2010

Integrating Energy Efficiency and Renewables in Rocky Mountain National Park

Rocky Mountain National Park

Colorado State University

Prepared by:

Institute *for the* Built Environment
&
Warner College of Natural Resources

Colorado State University

With support from:

Cooperative Agreement No: H1200090004 (IMR)

Task Agreement No: J1524090057 and J1526105082

Contents

[Page left intentionally blank]

Background and Overview

Executive Summary

Executive Orders 13423 (2007) and 13514 (2009) changed the federal government's energy policy by mandating that federal agencies "strengthen their environmental, energy, and transportation management" and prioritize "reduction in greenhouse gas emissions." To fulfill these goals, Rocky Mountain National Park (ROMO) initiated a project to assess and rehabilitate energy use in park buildings in an ecologically and culturally sensitive manner. *Rehabilitation* addresses energy efficiency measures and renewable energy applications. For this unique project, ROMO formed a partnership with Colorado State University (CSU). The CSU team included faculty and students from the College of Natural Resources, staff from the Institute for the Built Environment, and students from Construction Management and from CSU's Live Green Team. In the first phase of the project, park staff worked with the CSU team to research energy efficiency and renewable energy options at ten sites identified in the park. The results of this research were compiled into ten site-specific binders, which will guide the park as they rehabilitate sites across the park.

In the second phase of the project, the CSU and ROMO team organized and held an interdisciplinary design charrette, incorporating members of varied sustainable industries, representatives from across ROMO, and CSU faculty, staff and students. The principal goal of the charrette was to inform the development of an Implementation Guide for improving energy efficiency and renewable energy technologies within the context of the National Park System, while taking into consideration historic assets, natural resources, and visitor experience.

Recommendations and feedback collected during the charrette were compiled into a final report. Information from the charrette report was analyzed, reviewed, and combined with the CSU team's previous research to create the following Implementation Guide. The purpose of this guide is to provide ROMO with a clear, comprehensive process guide for improving energy efficiency and renewable energy in park facilities. In addition, this guide may be useful to other parks as they seek to fulfill the energy efficiency mandates of Executive Orders 13423 and 13514.

Acknowledgements

This report was developed for the Rocky Mountain National Park. Funding for this study was provided by Rocky Mountain National Park and a Technical Assistance Project Mini-Proposal Grant.

Principal Investigators

Gillian Bowser, Ph.D., Assistant Dean College of Natural Resources
Josie Plaut M.S., Director of Projects, Institute for the Built Environment

Graduate Research Assistants

Kate Cleary, Masters Candidate, Department of Fish Wildlife and Conservation Biology
Debra Domres, Masters Candidate, Department of Construction Management

Work Study Students

Adam Jorck, Doogie Mead, Ramsey Sullivan

Rocky Mountain National Park Staff

William Thompson, Chief of Facilities Management
Kevin Soviak, Agreements Technical Representative
Tom O'Neil, Buildings and Utilities Supervisor
Joe Arnold, Park Engineer
Jeff Connor, Natural Resource Management Specialist
Sterling Holdorf, Historic Preservation Project Manager
Karen Waddell, Cultural Resource Specialist
Cheri Yost, Park Ranger
Steve LeBeau, Park Electrician

A special thanks to Nolan Doesken and Wendy Ryan from Atmospheric Science for their generous assistance with the weather station.

Charrette Participants

We wish to thank all of the charrette participants for their time and commitment to sustainability. We would like to recognize our hosts at Sylvan Dale Guest Ranch, in Loveland, Colorado for providing beautiful accommodations and down home hospitality.

Participants:
Amy Cook, Andrew Michler, Barrett Ramey, Ben Bobowski, Ben Hawkins, Bill Franzen, Bill Thompson, Bryce Lloyd, Cheri Yost, Chris Koziol, Erin Epperson, Danny Basch, Deb Domres, Leo Whiteley, Gillian Bowser, Glen Girard, James Trujillo, Jason Tanner, Jeff Conner, Jeff Medanich, Jim Cheatham, Joanne Sender, Joe Arnold, John Hannon, John Sellers, John Walker, Josie Plaut, Justin Retzlaff, Karen Waddell, Kate Cleary, Kathy Brown, Kevin Soviak, Larry Gamble, Margaret McRoberts, Margaret Rogers, Mark Baudino, Mark Benjamin, Michael Payne, Mike Singleton, Paul Mischo, Peter Watson, Philip Freedman, Rainey Kreis, Ramsey Sullivan, Stacey Baumgarn, Sterling Holdorf, Steve LeBeau, Steve Steinbicker, Tom O'Neill and Wendy Ryan.

Background and Overview

History and Background

The mission of the National Park Service is to "conserve the scenery and the natural and historic objects and the wildlife of the national parks, by such means as will leave them unimpaired for the enjoyment of future generations." To fulfill this mission, parks must be at the forefront implementing, innovative strategies for climate-friendly energy systems.

In response to this mission, Rocky Mountain National Park (ROMO) formed a partnership with Colorado State University (CSU). A team of multidisciplinary students and professionals helped the park assess procedures and opportunities for buildings to become models of culturally and ecologically sensitive solutions for energy efficiency and renewable energy. The student teams, in cooperation with park staff, began working in September 2009 to identify and collect essential structural and ecological background data at 10 sites and for 52 buildings. Data was organized into a comprehensive project profile for each site. The purpose of the project profiles is twofold: 1) to serve as a resource to park staff who will be managing improvements to sites and structures; 2) to serve as a guide and source of basic information for charrette participants. An interdisciplinary charrette, incorporating members of the renewable energy industry along with representatives from ROMO and CSU was held in February 2010. The goal of the charrette was to generate information to create an Implementation Guide for use on projects in the park that are seeking to improve energy efficiency and/or utilize renewable energy technologies. The charrette results were incorporated into this guide and supplemented by park staff and the CSU research team. The Implementation Guide will serve as a tool for park project managers as they move toward energy efficiency upgrades during the implementation of renewable energy projects.

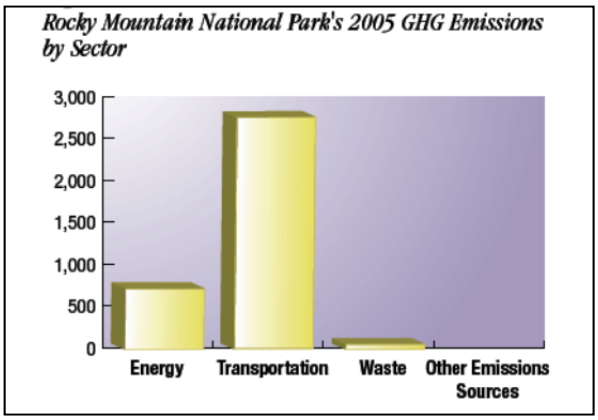
Each energy efficiency upgrade and renewable energy project will be evaluated according to the following criteria: benefits, percent savings, life cycle costs (including operations and maintenance), and impact on historical structures and districts, natural resources, and visitor use. The Implementation Guide will help facility staff determine the feasibility and benefits of specific installations and upgrades on buildings throughout the park. According to the National Park Service's target minimum goals, building renovations and improvements should increase energy efficiency by 20% by the years mandated in Executive Orders 13423 and 13514 **(General References 1)**.

Information Gathering

Preliminary scoping

Over the past decade, ROMO has taken the initiative to reduce their carbon footprint. In 2005, ROMO hosted a Climate Friendly Parks conference and boosted their efforts to provide recycling opportunities to park visitors and employees. Additionally, they have made efforts to reduce their energy, gas, and water usage by installing energy efficient lighting, tankless (on demand) hot water heaters, and by improving their structural envelopes with energy efficient windows and doors.

Background and Overview



The graph at the left from the 2005 Climate Friendly Parks report. It clearly illustrates the makeup of the park's carbon footprint; transportation is by far the largest contributor, and energy is second, with waste and other emissions being lowest. The energy category is primarily associated with building operations and includes heating, lighting, computers, etc. The information in this graph alerted ROMO officials to the need for introducing comprehensive energy efficiency efforts and/or renewable energy systems to their facilities.

In 2008, the park identified the greatest challenge to improving energy performance was collecting and organizing the information necessary to gain compliance for building and site improvements. Compliance hurdles include preserving the historic and cultural value of existing facilities, potential impacts to surrounding natural resources and sensitive habitat areas, visitor experience perceptions, and concerns from adjacent communities. To address the complex challenges of making energy upgrades in the park, ROMO Facility Management staff determined that a decision model was needed to assure all relevant information was considered on each targeted project thorough out the park.

The park's decision to initiate the Implementation Guide project was also motivated by recent Executive Orders 13423 and 13514 **(General References 1)**, which mandate energy efficiency in the Park Service. In the fall of 2009, ROMO contacted Colorado State University (CSU) and began this project by establishing a Cooperative Ecosystems Studies Unit (CESU) agreement with CSU.

Team assembly

Two principal investigators, from CSU Warner College of Natural Resources (Gillian Boswer) and Institute for the Built Environment (Josie Plaut) engaged two graduate students, Kate Cleary and Deb Domres, to complete the project. These team members brought expertise in natural resource planning, conservation, green building, energy efficiency and renewable energy. Although the project is based out of CSU, all work was coordinated with key contacts in the park (Kevin Soviak and Bill Thompson). Additionally, the team drew on outside expertise from a variety of industry professionals, and also tapped into the creativity and energy of undergraduate students in CSU's Live Green community.

Data collection and research

From September 2009 to February 2010, the CSU team gathered and synthesized information regarding the current condition of ten preselected building sites within the park. In four different areas of the park, the team identified 10 sites and 52 buildings within those sites for evaluation.

Buildings within the sites were grouped according to location and utility hookups. CSU faculty and students, guided by ROMO staff, made five visits to the sites to gather relevant information on visitor use and facilities, and to inventory cultural and natural resources. The data gathering trips were led by the two graduate students on the team and included 17 undergraduate students from the Live Green community. The data gathering trips served the dual purpose of supplying more creative and unique input into the project while providing undergraduate students with an opportunity gain exposure to the National Park Service.

Additionally, the graduate student team conducted background research on relevant issues using a variety of sources and met with park staff to obtain recommendations and perspectives for respective subject areas. All of the information collected on the five site visits and through the research process was used to create assessments for each site. Assessments included visitor use, facilities information, utilities, cultural resources, and natural resources at each site. From the assessments, the team developed a preliminary list of concerns and recommendations for energy efficiency, renewable energy, natural resources, cultural and historic preservation and visitor use. The assessments were compiled into four user-friendly "profile" binders, including sections for each of the 10 sites. Each binder includes an executive summary, area maps, information regarding visitor use, facilities, utilities data, cultural and natural resources, photographs, and references. The purpose of these binders was threefold: 1) to serve as a reference during the interdisciplinary charrette 2) to serve as a starting reference for facility staff when planning work on one of the sites and 3) as a template for other sites in the park.

Charrette

On February 11, 2010 at Sylvan Dale Guest Ranch in Loveland, Colorado, 47 participants comprised of industry professionals, Rocky Mountain National Park staff, and CSU faculty and students participated in an interdisciplinary charrette. The goal of the charrette was to gain a diversity of perspectives and recommendations from subject matter experts on the range of opportunities and concerns regarding energy efficiency and renewable energy installations at the park. The charrette results were used to inform the development of this guide.

After introductions and a dichotomous key exercise, participants were divided into six teams focusing on six themes: facilities, natural resources, historic preservation, energy efficiency, renewable energy, and visitor experience. From the perspective of each discipline, participants brainstormed issues, processes, resources and options related to the implementation of energy efficiency and renewable technologies. During the afternoon session, participants were reassigned to groups based on the ten selected sites within the park. The reassignment of participants enabled team members to disseminate information from the morning session and apply ideas to specific sites. Finally, participants reflected on what they had learned during the Charrette and completed "closing thoughts" cards to provide the team with overall feedback and suggestions for next steps.

Information synthesis

After the charrette, the team synthesized the information that was gathered in the breakout sessions and created a charrette report. The report was reviewed by key staff at ROMO and their comments and suggestions were incorporated into the charrette report. The final report was distributed to charrette participants and additional park staff who were not able to participate in the charrette. The information in the charrette report represents the ideas and guidance of 47 experienced professionals in diverse fields and provided the foundation of the content for the Implementation Guide. Site specific recommendations from the charrette were also incorporated into the project binders so that ROMO Facility Managers will have easy access to the charrette results for each site.

As mentioned above, the primary goal of the Implementation Guide is to aid ROMO Facility Managers through the process of selecting the most appropriate buildings, technologies, and partners for energy efficiency and renewable energy upgrades with the overall goal of reducing the carbon footprint of the park. A secondary goal of this guide is that it be applicable to any unit in the National Park Service as they work toward meeting goals outlined in Executive Orders 13423 and 13514. With this goal in mind, the Implementation Guide uses languages and references that will be useful to all parks, but also contains specific references to issues/resources at ROMO.

Energy Audit

A comprehensive energy audit is the first step in the process of determining which buildings in a park should be prioritized for energy efficiency and renewables projects. An energy audit can be completed in one of two ways: either a park employee or department can apply for an energy audit through the normal project proposal procedure, or an energy audit can be mandated by the Washington office of the National Park Service (WASO). In the case of ROMO and this project, the energy audit has been mandated by the WASO office and an audit was planned for the summer of 2010. The audit will not be comprehensive, so it does not include a thorough examination of each building for specific inefficiencies. Rather, the audit will be an analysis of which buildings in the park have the highest cost per square foot on an annual basis and will include site visit to assess visible inefficiencies and readily available improvements. Results of this audit may be obtained in the future from the Facility Management offices at ROMO.

How to Use this Guide

This guide is designed to walk through the necessary steps for identifying, assessing, and preparing for successful energy-saving projects while remaining in compliance with all National Park Service (NPS) building regulations, historic properties regulations, and natural resource and visitor experience considerations. The steps in this guide will aid in the completion of the Project Management and Implementation (PMIS) form, which is the form used by the NPS to manage information about requests for project funding. The guide is divided into three parts: 1) project assessment, 2) processes for the six areas of consideration and 3) project completion and documentation.

1. Project Assessment: In this worksheet you will conduct a general scoping of your project site. You will determine the major opportunities and limitations represented by a given site. Considerations include condition of current facilities, energy use and opportunities for improvements, potential for renewables, historic status, natural resources concerns, and visitor use and experience.

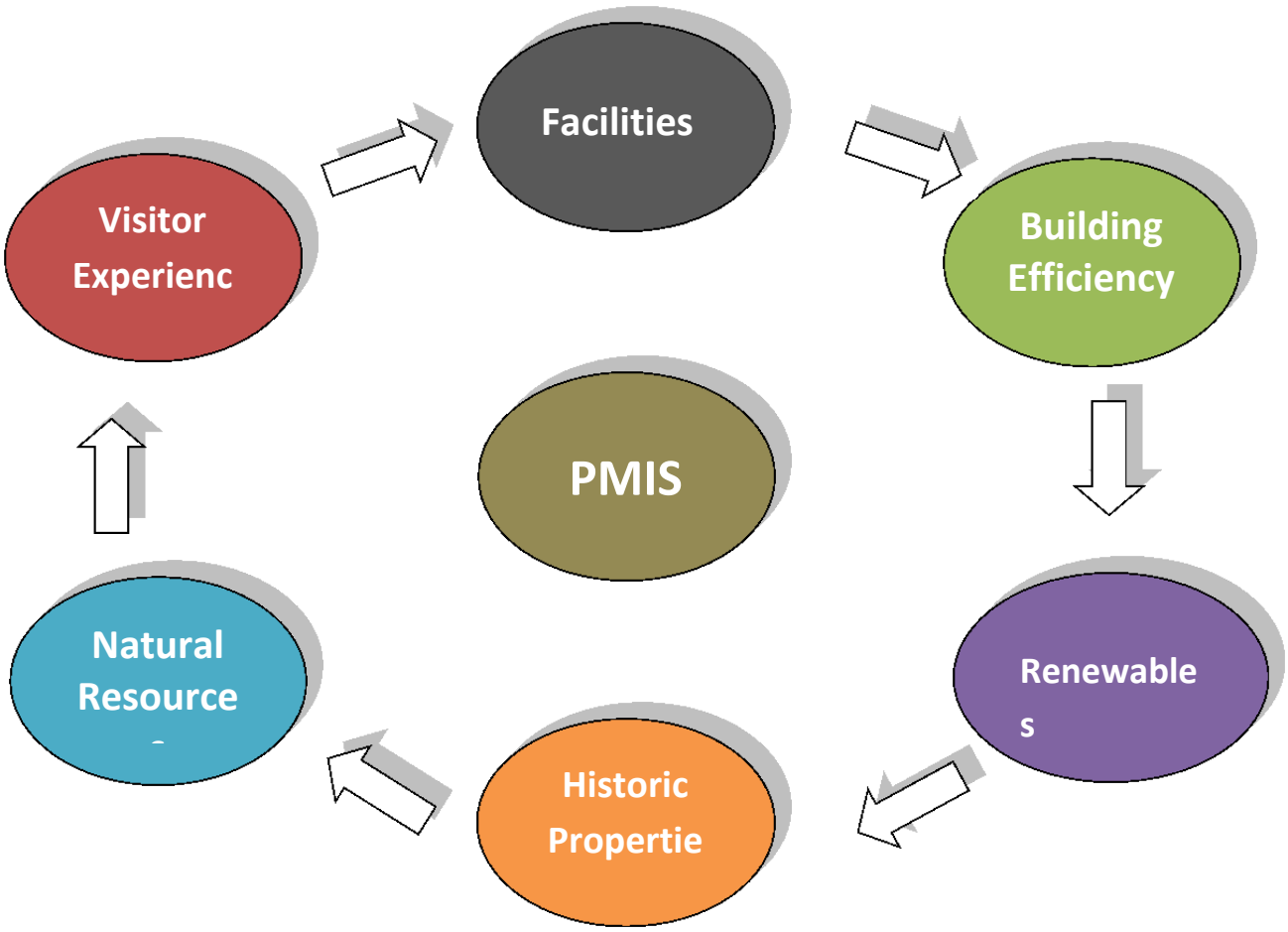
2. A section for each of the six processes: Facilities, Building Efficiency, Renewables, Historic Properties, Natural Resources, and Visitor Experience. In these sections you will follow a step-by-step procedure to ensure that your proposed energy efficiency or renewables installations make maximum use of the conditions at your site, and are within compliance. ROMO has an established process for proposing projects, ensuring compliance with regulations and policies, and for obtaining project approval. Except for minor energy-saving projects at ROMO, a Project Proposal & Clearance Form and accompanying support documentation must be submitted to the park Management Team.

3. Project Completion and Documentation: In this section you will assess the results of your project. In the accompanying "Evaluation and Lessons Learned" worksheet you will have an opportunity to reflect on challenges and opportunities during the project, and to provide recommendations for improving this guide.

Important note: *This document is intended to be modified over time and informed by experience. Please check with your office to determine who is making updates to the document and make recommendations based on your experiences using the document in the field.*

Process Overview Diagram

This diagram shows that the process for determining building energy efficiency and renewable energy opportunities is an iterative process beginning at Facilities and moving through the other areas. A Facility Manager may need to go around the wheal a couple of times during assessment and information gathering. The goal is to make informed decisions and complete the Project Management and Implementation (PMIS) form.



Project Assessment Worksheet

Conduct a general project assessment by asking the following questions. Each question addresses the initial assessment considerations for the processes described in the Process Overview Diagram. Use the six process sections in this guide to help complete these questions. When you have completed this worksheet, you will begin a more thorough evaluation for specific site conditions.

❒ Facilities: Collect and assess general utilities data for the proposed project site.

❒ Building Efficiency: What are the likely energy efficiency opportunities?

❒ Renewables: What are the likely renewable energy possibilities?

Project Assessment Worksheet

- ❒ Historic Properties: Is the building eligible, listed, or in a designated historic district or landscape?

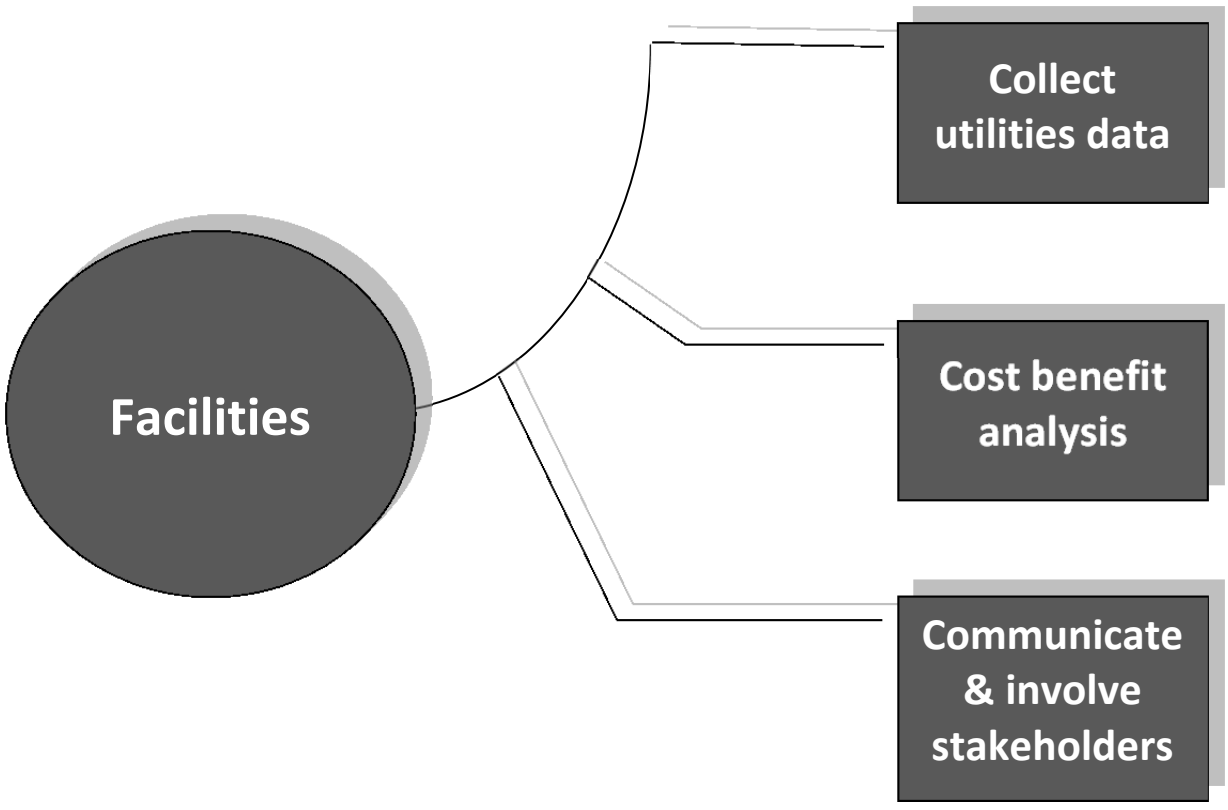
- ❒ Natural Resources: What are the natural resources considerations?

- ❒ Visitor Experience: Are there visitor experience considerations?

- ❒ Outline preliminary opportunities and challenges for the project based on the above considerations:

Process 1: Facilities

This process deals with aspects of the project which are usually the responsibility of Facility Management. It involves collecting utilities data related to your project site, and determining where there are clear opportunities for reducing energy use.



Process 1: Facilities

Facilities Checklist

❒ Collect and Assess Utilities Data

- ❒ Determine if an energy audit has been conducted. If so, review energy audit information and recommendations.
- ❒ Collect building utility data, if not already provided in the energy audit. ROMO is currently developing a Climate Leadership in Parks (CLIP) tool that will guide in inventory and action planning for greenhouse gas emissions. If outside ROMO, determine if the site is already in FMSS (facility management software system). If unsure seek FMSS Coordinator in your park, network or region for assistance **(1, 2).**

  When collecting utility data, consider the following:

  - Determine building metering (shared or individual), in an effort to determine total building energy use
  - Assess usefulness of metering data

- ❒ Develop an annual energy consumption report including relevant utility costs, kWh per year, therms per year, propane use, gallons of water per year, etc. for future cost benefit analysis.

- ❒ **If an energy audit has not been done**, assess electrical, plumbing, and insulation of buildings. Conduct an assessment by reviewing **Process 2: Building Efficiency, High Yield/Low Cost**.

❒ Cost Benefit Analysis

A cost benefit analysis is used to analyze and evaluate potential solutions to meet the park's needs. Cost benefit analysis requires:

- ❒ Analysis of the existing conditions & options
  - Identifying the range of feasible options
    - Look for balance between energy goals, natural resources, historic preservation and visitor experience
    - Remember to include leaving things as they are as an option
  - Describe the proposed system and its alternatives
  - Identify payback and upfront costs including maintenance for feasible options

- Seek to Identify and understand the impacts of each option (see **Simple Cost Analysis Worksheet**)
- Compare the options and identify the best option(s) by weighing the costs and benefits (see **Costs and Benefits Prioritization Worksheet**)

❒ Depending on the scope and complexity of your project, you will want to complete a more thorough cost benefit analysis. Below is a list of additional considerations and tools that will help with detailed cost benefit analysis.

- Factors to consider
  - Building lifespan
  - Cost of operation vs. building value?
  - Lifespan o f proposed equipment and major renovation
  - Will the new product require additional maintenance training requirements?
  - Will a service contract will be necessary to operate and/or maintain the improvement?
  - How will inflation impact your project?
  - Are there additional tangible and intangible benefits to a proposed project (i.e. educational, improved visitor perception, etc.)?
- What are the embodied energy and other environmental considerations the proposed materials?
  - Consider energy, pollution and human health impacts of materials extraction, manufacturing process and transportation.
  - Can you determine the labor conditions of the people who are involved in the extraction and manufacturing process?
  - What are the energy, pollution and human health impacts from construction and demolition?
  - Consult BEES3.0.d 2002 (Building for Environmental and Economic Sustainability) tool. This tool applies an LCA (Life Cycle Cost) approach of building products following ISO (International Organization for Standardization) 1440 series of standards. BEES measures economic performance using ASTM (American Standard for Testing and Materials life cycle cost. **(6)**
- Determine if detailed Life Cycle Costing can be done in-house
  - See the Building Life Cycle Cost program (BLCC5 software) for guidelines on how to compute the life cycle costs of an initial investment in a building **(3).**
  - You may also use the NPS "Total Cost of Facility Ownership Tool" once it is made available **(4).**
  - The International Masonry Institute has a detailed spreadsheet that assists with detailed cost benefit analysis. **(5).**

- If unable to complete in-house, contact the Facility Manager in the appropriate NPS regional office (2)

❒ Communicate with and involve stakeholders

- ❒ Create list of potential stakeholders including SHPO, in house staff (ROMO), industry leaders and other agencies. Depending on the project this could include organizations such as National Renewable Energy Lab (NREL), Department of Energy (DOE), U.S. Forest Service (USFS), local and national Universities and local utility companies. The list of potential partners and stakeholders should be included as part of the documentation that accompanies the Project Proposal & Clearance Form.
- ❒ During the review of the Project Proposal, the management team will determine if public notice is required for the project. If public notice is required, consult with the Public Information Officer and review the park's public communication standard operating procedures to determine the appropriate method of communication with each stakeholder.
- ❒ During the review of the Project Proposal, the Management Team will determine the appropriate National Environmental Policy Act (NEPA) pathway. The three options include Categorically Excluded from NEPA (Cat Ex), Environmental Assessment (EA), or Environmental Impact Statement (EIS). A public comment period is required for Environmental Assessments and Environmental Impact Statements. A public notice may or may not be required for projects that are Categorically Excluded from NEPA.
    - Projects which require a public comment period, all EAs and all EISs are posted on the NPS Planning, Environment and Public Comment (PEPC) website **(7)**.
- ❒ Consider if there are any internal and/or external educational opportunities and follow up accordingly.

Facilities annotated resource list

(1) Climate Leadership in Parks tool

The Climate Leadership in Parks (CLIP) Tool is a Microsoft Excel-based application and is associated with Climate Friendly Parks. The Emission Inventory Module is designed to help park staff estimate (or inventory) the emissions resulting from activities occurring within the park. The Action Planning Module is designed to help park staff identify actions to reduce emissions of greenhouse gases and. If your park is interested in using these tools to develop an emissions inventory and action plan, please contact CLIPTool@icfi.com.

(2) Regional NPS Office

This is a site on the NPS intranet (accessible only on NPS computers). On this page you can find contact information for the Regional FMSS coordinator and Regional Facility Manager for your region, and find out how to make a technical assistance request for your project.
http://inside.nps.gov/regions/orglist.cfm

(3) DOE – Building Life Cycle Cost Programs (BLCC5) software

This site provides free of charge the Windows based software BLCCS5. It is a program developed for comparing alternate designs that have higher initial costs but lower operating costs over the life of a building. This program calculates life cycle costs, net savings, savings to investment ratio, internal rate of return and payback period.
www1.eere.energy.gov/femp/information/download_blcc.html OR www.doe2.com

(4) Total Cost of Facility Ownership

The Total Cost Ownership Tool was still in development at the Washington level at the time of publication for this document. Check to determine if this tool is available for your project.

(5) International Masonry Institute

This site contains information on how to calculate life cycle cost of energy upgrades/other technologies. The calculations are detailed and should be used for projects with a significant scope.
www.imiweb.org

(6)BEES Manual and Software

This site and program was developed by the National Institute of Standards and Technology (NIST) in conjunction with the EPA Environmentally Preferable Purchasing Program. Software and manual may be downloaded free of charge from:
www.bfrl.nist.gov/oae/software/bees/html

(7) Planning, Environment and Public Comment (PEPC)

This site provides access to current plans, environmental impact analyses, and related documents on public review. Users of the site can submit comments for documents available for public review. http://parkplanning.nps.gov

Project Assessment Tools

Simple Cost Analysis Worksheet

Option	First Cost	Savings/year	Frequency of Maintenance	Other Considerations
1. Leave things as they are	$0	$0 0 kWh 0 BTUs		
2.				
3.				
4.				

Project Assessment Tools

Costs and Benefits Prioritization Worksheet Instructions

Before beginning this worksheet, you need to have some information about your building: you should know the kW/hrs, BTUs, Therms, and/or gallons of propane, plus gallons of water that the building consumes in a year. You also need to be able to estimate the projected cost of your energy efficiency project. This worksheet will help you to use this information to figure out where your project lies along the cost/benefit continuum. The 20% threshold corresponds to the 20% energy efficiency increase mandated in Executive Orders 13423 and 13514.

This is a useful decision-making tool, but should be used in conjunction with other considerations. For example, suppose that you have determined that a building needs weather stripping and caulking. This project may not be quantifiable as a percent energy savings, but it does not mean that the project should not be done; weatherization is a simple, energy-saving modification that has known benefit and has a low impact on the building and on surrounding resources (see **Process 2: High Yield / Low Cost** for more examples) . Similarly, projects that have an anticipated energy reduction of less than 20% should still be considered, especially when they are low cost and simple implement. Such projects will still contribute to overall energy savings.

To figure out where your project lies along the y axis, you need to calculate the % energy reduction yielded by your proposed project. One way to calculate the percent energy reduction is to calculate the building's total carbon footprint. Follow this link to an online carbon footprint calculator for buildings:

www.carbonfootprint.com/calculator.aspx

Using the calculator, follow these three easy steps:

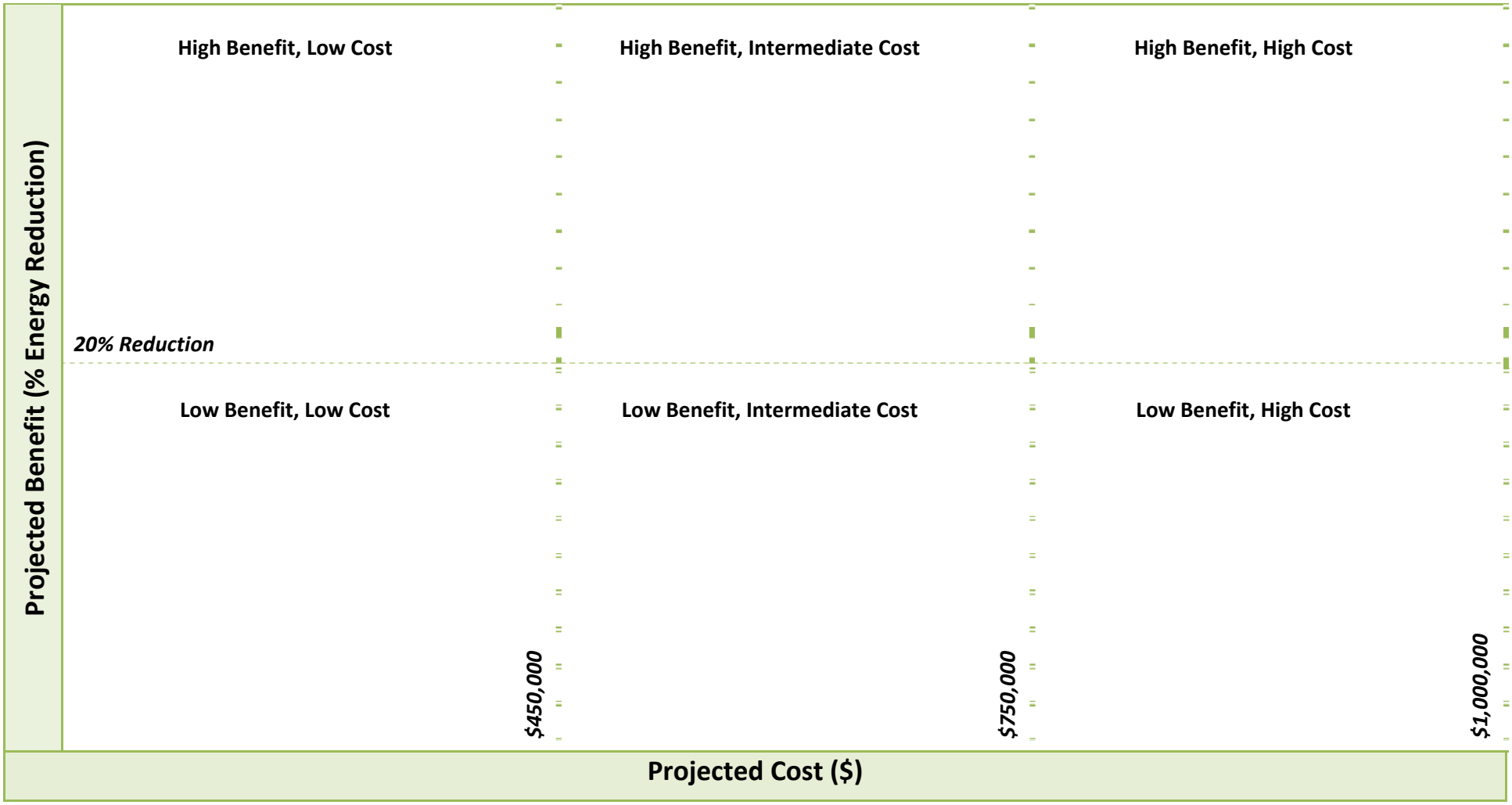
1. Plug in your kW/hrs, BTUs, Therms, for the building, and the calculator will tell you the building's current carbon footprint.

2. Next, calculate the reduced footprint using the utilities costs/amounts you expect after your project is done.

3. To get the percent reduction, divide the future carbon footprint by the current carbon footprint.

Project Assessment Tools

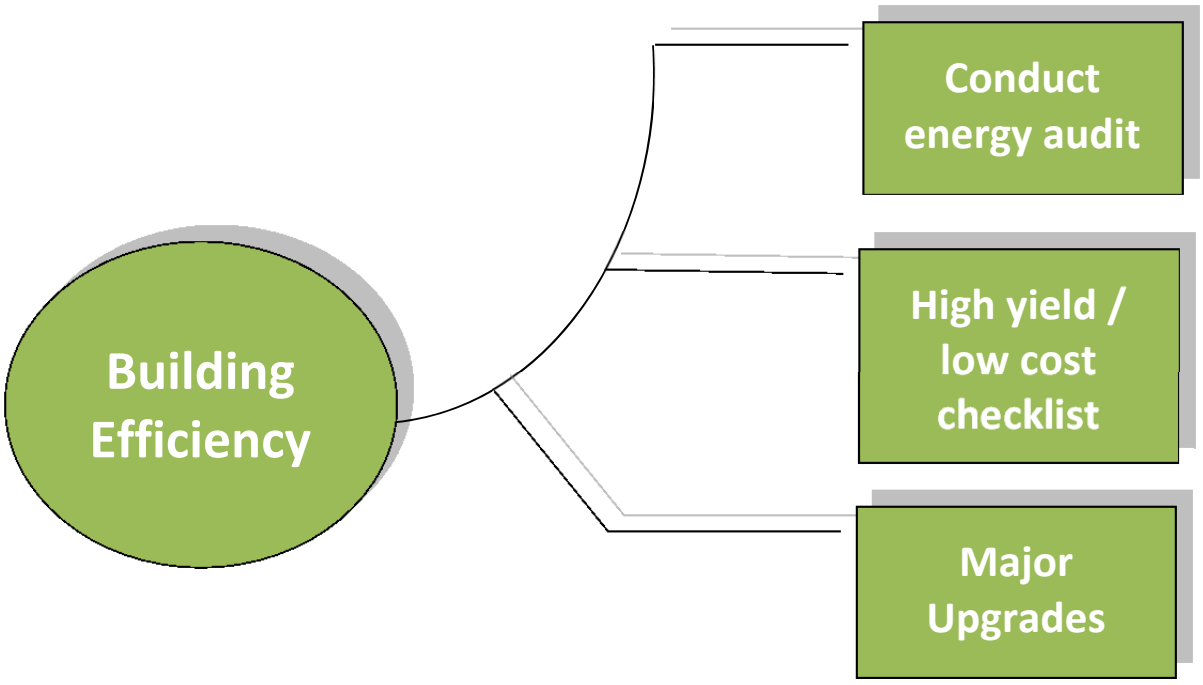
Costs and Benefits Prioritization Worksheet



Notes

Process 2: Building Efficiency

This process helps you to recognize opportunities for improving building efficiency, which is usually less expensive and less disruptive to a site than installing renewable energy technologies. In this process you may conduct a simple energy audit, especially if an energy audit has not already been done. This is done by reviewing a list of "high yield / low cost" approaches to improving building efficiency at your selected site.



Process 2: Building Efficiency

Building Efficiency Checklist

❒ Conduct energy audit

❒ Has an energy audit been conducted on the building?

- **If yes**, review this information to determine additional energy efficiency opportunities. Also, start using the cost benefit assessment and prioritization tools in **Process 1: Facilities, Cost Benefit Analysis and go to Processes 3, 4 & 5** to determine additional site constraints and opportunities.
- **If no**, either determine if an audit may be obtained or begin a simple energy audit by collecting and assessing utility data (see **Process 1: Facilities**). Use the section below to help identify opportunities for improvements.

❒ High yield/low cost checklist

❒ Behavioral Change Checklist

If the building is high staff use, many of these changes may be effective in reducing energy use. If it is not often used by staff or not used year-round, these behavioral changes will be less applicable.

- Set thermostat to 68°F in winter for heating and 74°F in summer for air conditioning/
- Install programmable thermostats and program for evening or unoccupied time setbacks
- Identify any unused spaces that are being temperature conditioned and see if there is a way to reduce the amount of conditioning in unused spaces
  - Close off areas/rooms when unoccupied
- Turn off air conditioning/heat when leaving a space.
- Cool with fans whenever possible. They use as little as one-tenth the electricity used by an air conditioner.
- Encourage use of operable windows and vents as originally intended to control interior environment
- Save heat-producing activities such as washing and drying clothes indoors for summer's cooler evening hours
- Have mechanical equipment serviced regularly to ensure maximum efficiency
- Clean radiators and forced air registers to ensure proper operation
- Provide occupants with information on the energy and water consumption in their space. Recognize/reward when people make improvements.

Process 2: Building Efficiency

❒ Electrical Checklist

- Look for incandescent light bulbs and replace with compact florescent bulbs (CFLs) or LEDs (light emitting diodes). . LEDs are becoming more available and affordable and require much less maintenance than incandescent bulbs or CFLs. Note that special CFLs are required for dimming fixtures. Remember to check desk lamps – LED desk lamps are becoming widely available and relatively inexpensive
- Look for T12 florescent bulbs and replace them with T8 or T5 bulbs. Note that ballasts MUST be changed to accommodate the new bulbs. Also, choose low mercury bulbs.
- Look for areas that have ample electric light and experiment with de-lamping to an acceptable level. (i.e. take out every other bulb in a bank for florescent tubes)
- Determine if there are occupancy sensors in areas where lights get left on (e.g. bathrooms, storage rooms, conference rooms, etc.). Install sensors and/or "manual on / auto off" switches. Occupancy sensors may also be used for exhaust fans.
- Check for any lighting, especially recessed lights that might have contact with insulation. Install and/or replace with sealed or airtight insulation contact (IC) recessed lighting as fire prevention strategy.
- Consider light pipes or solar tubes for interior rooms, hallways, stairwells, etc.
- Identify older appliances and replace with energy-efficient appliances (e.g. computers, refrigerators, ranges, microwaves, etc) Target highest use and oldest equipment first.

❒ Plumbing Checklist

- Check for insulation on hot water pipes, insulate as possible
- Remove plumbing from outside walls where possible
- Look for opportunities for on-demand hot water heaters
- Consider solar hot water options. They often have a payback of less than 10 years.
- Water closets
  - Check gallons per flush (gpf) for toilets, install a new low-flush toilets for every toilet over 1.6 gpf. Consider 1.28 gpf or dual flush toilets for all flush fixtures Choose fixtures with a high score on the Maximum Performance Testing **(1, 2, 3)**
  - Consider composting toilets where possible**(1, 2)**
  - Consider greywater flushing (e.g. using wastewater from sinks and showers for toilet flushing). This option would need involvement for related health department officials and would probably be demonstration in nature. **(1, 2)**
- Plumbing Fixtures
  - Test the gallons per minute (gpm) for showerheads and replace any showerheads with more than 2.5 (gpm) with heads that flow at 1.5 to 2.2 (gpm)
  - Consider pull-chain showers
  - Install faucet flow reducers in all bathroom sinks

- ❒ Building Envelope Checklist: Assess existing building envelope
    - Caulk, seal and weather-strip
    - Evaluate opportunities for increasing insulation, especially if none exists
    - Ensure adequate attic insulation, where applicable
    - Consider installing radiant barriers and insulation baffles
    - Install energy-efficient doors and windows **(See Process 4: Historic Properties prior to this type of building modification)**

❒ Major Mechanical Upgrades and Renovations:

- ❒ Do High yield / low cost projects first
- ❒ Consider large systems replacement and upgrades, depending on project.
    - Upgrade to high efficiency condensing boilers with 90% AFU (Annual Fuel Utilization Efficiency) or better.
    - Replace electric furnaces with gas, propane or biomass, as appropriate
    - Install new energy efficient furnaces - Energy Star is a reasonable indicator of efficiency.
    - Replace Air Conditioning Units
        - If an evaporative cooler could be used for cooing, they are strongly preferable to refrigerant based air conditioners. Direct indirect evaporative coolers do not add moisture to the air.
        - For smaller AC units, select units with a high SEER (Seasonal Energy Efficiency Ratio) compared other similarly sized units. Energy Star is a reasonable indicator of energy efficiency.
        - For larger AC units that cannot be replaced with an evaporative cooling system, select AC units with long life, low global warming potential and very low ozone depletion potential.
    - Consider Building Automation Systems (BAS) for larger buildings.
    - Consider under floor radiant heating systems. The City of Ft. Collins has radiant systems in their vehicle storage building and they love it.
    - Determine if a heat recovery or heat exchange unit system would be appropriate.
- ❒ For large scale modifications, strongly consider hiring a third party commissioning agent to assure that systems are designed, installed and operating as intended.
- ❒ Consult with other park staff on complex projects

Remember to conduct a detailed cost benefit analysis to aid in the decision making process. **(See Process 1: Facilities, Cost Benefit Section)**

Building Efficiency annotated resource list

(1) DOE Fact Sheets

This site contains further information on ways to maximize efficiency from the Department of Energy
www.eere.energy.gov/buildings/documents

(2) Colorado Department of Public Health and Environment

This office provides guidelines on individual sewage disposal systems, composting toilets and graywater systems collection. Additional information may be found regarding constructed wetlands. www.chelper.net/humanure/appendix3.html

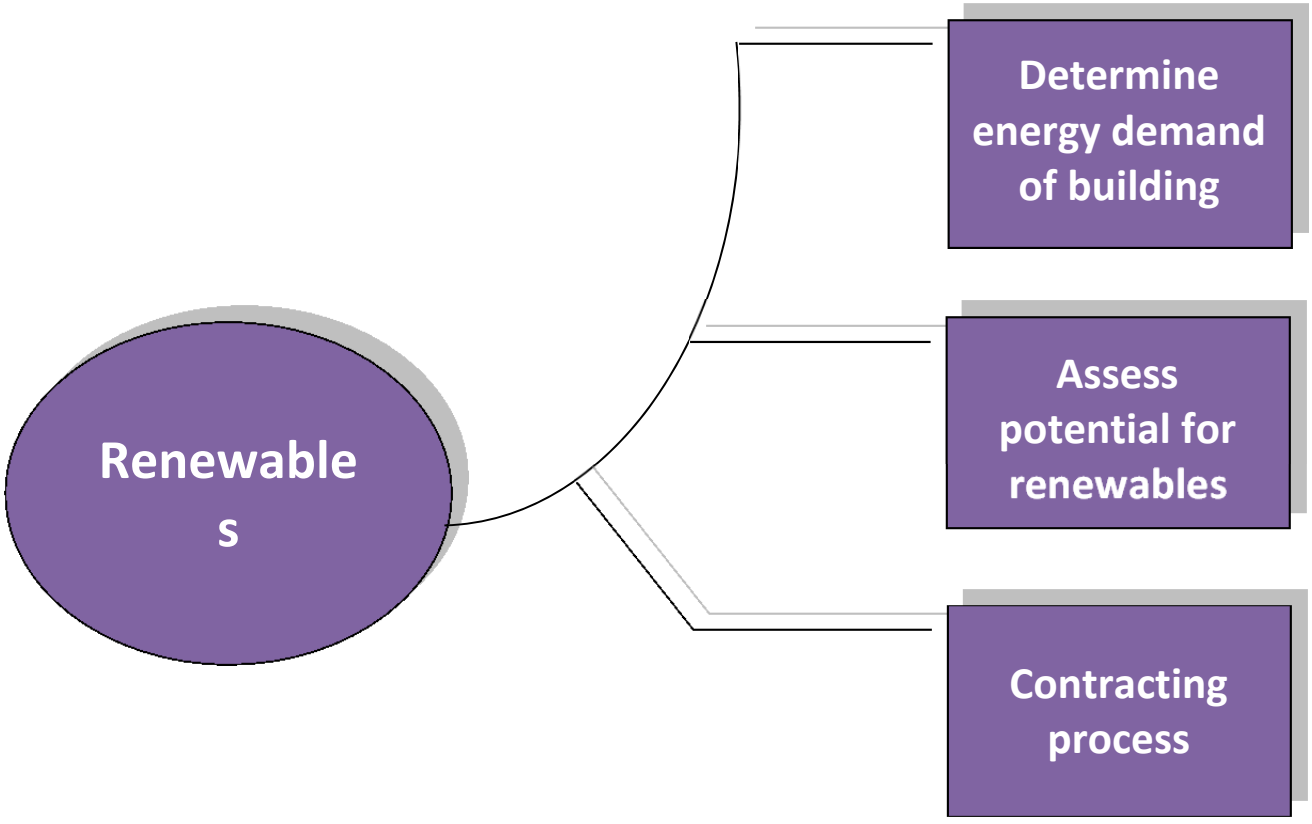
(3) California Urban Water Conservation Council

The California Urban Water Conservation Council publishes performance ratings for almost 1400 models of toilets. A convenient matrix shows toilets by manufacturer, flow rate and reliable flushing capacity. Residential and valve flush fixtures are included.
www.cuwcc.org/MaPTesting.aspx

Notes

Process 3: Renewables

In this process, you will determine whether or not renewable energy technologies are an appropriate choice for your site. Renewable energy must be carefully considered in regard to cost, historic sites, natural resource impacts and visitor expectations.



Process 3: Renewables

Renewables Checklist

❒ Determine energy demand of building

- ❒ Refer to **Process 1 Facilities, Collect and Assess Energy Data** and to determine if an energy audit has been completed for energy demand/use information.
- ❒ Determine quantity of renewable energy needed and which renewable energy source might be appropriate for a given site
- ❒ Conduct a Cost Benefit Analysis as outlined in **Process 1,Cost Benefit Analysis**

❒ Assess potential for renewables

Below is a list of potential renewable energy options and some guiding principles for understanding if there is renewable potential at a given site.

- ❒ **IMPORTANT FOR ALL RENEWABLE ENERGY SYSTEMS**:
  - If the site seems for like a possible candidate for any renewable energy systems, refer to the criteria in **Processes 4, 5 & 6** to determine if there are constraints that would limit use of a given renewable system installation.
  - A specialized professional firm will be required to determine actual feasibility of any given renewable energy system.
  - You will probably want to have your renewable energy installations commissioned by a third party professional. **(1)**

- ❒ **Geothermal:** Does the site have potential for geothermal power? Is there known geothermal activity in the area? Note: A site does not have to be thermally active to be a good candidate for geothermal wells, but warm or hot ground water is a bonus. Geothermal loop fields can often be placed under parking areas.
  - Locate potential site and direct use applications **(2)**

- ❒ **Solar:** Does the site receive good solar exposure year-round or during the part of the year when buildings are in use?
  - If possible, install solar panel or solar eye to measure actual solar exposure at project site **(3)**.
  - Remember to consider solar electric and solar thermal. Solar thermal (hot water), typically has a better payback than solar electric.

- ❒ **Wind:** Does the site have constant low velocity wind?
  - If possible, install an anemometer to measure actual wind speed and direction at project site.

- Consider impact of wind turbine installation on the surrounding ecosystem, especially impacts on migrating birds and butterflies.

❒ **Hydropower:** Is there a river or stream close to the proposed project area?

- A simple equation estimates output power for a system with 53% efficiency, which is representative of most micro-hydro systems:
  - [Net Head* (feet) x Flow (gallons/min)]/10 = Output (watts),

  where *Net Hea*d is the difference in elevation between where the water would enter the micro-hydro system, and where it would come out, and *Flow* is measured with a flow meter.
- Does it flow year round? Does your flowing water source freeze in winter, overflow in spring, and dry up in summer?
- Is there floating or submerged debris which might damage hydropower installations?
- If river or stream meets these criteria, return to top and identify impact of hydropower installation on aquatic and riparian ecosystem.

❒ **Biomass:** Is Biomass an option in the proposed project area?

- *Biomass removal need:* Do you need to remove woody biomass to restore and maintain ecosystem health?
  - Do you generate biomass from wildfire protection activities?
  - What is the type, size, and species of biomass? Consider your system type and the amount of processing needed for a biomass system? Would you need to purchase additional equipment to process the biomass?
  - Will biomass removal improve public safety?

- *Biomass Availability:* Is your biomass removal a short term need or can you sustain the flow or product long term? **(4)**
  - Can you quantify the amount of material available and the duration of availability?
  - Are there others providers of wood in the area that could augment your wood supply over time (other agencies, private, state)?
  - Can you the long-term supply of wood (10 or more years)?
  - Consider cost and feasibility of operations and labor.

❒ Contracting process

For comprehensive information on the contracting process within National Park Service, consult the Government Contracting website **(5)**

- ❒ Is the project small enough to be handled by Facility staff? If so, ask the following:
  - Can your staff implement the projects themselves?
  - How experienced and trained is your staff? What is their availability?
  - Will work require the shutdown of essential operations? Is it feasible and economical to complete the project during non-operating hours?
  - What indirect disruptions will result?
  - Is this a complex project with regulatory complications?
  - Does your staff have environmental, health, and safety experience?
  - Do they have the necessary construction, installation and operations experience?

Renewables annotated resource list

(1) Commissioning and Operation and Maintenance Resources

This web site by the Portland Energy Conservation Incorporated contains information on building commissioning, operation and maintenance strategies and links to other organizations that have developed commissioning plans and specifications.

www.peci.org

(2) US Geothermal Resource Maps.

This site is maintained by the U.S. Department of Energy, Geothermal Technologies Program. In the maps section you can search to see if your target area has geothermal potential.

www.eere.energy.gov/geothermal/maps

(3) American Solar Energy Society

This site provides information on solar energy options, costs, lifetime payback, and more.

www.ases.org

(4) Woody Biomass Utilization Scorecard

This Scorecard is intended to help walk through the types of questions to ask when considering woody biomass.

www.fs.fed.us/woodybiomass/tools/scorecard.shtml

(5) Government Contracting Website

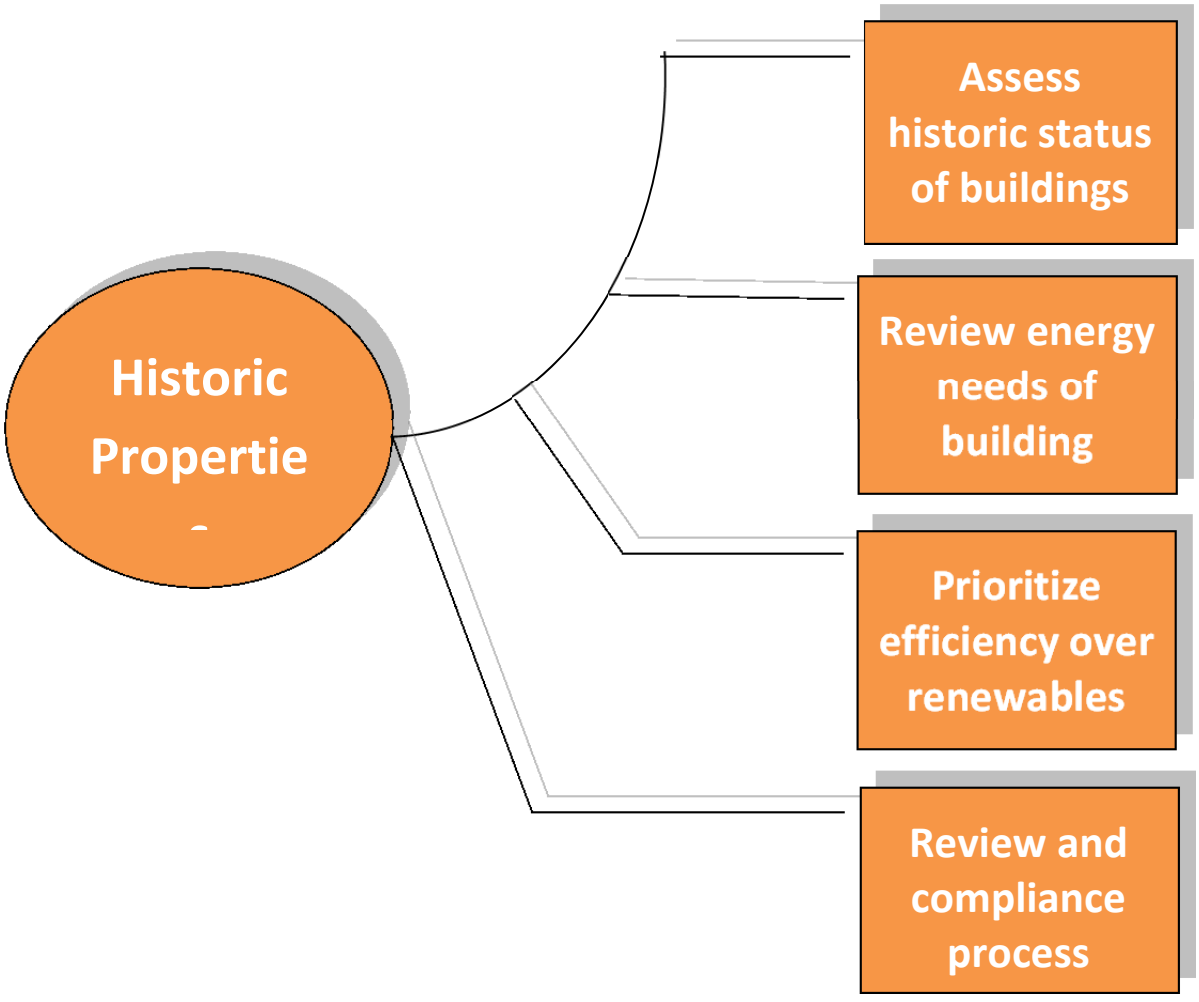
This site contains full guidelines on all steps of the contracting process for any project.

www.business.gov/.../government-contracting

Notes

Process 4: Historic Properties

This process will help you to ensure that your proposed building efficiency modifications and renewable energy installations developed in the previous three sections are in compliance with historic considerations. You may have already determined in the initial Project Assessment section that your site is not designated as "historic"; in this case you do not need to apply this process. As described in the Project Assessment, ***you should always check with your Cultural Resources Manager to ensure that your site is not a historic property.***



Process 4: Historic Properties

Historic Properties Checklist

❒ Assess historic status of buildings

- ❒ As early as possible, inform Cultural Resources Manager of potential project in the building or area to determine if the building is eligible, listed, or in a historic district or landscape **(1)**.
- ❒ The Cultural Resources Manager will help you determine what cultural compliance actions are necessary for the proposed project.
- ❒ ***If the building is not historic, and the process does not involve any ground disturbance, return to Process 1: Facilities.***
- ❒ ***If the building is historic or in a historic area, or involves ground disturbance, continue with this checklist.***

❒ Review energy needs of buildings

- ❒ Refer to **Process 1: Facilities Energy Audit** and **Process 2: Building Efficiency High yield / low cost** and **Process 3: Renewables** sections to determine potential energy upgrades

- ❒ Assess building in terms of use
  - Is the building used only in the summer?
    - Consider shutting down building in the winter and using energy efficiency/renewables options that are effective during the summer season (**See Process 2: Building Efficiency and Process 3: Renewables)**.
  - Is the building low or high visitor use?
    - Consider energy efficiency/renewables options that educate visitors and do not compromise historic character-defining elements or landscapes **(See Process 6: Visitor Experience, also 2, 5)**
  - Is the building low or high staff use?
    - Consider energy efficiency options that require staff to participate in reducing energy use. **(See Process 2: Building Efficiency)**

❒ Prioritize efficiency over renewables

- ❒ For historic buildings, focus on energy efficiency projects rather than renewables projects **(Process 3: Renewables)**. Energy efficiency projects generally do not

impact the historic structure or historic landscape as profoundly as does the installation of new renewables technologies **(2, 3, 4)**

- ❒ First, look for High yield / low cost upgrade options which do not require any modification of the building structure/historic landscape/district **(See Process 2: Building Efficiency)**
- ❒ Next, consider energy efficiency measures which may require some permits and construction but which do not noticeably alter the appearance of the historic structure/ landscape/district **(See Process 2: Building Efficiency, also 2, 3, 4)**
- ❒ If energy efficiency measures do not reduce the building's carbon footprint to the level desired, then consider renewables as a possible strategy. Some renewable technologies, such as geothermal and fuel cells, may provide less visible (and therefore less damaging to the historic landscape) than others. **(See Process 3: Renewables and Process 5: Natural Resources)**
- ❒ Remember that all proposed changes to a historic structure are more feasible if they are definitely reversible!

❒ Review and compliance process

- ❒ The project manager and the Cultural Resource Manager should communicate throughout the project to ensure that cultural compliance is met. Cultural compliance is not complete until the Cultural Resource Manager has signed off on the Project Proposal & Clearance Form.
- ❒ If the project is an "Undertaking", the Cultural Resource Manager determines if the 2008 National Programmatic Agreement (PA) can be used for compliance to streamline the process **(6)**
- ❒ If the PA cannot be used, project information is gathered and a letter is written to the State Historic Preservation Office (SHPO). SHPO has 30 days to respond **(1)**
- ❒ "Historic Properties that teach": Is there an educational opportunity to present the innovative mixture of preservation and energy efficiency? **(See Process 6: Visitor Experience)**

Historic Properties annotated resource list

(1) National Register of Historic Places

This National Park Service site maintains an "official list of the historic places worthy of preservation". It contains links to the State Historic Preservation Offices in every state, and a searchable database where users can determine the historic status of a certain building or area.
www.nps.gov/history/nr/shpolist.htm

(2) Secretary of the Interior's Standards for the Treatment of Historic Properties

These standards and guidelines are intended to promote responsible preservation practices that help protect our Nation's irreplaceable cultural resources. This site provides guidance on choosing/maintaining materials, exterior and interior features, new additions, and even has a short blurb addressing energy efficiency concerns in historic structures.
www.nps.gov/history/hps/tps/standguide/

(3) National Park Service Preservation Briefs

Preservation Briefs 3-Conserving Energy in Historic Buildings. All briefs provide guidance on preserving, rehabilitating and restoring Historic Properties. The 44 briefs are all available online at NPS's Technical Preservation Services site:
www.nps.gov/history/hps/tps/briefs/presbhom.htm

(4) Whole Building Design Guide: Sustainable Historic Preservation

The WBDG is the only web-based portal providing government and industry practitioners with one-stop access to up-to-date information on a wide range of building-related guidance, criteria and technology from a 'whole buildings' perspective. This link connects to their pages on Sustainable Historic Preservation, which include guidelines for Operational Control measures, Relevant Codes and Standards, and more.
www.wbdg.org/resources/sustainable_hp.php

(5) Whole Building Design Guide: Archaeological Site Considerations

The WBDG is the only web-based portal providing government and industry practitioners with one-stop access to up-to-date information on a wide range of building-related guidance, criteria and technology from a 'whole buildings' perspective. This link connects to their pages on what needs to be considered if the site has significant archeological resources which need to be preserved.
www.wbdg.org/resources/archconsider.php?r=historic_pres

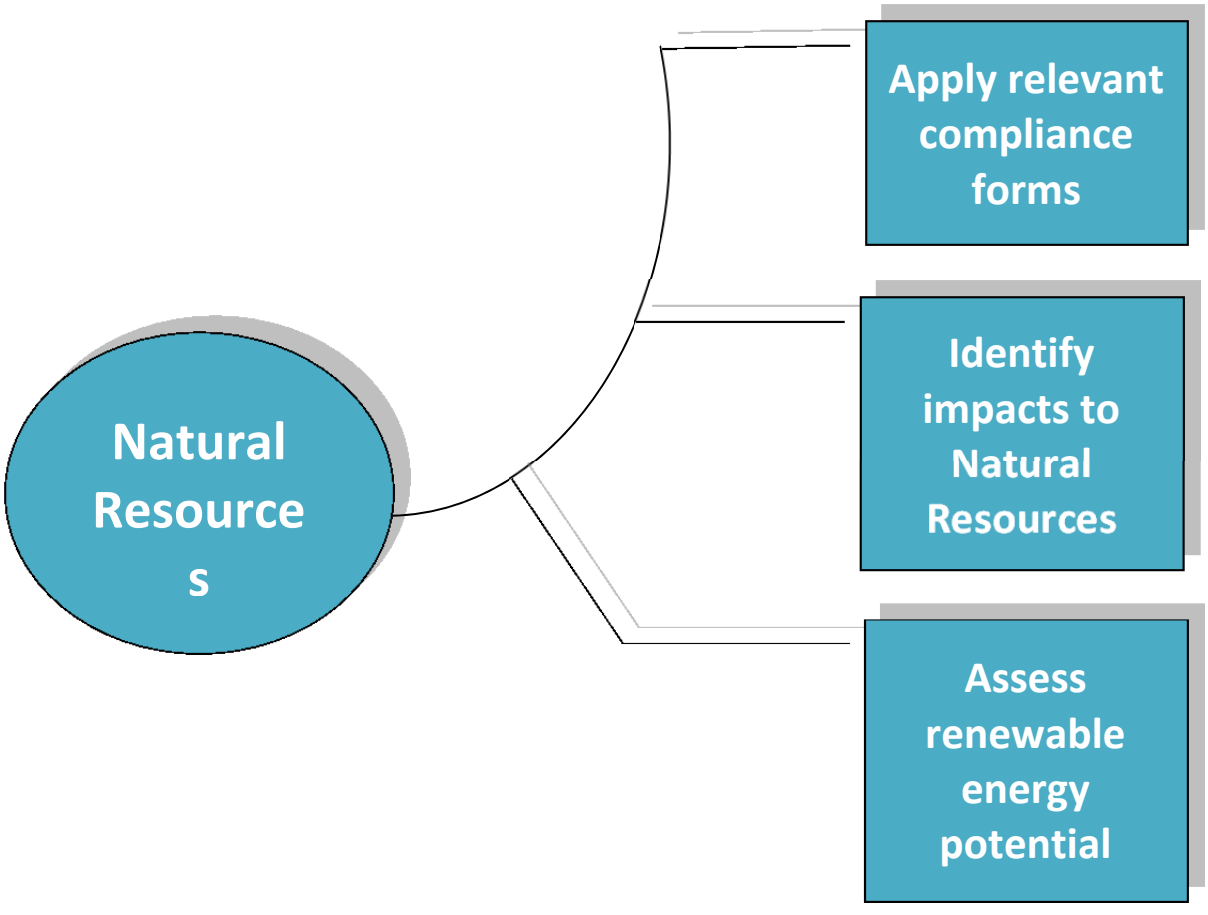
(6) Interagency Programmatic Agreement on Historical Preservation

This document provides guidelines on how to comply with Section 106 of the National Historic Preservation Act. NPS, the Advisory Council on Historic Preservation, the National Conference of State Historic Preservation Officers are all cooperators on this agreement
www.achp.gov/2008%20NATIONWIDE%20PA%20-%20SIGNED.pdf

Notes

Process 5: Natural Resources

The Natural Resources process will guide you through the key natural resource considerations at your site, and will help you to ensure that you are in compliance with all regulations protecting these resources. The species lists provided in this section apply to ROMO; if you are in a different park you should obtain your own applicable species lists.



Process 5: Natural Resources

Natural Resources Checklist

Rocky Mountain National Park has an established process for proposing projects, ensuring compliance with regulations and policies, and obtaining project approval. This process ensures that all projects consider the complex natural resources at the proposed project site, including issues such as the presence of threatened and endangered species and preservation of critical habitat. Generally, these natural resource assessments are not made by the Facility Managers, but by subject matter experts and/or an Interdisciplinary Team (IDT).

The first step in this process is to apply relevant compliance forms: all steps after that will be completed by subject matter experts and/or an IDT.

❒ Apply Relevant Compliance Forms

- ❒ Except in the case of minor energy-saving projects, a Project Proposal & Clearance Form (ROMO-178) and accompanying support documentation must be submitted to the park Management Team for all other projects. **(1)**
- ❒ The Chief of Planning & Compliance will enter the project on the Planning, Environment and Public Comment (PEPC) website and will use the PEPC Environmental Screening Form to determine the appropriate National Environmental Policy Act (NEPA) pathway, the National Historic Preservation Act (NHPA) pathway and other compliance that may be needed for the project. An IDT may be formed to assist with this process **(2)**
    - The Environmental Screening Form considers such resources as federally listed endangered, threatened and rare species, wetlands, cultural resources, wilderness, etc.
- ❒ If the site is within a designated wilderness, a Minimum Requirement Analysis Worksheet (ROMO-180) must be included with the Project Proposal & Clearance Form **(3)**

❒ Identify Impacts to Specific Natural Resources

- ❒ Identify presence and distribution of federally-listed endangered, threatened, and rare species **(4)**
- ❒ Identify presence and distribution of state-ranked endangered, threatened, and rare species **(5)**
- ❒ Identify presence and distribution of species of concern in the park **(4, 5)**
- ❒ Identify rare and imperiled plant communities **(4, 5)**

- ❒ Identify potential (not currently occupied but may be occupied in future) habitat for these species/communities within the site. Ensure that any modifications/installations do not impact these species or their habitat.

❒ Renewable Energy Potential Assessment

- ❒ Hydropower: Has hydropower been determined as a possible alternative energy source for the site?
    - Does it provide habitat for the Rocky Mountain Capshell snail (*Acroloxus coloradensis*)?
    - Does it provide habitat for or is it upstream from habitat for Greenback cutthroat trout (*Oncorhynchus clarki stomias*)

- ❒ Geothermal: Has geothermal energy been determined as a possible alternative energy source for the site?
    - Would digging for geothermal installation disrupt the current or potential future habitat of plant species of concern?
        - Especially check for federally-listed species (the following species may occur in ROMO although they have not yet been identified) **(4)**
            - Colorado butterfly plant, *Gaura neomexicana* spp. *Coloradensis*, (Threatened)
            - Utes ladies'-tresses, *Spiranthes diluvialis*, (Threatened)
        - Check for state-listed species and species of concern **(5)**

- ❒ Solar: Has solar been determined as a feasible alternative energy source for the site?
    - Is the site in a known migration corridor for bird species of concern which might be affected by the installation of solar panels on buildings/in open areas?
        - No federally-listed migratory bird species known in ROMO **(4)**
        - Check for presence of state-listed species or species of concern which migrate through ROMO **(5)**:
            - Swainson's Hawk (*Buteo swainsonii)*
            - Ferruginous hawk (*Buteo regalis)*
            - Lewis's woodpecker (*Melanerpes lewis)*
            - Flammulated Owl (*Otus flammeolus*)
            - Forster's tern (*Sterna forsteri)*
            - White-faced ibis (*Plegadis chihi)*
            - American white pelican (*Pelecanus erythrorhynchos)*
            - Long-billed curlew (*Numenius americanus)*

- Rufous hummingbird (*Selasphorus rufus)*
- Willet (*Catoptrophorus semipalnatus)*
- Veery (*Catharus fuscescens)*
- McCown's longspur (*Calcarius mccownii)*

❒ Wind: Has wind been determined as a feasible alternative energy source for this site?

- If possible, install an anemometer to measure actual wind speed and direction at project site.
- Is the site in a known migration corridor for bird species of concern which might be affected by wind turbine installation?
  - No federally-listed migratory bird species known in ROMO **(4)**
  - Check for presence of state-listed species or species of concern which migrate through ROMO **(5)**:
    - Swainson's Hawk (*Buteo swainsonii)*
    - Ferruginous hawk (*Buteo regalis)*
    - Lewis's woodpecker (*Melanerpes lewis)*
    - Flammunlated Owl (*Otus flammeolus*)
    - Forster's tern (*Sterna forsteri)*
    - White-faced ibis (*Plegadis chihi)*
    - American white pelican (*Pelecanus erythrorhynchos)*
    - Long-billed curlew (*Numenius americanus)*
    - Rufous hummingbird (*Selasphorus rufus)*
    - Willet (*Catoptrophorus semipalnatus)*
    - Veery (*Catharus fuscescens)*
    - McCown's longspur (*Calcarius mccownii)*
- Identify impact of wind turbine installation on butterflies, especially Morrison's skipper, Snow's skipper, and the Two-banded skipper

Natural Resources annotated resource list

(1) Project Proposal/Clearance Form (ROMO-178)

This worksheet is the basic form which park staff must fill out in order to gain final approval for any project. It includes a checklist of compliance requirements which must be completed and approved according to the nature of the project (i.e. if it is near wilderness, project lead must apply Minimum Requirement Analysis Worksheet, etc.).
www.romo.nps.gov/etools/formslist.cfm

(2) NPS Director's Orders: Director's Order 12: Environmental Impact Analysis

You can use this Handbook for Environmental Impact Analysis to guide you through projects, and the Director's Order 12 mandating Environmental Impact Analyses for all projects in the parks.
http://home.nps.gov/applications/npspolicy/DOrders.cfm

(3) Minimum Requirement Analysis Worksheet (ROMO-180)

This worksheet provides park staff with clear guidelines to help them determine whether or not a proposed action is permissible within designated wilderness. It addresses two questions: *Should* the action be performed and *How* the action should be performed.
www.romo.nps.gov/etools/formslist.cfm

(4) Unit—Specific Species List

Each park maintains a validated species list. This list is available through Resource Management in each park, and will be used by subject matter experts and/or the IDT in Natural Resource impact analysis.

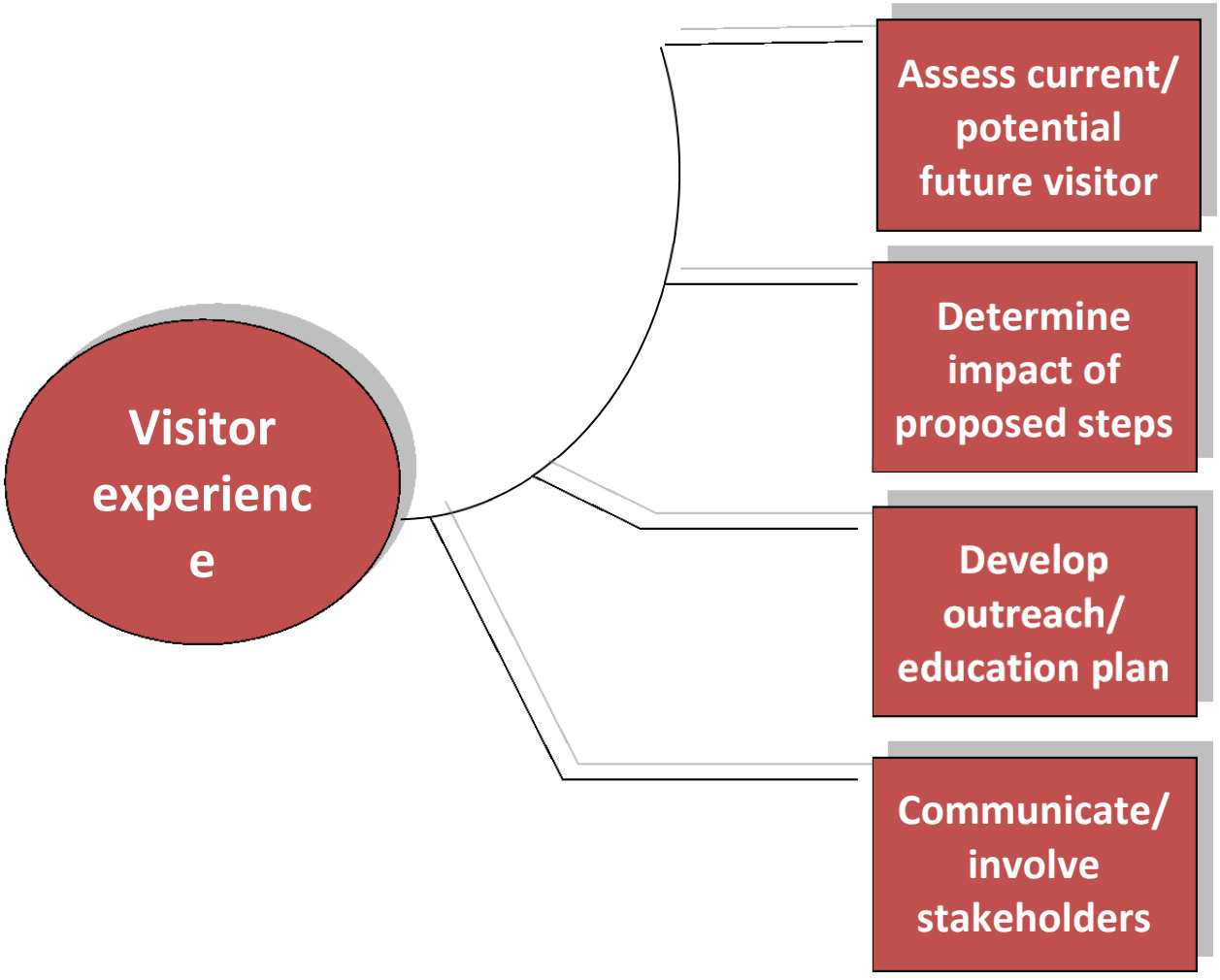
(5) State Listed Endangered, Threatened, and Rare Species

This list identifies state endangered and threatened species, species of concern and rare species that must be protected if found within a proposed project site. Federally threatened, endangered and candidate species are maintained in another list, separate from state listed species. The Colorado Division of Wildlife maintains an updated list of species at:
http://wildlife.state.co.us/wildlifespecies/speciesofconcern

Notes

Process 6:
Visitor Experience

This process will help you decide how your proposed project may affect the experience of visitors. If you have already determined in the Project Assessment that your site is only used by internal staff, then you may not need to apply this process. The impact on of the proposed project on visitor use and visitor experience will be evaluated as part of the Project Proposal & Clearance process, and is considered as part of the Environmental Screening Form. In addition, an internal communications plan (described in final item in this section) is always necessary regardless of whether or not the project site is frequented by visitors.



Visitor Experience Checklist

❒ Assess current/potential future visitor use

- ❒ To obtain information on visitor use of the proposed project site, consult with relevant park staff who work with visitors, such as:
    - District rangers: will know use of site in different seasons
    - Branch of Planning & Compliance: will know what projects have previously been proposed for the area and what related outreach efforts were made
    - Cultural Resources staff: will know any mandates for preservation of historic viewsheds, historic experience, etc.
- ❒ If your park does not have these staff, consult the following resources **(1, 2)**

❒ Determine impact of proposed steps

- ❒ Considering the current/potential future visitor use of the proposed project site, determine impact of the modification/installation. **(1)**
    - Will the modification/installation increase/decrease visitor use?
    - Will the modification/installation impact the visitor experience of the site? **(1,3)**

❒ Develop outreach/education plan

- ❒ Work with park Public Information Officer to determine the appropriate messages, audiences, and techniques for a communication plan.
- ❒ Depending on the project, the communication plan may include the following elements:
    - Information signs near installation
    - Letters to stakeholders
    - News releases to area newspapers
    - Brochures about project placed in strategic locations
    - Announcements on local radio/television and at local community meetings
    - Factsheets
    - If an EA or EIS is required, public involvement which may include public meetings or hearings
    - Discuss with managers and other park staff for ideas on additional communication efforts

- ❒ For technical assistance with communications/outreach/educations plans, you may contact the WASO Natural Resource Program Center, which has an Office of Education and Outreach. This office can guide you in the process of creating a tailored communications plan **(4)**

❒ Communicate with and involve stakeholders

All steps in this section should be worked through with the assistance and guidance of the Public Information Officer and the Branch of Planning and Compliance. If you do not have these staff at your park, contact the WASO Natural Resource Program Center for technical assistance **(4).**

- ❒ Ensure that all internal staff is aware of the project (all staff have some contact with visitors and can affect visitor perception of the project)
  - Internal newsletter
  - Posting on Sharepoint, park intranet
  - Announcement at staff meetings
  - Targeted email announcements to relevant staff
  - Park "Morning Report" or "Weekly Report"

- ❒ For external stakeholders: Public Information Officers and the Branch of Planning & Compliance will provide guidance on public involvement related to the National Environmental Policy Act (NEPA).
  - In some cases public outreach will be needed even for Categorical Exclusions (Cat Ex) from NEPA to determine if there are any public concerns about the project.
  - Public involvement is always required for Environmental Assessments and Environmental Impact Statements. The Public Information Officer and the Branch of Planning & Compliance will develop a strategy for involving the public in the decision-making process, which may include press releases, newsletters, public meetings, etc.
  - The NPS Planning, Environment and Public Comment website serves as a central "location" where the park can post information to the public, and receive comments from the public.

Visitor Experience annotated resource list

(1) Maintaining the Quality of Park Resources and Visitor Experience: a handbook for managers

This handbook provides managers with a step-by-step, easy-to-use process for identifying and defining unacceptable impacts to biological and cultural resources and to visitor experience.
http://planning.nps.gov/document/Maintaining_Quality%20of%20Park_Resources.pdf

(2) VERP: The Visitor Experience and Resource Protection (VERP) Framework A Handbook for Planners and Managers

This handbook is the complete guide to protecting resources with regards to visitor impacts. Pieces of this document will also apply to the importance of visitor experience and impacts to that based on changes in resources such as modifications/installations for energy projects.
http://planning.nps.gov/document/verphandbook.pdf

(3) Whole Building Design Guide: Archaeological Site Considerations

The WBDG is the only web-based portal providing government and industry practitioners with one-stop access to up-to-date information on a wide range of building-related guidance, criteria and technology from a 'whole buildings' perspective. This link connects to their pages on what needs to be considered if the site has significant archeological resources which need to be preserved.
www.wbdg.org/resources/archconsider.php?r=historic_pres

(4) Natural Resource Program Center, Office of Education and Outreach.

Any park in the National Park Service can make a technical request for assistance with education and communications plans. The degree of assistance depends on the budget, but some level of assistance is always available.
www.nature.nps.gov/nrpc

Notes

Project Completion and Documentation

This section is in development: As ROMO applies the guide to the first projects in the park, they will determine the best format for this section. As with all section s of this document, any comments or suggestions are welcome.

Simple Action Matrix – Implementation Plan

This matrix will help you to track responsibilities and responsibilities for particular assignments and processes underway.

Activity	Responsible Party	Comments	Due Date

Evaluation and Lessons Learned

- ✓ Were the preliminary challenges and opportunities you identified at the beginning of the project accurate?

- ✓ If not, what unforeseen challenges and opportunities arose?

- ✓ Did this guide correctly point you toward the necessary compliance requirements for the six processes? If not, please describe below what additional compliance information you were required to include for each section:

  Facilities:

  Building Efficiency:

  Renewables:

  Historic Properties:

  Natural Resources:

  Visitor Use:

- ✓ Were you able to reduce your carbon footprint the desired amount simply through improving building efficiency, or did you need to turn to renewable options?

- ✓ What natural resource was the most limiting (i.e. you were not able to modify existing structures or install renewables because of potential impact to natural resources) at your project site? Why?

- ✓ What aspect of visitor use or visitor experience was most altered by the modifications and/or installations completed during your project?

Glossary

Term	Definition
Biomass	Living or recently living biological material such as wood that is used as an energy source
Carbon Footprint	The total set of greenhouse gases (GHG) emissions caused by an organization, event, or product
Composting Toilets	Composting toilets use little to no flush water, and use aerobic decomposition. They can help keep nutrients form leaching into environmentally sensitive areas
Constructed Wetlands	Artificial marsh or swamp that is generally used to manage storm water runoff, waste water, or for wildlife habitat
Consultation	A legal term used to define the procedure of clearing an undertaking through the State Historic Preservation Office (SPHO), tribes, and sometimes the Advisory Council on Historic Preservation (ACHP) through letters, conversations, or meetings
Cooperative Ecosystems Studies Unit	Collaboration among federal agencies, universities, state agencies, non-governmental organizations, and other nonfederal institutional partners
Cultural Resource Manager	The staff in either a NPS Unit or Region that is responsible for Section 106 consultation
Dichotomous key	A key generally used to help identify species esp. used in wildlife and plant biology. It is designed by providing two choices that, based on the best match, guide the user to more choices, or the answer that the user was looking for
Embodied Energy	The energy needed to produce a building product, not accounting for transportation, durability, reuse, and recycling
Environmental Impact Assessments	An assessment of all impacts, positive and negative, that a proposed project may have on a given area
Fuel Cell	An electrochemical cell in which the energy of a reaction between a fuel and an oxidant is converted directly and continuously into electrical energy
Geothermal	Heat derived from the interior of the earth i.e. hot springs
Greywater systems	Partially filtered water, cleaner than sewage or waste water, but still not to human consumption standards. Generally such water is used as recycled water to do a number of tasks, such as flush toilets.

Glossary

Historic District	An area that generally includes within its boundaries a significant concentration of properties inked by architectural style, historic development, or a past event
Historic Property	Building, site, district, object, or structure evaluated as historically significant
Hydroelectric (Water Power)	Energy obtained from water by diving a turbine and generator.
LED	Light-emitting diode - LED bulbs draw considerably less power and are up to 90% more efficient than incandescent and halogen bulbs.
Life Cycle Analysis	LCC takes into account all costs of acquiring, operating, maintaining, and disposing of a building or building system.
High yield/Low cost	An energy-saving modification that requires little cost and or labor i.e.; changing light bulbs with more efficient ones, painting, caulking, etc.
Natural Ventilation	The process of supplying and removing air through an indoor space by natural means.
Passive Solar	Design strategies that contribute to the requirements of the heating load without requiring an energy input to operate i.e. pumps or fans.
Passive Thermal Mass	Mass in a building (furnishings or structure) that is used to absorb solar gain during the day and release the heat as the space cools in the evening.
Preservation Briefs	Guidance on preserving, rehabilitating and restoring Historic Properties
PV (Photovoltaics)	Devices that convert sunlight directly into electricity.
Riparian Area	The plant and wildlife communities that border near the edge of a water way such as a stream, creek, or river
Section 106	Provision in National Historic Preservation Act that requires federal agencies to consider effects of proposed undertakings on properties listed or eligible for listing in the National Register of Historic Places
Undertaking	Federal agency actions requiring review under Section 106 of the National Historic Preservation Act
Wind (Power) Energy	Energy generated from air currents used to create electricity or mechanical power.

Additional Resources

Policy Related Executive Orders

This site is from the National Park Service's Office of Policy. It includes a list of executive orders which relate to management of park resources. The Orders which are most relevant to energy efficiency projects such as the one outlined in this guide are 13423 and 13514.
http://home.nps.gov/applications/npspolicy/getEOs.cfm

Project Proposal/Clearance Form (ROMO-178)

This worksheet is the basic form which park staff must fill out in order to gain final approval for any project. It includes a checklist of compliance forms which must be filled out and approved according to the nature of the project (i.e. if it is near wilderness, project lead must apply Minimum Requirement Analysis Worksheet, etc.).
www.romo.nps.gov/etools/formslist.cfm

Minimum Requirement Analysis Worksheet (ROMO-180)

This worksheet provides park staff with clear guidelines to help them determine whether or not a proposed action is permissible near designated wilderness. It addresses two questions: *Should* the action be performed and *How* the action should be performed.
www.romo.nps.gov/etools/formslist.cfm

Climate Friendly Parks: Rocky Mountain National Park Action Plan. September 2007.

This website contains details of ROMO's plan to reduce greenhouse gases (GHGs) and criteria air pollutants (CAPs) through the climate friendly management of park operations and increased outreach and education efforts.
www.nps.gov/climatefriendlyparks/downloads/CFP%20RockyMountain%20actionplan_FINAL.pdf

National Institute of Standards and Technology (NIST), Handbook 135 "Life Cycle Costing Manual for the Energy Management Program"

This handbook is the source for the cost-benefit analysis described above. It also contains other useful information on Life Cycle Costing. The link below will take you to the NIST publications site; from here, search for Handbook 135.
http://fire.nist.gov/bfrlpubs/

U.S. Energy Information Administration (EIA), Independent Statistics and analysis.

This is a resource guide which defines, discusses and covers **every aspect of energy** production, embodied energy, environmental impacts. Additionally it provides charts and calculators to determine energy use, for renewable and non-renewable sources.
www.eia.doe.gov