

Challenges and opportunities: Microgrid modular design for Tribal Healthcare facilities

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Abstract—There exist significant challenges and opportunities for improvement the power system of healthcare facilities for American Indian and Alaska natives. Creativities, new technologies, and joint efforts among different stakeholders are needed to address tribal concerns about their environment, their wild life and their traditions while improving the electrical power system. This paper establishes plans and methodology to include the research process in the power system design utilizing Kayenta health center, which is located in the Navajo nation, as a subject study. A microgrid modular design architecture is defined. Modeling and simulation tools combined with experimental results are proposed for future implementation of the actual microgrid. The microgrid architecture can be used for improvement the power system of existing and new healthcare facilities for American Indian and Alaska natives.

Keywords—Microgrid; tribal healthcare facilities; renewable energy; power systems improvement; Indian Health Services

I. INTRODUCTION

Congress recognized the importance of tribal decision-making in tribal affairs and the primacy of the nation-to-nation relationship between the United States and Tribes through the passage of the Indian Self-Determination and Education Assistance Act (ISDEAA, Public Law 93-638, 1975). In subsequent amendments to the ISDEAA, among other things congress authorized federally recognized Tribes the option of entering into self-governance compacts to gain more autonomy in the management and delivery of their health care programs [3].

Throughout the process of construction of new healthcare facilities and updating existing ones, the Tribes are facing significant challenges regarding the design process as well as the reliability and efficiency of the electrical power service:

1. The healthcare facilities are usually located in remote locations. In some cases, there is no electrical power service or the service is not reliable enough for a healthcare facility.
2. Most Tribes does not have the expertise in latest technologies of power systems and they rely on the support of the Indian Health Services (IHS) and private designers. In some cases, the electrical system is over design, low efficient or has power quality issues.

3. Tribes prefer to be as much independent as possible from the US government and they have specific preferences about the way they foresee the power system for the healthcare facilities. The electrical power system needs to be designed such way that it fits in Tribes concerns about their environment, their wild life or their traditions.

4. The budget available for the design and construction and upgrades of power system for healthcare facilities varies significantly among different tribes.

5. One of the top priorities of the IHS is to renew and strengthen partnerships with Tribes and Urban Indian Health Programs. Most of the time, Tribes expect IHS to perform costly changes during the design process for the power system of healthcare facilities.

The question is how is it possible to overcome all these issues all together? Is there a way to optimize the power system of a typical healthcare facility located in the Indian lands by developing a Microgrid modular design?

IHS current A/E Design Guide (2013) provides general guidance and rules for the development of design documents, specifications, and other contract documents, architectural and engineering design features, submittals, and supplemental information. However, it does not contain specific information or guidance related to the power system reliability, efficiency and security or survivability analysis. The quality of the power system design rely mostly on the competence of the A/E design firm (which varies significantly from project to project) and the design revision process from IHS and the Tribal team. There is no research component in the A/E Design Guide [4].

IHS recognizes the need of going beyond the traditional way of providing Electrical Engineering support to the Tribes. This paper explores the feasibilities of deploying Microgrid (either grid tie or islanded) to improve the reliability and quality of the power supply of healthcare facilities for American Indian and Alaska natives. Since the electrical power system needs to be designed such way that it fits in Tribes concerns about their environment, their wild life or their traditions, it is necessary to combine the available latest technologies and processes, the Clean Energy resources and the new ideas into the research process in order to come up with improved and acceptable solutions. Through extensive

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