[Slide 1]
Dan Olis: Welcome to the Federal Energy Management Program's sponsored training. This training is called Project Planning: Determining the Best Renewable Energy Project for your site. I am Dan Olis and I am joined by my colleague Otto VanGeet, both engineers at the National Renewable Energy Lab.

[Slide 2]
Today's course will introduce the nine steps in Federal renewable energy projects with a focus on the planning phase - or the first two steps. Site energy managers who complete this course will understand what site information is needed to do a renewable energy screening for your site and will be shown resources that can be used to do a preliminary renewable energy screening on your own. Lastly, we'll also talk about technical support available through FEMP and other resources to have more thorough renewable energy studies done for your site.

[Slide 3]
Quick course overview: First we'll talk about the motivators and drivers for renewable energy projects. We'll introduce the nine steps to renewable energy projects as done in the Federal sector. It includes the first two steps, which are planning, and then the steps three through nine, which are typically considered implementation steps. Today's course emphasizes planning steps one and two.

[Slide 4]
FEMP is the Federal Energy Management Program. The mission of FEMP is to facilitate the Federal Government's implementation of sound, cost effective energy management and investment practices to enhance the nation's energy security and environmental stewardship. FEMP helps renewable energy projects, energy efficiency projects, and water conservation projects.

[Slide 5]
FEMP's mission as a DOE information and consulting program for Federal agencies is executed under these three general service categories: project transaction services, applied technology services, and decision support services. Under the transaction services heading you can receive consultation on energy savings performance contracts, utility energy service contracts, power purchase agreements, and also get training and advice on capturing state and Federal incentive programs. The applied technology services section provides technical support services, enabling agencies to meet their renewable energy and other goals while the decision support services is an outreach training education section and provides webinars like the one presented today.

[Slide 6]
This course is the third in a series of webinars designed to help Federal agencies meet legislative goals for renewable energy. The previous two were Introduction to Renewable Energy Technologies and Introduction to Federal Renewable Energy Goals and FEMP Services. Both of those are available at the link shown on this page. There are other relevant courses not only on renewable energy but energy efficiency and operations and maintenance that can be accessed through these other links shown.

[Slide 7]
Okay, let's first talk about motivators and drivers for Federal renewable energy projects.

[Slide 8]
Like almost all goods and services, the cost of fuel and electricity tend to trend upwards. Investment in renewable energy often presents a large initial cost, which should be viewed as providing certainty in future energy costs at relatively low risk. I say certainty and low risk because we don't know what the future will bring in terms of utility electricity and fuel costs as well as we can estimate or predict the performance of turnkey renewable energy systems. There are also benefits to the local economy, job creation, as well as environmental benefits including reduced hazardous wastes, emissions of sulfur, heavy metals, particulates and CO2.

In addition, renewable energy has a good fit where the initial costs of an extension to the grid is cost prohibitive, so renewable energy is very cost competitive where there's going to be high capital costs to extend the power grid to a remote building. There are also LEED points that can be earned for renewable energy. LEED stands for Leadership in Energy and Environmental Design and is becoming more and more popular in building construction.

[Slide 9]
Another important motivator for Federal renewable projects is to comply with Federal goals and requirements, so in addition to the benefits described on the previous slide, there are agency goals and Federal goals that each agency must meet.

[Slide 10]
This slide shows Federal laws and executive orders that each agency has in terms of renewable energy goals. One of the first important Federal acts is the Energy Policy Act of 2005. It has renewable energy targets based on electrical energy consumed by each agency. Following that is Executive 0rder 13423, which states that half of the Energy Policy Act renewable energy must come from new sources where new means installations that come after 1999. The Department of Defense has a pretty ambitious goal. It's a 2025 goal where 25 percent of all electricity will come from renewable energy sources. More recently we have Executive Order 13514. This is an order that was recently sent out by the President, which has greenhouse gas inventory goals and mentions renewable energy in terms of reducing greenhouse gas emissions.

The Energy Independence and Security Act, sometimes called EISA, has a solar water heating requirement. Within it, there's a section that requires 30 percent of hot water needs in all new buildings and major renovations should be met by solar water heat where it's found to be life cycle cost effective. These goals have all been described in some detail in a previous training, and I've got a link at the bottom of the page that goes into much more detail on what each act and executive order states and describes - some of the subtleties within the language of those.

[Slide 11]
The next slide shows a list of important acronyms that we're going to be using throughout this webinar. I wanted to point out a couple of the ones that may not be so commonly understood. First, the renewable energy ones. PV you'll hear me say a lot. That stands for photovoltaics. SVP is an acronym for solar ventilation preheat. That's a solar thermal renewable energy for preheating building ventilation air. Lastly solar water heat is often abbreviated as SWH.

Other important acronyms are the economic terms. You'll see on the list LCOE. That stands for levelized cost of energy, NPV, which is the net present value, and savings to investment ratio is abbreviated as SIR. These will be discussed in a little more detail later in the presentation but again are important acronyms. My apologies in advance if I throw out an acronym. I'll try to spell out each term as I go along, but please refer to the acronyms sheet as needed.

[Slide 12]
Now we'll describe the nine steps of the Federal renewable energy project planning and implementation.

[Slide 13]
A typical Federal renewable energy project has these nine steps. One is defining facility and energy characteristics, two, renewable energy studies, three, requesting and evaluating renewable energy project proposals, four is the contract phase, five is design, six is the construction phase listed here as "Build it", seven includes accepting testing and commissioning, eight is performance period, and the ninth step is end of project or close out.

[Slide 14]
The focus of today's seminar is on steps one and two, what are described as the planning steps. As I said in the previous slide, facility and energy characteristics is really about gathering the site relevant data needed to analyze the renewable energy project's merits, so it's really a collection of the energy data plus characteristics of the site that are important to try to see if renewable energy will fit to the site. Step two, renewable energy study, is to determine which renewable energy projects would prove to be cost effective.

[Slide 15]
Steps three through nine are considered implementation steps. While the first two steps can typically be done by a single individual at a site with perhaps some help from an outside consultant, steps three through nine really are going to take full time people: renewable energy project manager, contracting officers. You're going to need an environmental expert to comply with NEPA requirements. NEPA is the National Environmental Policy Act. You've got site energy managers and facility managers. You're going to, of course, need a renewable energy contract, so steps three through nine is really a team effort and these steps will be described in more detail in a later training, so check back often to this site for availability on that.

[Slide 16]
Next we will talk about facility and energy characteristics, which are step one of the nine steps for the Federal renewable energy project.

[Slide 17]
Step one is all about assembling your site data package required to do an investment grade renewable energy assessment, so before deciding what renewable energy systems to consider you're really going to have to know what energy the site is using, where it goes, how much it's costing, and then it's also important to collect information on the real estate, the number of buildings, what types of buildings, offices that have different energy profiles than, say, warehouse space or shops, and then of course the address is important not only to understand renewable energy, the local renewable energy resources, but also to understand the incentives that might be available in any region.

It's important to state, which I've got at the bottom of the slide here, that the energy manager is really key to this process. The energy manager has a really good understanding of not only how much the site is paying for energy and what energy costs, but also how it's being used at the site. It's the subtleties often on the site that determine how well a renewable energy project will fit. So again I just want to stress that the energy manager is very important in this first step.

[Slide 18]
In terms of energy characteristics, energy includes both electricity that's purchased from the utility as well as fuels. Fuels could be natural gas, propane, diesel and heating fuels. How much is being used, how much does it cost, where does it go, what is it used for. Is it used for space heating, lighting and plug loads? Do you have considerably high hot water use? Each of these questions is going to help us figure out which renewable energy technology is the best fit for your site. Sub meter data, if it's available, should be looked at, so don't only necessarily look at the utility bills but if you're a large campus, say like a military base, often the buildings have sub meter data, which will help you figure out where it's being – where the energy is going and how it's being used. So wherever sub meter data is available it's valuable.

[Slide 19]
In terms of the energy characteristics, the best place to start is just to gather the utility bills. It's best to gather at least a year. Two years might be better if it's available. What we want to do with the data is really understand total consumption and unit costs for both the electricity and your fuels. It's useful to not only calculate annual averages but look at season-by-season variations in use and costs, and then also if you have generators we want to understand if the generators are used for an off-grid application or if they're used for some backup power systems and what are the fuel costs for those systems as well.

[Slide 20]
To compile the monthly electrical and fuel bills, you might have to talk to the finance department to collect the data. Often times energy management systems have this included in there, but again what you're going to be looking for total consumption and rates on the usage, but you also want to look at other charges and make sure you understand if there's on peak and off peak rates. It's important to document who your utility provider is, and again that goes back to the question of regional incentives, and then often times the bills can be confusing, so don't hesitate to contact your utility or colleagues within the finance department who may have a better understanding of the terms and the bills.

[Slide 21]
Understanding common charges on the utility bills is the focus of this slide. Some are listed. Often times there are different names for these charges, but I'll read through the list and describe some of the common charges you might see. Often there's a fixed monthly charge, sometimes called the meter charge. That's just the monthly fixed cost that you pay to have utility connection in your building. Demand charges are based on a dollar per kilowatt. They're often added to energy charges on the dollars per kilowatt hour.

The demand charges are meant to reflect the cost of the utility for having to have generators and transmission capacity to meet all expected loads. Demand charges often aren't seen on residential bills but are often a part of industrial and commercial services. The other important thing to note about demand charges is that they can be significant. Sometimes they're as much as 50 percent of the total electrical costs. The important thing to understand about demand charges is not only are they pricey, but renewable energy systems can also be selected to control that demand charge.

The block rate charge here is often called a tiered rate. For example, during the summer months at my home, I pay 4.5 cents per kilowatt hour for the first 500 kilowatt hours and then if I exceed 500 kilowatt hours at any given month the cost per unit of electricity goes up to 9 cents. So this is what you would call an inclining block charge or an inclining tiered rate, and the motivation for that kind of rate structure is energy conservation. There's also declining rate structures where the cost of energy for the first block of electricity is higher and then there's a discount for larger users that kicks in after certain tier levels are met.

Time of use rates are described here. Meters not only have to record how much electricity you're using on a monthly basis, but they really record at what point in the day you're using the electricity. The rate structure here is that the cost of electricity changes depending on the hour of the day or the season of the year. So again, another important structure that we often see within utility rate structures that you should understand and document in part of your site characteristics.

Power factor is another charge we often see. Power factor is impacted by motors, lighting ballasts. That's again another charge that you might see on your bill. The definition of the power factor is really not important for this discussion, but it is a ratio of the real power to the apparent power and in large facilities that have a number of motors or a high number of lighting ballasts, the power that you receive appears to the utility to be less than they deliver. So where you have poor power factors you might see an additional charge on your utility bill.

[Slide 22]
I think it's worthwhile to give special mention to the on peak/off peak time of use rates in the context of photovoltaic systems because the energy generated in a PV system often times matches well with the load profile in the electrical grid. More energy is typically consumed during daytime hours when PV systems are also generating electricity. So if your site is on a time of use rate, your PV system may be generating electricity at a time when utility electricity is also high. So system economics will look a lot more favorable when it's properly considered instead of only using annual average costs of dollars per kilowatt hour in your analysis.

[Slide 23]
Once you've gathered all the energy bills and start to summarize in an Excel spreadsheet, the distillation of your bills may look like the table here. The bottom row shows in bold annual totals on energy and dollars spent as well as unit costs. As energy managers know, this important exercise is not only useful for renewable energy project viability but it's also used in benchmarking, tracking progress on energy reduction and conservation goals, and looking for energy leakage that may or may not actually be the result of leaks in terms of gas but where equipment maintenance or operation problems have resulted in non-optimal performance of building systems in energy consumption goes up. This exercise is not only useful for renewable energy screening as described here but for all energy management.

[Slide 24]
Okay, moving on to facility characteristics. Your site data package needs to not only include those energy characteristics that we already described but information on the facility to complete the picture for on-site renewable energy. First and foremost we need to understand whether the buildings are actually owned by the site, whether the site is leasing buildings or has leased them out to a sublet tenant.

This is an obvious go/no-go spot, so it really should be answered up front whether or not you're in control of the site where you want to install the project. It's also worth mentioning that sometimes the brown field sites that are often on some Federal facility sites may have little value to you currently. It might be seen as a detriment. Those can often be used for renewable energy installations. There are lots of places where photovoltaics have been installed over brown fields or landfills, so consider all real estate.

[Slide 25]
Next we'll move on to step two in the nine-step to a Federal renewable energy projects, and we'll talk about renewable energy studies.

[Slide 26]
The goal of the studies of course is to identify which renewable energy technologies fit the site's needs, and then to determine the technical and economic viability for the technologies. So although there are a number of different types of studies that might vary in complexity, cost, application, or usefulness, they all have these things in common. We need to understand

energy costs, energy needs. We need to know what site characteristics are germane to renewable energy. We need to know what the renewable energy resources are and what incentives are available in your region either through your state or through your utility.

[Slide 27]
Renewable energy project viability or economic viability depends on several factors, not just the renewable energy resources alone. As I mentioned in the previous slide, incentives are often deterministic in whether or not the project is going to pencil out in terms of financials. A couple slides later in the presentation we'll talk more about the incentives, but I just wanted to mention it again as one of the important influencing factors on project viability, so we've got local renewable resources, the incentives, and then of course your current costs for utility purchase power.

[Slide 28]
Step two within the Federal renewable energy project is your renewable energy studies, and the renewable energy studies can kind of be broken down into multiple levels: the preliminary screening, screening, and feasibility study. Preliminary screening can be done on site by the energy manager. It's really a reality check or a go/no go look at renewable energy technologies. The energy manager can use maps or rules of thumbs and easy to use online tools such as IMBY or RETScreen to really understand whether or not the technology makes sense for the site and whether or not it's worthwhile to request screening or feasibility studies from outside experts.

The outcomes shown in the outcome column in all the levels of studies include economic metrics abbreviated in the table as SIR, NPV, and LCOE. SIR stands for savings to investment ratio, and where the SIR is greater than one indicates that the savings for a project are greater than the costs and that the project is indeed a good financial investment. Net present value is abbreviated by the acronym NPV. Net present value is the sum of all the costs and savings that result from a project, so a net present value greater than $0 indicates that more money is saved than is spent if a renewable energy projects were to be implemented.

The LCOE is another common metric that we hear when we talk about renewable energy electrical generating systems. LCOE stands for the levelized cost of energy and has units of dollars per kilowatt hour for electrical systems, so the same units of purchased electricity. If the LCOE is less than your current and expected future costs of energy over the life of the system, then the project is considered a good investment.

So for the preliminary screening that might be done by the on-site energy manager, outcomes are often a simple go or no go, but some of the tools do provide possible savings to investment ratio, possible net present value, or possible LCOE, so we use a word like "possible" because as I said, these are a go/no go look and so the analysis predicts those metrics, but it doesn't predict them with a high level of accuracy. Preliminary screenings should always be followed up with studies by renewable energy experts. We have two tiers on renewable energy expert screenings, two renewable energy expert studies.

The first is a screening and while the next level is the feasibility study. Screenings are high level looks at utility use as well as the incentives available in a region. No site visit is typically used or is required for these kinds of visits. Sometimes the renewable energy screenings are done for one building or one site, but screenings can also be done for agencies on multiple sites at one time to help the agencies decide where to focus a higher level look or a feasibility study. Following a screening of multi-sites, like in the military, we might look at a number of Air Force bases throughout the country and identify that renewable energy looks very promising in a base in Dover, Delaware. Through that screening process, the expert would then be invited to the site to do a closer look, a more on-the-ground look at the facility to understand how energy is being used and how renewable energy can be integrated within the site of the building.

In both the screening and the feasibility study, calculations are done by hand or more sophisticated analysis tools, but it requires kind of an engineering understanding of not only energy terms but also the technologies. At this point, I'd like to introduce Otto VanGeet. He's a senior engineer at the National Renewable Energy Lab who is likely known to some of the participants in today's training due to his considerable work in the Federal sector consulting for and counseling many of the agencies on renewable energy. Otto, please take it away at the next slide and talk about the different levels of renewable energy studies in more detail.

[Slide 29]
Otto VanGeet: Thank you, Dan. I'll be talking about how to conduct the actual screenings in more detail. I'll start with the level one screening, which is the preliminary screening.

[Slide 30]
To conduct a level one preliminary screening, what I'll cover in the next few slides is NREL resource maps and then FEMP RE financial analysis maps. For the FEMP maps, the technologies will be for photovoltaics, solar hot water, and solar vent preheat. Some options for the analysis are electricity rates needed to produce a savings to investment ratio of one and systems cost to produce a SIR of one. Again, as Dan had mentioned, SIRs with greater than one show that a system is financially viable. At the bottom of the slide, you can see a link to where all these maps are located.

[Slide 31]
The NREL resource maps are shown on this slide. Again, the links to the map are at the bottom of this slide. The way to read these maps, for example the wind map shows by different colors the darker the color the better the wind resource. Looking at the wind map, you can see for example that the wind resources are better in the western part of the U.S. and in the great plain states.

[Slide 32]
The FEMP renewable financial analysis maps are shown on this slide. This map is for photovoltaic systems not considering incentives. As you can see, without incentives the savings to investment ratios are less than one in all portions of the country. The way this analysis is conducted and is noted at the bottom of the slide is it assumes a system cost of $7.00 per watt, a 40-year life, net present value factor of 23.15, that the PV is tilted at latitude – I'll talk some more about that later – and an average commercial electricity rate for 2006 by utility and state.

[Slide 33]

On the next slide, this is savings to investment ratios with incentives, and you can see that this map is significantly different. All of the green colored areas have positive savings to investment ratios, or again an investment ratio greater than one. It's dominated by the western U.S. states as you might guess: California, Oregon, Arizona, but there's also some surprises on this map. For example the incentives are very good in Michigan and New Jersey, so you can see they're dark green on this map, similar for Tennessee. As noted on the right hand part of this slide, the incentives are based on a database I'll talk about later called DSIRE in the March 2010 release of DSIRE and a 100-kilowatt PV system.

[Slide 34]
Analysis maps exist for solar hot water - in this case, competing with electricity. The first map here is savings to investment ratios without incentives, and again the same states, the states with good solar resources, California and others, show good savings to investment ratios, but some of the northeast states that have high electricity costs such as New Jersey and New York also show positive savings to investment ratios. In the case of solar hot water, as noted at the bottom of the slide, it assumes a system cost of $150.00 per square foot, a solar to thermal efficiency of 40 percent, and the same present worth factors, costs, and tilts.

[Slide 35]
With incentives, the map looks similar, but some states such as Oregon are now shown in green because they have good incentives for solar hot water.

[Slide 36]
There are several free great online assessment tools. I'll talk about one of them, and that's In My Backyard or IMBY. That's a tool that uses web-based software that estimates the electricity produced from photovoltaics and in some location wind arrays. There's a whole bunch of other free assessment tools. A great one that I won't be talking about is RETScreen. It's based out of Canada and covers many renewable and efficiency technologies. RETScreen also has training opportunities, and all the RETScreen information can be assessed by the website below. For a list of all kinds of tools, look at the NREL link at the bottom of this slide.

[Slide 37]
Some more detail for In My Backyard; it uses a Google Maps web interface. It estimates the PV size suitable for open areas, roof or ground, based on user drawn boundaries, and I'll show you an example. It's very easy to use. The PV system output is shown in kilowatt hours plus a simple payback. It also has a limited amount of wind sites available for approximately 30 states in the U.S. The link for In My Backyard is shown at the bottom of this slide.

[Slide 38]
This is the actual interface you'll use once you type in the address that comes up for In My Backyard. In this case, in the center of the Google Map, you can see a blue rectangle that we drew on this slide. This rectangle is representative of the area available for PV, and you can see it shows a good open area. What it assumes for doing its sizing is ten watts per square foot for the PV. The default ratings, and you can adjust all these, is a D rating of 80 percent. That's compared the DC rating to AC output. It also defaults to a latitude tilt. These are all adjustable in direction of 180 degrees, which is south. You can run it for specific years, but it defaults to the typical meteorological years. Once you've entered the rectangle and then you just hit step three, you click on the "run" button.

[Slide 39]
The outputs that IMBY creates are shown on the right hand portion of this slide and its estimated output production and simple payback. It does go to DSIRE and grab the incentives, the current incentives from DSIRE, and then you can play some "What if?" scenarios. For example, if you wanted to rerun the simulations, let's say we wanted to see if we tilted the panels at 10 degrees instead of 40 degrees what it does to the output, the system size, and the economics, you could do that.

If you wanted to play with the costs, dollars per watt, that's obviously a key portion of the economics. You could hit the "recalculate" button and come up with new outputs. On the very right hand side of the slide, it shows the actual outputs in kilowatt hours and the dollar value. In this case it defaulted to the site electric rate of 8 cents per kilowatt hour. Again you could adjust that, but it shows the output by month, the value by month, and then at the bottom, system output chart of the annual outputs.

[Slide 40]
Some level one considerations that you should look at for site. For putting renewables in open areas you need to determine the available open area. For ground mounted PV, or for wind turbines, or for ground source heat pump wells, or for central plant systems, the available area for bio mass, solar thermal, or possibility geothermal power. The diagram or the picture on the right hand side is a picture of solar thermal concentrating solar thermal system. For buildings, what you need to do is determine available area for rooftop PV, solar hot water. Those would be rooftop areas, or for solar vent preheat, the available south facing building area, and the same building areas for daylighting.

[Slide 41]
Wind turbines need to be above obstructions. The diagram at the bottom of the slide shows that there's a significant disturbance created by obstructions - about two times the height in front of an obstruction and about 20 times the height behind the obstruction. The reason is the very bottom of the wind turbine blades need to stay out of the turbulent zone created by the obstruction. Also important to note that we had talked about wind resource maps before, but wind is far more site specific than solar. For example, you could be in an excellent wind resource map location but in the bottom of a valley where the wind doesn't blow, and in the same location on top of a ridge could have an excellent resource.

Wind is more difficult to site than solar. When you get into large turbines, megawatt scale turbines, typically we'll see a met tower erected to determine the actual resources on the site. These met studies are usually a year or more so that you can cover wind for all four seasons, and this is important just because the wind does vary significantly as I discussed site-by-site even if it looks good on a map. Again for smaller wind installations simply go without installing a met tower.

[Slide 42]
The next technology I'd like to discuss is solar ventilation preheat. What solar vent preheat is, as can be seen by the diagram on the bottom right hand portion of the slide, is perforated dark colored metal surface that the air is drawn through. As the sun hits that surface, it preheats the air and then is sent to the building ventilation system. What you're doing is preheating the ventilation air. This needs to go on a south wall with good solar exposures. The upper pictures on this slide are the new NREL research support facility. It has PV on the roof as you can see by the middle diagram, and then solar vent preheat on the south-facing portion of the building to preheat the ventilation air for the building.

The dark colored aesthetic fits well with many shops, warehouses, rec centers, lab buildings, any buildings that have a high ventilation load as well as office buildings as the NREL RSF example shows. Very, very low operation and maintenance costs since it's simply a sheet of perforated metal. We have some of these systems that are over 25 years old and have required no maintenance.

It's easier to install if you plan the ventilation intakes close to the south wall when you're building the building, or better yet to install it as part of the building as the RSF example shows. The flow rate varies. You'd use RETScreen to determine this, but the flow rate is nominal, about 4 CFM per square foot, but that can range to up to about 10 CFM per square foot. Again because the simple technology it has a very good payback. It also has very good conversion efficiency - up to 80 percent.

[Slide 43]
Next slide will be considerations for rooftop, PV, and solar hot water. The most important consideration is an open, unobstructed, un-shaded view to the southern sky. The next most important portion is a good roof, a roof that won't need to be touched for many years, so part of the screening process is to determine how old the roof is and the condition of the roof and the warranty of the roof. Ideally you'd like to install these systems with a new roof, but an existing roof that's in good condition is certainly viable. As the third bullet shows, PV is particularly sensitive to shading.

That's by the physics, the way a PV system works, but even a small amount of shading can shut down a significant portion of the PV array. Solar hot water is not as sensitive to that. To determine this, you want to look for shading from HVAC equipment, parapets, adjacent buildings, etc. Again, as I mentioned before, typical rule of thumb for PV systems is 8-10 watts per square foot of available area.

[Slide 44]
I'm going to shift gears here a little bit and talk about daylighting. Daylighting is a very key strategy for all building types. Daylighting can be incorporated into almost all building types. It's best to consider this in the initial design of a building. The way we would do that is to orient the building ideally with the long axis facing south, or said another way, with the long axis running east to west. This makes the daylighting easier. It's also very cost effective for existing buildings, especially warehouses or industrial buildings that can be top lit. If it's a single story building, it's very easy to install skylights. The picture on the right hand side is one of the NREL labs. It happens to be the SNTF, and it has both north and south facing daylighting high in the vertical side walls. With daylighting, it's very important to include lighting controls, and that would be both lighting sensors and controls to turn the lights down or off when the natural daylight allows that. Again, daylighting can be done by roof mounted options such as skylights or solar tubes, windows on the vertical plain, or translucent wall panels either on the vertical or horizontal plains.

[Slide 45]
Some practical considerations when you're doing level one screening. Per unit of energy, electricity is a considerably more expensive heating source than fuels such as natural gas, so that's why in the maps when we were comparing solar hot water, we compared it to electricity. Per unit of energy, propane is considerably more expensive than natural gas, so again knowing through the preliminary screening what your utility is, is important. If electricity or propane is used for space heating or water heating, solar vent preheat and solar hot water payback is much faster.

Economies of scale do matter. Larger systems of all types, solar hot water, solar vent preheat, PV, do cost less than small systems. For example, buildings with higher solar hot water usage have improved paybacks for solar hot water, and small systems may not be cost effective. The reason for that is the infrastructure required. The pumps and storage tanks and controls are the same for small and large systems in the case of solar hot water, similar for invertors, wiring, etc. for PV.

Think of installing our renewable energy, replacing equipment, remodeling or planning new construction and major building upgrades also. EISA 2007 requires 30 percent of water heating to be by solar hot water. When you're doing these upgrades, the incremental cost of adding renewables may be far less than replacing the equipment outright. An important consideration is the last bullet there; operation and maintenance costs do need to be considered when you're looking at the economics of all types of renewables.

[Slide 46]
I'm going to change gears a little bit and talk about financial incentives, and again I'd mentioned those in some of the previous resource maps, but what these next slides will talk about is where to determine these incentives and the impact of these incentives.

[Slide 47]
This first example is a list of states leading in solar energy development. You can see by the charts on the right for all types of solar energy, California is by far the leader and that's because they have a good solar resource and, more importantly, good incentives. The amount of PV and CSP, or concentrating solar power, is greater in California than in the rest of the country combined, but some interesting things happen. For example, the next largest installation of PV is in New Jersey, which has, comparatively speaking, lower solar resources but has much more solar installed than some of the sunny states such as New Mexico, which doesn't make the top ten list. Colorado is a nice combination of decent solar resources and decent incentives, and you can see the pattern continues as you go down that list.

[Slide 48]
This slide is a map of the U.S. solar resources, and again it's to build on the previous slide. As you would expect, the solar resource is best in the desert southwest states: California, Nevada, Arizona, New Mexico, but as the previous slide showed states that have good incentives such as New Jersey can be very viable. If you can incorporate the resources, the economics can be quite good for renewables.

[Slide 49]
The best location for determining the current financial incentives is the Database for State Incentives for Renewables and Efficiency or DSIRE for short. The website is shown there, dsireusa.org. This is constantly updated, so every time you do a screening, make sure you look at the current incentives. The incentives are broken down into all types: Federal, state, local, and utility. They include all kinds of things, such as all kinds of taxes, corporate, personal, state, sales, and property taxes, grant programs, industrial recruitment incentives, leasing, lease purchase programs, loan programs, production incentives, rebate programs, and sales of renewable energy certificates, or REC's for short.

[Slide 50]
Some considerations for facilities and facility characteristics, existing versus planned sites. For existing sites, consider the present cost of the energy and future project costs. For planned sites, consider the cost to add power, extend the grid, add utilities, etc. There are some nice case examples where it's cheaper to install renewables than to install significant infrastructure for buildings. The same kind of thing can be said for off-grid sites.

In the case of off-grid sites, what you're doing is comparing the cost of extending the grid, be it electrical or thermal, to the site, and then also be sure to consider the cost of transporting the fuels, like diesel, fuel to the site, and security and environmental safety risks. If you can mitigate some of those risks and monetize that mitigation, the economics of renewables may be very good. There are some great examples of that in several national parks where large renewable systems are installed and are very cost effective.

[Slide 51]
I'm going to talk about the next level of screening, which we're calling level two screening.

[Slide 52]
Level two screening identifies dead ends and potential opportunities. The difference from level one screening, it's typically conducted by a renewable energy expert. That expert would use complex calculations and tools, such as software tools, to identify likeliest opportunities. It usually doesn't involve a site visit, though it could, and then the results can be used for further screening or used in RFPs, budgeting, and engineering studies.

[Slide 53]
This slide discovers finding technical support options. A great site for that is the FEMP website. A cut of that site is shown on the right hand side and the link is shown at the bottom option of this slide. Also from FEMP you can get to GSA blanket purchase agreements and I'll talk about that some more, and you can also work with renewable energy vendors, consultants, and some utility providers.

[Slide 54]
This slide is talking in some more detail about level three feasibility studies.

[Slide 55]
Feasibility studies are conducted for sites after screening reveals a high potential. Level three feasibility studies involve experts who conduct detailed technical or economic studies, including environmental and other constraints for each opportunity that was earlier identified. It usually requires a site visit to see the actual conditions at the site, and the result of this would be recommendations of technologies and project financing mechanisms to pursue.

[Slide 56]
Another place to find technical support is again through FEMP. They have limited funding and occasional calls for projects. There's also the GSA option, which I'll discuss in some more detail, vendors and utilities, and then National Labs as shown on the right hand side of this slide can be engaged through work for others agreements.

[Slide 57]
This slide discusses blanket purchase agreements, GSA's, comprehensive professional energy services. The BPA program maintains a list of pre-qualified providers who can assist Federal agencies with renewable energy screening and assessment. You can access these vendors with a credit card for $3,000.00 or less. They will provide guarantees to have capabilities and rates suitable for screening and other work. For more information, see the links at the bottom of this slide.

[Slide 58]
At this point, I'm going to turn the presentation back over to Dan. Dan's going to summarize what happens in the future steps 3-9.

[Slide 59]
Dan Olis: Okay, Otto. Thank you very much. To recap today, we talked in detail about the planning steps, steps one and two of the nine steps of the Federal renewable energy project. Implementation steps 3-9 will be discussed in later training, so check back often with FEMP for those training offers. All nine steps are provided at the link below shown at the bottom of the slide.

[Slide 60]
In conclusion, it has never been easier to learn about renewable energy and perform preliminary screenings. I encourage you all to jump in, ask questions, and become informed, and become an on-site expert for your facility. With an onsite expert and a champion, renewable energy projects can happen at your site. Use the link at the bottom of the page to learn more about all the resources FEMP has to offer and to develop yourself as a renewable energy expert.

[Slide 61]
I'd like to close with a couple slides on resources and additional information.

[Slide 62]
There's a recently published guide that's developed specifically for solar renewable energy. It's developed for building energy and project decision makers and it has solar specific guidance that describes the process from planning to execution. Access that guide through the link shown here.

[Slide 63]
Here are the links to a number of important resources available to you.

I would like to thank you all for your participation today and to thank the Federal Energy Management Program for sponsoring today's webinar.

[End of Audio]