construction:

Transmission Towers: Transmission towers are the most visible component of the bulk power transmission system. Their function is to keep the high-voltage conductors separated from their surroundings and from each other. Higher voltage lines require greater separation. The unintended transfer of power between a conductor and its surroundings, known as a fault to ground, will occur if an energized line comes into direct contact with the surroundings or comes close enough that an arc can jump the remaining separation. A fault can also occur between conductors. Such a fault is known as a phase-to-phase fault.

The first design consideration for transmission towers is to separate the conductors from each other, from the tower, and from other structures in the environmental to prevent faults. This requirement and the electrical potential (voltage) define the basic physical dimensions of a tower, including its height, conductor spacing, and length of insulator required to mount the conductor. Given these basic dimensions, the next design requirement is to provide the structure strength necessary to maintain these distances under loading from the weight of the conductors, wind loads, ice loading, seismic loads, and possible impacts. Of course, the structure must meet these requirements in the most economical possible manner. This has led to the extensive use of variants on a space frame or truss design, which can provide high strength with minimal material requirements. The result is the ubiquitous lattice work towers seen in all regions of the country. The last design requirement is to provide a foundation adequate to support the needed tower under the design loads.

A typical transmission tower height for the horizontal configuration is 100 feet. The tower is designed to bear the vertical load of the conductor weight and horizontal loads from wind against the towers and the conductors. In long straight runs, the horizontal load from the conductor tension is balanced by lines going in opposite directions. However, where a change of direction is required, the conductor tension is unbalanced and a stouter tower, called a deviation tower, is required. This tower is likely to have a broader footprint than the other towers. The footprint for towers along straight segments is smaller because the balanced conductor load reduces the bending moment that must be supported at the foundations.

Conductors: A variety of conductor compositions and constructions are currently in use to meet a variety of specific requirements. In the early years of the industry, copper was used almost exclusively because of its high electrical conductivity, but cable diameters with copper were determined more by the need for mechanical strength than by the need for improved conductivity. The low strength-to-weight ratio of copper limited the acceptable span length (distance between towers). Aluminum, with its higher strength-to-weight ratio, was introduced as an alternative to copper, allowing for greater span lengths. Very recently, a new type of composite using ceramic fibers in a matrix of aluminum has been introduced that has lighter weight and higher strength.

Substations: A typical substation will occupy sites from one to ten acres. Typically, the very high voltages used for electric transmission are converted to lower voltages for consumer use at substations. In the case of certain renewable energy generation facilities, the voltage produced by the generation plant also needs to be "stepped up" and converted to a higher voltage. In either case, the function of the substation is to convert voltages for further transmission. Substations vary in size and configuration but may cover several acres; they are cleared of vegetation and typically surfaced with gravel. They are normally fenced and are reached by a permanent access road. In general, substations include a variety of structures, conductors, fencing, lighting, and other features that result in an "industrial" appearance.

The voltage required for economical transmission of electric power exceeds the voltage appropriate for distribution to customers. First, customer equipment generally operates at only a few hundred volts, rather than at the hundreds of thousands of volts used for transmission. Second, if high voltages were maintained up to the point of customer connection, fault protection would be extremely expensive. Therefore, distribution from the transmission line to customers is accomplished at much lower voltages, so transformers are required to reduce voltage before the power is introduced to a distribution or sub transmission system. These transformers mark the end of the transmission line and are located at substations. Similarly, voltages produced by renewable energy generation facilities are too low for economical transmission and the substations contain transformers which mark the beginning of the transmission line.

The components of a substation include:

- standoff insulators - keep the high voltage conductor mounted in the proper configuration according to the engineering design of the substation
- lightning arresters - protect electrical equipment from damaging surges from lightning
- bushings - allow electricity to enter an electrical device safely, preventing it from going to ground or shorting to another phase
- load tap changer (LTC) - changes the voltage output of the transformer in order to maintain the proper operating voltage to the system being fed
- coupling capacitors - double as a potential transformer and a power-line carrier coupling device.
- transformers measure and provide a method for obtaining the current or amp value from a high voltage line, bus or circuit breaker
- circuit breakers - are designed to trip during a fault condition, which protects transformers or other sensitive equipment in the circuit.

Obsolescence

"Obsolescence" is defined by NAC 361.116 as an impairment to property resulting in the full cash value of the property being less than its taxable value as otherwise computed. "Functional depreciation" is defined by NAC 361.302 as the loss of service usefulness or obsolescence due to technological advances or social requirements. The "cost of replacement" is defined by NAC 361.1117 as the total cost of construction required to replace an improvement with a substitute of like or equal utility using current standards of materials and design, including the cost of any pertinent labor, materials, supervision, contractor's' profit and overhead, architects' plans and specifications, sales taxes and insurance.

Obsolescence may need to be considered in cases where companies have received grants or federal aid for construction which may indicate a loss in value, but these items should not reduce the cost of replacement.

A review of renewable energy literature produced sufficient information to suggest that certain fixtures used to capture or harvest energy from renewable resources suffer from functional and economic obsolescence. Fixtures which may suffer additional functional obsolescence include:

- Heat Collection Elements
- Heliostat Fields
- HTF System
- HTF Ullage System
- HTF Freeze Protection System
- HTF Leak Detection
- Inverters
- Parabolic Trough Collector Loop
- Protective Relay Circuits
- PV Solar Modules and Tracker Systems
- Solar Collector Assemblies
    - Parabolic Reflectors
    - Heat Collection Elements
    - Low-Iron Glass Mirrors
- Telecommunications, fiberoptic lines
- Wind Turbine Generator
    - Rotor Blades
    - Generator
    - Power Regulation
    - Nacelle, Gearbox, Controls, Couplings, Brake, Lightning Protection

Project Types & Information

Solar Energy

Parabolic Trough System (CSP) – This system comprises solar thermal technologies that create electrical power by using the sun's energy to capture and manipulate heat to produce steam to drive a conventional steam turbine/electric generator set (STG) or to power an external heat engine that produces mechanical energy to drive a generator. Reflecting or concentrating mirrors can be used to concentrate the solar energy to improve the efficiency of the thermal technologies. This is commonly referred to as concentrating solar power, or CSP.

Photovoltaic System (PV) – This system is based on the use of semiconductors or materials that can generate small amounts of electric current when exposed to sunlight. The materials are present as a thin film in a solar cell; many individual solar cells are connected into chains as a module; and modules are combined to make solar panels. In a utility-scale operation, the solar panels are grouped into arrays producing direct current (DC) electricity. The arrays produce power in the "solar field". The power conditioning system, consisting of inverters, converts the DC power to AC so that the energy thus produced can be transmitted onto the power grid.

The U.S. Department of the Interior, Bureau of Land Management, has produced a [Programmatic Environmental Impact Statement for Solar Energy Development in

Six Southwestern States (PEIS), of which Nevada is one. The PEIS has an excellent description of the types of utility-scale solar systems (see Chapter 3).

Site Preparation: Site preparation and construction will vary depending on the technology and the location of the facility. In general, site preparation consists of establishing site access, site clearing, and grading. Major heavy equipment that may be used in the site preparation phase would include bulldozers, graders, excavators, scrapers, front-end loaders, trucks, cranes, rock drills, chain saws, chippers, trenching machines, and equipment for blasting operations if required.

Construction: The foundations required for permanent structures at solar facilities (e.g., control and administrative buildings and storage tanks) would require only slab-on-grade foundations except for towers at power tower facilities and the steam turbines at CSP facilities. Wind loading and the structure weight of towers, and the weight and vibration of steam turbines, would typically require more robust foundations that would require excavations to varying depths, depending on existing subsurface conditions. Foundations for towers and turbines would also likely utilize high-strength, steel reinforced concrete and extend to depths as great as 35 feet. The diameter of the excavations would be approximately the same as that for the tower base.

Most components of the solar field (parabolic troughs or PV panels) would require only minimal foundations, with many simply having preformed concrete feet resting on the ground surface. Dish engines would typically rest on pile-driven foundations. Electrical transformers would require concrete pads.

Additional construction activities might include the construction of the control/electrical building, power block-related structures (including cooling towers, water treatment facilities, and evaporation ponds), placement of tanks, installation of electric substations, and trenching for power and signal cables. Conventional construction methods may be sufficient for these activities.

Construction of the control building and additional storage or maintenance/repair buildings may involve either conventional construction techniques or the placement of a prefabricated building on a slab-on-grade concrete foundation.

Power-conducting cables and signal cables would interconnect the power block or solar field (for dish engine and PV facilities) with the control building and the electrical substation. Where the soil mantle permits, the preferred method would involve burial of these cables to a nominal depth of 4 ft. Standard trenching techniques should be sufficient.

Wind Energy

A wind generation system is comprised of several components including land, wind turbines and access roads to the site and each turbine. All three must be present to have a working system.

Wind turbine components include the rotor blades, generator (asynchronous/induction or synchronous), power regulation, aerodynamic (yaw) mechanisms and the tower. At the top of the tower of a horizontal axis turbine are the nacelle containing the rotor, gearbox, generator, bedplate, enclosure, and various sensors, controls, couplings, a brake, and lightning protection. At the foot of the tower are the transformers, switchgear, protective relays, necessary instrumentation, and controls. A distribution line connects the wind turbine to the utility grid. In addition, a wind generation system will include steel monotube meteorological towers, generally 100 feet and higher, and anemometry equipment.

Turbines will typically be placed in rows perpendicular to the prevailing wind direction.

Wind turbine sizes may be categorized into three general classifications:

1.) Utility-Scale – Corresponds to large turbines (900 kW to 2 MW or more per turbine) intended to generate bulk energy for sale in power markets. They are typically installed in large arrays or 'wind energy projects,' but can also be installed in small quantities on distribution lines, otherwise known as distributed generation. Utility-scale development is the most common form of wind energy development in the U.S.
2.) Industrial-Scale – Corresponds to medium sized turbines (50 kW to 250 kW) intended for remote grid production, often in conjunction with diesel generation or load- side generation (on the customer's side of the meter) to reduce consumption of higher cost grid power and possibly to even reduce peak loads.
3.) Residential-Scale – Corresponds to micro- and small- scale turbines (400 watts to 50 kW) intended for remote power, battery charging, or net metering type generation. The small turbines can be used in conjunction with solar photovoltaics, batteries, and inverters to provide constant power at remote locations where installation of a distribution line is not possible or is more expensive.

Site Preparation: Similar to the process used for solar projects, vegetation is removed from permanent facility sites using standard earth-moving equipment for the O&M building, substation, and switchyard.

Construction: Turbine towers and foundations are typically designed to survive a gust of wind more than 133.1 miles per hour (mph) with the blades pitched in their safest position. Turbine foundations are approximately 8 feet deep, with a projection of approximately 6 inches above final grade and use approximately 350 cubic yards of concrete. Each tubular steel tower may have a maximum 15-foot-diameter (4.5-m-diameter) base. Turbine crane pads would be constructed for each wind turbine.

Within the temporary construction area, permanent foundations are excavated, compacted, and constructed of structural steel and reinforced concrete designed to meet turbine supplier and geotechnical engineer's recommendations. The WTGs' freestanding tubular towers are connected by anchor bolts to the concrete foundation at the pedestal. The towers may have a maximum 15-foot-diameter base. The area immediately surrounding the concrete pedestal is covered with a gravel ring, followed by roads to provide a stable surface for future maintenance vehicles accessing the turbine and as required by electrical codes.

Biomass and Landfill Gas

The production of renewable energy from landfill gas (LFG) first involves collection of LFG, and then either flaring or treating the gas to remove excess moisture, particulates, and other impurities. After processing and treatment of the LFG, it is then used to power an internal combustion engine, a gas turbine, or a micro-turbine which produces electricity. Typical LFG collection systems have three central components: collection wells or trenches, a condensate collection and treatment systems, and a blower. Most landfills with energy recovery systems include a flare for the combustion of excess gas and for use during equipment downtimes.

LFG is typically composed of 55% methane and 45% carbon dioxide; it is wet in nature and therefore quite corrosive. Most landfills in North America have been required to install a gas gathering system to collect the LFG rather than allowing it to vent to the atmosphere. The most common method of collection involves drilling vertical wells in the waste and connecting those wellheads to lateral piping that transports the gas to a collection header using a blower or vacuum induction system. Another type of collection system uses horizontal piping laid in trenches in the waste. These systems are useful in deeper landfills and in areas of active filling. Some collection systems involve a combination of vertical wells and horizontal collectors. Ideally, it should be designed so that the operator can monitor and adjust the gas flow if necessary.

After collection, it can either be flared or used in an energy recovery system to remove excess moisture, particulates, and other impurities. Boilers and most internal combustion engines generally require minimal treatment (e.g., dehumidification, particulate filtration, and compression). Some internal combustion engines and may gas turbine and microturbine applications also require siloxane removal using adsorption beds after the dehumidification step. The type and extent of treatment depends on site-specific LFG characteristics and the type of energy recovery system employed.

Compressor systems collect the LGF from the manifold and compress it to be used to power natural gas burning engine-drive generator packages, such as:

<u>Internal Combustion Engines:</u> The internal combustion engine is the most used conversion technology in LFG applications; more than 70 percent of all existing LFG electricity projects use them. The reason for such widespread use is their relatively low cost, high efficiency, and good size match with the gas output of many landfills. Internal combustion engines have generally been used at sites where gas quantity can produce 800 kilowatts (kW) to 3 megawatts (MW), or where sustainable LFG flow rates to the engines are approximately 0.4 to 1.6 million cubic feet per day (cfd) at 50 percent methane. Multiple engines can be combined for projects larger than 3 MW.

<u>Gas Turbines:</u> Gas turbines are typically used in larger LFG energy projects, where LFG volumes are sufficient to generate a minimum of 3 MW, and typically more than 5 MW (i.e., where gas flows exceed a minimum of 2 million cfd). This technology is competitive in larger LFG electric generation projects because, unlike most internal combustion engine systems, gas turbine systems have significant economies of scale. The cost per kW of generating capacity drops as gas turbine size increases, and the electric generation efficiency generally improves as well.

<u>Microturbines:</u> Microturbines have been sold commercially in landfill and other biogas applications since early 2001. In general, microturbine project costs have been more expensive on a dollar- per- kW installed capacity basis than internal combustion engine projects. Some of the reasons projects have selected microturbine technology instead of internal combustion engines include:

- LFG availability at less than the 300-cfm required for typical internal combustion engines (although recently, small internal combustion engines have become available in this size range).
- Lower percent methane as microturbines can function with as little as 35 percent methane.
- Low nitrogen oxides emissions desired.
- Ability to add and remove microturbines as available gas quantity changes.

More information can be found at: https://www.epa.gov/sites/production/files/2016-09/documents/pdh_chapter3.pdf, pages 3-7

Geothermal Facilities

Geothermal facilities fall under the jurisdiction of the Department of Taxation as mining property per NRS 362.100(1)(b).

Definitions

"Acquisition cost" or "original cost" is defined by NAC 361.1351 as the actual cost of property to its present owner, including, without limitation, the costs of transportation and installation.

"Anemometry Equipment" is defined as the set of meteorological measuring and logging devices used to collect wind data for a wind resource assessment study. Equipment set typically includes tower, anemometer, wind vane, temperature sensors, heating device, and data logger. See also meteorological tower.

"Capacitor Banks" are used in fixed-speed or limited variable speed wind turbines. It is an electrical component that supplies reactive power to the induction generator. These generators require current from the electrical grid to create a magnetic field inside the generator in order to work. As a result of this, the alternating current in the electrical grid near the turbine will be affected (phase-shifted). This may at certain times decrease (though in some cases increase) the efficiency of electricity transmission in the nearby grid, due to reactive power consumption.

In most places around the world, the power companies require that wind turbines be equipped with switchable electric capacitor banks which partly compensate for this phenomenon, thus the reactive power absorbed by the generator from the grid is minimized.

The capacitor banks are usually mounted at the bottom of the tower or to the nacelle. They may be heavy loaded and damaged in the case of excessive voltages on the grid and thereby may increase the maintenance cost of the system.

"Cost of replacement" is defined by NAC 361.1117 as the total cost of construction required to replace an improvement with a substitute of like or equal utility using current standards of materials and design, including the cost of any pertinent labor, materials, supervision, contractors' profit and overhead, architects' plans and specifications, sales taxes, and insurance. NAC 361.128 indicated the cost of replacement of an improvement must include all costs for labor, materials, supervision, contractor's profit and overhead, architect's plans and specifications, sales taxes, and insurance. In general, the costs published by the Marshall and Swift Publication company are to be used to establish replacement cost, however, if the Marshall and Swift publication does not apply to improvements of a particular occupancy or construction type, the Assessor may apply for permission to use alternative recognized cost manuals, cost determinations or subscription services.

“Distributed generation” refers to the installation of small-scale solar or wind energy facilities at individual locations at or near the point of consumption (e.g., use of solar photovoltaic (PV) panels on a business or home to generate electricity for on-site consumption). Distributed generation systems typically generate less than 10,000 kW. Other terms for distributed generation include on-site generation, dispersed generation, distributed energy, and others.

“Fixture” is defined as an item that was originally personal property which has been installed or attached to land or an improvement in a permanent manner and shall be treated as real property for property tax purposes. A three-part test is included in NAC 361.1127 to assist the appraiser in determining whether the item should be treated as real or personal property.

“Flare” is defined as a device igniting and burning excess landfill gas (LFG). Flares are a component of each energy recovery option because they may be needed to control LFG emissions during energy recovery system startup and downtime and to control gas that exceeds the capacity of the energy conversion equipment. In addition, a flare is a cost-effective way to gradually increase the size of the energy recovery system at an active landfill. As more waste is placed in the landfill and the gas collection system is expanded, the flare is used to control excess gas between energy conversion system upgrades (e.g., before addition of another engine).

Flare designs include open (or candlestick) flares and enclosed flares. Enclosed flares are more expensive but may be preferable (or required by state regulations) because they provide greater control of combustion conditions, allow for stack testing, and might achieve slightly higher combustion efficiencies than open flares. They can also reduce noise and light nuisances

“Geothermal resources” are defined as the natural heat of the earth and the energy associated with that natural heat. It is considered a mineral for purposes of the net proceeds of minerals tax. The Department is required to value mines for property tax purposes using the valuation methodology for locally assessed properties. Although the ultimate product of a geothermal generating facility is electricity, the fuel used to produce the electricity is the product of a mine; therefore. the Department determines the taxable value of geothermal plant, fixtures, and personal property, but transmits that taxable value to the Assessor for inclusion in the assessment roll, billing, and collection of property taxes.

“Grid-Tie Inverter” is a special type of inverter that converts direct current electricity into alternating current electricity and feeds it into an existing electrical grid. GTIs are often used to convert direct current produced by many renewable energy sources, such as solar panels or small wind turbines, into the alternating current used to power homes and businesses. The technical name for a grid-tie inverter is "grid-interactive inverter". They may also be called synchronous inverters. Grid-interactive inverters typically cannot be used in standalone applications where utility power is not available.53 Inverters take DC power and invert it to AC power so it can be fed into the electric utility company grid. The grid tie inverter must synchronize its frequency with that of the grid (e.g. 50 or 60 Hz) using a local oscillator and limit the voltage to no higher than the grid voltage. A high-quality modern GTI has a fixed unity power factor, which means its output voltage and current are perfectly lined up, and its phase angle is within 1 degree of the AC power grid. The inverter has an on-board computer which will sense the current AC grid waveform and output a voltage to correspond with the grid.

"Improvement" is defined by NAC 361.1133 as any building, fixture or other structure erected upon or affixed to the land, including, without limitation, any of those improvements listed in paragraphs (a) and (b) of subsection 1 of NRS 361.035. The term does not include any land enhancements, which are physical modifications of the land or rights which allow the land to be used.

"LFG Treatment System" is defined as a system to remove condensate, particulates and other impurities. After the landfill gas (LFG) has been collected and before it can be used in a conversion process, it must be treated to remove condensate not captured in the condensate removal systems, particulates, and other impurities. The cost of gas treatment depends on the gas purity requirements of the end use application. The cost of a system to filter the gas and remove condensate for direct use of medium-Btu gas or for electric power production is considerably less than the cost of a system that must also remove contaminates such as siloxane and sulfur that are present at elevated levels in some LFG.

"Meteorological Tower" is defined as a tower used at a potential wind project site has equipment attached to it which is designed to assess wind resource. Generally, a met tower will have anemometers, wind direction vanes, temperature and pressure sensors, and other measurement devices attached to it at various levels above the ground.

"Obsolescence" is defined in NAC 361.116 as the impairment to property resulting in the full cash value of the property being less than its taxable value as otherwise defined. "Obsolescence" is also defined at NAC 361.344 for application to centrally assessed properties as "the lessening of value due to causes other than physical causes and may be functional where circumstances internal to the property item render it less desirable or economic where circumstances external to the item and beyond the control of the owner render the property item less desirable." "Functional depreciation" is defined as "the loss of service usefulness or obsolescence due to technological advances or social requirements."

“Possessory Interest” for this document is defined as BLM granting the use of public domain land for wind, solar and other renewable energy projects through the BLM Right-of-Way Program. It is the right to occupy and use property by virtue of the rights granted under a lease agreement or other type of contract. Most commonly, the term possessory interest refers to a lessee or user's interest in government-owned or exempt property. It is a private right to the possession of such property for a specific term. Possessory interests are not considered to be real property. This is so because NRS 361.035 (4) states "real estate or real property does not include leasehold or other possessory interests in land owned by the Federal Government on which land the Federal Government is paying taxes to the State of Nevada or is, pursuant to contractual obligation, paying any sum in lieu of taxes to the State of Nevada." As a result, Assessors list possessory interests on the unsecured assessment roll rather than the secured roll.

“Real property” is defined as all houses, buildings, fences, ditches, *structures*, erections, railroads, toll roads and bridges, or other improvements built or erected upon any land.

“Renewable energy” is defined as biomass, fuel cells, solar energy, geothermal energy, waterpower, or wind, but does not include coal, natural gas, oil, propane or any other fossil fuel, or nuclear energy per NRS 701A.340.

“Transformers” are defined as a system to “transform” voltage from one level to another, usually from a higher voltage to a lower voltage. They do this by applying the principle of magnetic induction between coils to convert voltage and/or current levels. In this way, electrical transformers are a passive device which transforms alternating current (otherwise known as “AC”) electric energy from one circuit into another through electromagnetic induction. An electrical transformer normally consists of a ferromagnetic core and two or more coils called “windings”.

“Utility-scale” refers to a centralized power generating unit generally having an output of 10 megawatts (MW) or greater of electricity.

“Utility-scale renewable energy facilities” consist of energy collection, generation, and transmission components. Because transmission lines have the potential for crossing county or state boundaries, it is possible that the facility could be considered property of an interstate or inter-county nature and would be subject to valuation by the Department of Taxation per NRS 361.320.

PART C

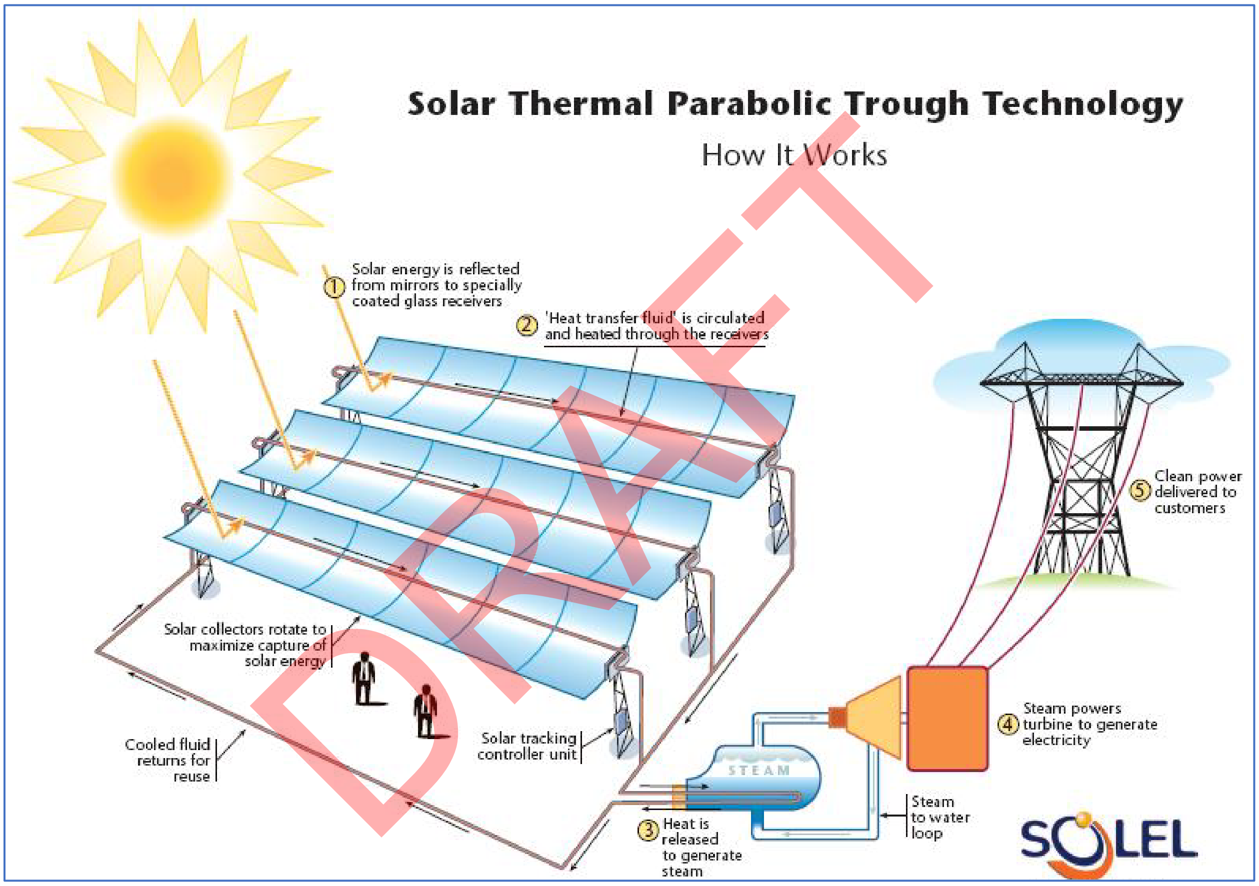
2024-2025 RENEWABLE ENERGY COSTS

Section 1

CONCENTRATING SOLAR POWER (CSP COMPONENTS)

**CONCENTRATING SOLAR POWER (CSP) –
PARABOLIC TROUGH**

Concentrating Solar Power (CSP) is solar thermal technology that creates electrical power by using the sun's energy to capture and manipulate heat to produce steam to drive a conventional steam turbine/electric generator set (STG) or to power an external heat engine that produces mechanical energy to drive a generator. "Typically, some means of concentrating the incident solar energy is used to improve the efficiencies of thermal technologies, such as reflecting or concentrating mirrors. If costs are not readily identifiable or if sources of cost information are not adequate to properly cost the property, please refer to Part C, Section 4 of this manual.



Concentrated Solar Parabolic Trough System

Asset Group	Item	Description	Valuation Method	Cost Source	Comment
Land	Fee simple ownership	The amount of land necessary to support the generation and transmission facilities.	Market		
Land	Possessory interests (right-of-way leases)		Ground rent Capitalization		
Site Preparation, Land Enhancements	Construction Survey				
Site Preparation, Land Enhancements	Grading			M & S, Sec. 51	Earthwork
Site Preparation, Land Enhancements	Drainage features			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Erosion protection features			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Diversion channels			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Detention ponds			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Culverts for road crossings			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Containment berms			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Firebreak			M&S, Sec. 51	Earthwork
Access	Facility Access Roads	Paved or gravel surfaced.	RCNLD	Acquisition	M&S lists "residential street improvements" which could be used, but likely does not reflect the costs associated with remote roads.
Foundations	Excavations for large equipment		RCNLD	M & S, Sec. 51	
Foundations	Solar steam generator		RCNLD	M & S, Sec. 51	
Foundations	Generator step-up transformer		RCNLD	M & S, Sec. 51	
Foundations	Steam turbine generator		RCNLD	M & S, Sec. 51	
Foundations	Footings for solar field		RCNLD	M & S, Sec. 51	
Foundations	Ancillary Foundations		RCNLD	M & S, Sec. 51	
Buildings	Operations and maintenance buildings		RCNLD	M&S, Sec. 14	
Solar Collector Assemblies	Linear troughs of parabolic reflectors		Acquisition		
Solar Collector Assemblies	Heat Collection Elements (HCE)	Welded along the focus of the parabolic trough.	Acquisition		
Solar Collector Assemblies	Low-iron glass mirrors	Typical life spans of the reflective mirrors are expected to be 30 years or more.	Acquisition		
Parabolic Trough Collector Loop	Adjacent rows of Solar Collector Arrays (SCAs) connected by crossover pipes	HTF (heat transfer fluid) is heated in the loop and enters the header which returns hot HTF from all loops to power block.	RCNLD	M&S, Sec. 62, pp. 2-3	Piping
Parabolic Trough Collector Loop	Header		RCNLD	M&S, Sec. 62, pp. 2-3	Piping
Heat Collection Elements (HCE)	Steel tube surrounded by an evacuated glass tube insulator	The steel tube has a coated surface, which enhances its heat transfer properties with a high solar radiation, accompanied by low emissivity.	RCNLD	M&S, Sec. 62, pp. 2-3	Piping
HTF System	HTF piping in solar field		RCNLD	M&S, Sec. 62, pp. 2-3	Piping
HTF System	HTF heater		Acquisition		
HTF System	HTF expansion vessel and overflow vessel		RCNLD	M&S, Sec. 53, p. 2	Hydronic expansion tanks

Concentrated Solar Parabolic Trough System

Asset Group	Item	Description	Valuation Method	Cost Source	Comment
HTF System	HTF ullage system	HTF waste disposal system - eliminates degraded compounds from the thermal oil. A system composed of several flush tanks and successive cooling with a recovery of some of the thermal oil purged in the expansion tank.	Acquisition		
HTF Freeze Protection System	Natural gas-fired HTF Heater	A freeze protection system to prevent freezing of the HTF piping systems.	RCNLD	M&S, Sec. 53, p. 2	Heat recovery systems
HTF Leak Detection	Remote pressure sensing equipment	Detection of large leaks can be made using remote pressure sensing equipment and remote operating valves to allow for	Acquisition		
HTF Leak Detection	Remote operating valves		Acquisition		
Power Blocks	Steam generation heat exchangers		RCNLD	M&S, Sec. 14, p. 40; see also Sec. 53, p. 2	If acquisition cost used, compare to M&S Sec. 14, p. 14
Power Blocks	Auxiliary boiler	Determine fuel - can be natural gas.	RCNLD	M&S, Sec. 53, p. 2	Boilers
Power Blocks	Steam turbine-generator (STG)		Acquisition	M&S, Sec. 54, p. 3	M&S does not show utility-scale
Power Blocks	Generator step up transformer (GSU)		Acquisition	M&S, Sec. 54, p. 2	M&S does not show utility-scale
Power Blocks	Air Cooled Condenser (ACC)	See Steam Cycle Heat Rejection System.	Acquisition		
Power Blocks	Small wet cooling tower for ancillary equipment	See Auxiliary Cooling Water System.	Acquisition		
Power Blocks	Reverse osmosis (RO) concentrate/dust control water storage tank		RCNLD	M&S, Sec. 61, pp 1-8	
Power Blocks	Treated water tank	See Fire Protection System	RCNLD	M&S, Sec. 61, pp 1-8	
Power Blocks	Water treatment system		Acquisition		
Power Blocks	Water, natural gas, and HTF pipelines exiting the power block		RCNLD	M&S, Sec. 62, pp. 2-3	Piping
Power Blocks	Diesel fuel storage tanks - carbon steel tanks		RCNLD	M&S, Sec. 61, pp 1-8	
Power Blocks	Secondary containment for diesel fuel storage tanks		RCNLD	M&S, Sec. 61, pp 1-8	
Power Blocks	Underground and overhead cabling and cable termination		RCNLD	M&S, Sec. 54, p. 1	
Power Blocks	Ground grid trenching and termination	Cable trenches vary between 2 to 3 feet wide and 2 to 3 feet deep, depending on the number of conductors and voltage of equipment, to comply with electrical code	RCNLD	M&S, Sec. 51, p. 2	
Water Delivery Systems	Pumps	Groundwater pumps from wells. Water used for solar mirror washing, feedwater makeup, fire water supply, onsite domestic use, cooling water for auxiliary equipment, heat rejection, and dust control.	RCNLD	M&S, Sec. 62, p. 1	Industrial pumps
Water Delivery Systems	Wells		RCNLD	M&S, Sec. 53, p. 10	Water wells
Water Delivery Systems	Water Storage Tanks	Vertical, cylindrical field-erected steel tanks supported on foundations consisting of either a reinforced concrete mat or a reinforced concrete ring wall with an interior bearing layer of compacted sand supporting the tank bottom.	RCNLD	M&S, Sec. 61, pp 1-8	
Cooling System - Steam Cycle Heat Rejection System	Forced draft air-cooled condenser (ACC) (dry cooling system)	At each power block, the dry cooling system receives exhaust steam from the LP section of the STG and condenses it to liquid for return to the SSG.	Acquisition		

Concentrated Solar Parabolic Trough System					
Asset Group	**Item**	**Description**	**Valuation Method**	**Cost Source**	**Comment**
Cooling System - Auxiliary Cooling Water System	Small wet cooling towers, including	The water picks up heat from the various equipment items being cooled and rejects the heat to the cooling tower. This auxiliary cooling system would allow critical equipment such as the generator and HTF pumps to operate at their design ratings during hot summer months when the project's power output is most valuable.	Acquisition		
Cooling System - Auxiliary Cooling Water System	STG lubrication oil cooler		Acquisition		
Cooling System - Auxiliary Cooling Water System	STG generator cooler		Acquisition		
Cooling System - Auxiliary Cooling Water System	Steam cycle sample coolers		Acquisition		
Cooling System - Auxiliary Cooling Water System	Large pumps		RCNLD	M&S, Sec. 62, p. 1	Industrial pumps
Waste and wastewater Management	Septic tank	Manage domestic sewage	RCNLD	M&S, Sec. 66, p. 1	Sewer, storm drainage
Waste and wastewater Management	Leach field		RCNLD		
On-site Land Treatment Unit	Bioremediation facility	Utilize indigenous bacteria to metabolize hydrocarbons contained in non-hazardous HTF contaminated soil.	Acquisition		
Structures	Maintenance Wing Structure, Foundation and Connections		RCNLD	M&S, Sec. 51, p. 2	
Structures	Emergency Generator Foundation and Connections		RCNLD	M&S, Sec. 51, p. 2	
Structures	Emergency Generator Exhaust Structure, Foundation and Connections		RCNLD	M&S, Sec. 51, p. 2	
Structures	Pipe Bridge Structure, Foundation and Connections		RCNLD	M&S, Sec. 51, p. 2	
Structures	Electrical equipment enclosures	Structures that house inverters and transformers, usually metal or concrete structures	RCNLD	M&S, Sec. 17, p. 25	
Structures	Natural gas pipeline	Natural gas used for such items as the auxiliary boiler and HTF heaters. Includes filtering system, pressure regulating valves, fiscal flow meter, pressure limiting equipment	RCNLD	M&S, Sec. 66, p. 1 See also Sec. 62, p. 6 "Pipeline costs"	Public utilities
Fire Protection Systems	Water system	Fire protection systems are provided to limit personnel injury, property loss, and project downtime resulting from a fire.	RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Foam generators	Firewater would be supplied from the treater water storage tanks. Electric or diesel-fueled backup firewater pumps deliver water to the fire protection piping network.	RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Portable Fire Extinguishers		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Treated Water Storage Tank		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Electric, or diesel-fueled backup firewater pump		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Firewater piping system		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Fire hydrants		RCNLD	M&S, Sec. 53, pp. 11-12	See also Sec. 66, p. 1

Concentrated Solar Parabolic Trough System					
Asset Group	**Item**	**Description**	**Valuation Method**	**Cost Source**	**Comment**
Tele - communications and Telemetry	Telecommunications, Fiber optic line		RCNLD	M&S, Sec. 66, p. 1	Public utilities, Telephone lateral, underground
Lighting System	AC lighting	Provide operations and maintenance personnel with illumination in normal and emergency conditions.	RCNLD	M&S, Sec. 66, p.5; also Sec. 54, p. 3	
Lighting System	DC lighting		RCNLD	M&S, Sec. 66, p.5	
Fencing and Security	Chain link fencing	Chain link metal fabric security fencing, 8 foot tall with one-foot barbed wire or razor wire on top	RCNLD	M&S, Sec. 66, pp. 4-5	
Fencing and Security	Wind fencing	30 foot tall wind fencing comprised of A-frames and wire mesh	RCNLD	M&S, Sec. 66, pp. 4-5	
Fencing and Security	Controlled access gates		RCNLD	M&S, Sec. 66, pp. 4-5	
Transmission System Interconnection	Switchyard (grounding system, insulators, lightening arrestors, circuit breakers)	The purpose of a Switchyard is to provide a central location for power transfers between power system components.	RCNLD	M & S, Sec. 54, pp 1-3	Use industrial type
Transmission System Interconnection	Step-up transformer to increase generator output voltage to 115 kV or to reduce voltage before the power is introduced to a distribution system.	Switchyards are classified by voltage level and by circuit breaker and bus arrangement. A switchyard delivers the generated power from the	RCNLD	M & S, Sec. 54	Determine whether oil-filled or dry-type for transformers; size & footage for rigid conduit; copper or aluminum, 3 or 4 pole bus duct; size and cost underground wiring; amps for transfer switches; wattage for generators and whether gas or diesel.
Transmission System Interconnection	Generator tie line supported by single-pole structures	Taller steel poles, typically over 45 feet long	RCNLD	M&S, Sec. 64, p. 3	See also Sec. 54, p. 2, "power pole"
Transmission System Interconnection	Substations	Substations are assemblies, at two or more voltage levels, of transformers, switchyards, and power system subcomponents where transmission lines, distribution lines, and generator circuits are brought together for the purpose of transforming power from one voltage level to another. Smaller substations include one or more transformers and a low-voltage switchyard. Larger substations usually include two or more transformers, one or more low-voltage switchyards, and one or more high voltage switchyards.	RCNLD	M&S, Sec. 54, p. 2	
Transmission System Interconnection		Substation steps up or down the voltages as per requirements. Substation and switchyard structures are used to support the above grade components and electrical equipment such as cable bus, rigid bus, and strain bus conductors, switches, surge arresters,			
Transmission System Interconnection	Transmission Lines, conductors		RCNLD	M&S, Sec. 54, p. 1	3-phase. May not be applicable
Transmission System Interconnection	Buses, Insulators		RCNLD	M&S, Sec. 54, p. 2	

Concentrated Solar Parabolic Trough System

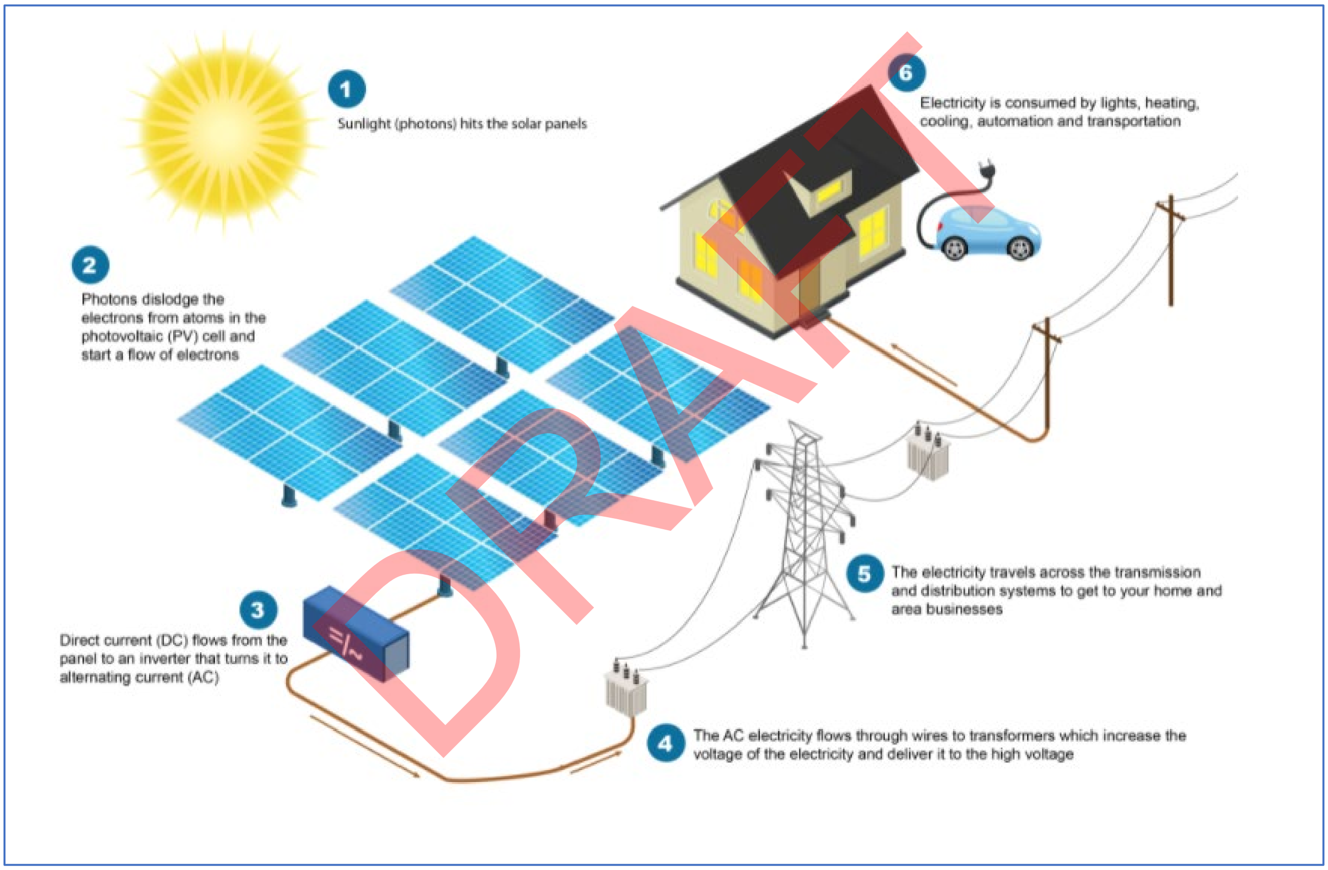
Asset Group	Item	Description	Valuation Method	Cost Source	Comment
Transmission System Interconnection	Towers, Monopole	Steel monopoles would be supported by steel-reinforced poured pier concrete foundations	RCNLD	M&S, Sec. 67, p. 6	
Transmission System Interconnection	Towers, Lattice-work		RCNLD	M&S, Sec. 67, p. 6	
Transmission System Interconnection	Electrical Duct Banks		RCNLD	M&S, Sec. 54, p. 2	
Transmission System Interconnection	Control House		RCNLD	M&S, Sec. 17, p. 25	
Transmission System Interconnection	Pad-mounted transformers, Coupling Capacitors		RCNLD	M&S, Sec. 54, p. 2	Transformers
Transmission System Interconnection	Three-phase conductors		RCNLD	M&S, Sec. 54, p. 1	Determine amperes
Transmission System Interconnection	Steel angle pull-off structures		RCNLD	Acquisition	Need additional info
Transmission System Interconnection	Underground and overhead cabling and cable termination		RCNLD	M&S, Sec. 54, p. 2	Underground wiring and Rigid Conduit & exposed wiring
Transmission System Interconnection	Ground grid trenching and termination		RCNLD	M&S, Sec. 51, p. 2	Trenching
Anemometry Equipment	Solar meteorological stations, Anemometry equipment	Gather information on air temperature, wind direction and speed, and solar transmissivity. The SMSs would consist of two tripods, 2 and 3 meters in height. Each tripod would penetrate the ground with a small stake at each foot and a single ground rod, with electrical power provided by a small PV pane.	Acquisition	Personal Property Manual	NAICS 2211, 30 yrs.
Electronic Systems	Electronic systems to control equipment and facilities operations	See SCADA circuit.	Acquisition	Personal Property Manual	Information systems
Office furniture and equipment			Acquisition	Personal Property Manual	Furniture & trade fixtures
SCADA Circuit	Supervisory control and data acquisition (SCADA) circuit		Acquisition	Personal Property Manual	Information systems
Vehicles	Trucks for on-site welding, refueling, lubricating, panel washing			If licensed, no property tax	
Vehicles	Crane trucks for minor equipment maintenance.		Acquisition	Personal Property Manual	Use construction, 238
Vehicles	Forklifts, manlifts, and chemical application equipment for weed abatement and soil stabilizer treatment in the bioremediation area.	Additional maintenance equipment.	Acquisition	Personal Property Manual	Use construction, 238
Vehicles	Flatbed trucks, dump trucks, and pick-up trucks	Daily Operations & Maintenance.		If licensed, no property tax	
Tools	Hand tools, power tools		Acquisition	Personal Property Manual	Use construction, 238
Telecommunications	Wireless telecom equipment		Acquisition	Personal Property Manual	
Tele - communications and Telemetry	Protective relay circuit		Acquisition		

Section 2

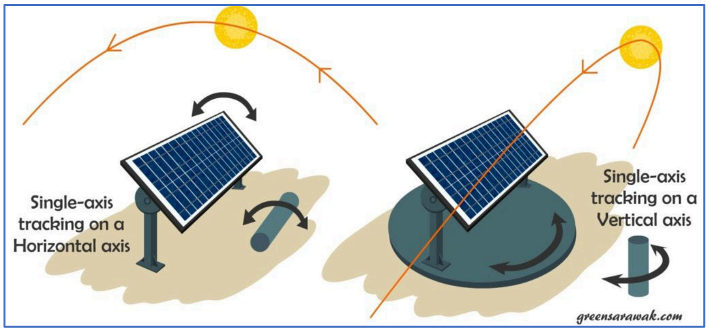
PHOTOVOLTAIC COMPONENTS

PHOTOVOLTAIC

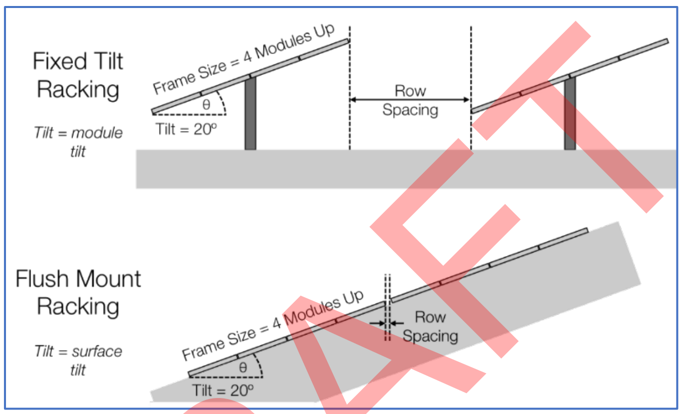
A photovoltaic (PV) system is based on the use of semiconductors and materials that generate electric current when exposed to sunlight. The materials are present as a thin film in a solar cell; many individual solar cells are connected into chains as a module; and modules are combined to make solar panels. In a utility-scale operation, the solar panels are grouped into arrays producing direct current (DC) electricity. The arrays produce power in the "solar field" and the power conditioning system, consisting of inverters, convert the DC power to AC so that the energy that is produced can be transmitted onto the power grid. If costs are not readily identifiable or if sources of cost information are not adequate to properly cost the property, please refer to Part C, Section 4 of this manual.



Solar modules can be mounted on tracking systems to follow the sunlight across the sky or on fixed-tilt or flush mounted racks.

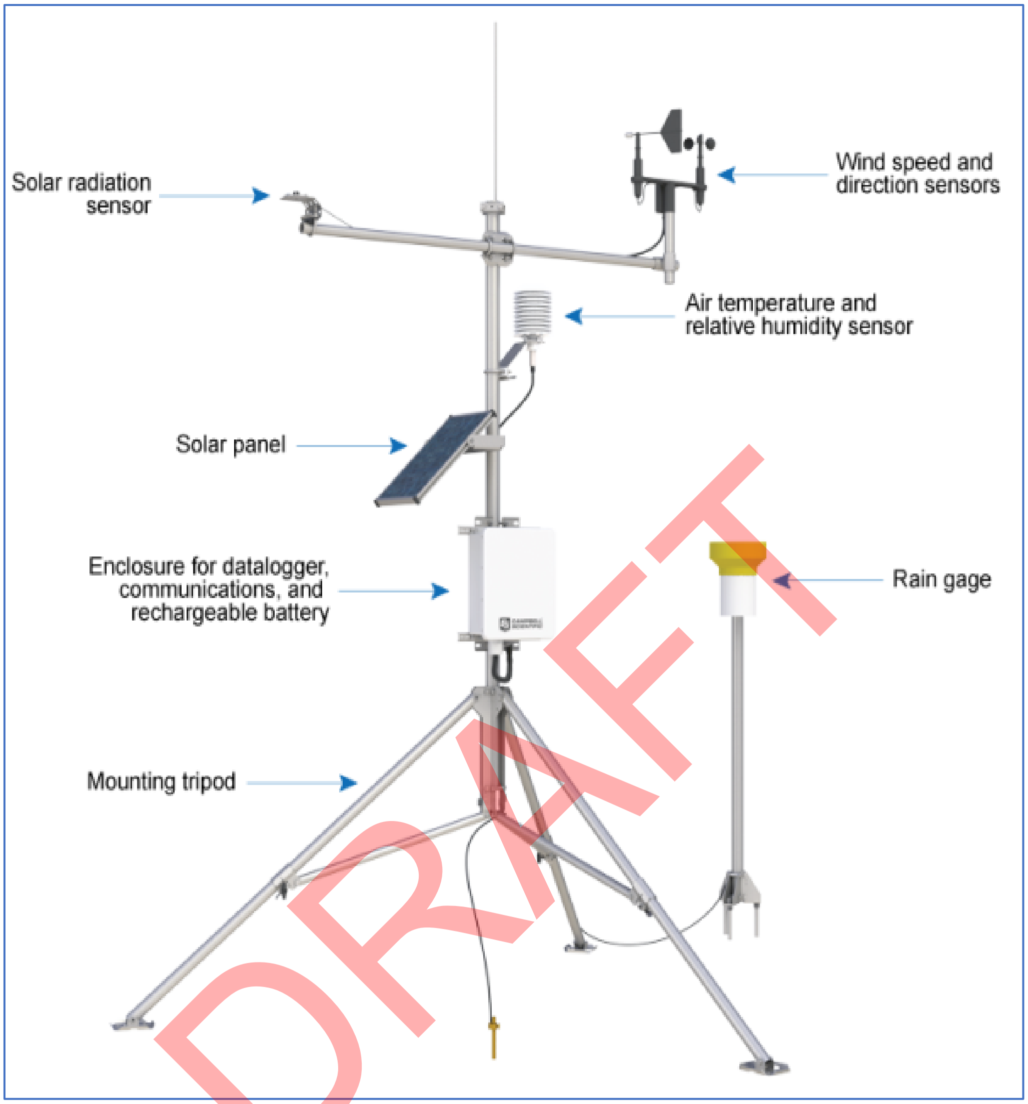


Single-Axis Tracking System



Fixed-Tilt & Flush Mount Racking

Weather stations (anemometry equipment) are generally located at a solar facility to monitor the weather and sunlight hours at the facility.



Weather Station (Anemometry)

Photovoltaic Solar Panel System

Asset Group	Item	Description	Valuation Method	Cost Source	Comment
Land	Fee simple ownership	The amount of land necessary to support the generation and transmission facilities.	Market		
Land	Possessory interests (right-of-way leases)		Ground rent Capitalization		
Site Preparation, Land Enhancements	Construction Survey				
Site Preparation, Land Enhancements	Grading			M & S, Sec. 51	Earthwork
Site Preparation, Land Enhancements	Drainage features			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Erosion protection features			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Diversion channels			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Detention ponds			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Culverts for road crossings			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Containment berms			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Firebreak			M&S, Sec. 51	Earthwork
Access	Facility Access Roads	Paved or gravel surfaced.	RCNLD	Acquisition cost	M&S lists "residential street improvements" which could be used, but likely does not reflect the costs associated with remote roads.
Foundations	Excavations for large equipment		RCNLD	M & S, Sec. 51	
Foundations	Tracker foundations		RCNLD	M & S, Sec. 51	
Foundations	Drive motor foundations		RCNLD	M & S, Sec. 51	
Foundations	Footings; pre-cast piers		RCNLD	M & S, Sec. 51	
Foundations	Ancillary Foundations		RCNLD	M & S, Sec. 51	
Buildings	Operations and maintenance buildings		RCNLD	M&S, Sec. 14	
Solar Fields	PV solar modules	The assembled solar equipment installed on pre-cast concrete foundations or embedded piers to form a row of panels. If tracking technology is used, these rows would be attached to an aboveground driveshaft.	RCNLD	M & S, Sec. 54, p. 5	May not cover utility-scale
Solar Fields	Single-axis tracker systems	Each block contains solar panels, an inverter, and an SUT (Step-up transformer).	RCNLD	M & S, Sec. 54, p. 5	May not cover utility-scale
Solar Fields	Fixed-tilt panel systems	For tracking structures, a concrete equipment pad is poured to support the drive motor. Mechanical linkage would be connected to each tracker unit. The tracker motors/foundations are located at each row.	RCNLD	M & S, Sec. 54, p. 5	May not cover utility-scale
Solar Fields	Tracker motors		RCNLD	M&S, Sec. 62, p. 4	
Solar Fields	Pad-mounted inverters		RCNLD	M&S, Sec. 54, p. 5	Use industrial
Solar Fields	Battery Storage		RCNLD		
Solar Fields	Underground and overhead cabling and cable termination		RCNLD	M&S, Sec. 54, pp. 1-2	

Photovoltaic Solar Panel System					
Asset Group	Item	Description	Valuation Method	Cost Source	Comment
Solar Fields	Ground grid trenching and termination	Cable trenches vary between 2 to 3 feet wide and 2 to 3 feet deep, depending on the number of conductors and voltage of equipment, to comply with electrical code.	RCNLD	M&S, Sec. 51, p. 2	

Photovoltaic Solar Panel System

Asset Group	Item	Description	Valuation Method	Cost Source	Comment
Structures	Maintenance Wing Structure, Foundation and Connections		RCNLD	M&S, Sec. 51, p. 2	
Structures	Emergency Generator Foundation and Connections		RCNLD	M&S, Sec. 51, p. 2	
Structures	Emergency Generator Exhaust Structure, Foundation and Connections		RCNLD	M&S, Sec. 51, p. 2	
Structures	Pipe Bridge Structure, Foundation and Connections		RCNLD	M&S, Sec. 51, p. 2	
Structures	Electrical equipment enclosures	Structures that house inverters and transformers, usually metal or concrete structures.	RCNLD	M&S, Sec. 17, p. 25	
Fire Protection Systems	Water system	Fire protection systems are provided to limit personnel injury, property loss, and project downtime resulting from a fire.	RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Foam generators	Firewater would be supplied from the treater water storage tanks. Electric or diesel-fueled backup firewater pumps deliver water to the fire protection piping network.	RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Portable Fire Extinguishers		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Treated Water Storage Tank		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Electric or diesel-fueled backup firewater pump		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Firewater piping system		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Fire hydrants		RCNLD	M&S, Sec. 53, pp. 11-12	See also Sec. 66, p. 1
Telecommunications and Telemetry	Telecommunications, Fiber optic line		RCNLD	M&S, Sec. 66, p. 1	Public utilities, Telephone lateral, underground
Lighting System	AC lighting	Provide operations and maintenance personnel with illumination in normal and	RCNLD	M&S, Sec. 66, p.5; also Sec. 54, p. 3	
	DC lighting		RCNLD	M&S, Sec. 66, p.5	
Fencing and Security	Chain link fencing	Chain link metal fabric security fencing, 8 foot tall with one-foot barbed wire or razor wire on top.	RCNLD	M&S, Sec. 66, pp. 4-5	
Fencing and Security	Wind fencing	30 foot tall wind fencing comprised of A-frames and wire mesh.	RCNLD	M&S, Sec. 66, pp. 4-5	
Fencing and Security	Controlled access gates		RCNLD	M&S, Sec. 66, pp. 4-5	
Transmission System Interconnection	Switchyard (grounding system, insulators, lightening arrestors, circuit breakers)	The purpose of a Switchyard is to provide a central location for power transfers between power	RCNLD	M & S, Sec. 54, pp 1-3	Use industrial type

Photovoltaic Solar Panel System

Asset Group	Item	Description	Valuation Method	Cost Source	Comment
Transmission System Interconnection	Step-up transformer to increase generator output voltage to 115 kV or to reduce voltage before the power is introduced to a distribution system.	system components. Switchyards are classified by voltage level and by circuit breaker and bus arrangement. A switchyard delivers the generated power from the power plant at desired voltage level to the nearest grid or transmission line.	RCNLD	M & S, Sec. 54	Determine whether oil-filled or dry-type for transformers; size & footage for rigid conduit; copper or aluminum, 3 or 4 pole bus duct; size and cost underground wiring; amps for transfer switches; wattage for generators and whether gas or diesel.
Transmission System Interconnection	Generator tie (Gen-Tie) line supported by single-pole structures	Taller steel poles, typically over 45 feet long.	RCNLD	M&S, Sec. 64, p. 3	See also Sec. 54, p. 2, "power pole"
Transmission System Interconnection	Substations	Substations are assemblies, at two or more voltage levels, of transformers, switchyards, and power system subcomponents where transmission lines, distribution lines, and generator circuits are brought together for the purpose of transforming power from one voltage level to another. Smaller substations include one or more transformers and a low-voltage switchyard. Larger substations usually include two or more transformers, one or more low-voltage switchyards, and one or more high voltage switchyards.	RCNLD	M&S, Sec. 54, p. 2	
Transmission System Interconnection		Substation steps up or down the voltages as per requirements. Substation and switchyard structures are used to support the above grade components and electrical equipment such as cable bus, rigid bus, and strain bus conductors, switches, surge arresters, insulators, and other equipment. These structures must be designed such that applicable steel design codes and standards are incorporated into the final build. Structures must be designed to withstand various static and dynamic loads such as the dead weight of conductors and electrical components, wind, snow/ice, and seismic loads.			
Transmission System Interconnection	Transmission Lines, conductors		RCNLD	M&S, Sec. 54, p. 1	3-phase. May not be applicable
Transmission System Interconnection	Buses, Insulators		RCNLD	M&S, Sec. 54, p. 2	

Photovoltaic Solar Panel System					
Asset Group	**Item**	**Description**	**Valuation Method**	**Cost Source**	**Comment**
Transmission System Interconnection	Towers, Monopole	Steel monopoles would be supported by steel-reinforced poured pier concrete foundations.	RCNLD	M&S, Sec. 67, p. 6	
Transmission System Interconnection	Towers, Lattice-work		RCNLD	M&S, Sec. 67, p. 6	
Transmission System Interconnection	Electrical Duct Banks		RCNLD	M&S, Sec. 54, p. 2	
Transmission System Interconnection	Control House		RCNLD	M&S, Sec. 17, p. 25	
Transmission System Interconnection	Pad-mounted transformers, coupling capacitors		RCNLD	M&S, Sec. 54, p. 2	Transformers
Transmission System Interconnection	Three-phase conductors		RCNLD	M&S, Sec. 54, p. 1	Determine amperes
Transmission System Interconnection	Steel angle pull-off structures		RCNLD	Acquisition	Need additional info
Transmission System Interconnection	Underground and overhead cabling and cable termination		RCNLD	M&S, Sec. 54, p. 2	Underground wiring and Rigid Conduit & exposed wiring
Transmission System Interconnection	Ground grid trenching and termination		RCNLD	M&S, Sec. 51, p. 2	Trenching
Anemometry Equipment	Solar meteorological stations, Anemometry equipment	Gather information on air temperature, wind direction and speed, and solar transmissivity. The SMSs would consist of two tripods, 2 and 3 meters in height. Each tripod would penetrate the ground with a small stake at each foot and a single ground rod, with electrical power provided by a small PV pane.	Acquisition	Personal Property Manual	NAICS 2211
Electronic Systems	Electronic systems to control equipment and facilities operations	See SCADA circuit.	Acquisition	Personal Property Manual	Information systems
Office furniture and equipment			Acquisition	Personal Property Manual	Furniture & trade fixtures
SCADA Circuit	Supervisory control and data acquisition (SCADA) circuit		Acquisition	Personal Property Manual	Information systems
Vehicles	Trucks for on-site welding, refueling, lubricating, panel washing				
Vehicles	Crane trucks for minor equipment maintenance		Acquisition	Personal Property Manual	Use construction, 238
Vehicles	Forklifts, manlifts, and chemical application equipment for weed abatement and soil stabilizer treatment in the bioremediation area	Additional maintenance equipment.	Acquisition	Personal Property Manual	Use construction, 238
Vehicles	Flatbed trucks, dump trucks, and pick-up trucks	Daily Operations & Maintenance (O&M).			
Tools	Hand tools, power tools		Acquisition	Personal Property Manual	Use construction, 238

Photovoltaic Solar Panel System					
Asset Group	Item	Description	Valuation Method	Cost Source	Comment
Telecommunications	Wireless telecom equipment		Acquisition	Personal Property Manual	
Telecommunications and Telemetry	Protective relay circuit		Acquisition		

PART C

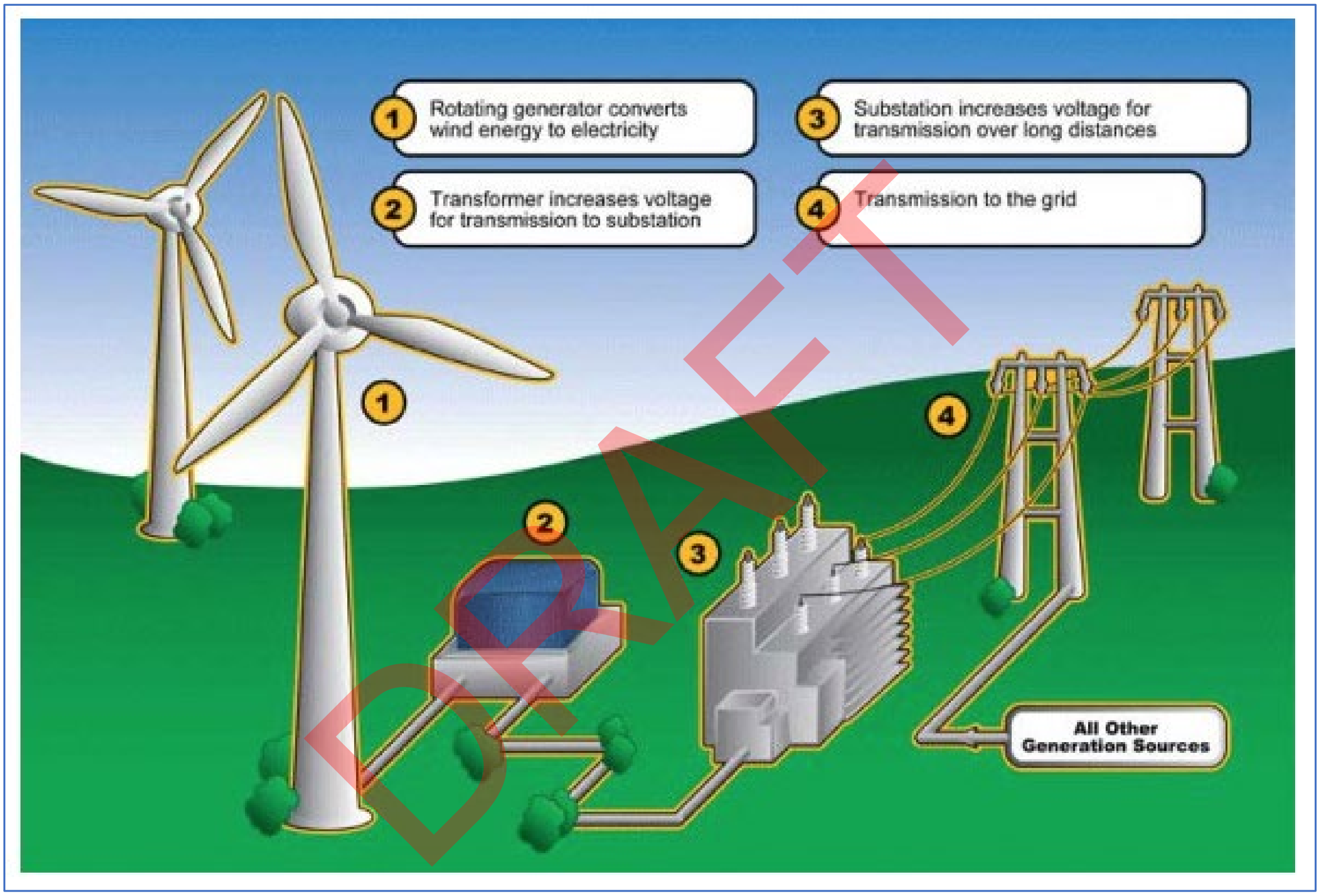
2024-2025 RENEWABLE ENERGY COSTS

Section 3

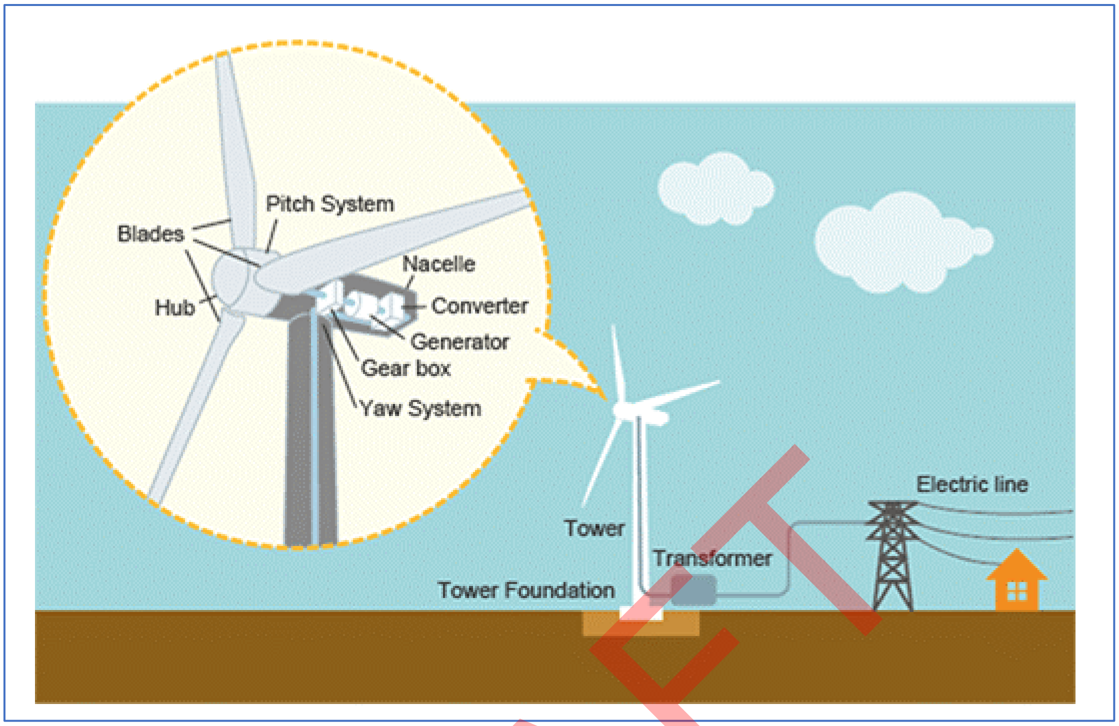
WIND COMPONENTS

WIND

Wind power turns the blades of the wind generator which creates energy that is converted to electricity. A transformer increases the voltage of the electricity for transmission to a substation where the energy is again increased for transmission over long distances and then the power is transmitted to the energy grid.



The wind turbine generator includes rotor, gearbox, generator, bedplate, enclosure, sensors, controls, couplings, brake and lightning protection.



Wind Turbine Generator Systems: Real Property, Fixtures, Personal Property					
Asset Group	**Item**	**Description**	**Valuation Method**	**Cost Source**	**Comment**
Land	Fee simple ownership	The amount of land necessary to support the generation and transmission facilities	Market		
Land	Possessory interests (right-of-way leases)		Ground rent Capitalization		
Site Preparation, Land Enhancements	Construction Survey				
Site Preparation, Land Enhancements	Grading			M & S, Sec. 51	Earthwork
Site Preparation, Land Enhancements	Drainage features			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Erosion protection features			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Diversion channels			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Detention ponds			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Culverts for road crossings			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Containment berms			M&S, Sec. 66, p. 1	Public Utilities
Site Preparation, Land Enhancements	Firebreak			M&S, Sec. 51	Earthwork
Access	Facility Access Roads	Paved or gravel surfaced	RCNLD	Acquisition cost	M&S lists "residential street improvements" which could be used, but likely does not reflect the costs associated with remote roads.
Foundations	Excavations for large equipment		RCNLD	M & S, Sec. 51	
Foundations	Tower foundations		RCNLD	M & S, Sec. 51	
Foundations	Drive motor foundations		RCNLD	M & S, Sec. 51	
Foundations	Footings; pre-cast piers		RCNLD	M & S, Sec. 51	
Foundations	Ancillary Foundations		RCNLD	M & S, Sec. 51	
Buildings	Operations and maintenance buildings		RCNLD	M&S, Sec. 14	
Wind Turbine Generator	Tower		Acquisition	See M&S, Sec. 14, p. 40	per KW cost
Wind Turbine Generator	Rotor blades		Acquisition	See M&S, Sec. 14, p. 40	per KW cost
Wind Turbine Generator	Generator		Acquisition	See M&S, Sec. 14, p. 40	per KW cost
Wind Turbine Generator	Power regulation		Acquisition	See M&S, Sec. 14, p. 40	per KW cost
Wind Turbine Generator	Nacelle	Includes rotor, gearbox, generator, bedplate, enclosure, sensors, controls, couplings, brake and lightning protection	Acquisition	See M&S, Sec. 14, p. 40	per KW cost
Wind Turbine Generator	Underground and overhead cabling and cable termination		RCNLD	M&S, Sec. 54, p. 1	
Wind Turbine Generator	Ground grid trenching and termination	Cable trenches vary between 2 to 3 feet wide and 2 to 3 feet deep, depending on the number of conductors and voltage of equipment, to comply with electrical code	RCNLD	M&S, Sec. 51, p. 2	
Fire Protection Systems	Water system	Fire protection systems are provided to limit personnel injury, property loss, and project downtime resulting from a fire.	RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Foam generators	Firewater would be supplied from the treater water storage tanks. Electric or diesel-fueled backup firewater pumps deliver water to the fire protection piping network.	RCNLD	M&S, Sec. 53, pp. 11-12	

Wind Turbine Generator Systems: Real Property, Fixtures, Personal Property					
Asset Group	**Item**	**Description**	**Valuation Method**	**Cost Source**	**Comment**
Fire Protection Systems	Portable Fire Extinguishers		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Treated Water Storage Tank		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Electric, or diesel-fueled backup firewater pump		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Firewater piping system		RCNLD	M&S, Sec. 53, pp. 11-12	
Fire Protection Systems	Fire hydrants		RCNLD	M&S, Sec. 53, pp. 11-12	See also Sec. 66, p. 1
Telecommunications and Telemetry	Meteorological Tower	100 feet or higher	Acquisition		
Telecommunications and Telemetry	Telecommunications, Fiber optic line		RCNLD	M&S, Sec. 66, p. 1	Public utilities, Telephone lateral, underground
Lighting System	AC lighting	Provide operations and maintenance personnel with illumination in normal and emergency conditions.	RCNLD	M&S, Sec. 66, p.5; also Sec. 54, p. 3	
Lighting System	DC lighting		RCNLD	M&S, Sec. 66, p.5	
Fencing and Security	Chain link fencing	Chain link metal fabric security fencing, 8 foot tall with one-foot barbed wire or razor wire on top	RCNLD	M&S, Sec. 66, pp. 4-5	
Fencing and Security	Wind fencing	30 foot tall wind fencing comprised of A-frames and wire mesh	RCNLD	M&S, Sec. 66, pp. 4-5	
Fencing and Security	Controlled access gates		RCNLD	M&S, Sec. 66, pp. 4-5	
Transmission System Interconnection	Switchyard (grounding system, insulators, lightening arrestors, circuit breakers)	The purpose of a Switchyard is to provide a central location for power transfers between power system components.	RCNLD	M & S, Sec. 54, pp 1-3	Use industrial type
Transmission System Interconnection	Step-up transformer to increase generator output voltage to 115 kV or to reduce voltage before the power is introduced to a distribution system.	Switchyards are classified by voltage level and by circuit breaker and bus arrangement. A switchyard delivers the generated power from the	RCNLD	M & S, Sec. 54	Determine whether oil-filled or dry-type for transformers; size & footage for rigid conduit; copper or aluminum, 3 or 4 pole bus duct; size and cost underground wiring; amps for transfer switches; wattage for generators and whether gas or diesel.
Transmission System Interconnection	Generator tie line supported by single-pole structures	Taller steel poles, typically over 45 feet long	RCNLD	M&S, Sec. 64, p. 3	See also Sec. 54, p. 2, "power pole"
Transmission System Interconnection	Substations	Substations are assemblies, at two or more voltage levels, of transformers, switchyards, and power system subcomponents where transmission lines, distribution lines, and generator circuits are brought together for the purpose of transforming power from on	RCNLD	M&S, Sec. 54, p. 2	
Transmission System Interconnection		Substation steps up or down the voltages as per requirements. Substation and switchyard structures are used to support the above grade components and electrical equipment such as cable bus, rigid bus, and strain bus conductors, switches, surge arresters,			
Transmission System Interconnection	Transmission Lines, conductors		RCNLD	M&S, Sec. 54, p. 1	3-phase. May not be applicable
Transmission System Interconnection	Buses, Insulators		RCNLD	M&S, Sec. 54, p. 2	

Wind Turbine Generator Systems: Real Property, Fixtures, Personal Property					
Asset Group	Item	Description	Valuation Method	Cost Source	Comment
Transmission System Interconnection	Towers, Monopole	Steel monopoles would be supported by steel-reinforced poured pier concrete foundations	RCNLD	M&S, Sec. 67, p. 6	
Transmission System Interconnection	Towers, Lattice-work		RCNLD	M&S, Sec. 67, p. 6	
Transmission System Interconnection	Electrical Duct Banks		RCNLD	M&S, Sec. 54, p. 2	
Transmission System Interconnection	Control House		RCNLD	M&S, Sec. 17, p. 25	
Transmission System Interconnection	Pad-mounted transformers, Coupling Capacitors		RCNLD	M&S, Sec. 54, p. 2	Transformers
Transmission System Interconnection	Three-phase conductors		RCNLD	M&S, Sec. 54, p. 1	Determine amperes
Transmission System Interconnection	Steel angle pull-off structures		RCNLD	Acquisition	Need additional info
Transmission System Interconnection	Underground and overhead cabling and cable termination		RCNLD	M&S, Sec. 54, p. 2	Underground wiring and Rigid Conduit & exposed wiring
Transmission System Interconnection	Ground grid trenching and termination		RCNLD	M&S, Sec. 51, p. 2	Trenching
Anemometry Equipment	Solar meteorological stations, Anemometry equipment	gather information on air temperature, wind direction and speed, and solar transmissivity. The SMSs would consist of two tripods, 2 and 3 meters in height. Each tripod would penetrate the ground with a small stake at each foot and a single ground rod, wit	Acquisition	Personal Property Manual	NAICS 2211
Electronic Systems	Electronic systems to control equipment and facilities operations	See SCADA circuit	Acquisition	Personal Property Manual	Information systems
Office furniture and equipment			Acquisition	Personal Property Manual	Furniture & trade fixtures
SCADA Circuit	Supervisory control and data acquisition (SCADA) circuit		Acquisition	Personal Property Manual	Information systems
Vehicles	Trucks for on-site welding, refueling, lubricating, panel washing		If licensed, no property tax		
Vehicles	Crane trucks for minor equipment maintenance.		Acquisition	Personal Property Manual	Use construction, 238
Vehicles	Forklifts, manlifts, and chemical application equipment for weed abatement and soil stabilizer treatment in the bioremediation area.	Additional maintenance equipment	Acquisition	Personal Property Manual	Use construction, 238
Vehicles	Flatbed trucks, dump trucks, and pick-up trucks	Daily O&M	If licensed, no property tax		
Tools	Hand tools, power tools		Acquisition	Personal Property Manual	Use construction, 238
Telecommunications	Wireless telecom equipment		Acquisition	Personal Property Manual	
Telecommunications and Telemetry	Protective relay circuit		Acquisition	Personal Property Manual	

Section 4

RENEWABLE ENERGY COST APPROVAL

COST APPROVAL

The costs for utility-scale solar facilities are not always readily available. If costs are identifiable, it is suggested and approved to use the costs provided within the Marshall and Swift manuals. If costs cannot be readily identified and determined, it is suggested and approved to use the same methodology in regards to the cost approach as used for electric companies that are centrally assessed according to NAC 361.421 and NAC 361.4215 which state:

NAC 361.421 Cost approach indicator of value: Determination. (NRS 360.090, 361.320) The cost approach consists of:

1. Determining the gross book cost for financial reporting purposes of all taxable operating property, including, but not limited to, all property relating to rail transportation, utility plant in service, plant held for future use, contributed plant, nuclear fuel, construction work in progress, experimental plant, acquisition adjustments, materials and supplies, plant and other property leased from others and common plant.
2. Deducting from the gross book cost the accrued book depreciation recorded for financial reporting purposes, which may include physical, functional and economic obsolescence. Additional obsolescence must be deducted when adequately quantified.

(Added to NAC by Tax Comm'n, eff. 9-30-88; A by R085-98, 11-23-98)

NAC 361.4215 Cost approach indicator of value: Optional cost information. (NRS 360.090, 361.320) The taxpayer may present and the Department shall consider, in addition to the information required by NAC 361.421, one or more of the following alternative cost indicators of value:

1. A calculation of the reproduction cost new less depreciation for all taxable operating property of the collective unit being assessed. The calculation must have been performed in accordance with generally accepted appraisal methodology.
2. A calculation of the replacement cost new less depreciation for all taxable operating property of the collective unit being assessed. The calculation must have been performed in accordance with generally accepted appraisal methodology.
3. Any other relevant and verifiable information, such as rate base for regulatory purposes.

(Added to NAC by Tax Comm'n by R085-98, eff. 11-23-98)

Part of the information to quantify possible obsolescence that can be provided may be using industry studies or income. With the technology in this industry continuing to rapidly evolve and change, it is recommended that if presented with such information correlation occurs with the Department of Taxation to help in the determining the validity of such information and to help with the equity of treatment amongst the counties.

PART C

2024-2025 RENEWABLE ENERGY COSTS

Section 5

RESIDENTIAL SOLAR

RESIDENTIAL SOLAR

Passive Solar Heating & Cooling

Passive solar heating and cooling systems consist of an assembly of natural and architectural components (collector, absorber, thermal storage, distribution, and control) that convert solar energy into thermal energy. These systems do not have any mechanical devices requiring auxiliary power, instead parts of the building are used to collect and store solar heat. These are examples of various components that might be part of the passive solar system:

- Collector: south-facing windows, sun rooms, skylights, panels
- Absorber, Thermal Storage and Distribution: concrete, brick, stone or tile walls and floors, water storage tanks, insulation
- Control: roof overhang, vents and dampers, window glazing, blinds and awnings

Some components may be considered part of the quality/class of the house.

Item	Description	Cost Source	Cost	CCM	LCM	Per Sq. Ft Cost
Passive Solar Wall	No collectors, uses solarium, skylight or solar walls (sf of residence)	Residential M/S B-21	10.45	1.11	1.1	$ 12.76
Passive Solar Wall with Heat Collectors Tanks	No collectors, uses water filled tanks to collect heat (sf of residence)	Residential M/S B-21	10.45	1.11	1.1	$ 12.76