Options Analysis Template

**[The instructional red and blue text below should be removed in the final version of the Options Analysis]**

*Instructions are in blue italic font.*

*All Applicants are required to provide an Options Analysis as part of their application to demonstrate that multiple options were considered and that the proposed project best meets the overall tribal objectives.*

*An “****Options Analysis****”, for purposes of this FOA, is a systematic assessment and evaluation of possible alternative approaches available for achieving specific energy objectives and determining which of the options are the most effective and provides the best solution to achieve those objectives. Such an analysis is intended to explore all feasible technology alternatives (e.g., conventional technologies, renewable technologies, energy efficiency measure(s)) and provide evidence that the proposed project choice can actually be implemented and is the best option available among all feasible alternatives.*

*Below is a sample Options Analysis format:*

1. *Energy Objectives*
2. *Specific Project Goals*
3. *Option Identification*
4. *Approach*
5. *Preliminary Screening*
6. *Pre-Feasibility Analysis*
7. *Option Selection*

*See additional instructions and examples in the template below.*

*Examples are in red italic font.*

Options Analysis

**[Control Number]**

**[Applicant Organization Name]**

**[Project Title]**

1. **ENERGY OBJECTIVES**

Provide a brief summary of the overall energy objectives and if applicable, secondary objectives.

***Examples*** *might include:*

* *Sustainable: Support tribal environmental and net-zero energy goals by reducing reliance on non-renewable energy resources, increasing local renewable generating capacity, and reducing the tribe’s environmental footprint.*
* *Affordable: Minimize life-cycle costs of energy services compared to historic costs.*
* *Resilient: Capable of safely and reliably providing autonomous energy service for critical energy loads during utility outages, including long-duration outages (12 hours or longer), and during regional emergencies that disrupt deliveries of fossil fuels.*
* *Commercial Technology: Rely on commercially available technologies with standard service warranties. Any experimental or demonstration technologies must not be relied upon for assurance of critical service.*
* *Strategically Integrated: Support the strategic goals, plans, and mission of the Tribe, including preserving and sharing cultural traditions; improving the general welfare of the tribal community; and compassionately providing for the people and future generations.*
* *Energy independence: The Tribe is committed to its long-term vision of energy independence. The Tribe is currently heavily reliant on the multiple local utilities that serve its members and is working towards setting up a Tribal Utility Authority (TUA) to take control of its energy needs and use.*
* *Economic Development: Economic development is a very high priority for the Tribe given the high poverty and unemployment rates on the reservation. The Tribe expects to drive projects that can generate employment for the members as well as provide training and expertise for high demand jobs.*
* *Cost-effective: In order for the project to be viable, it is necessary to evaluate options based on their cost effectiveness over a 25-year horizon. The net present value of capital and operating costs and the economic benefits generated are estimated to evaluate options.*
* *Maturity of the technology: Implementation of only commercial energy technologies, to ensure the other objectives are not compromised.*
* *Alignment with long-term vision of the community: As the Tribe executes its strategic plan, the project must support this vision and enable the progress towards it as much as feasible.*

*Secondary Objectives: Options that support the following requirements are preferred by the Tribe:*

* *Workforce Development: Provide local workforce development and education opportunities.*
* *Staff Capacity: Build housing authority capacity for operations and maintenance.*
* *Flexibility and Expandability: Support operational flexibility and potential future expansions to more effectively support primary requirements and potentially to serve additional tribal buildings.*
1. **SPECIFIC PROJECT GOALS**

Identify the specific project goals. Project goals should define the intended end result as a quantifiable metric.

***Examples*** *might include:*

* *On-site generation of 1 MW.*
* *Save 20% of annual energy costs.*
* *Provide power to critical facilities for 3 hours during an emergency situation.*
* *Provide peak power for the Tribal Administration building.*
* *Generate 100% power for all tribal community buildings.*
* *Increase renewable penetration by 10%.*
* *Reduce cost of electricity by $0.03 per kWh.*
* *Reduce fuel consumption by 30%.*
1. **OPTION IDENTIFICATION**

Provide a description of options considered. The options should include as a minimum, the baseline “current state” option, the “do-minimum” option(s), and a variety of “do-something” options. The “do-something” options should include all feasible technology options (e.g., conventional technologies, renewable technologies, energy efficiency measure(s)) to achieve the defined objectives and specific project goals.

* **“Current State” Option**: The “current state” option (or “do-nothing” option) is evaluated as a bench-mark, to determine whether the other options considered improved or detracted from the current situation. The “current state” option is a no-investment option (no costs beyond those currently being spent on energy, operations and maintenance, etc.). It is critical to analyze current energy use data to establish the baseline or current conditions. Establishing the “do-nothing” option typically begins with collecting historical energy use data (e.g., electricity, natural gas, fuel oil, propane, etc.) and conducting energy audits, either for energy efficiency or generation.
* Provide a description to include energy needs (current and forecasted), energy sources, costs, jobs, or other items for comparison.
* **“Do-minimum” Option(s):** Define the "do-minimum" option(s) for the project which is a scenario that requires minimum effort and cost. This option assumes incurring certain insignificant investment outlays that go beyond the existing operational and maintenance costs. For example, partial modernization of an existing infrastructure requires fewer investment efforts and expenditures than a full infrastructure modernization would. The "*do-minimum*" option provides the least cost solution for achieving the overall objectives or requirements.
* Provide a description of the “do-minimum” option(s) including the incremental costs and benefits (e.g., costs, jobs, or other items for comparison).
* **"Do-something" Options**. Identify other possible alternative solutions against the "do-nothing" and “do-minimum” options. Such solutions are identified on the basis of how they best meet the objectives or requirements. The "*do-something*" options typically involve an investment depending upon the energy objectives or requirements. In many cases, the focus is placed on cost, where every option is evaluated against the level of investment and amount of savings.
* Provide a description of the “do-something” option(s) including the incremental costs and benefits (e.g., costs, jobs, or other items for comparison).

**Note:** A Strategic Energy Plan (SEP) is an initial step in identifying energy options, as it should define the energy vision, energy objectives, project goals, and an initial assessment of energy use, resources and options.

***Example 1:***

* *“Current State” Option: Tribal facilities and residential consumers served by XYZ utility at an electrical load of 7.7MM kWh at an annual cost of $800,000.*
* *“Do-minimum” Options:*
	+ *Implement energy efficiency measures in community buildings and homes at a cost of $1 million, resulting in an energy savings of 10% annually.*
	+ *Fossil-fueled Gensets: Install 2 gensets at $1M with negligible reduction over current utility costs.*
* *“Do-something” Options: Include the list of options evaluated under the analysis, along with a description of the option and key information and benefits.*
* *Community Wind Energy Project: 1.5 MW single turbine.*
* *Large Scale Wind Energy Project: 25 MW (10-12 turbines) utility scale wind energy project.*
* *Community Solar Energy Project: 1 MW community scale solar energy project.*
* *Thermal Heaters: Install thermal heaters at the Tribe’s commercial loads to store energy from wind turbine during high-wind / low-load times to offset electric heating costs during times of no wind.*

**4. APPROACH**

*Describe the approach used in the analysis. Specifically, how the analysis was conducted.*

***Example:***

*One example of an approach might be:*

*An options evaluation was conducted using a three-step process of information gathering and analysis:*

*1) Preliminary Screening: Considered options and ruled out non-viable technologies, designs, and project approaches. [One such method might be to screen the options against the primary and secondary objectives, or to use a SWOT (strengths, weaknesses, opportunities and threats) analysis. Another initial screening technique is the use of a fatal flaws analysis. Examples provided in Section 5, Preliminary Screening, below.]*

*2) Vendor Proposals and Inputs: Identified several qualified vendors and solicited informal project proposals and advice. [The use of vendor proposals provides resource and technology information for comparison. The* [*Tribal Energy Atlas*](https://www.energy.gov/indianenergy/articles/new-interactive-tool-puts-tribal-energy-resource-data-tribes-hands) *funded by the Office of Indian Energy and developed by the National Renewable Energy Laboratory (NREL) may provide some basic information in order to evaluation various energy options.]*

*3) Design Modeling and Feasibility Analysis: Analyzed feasibility of proposed systems, performed iterative modeling, and produced recommendations. [The use of models and tools to optimize the selected option and/or to verify information.]*

**5. PRELIMINARY SCREENING**

As indicated in the example approach above, an initial step is to conduct a preliminary screening of various options before investing in a more detailed analysis. The preliminary screening will evaluate options against specific criteria such as the extent to which it meets the energy objectives and specific project goals.

The following four possible preliminary screening methods are exemplified in this section:

1. Screen the options against the primary and secondary objectives,
2. Use a SWOT (strengths, weaknesses, opportunities and threats) analysis,
3. Fatal flaws analysis, or
4. Identify the pros and cons of each option.

***Example 1: Screen Options Against Objectives***

*One preliminary screening method is to screen the options against the primary and secondary objectives as exemplified below.*

| ***Solution***  |  ***Screening Outcome*** |
| --- | --- |
| *Fossil-fueled Gensets* | *Provisionally Accepted: Fossil-fueled systems alone cannot fully support any of the primary requirements. However, dispatchable fossil-fueled standby generation may be required to assure adequate fuel diversity and availability to serve critical loads during most outage scenarios.* |
| *Rooftop-Mounted Solar Photovoltaics (PV)* | *Provisionally Accepted: Site rooftop capacity is inadequate to meet full requirements of critical loads. However, rooftop PV can support all requirements to some degree.* |
| *Carport-Mounted Solar PV* | *Provisionally Accepted: Site parking-lot capacity is inadequate to meet full requirements of critical loads. However, carport-mounted PV can support all requirements to some degree. Due to added costs of carport structures, carport capacity should be specified only after rooftop and ground-mounted capacity is cost-effectively exhausted.* |
| *Ground-Mounted Photovoltaics (PV)* | *Rejected: Site-adjacent real estate inadequate for system capable of supporting resilience and strategic integration requirements. In addition to space being constrained or dedicated to other uses, the location of the facilities are immediately surrounded by rugged lands unsuitable for placement of solar PV.* |
| *Wind Power* | *Provisionally Rejected: Wind assessments indicateinadequate resources to support economically viable onsite wind power generation with current technologies. Wind turbines could be integrated on an experimental basis, but not as a commercially viable resource.* |
| *Geothermal energy* | *Rejected: Site geothermal resources could support ground source heat pumping, but facility thermal loads are too dynamic to justify the capital cost.* |
| *Biomass/Biogas* | *Provisionally Rejected: Currently available biomass and biogas resources are inadequate to support requirements for resiliency and economics. The Tribe remains interested in biomass/biogas options to meet future load requirements, if and when suitable fuel supplies become available in the project area. At such time, fossil-fueled gensets could either be retrofitted or replaced with systems that burn biomass/biogas fuels.*  |

***Example 2: SWOT Analysis***

*Another preliminary screening method might be the use of a SWOT (strengths, weaknesses, opportunities and threats) analysis as shown below for natural gas-fired generators.*

***Example 3: Fatal flaw Analysis***

*Another preliminary screening method is a fatal flaw analysis, as exemplified below.*

*Anaerobic Digestion Process:*

*Anaerobic Digestion is a biological process that produces a gas principally composed of methane (CH4) and carbine dioxide (CO2) otherwise known as biogas. These gases are produced from organic wastes such as livestock manure, food processing waste, etc.*

*The Disadvantages of Anaerobic Digestion*

* *No available waste stream to generate fuel*
* *Substrates in the biogas have an unpleasant odor*
* *High investment is required to prepare a biomass plant*
* *No waste water treatment facility available*

*Conclusion*

*Combined with the lack of a viable waste stream to generate fuel and no waste water treatment facility available to process waste water, and coupled with the high investment costs associated with the implementation of this technology, it is viewed as a highly unfeasible solution to meet the Tribe’s alternative energy needs.*

*Nuclear Energy*

*There are two fundamental ways to release energy from nuclear reactions: fission and fusion of atomic nuclei. Electricity generating technologies based on fission are commercially available, whereas fusion is still in the early stages of research and development and is at the present only a theoretical possibility for controlled power generation. Nuclear fission is the process of splitting the nuclei of atoms, which release energy from within those atoms. Nuclear fusion is the process of joining rather than splitting, such atomic particles with similar releases of energy.*

*Issues with Nuclear Power:*

* *Nuclear plants may not be economically feasible in the United States.*
* *Need for a spent fuel disposal facility and a decommissioning plan*
* *Use of large amounts of water for cooling purposes (if wet cooling towers are used)*
* *Biological impacts on the ocean due to thermal discharge (if sea water cooling is used)*
* *Designing for seismic safety*
* *Public safety concerns*
* *Transportation issues associated with the development of an emergency evacuation plan*
* *Changes in visual quality due to the power plant structures, including the reactor vessel containment structure and cooling towers (if applicable)*
* *Potentially significant amounts of land Potentially significant public opposition*

*Conclusion*

*Most of the disadvantages with nuclear energy have to do with the inherent properties of nuclear fission. The energy and byproducts released by nuclear fission are health hazards--either because of being extremely hot, due to the highly energetic release of heat during nuclear fission, or because of the destructive effects of radiation poisoning. Other disadvantages tend to be industrial in nature. Not only does nuclear power come with an extremely high initial expense, but the storage of waste products remains a difficult and controversial problem*

*In conclusion, the risks associated with nuclear energy as outlined above, far outweigh the benefits gained through its implementation both publicly and privately and renders this technology an unfeasible option for the Tribe when all of the aforementioned costs and issues are taken into account.*

***Example 4: Identify Pros and Cons***

*Another example is to identify the pros and cons of each option, as follows:*

| ***Project***  | ***Pros*** | ***Cons*** |
| --- | --- | --- |
| *Status Quo* | *No capital investmentNo project risk* | *High energy costs, and**Total dependence on the utilitiesfor Tribe’s energy needs* |
| *Community ScaleWind Energy Project* | *Smaller undertaking for the Tribe compared to the Large scale wind project, Economically attractive project,Supports Tribe’s long-term vision of energyindependence, andTakes advantage of “best in the nation” wind resource in ND.* | *Lack of economies of scale* |
| *Large Scale Wind Energy Project* | *Significant savings through economies of scale.Take advantage of the federal tax creditsEconomically attractive,Supports Tribe’s long-term vision of energyindependence, andTakes advantage of exceptional wind resource.* | *Significant investment in time/effort, andTransmission capacity challenges.* |
| *Solar Energy Project* | *Low Operations & Maintenance costs, andEasy project development & execution compared to wind projects.* | *Low capacity factor, andNot economically attractive.* |

**6. PRE-FEASIBILITY ANALYSIS**

In the example approach above, vendor proposals were sought to develop specific project options to meet the objectives and project goals. However, in lieu of soliciting vendor proposals, a pre-feasibility analysis of the options that passed the preliminary screening could be conducted to determine the viability of specific project options.

Specifically, a pre-feasibility analysis might include the following:

* Carry out demand analysis. Such an analysis means you must evaluate the need for a project investment through assessing 1) current demand and 2) forecast demand of the project. Demand analysis aims to formulate a hypothesis about the project’s capacity and size which are defined by either current demand or forecast demand. For each of the identified options you need to conduct demand analysis and find out which options ensure the most suitable project capacity and size in terms of current/future demand.
* Evaluate energy resources. Evaluate the availability of energy resources (e.g., conventional and renewable). Technical potential data for conventional fuels are typically proprietary; however, Tribes may be able to access federal assistance to analyze their fossil fuel potential. Contact the Bureau of Indian Affairs Division of Energy and Mineral Development for additional information: <https://www.bia.gov/as-ia/ieed/division-energy-and-mineral-development>. Renewable energy resource potential information is freely available to tribes through the U.S. Department of Energy Office of Indian Energy-funded Tribal Energy Atlas: <https://maps.nrel.gov/tribal-energy-atlas/>. The Atlas also contains information on the location of power lines, gas lines, utility rates, and average household expenditures on energy sources. Note: In the example approach under 4 above, they chose to solicit project proposals from vendors.
* Explore technology alternatives. Explore all feasible technology alternatives (e.g., conventional technologies, renewable technologies, energy efficiency measure(s)). Note: In the example approach under 4 above, they chose to solicit project proposals from vendors.
* Other considerations. Consider other factors such as fuel costs, fuel supply, interconnection, logistics, operation and maintenance, and training.

**7. OPTION SELECTION**

Describe the preferred option and summarize why that is the best option available among all feasible alternatives.

● **Compare Project Options**. A common basis for selecting the best project among various options is cost, benefits, or economics. Below are a number of methods to compare project options.

* **Perform multi-criteria analysis**. Another way to select the best project option is to compare all the options by using various criteria. This kind of analysis lets you deal with a suite of different objectives that cannot be aggregated into a single benefit. Specifically, a multi-criteria analysis is when a project is evaluated by more than just monetary terms. It is a form of appraisal that, in addition to monetary impacts, measures variable such as material costs, time savings and project sustainability as well as the social and environmental impacts that may be quantified but not so easily valued.
* **Perform cost-effectiveness analysis**. This step is where project options are compared relative to cost and outcomes. Specifically, a cost-effectiveness analysis is a form of economic analysis that compares the relative costs and outcomes (effects) of different courses of action. Cost-effectiveness analysis is distinct from cost–benefit analysis, which assigns a monetary value to the measure of effect. The goal is to select an option that best meets the objectives.
* **Evaluate economic impact**. Another method that could be used to select the best project option is the use of an economic impact analysis. This evaluation could use the levelized cost of energy (LCOE), Rate of Return (ROI0, Net Present Value (NPV), or even simple payback.

● **Make the final decision**. At this last step all the steps taken are summarized and it is confirmed whether the analysis has demonstrated that alternative feasible options have been adequately examined and considered and that the best option has been selected.

***Example:***

*An example of a multi-criteria analysis is included as an example below.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Options*** | ***Current State*** | ***Community ScaleWind Energy Project*** | ***Large Scale Wind Energy Project*** | ***Solar Energy Project*** |
| *Community Load (kWh)* | *30,000,000* | *30,000,000* | *30,000,000* | *30,000,000* |
| *Capital Cost* | *-* | *5,000,000* | *40,000,000* | *1,200,000* |
| *Annual Energy**Generation* | *-* | *5,000,000* | *100,000,000* | *1,200,000* |
| *Energy from project**used by Tribe* | *-* | *5,000,000* | *5,000,000* | *1,200,000* |
| *Levelized Cost of Energy**(25 years)* | *$0.10* | *$0.07* | *$0.06* | *$0.16* |
| *Annual Power Cost* | *$3,000,000* | *$2,800,000* | *$2,750,000* | *$3,200,000* |
| *Annual Savings* | *0* | *$200,000* | *$250,000* | *-$200,000* |
| *Comments* | *The Tribe is served by 3 utilities with average rates of $.08, $0.10 and $0.15 per kWh* | *Assumes forming a utility to offset cost of electrical service* | *Assumes buying back a portion of the energy generated and paying wheeling charges* |  |

*Based on the analysis, the best option to meet the Tribe’s goal of providing cost-effective energy to all tribal members is to install one 1.8 MW wind turbine on Tribal trust lands. Installing this Turbine will take advantage of an excellent wind resource and accelerate efforts to develop wind energy on a utility scale. The 1.8 MW turbine is estimated to produce approximately 5,000,000 kWh of electricity per year, or 62% of the Tribe’s current energy load of 8,000,000 kWh annually for 15 tribal facilities and save approximately $500,000 or approximately 60% of the electricity costs for those buildings of $800,000.*

*This option supports the Tribe’s primary requirements and provides a path forward toward energy independence.*

**ATTACHMENTS – DETAILED ANALYSIS RESULTS**

Attach any detailed analyses to support the options and selected solution, as needed.