

Appendix A.
Interview Questions: For Health Facility Administrators

1. How many people does your facility cater to during regular working days?
2. What kind of energy disturbances (to electrical energy, thermal energy, or water) are common in your health facility? Are they weather related?
3. In predictable weather-related events, such as snowstorms or extreme cold, how do you prepare your facility for that event?
4. Does your facility have secondary energy generation? If so, what kind, and how much of your energy demand can be met?
5. How often does your health facility lose the electricity supply from the grid?
6. Are these outages as mentioned in the previous question/discussed weather related?
7. Have you noticed any changes in weather related outages?
8. In case of a long-lasting energy outage in the community, do you think the hospital can cater to more individuals than is standard with their energy service needs (dialysis equipment, medicine refrigeration). Note: This is for the people who are generally not in the hospital but have at home medical needs.
9. When your facility experiences outages, what happens? How do you manage providing care during an outage?
10. How significant is electricity cost in your total hospital expenditures and how much would you say it is the % cost of hospital expenditure?
11. What data do State and Federal agencies require you to report, during electricity outages or emergency events, and in what frequency? Do you report any other data voluntarily?
12. Has the health facility explored the development of renewable energy generation systems for the facility? How about energy storage systems?
13. Do you have a dedicated team of personnel who work to maintain in house electricity services? If yes, what primary tasks does this role include?
14. How concerned are you about the impact of natural disasters on the health facility and its energy service capability during a disaster?
15. What are the opportunities for improvement, to ensure your facility has a resilient electricity supply?
16. What is the biggest bottleneck in improving the resilience of your system in the face of weather-related events?
17. Is there anything else that you would like to share with us which you think would be important for our study and will benefit community and policy planning?

Appendix B.
Interview Questions For Broader Planning Stakeholders

1. What are the biggest vulnerabilities for healthcare facilities in the Western UP?
2. What are the biggest vulnerabilities for community members in obtaining health services in the Western UP in case of a natural disaster?
3. What are the challenges, from an energy perspective, in providing health care to the people in western UP, particularly during or after a disaster, based on your experience?
4. How concerned are you about the ability of healthcare facilities to maintain electricity dependent services during energy outages caused by natural disasters?
5. What do you think can be done to ensure these systems are resilient, and able to maintain electricity services needs during a disaster related outage?
6. How do you think this project team can best provide data, analysis, and results to inform decision making in the region?
7. Is there anything else that you would like to share with us which you think would be important for our study and will benefit community and policy planning?

**Appendix C.
Interview Participants**

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1	1	Houghton County	1/4/2023
2	1	Michigan Public Service Commission	1/6/23
3	1	Western Upper Peninsula Health Department	1/10/23
4	1	Portage Health Foundation	1/10/23
5	2	Western Upper Peninsula Planning	1/12/23
6	2	Aspirus Health	1/24/23
7	1	Michigan State Police	1/30/23
8	1	L'Anse Health Facility	2/14/23
9	1	Gogebic County	2/17/23
10	2	Portage Health	2/22/23
11	1	Ontonagon County	2/27/23

Appendices for Tiwari, S., Ketola, Z., Schelly, C., & Boyer-Cole, E. (2023). Energy Service Security for Public Health Resilience in Michigan's Western Upper Peninsula. Natural Hazards Center Public Health Report Series, 28. University of Colorado Boulder. <https://hazards.colorado.edu/public-health-disaster-research/energy-service-security-for-public-health-resilience-in-michigans-western-upper-peninsula>

Appendix D.
Survey Instrument Energy Service Security for Public Health Resilience (ESS-PHR)

You are being invited to participate in a research study that aims to better understand the energy services needs and vulnerabilities of health facilities in Western Upper Peninsula of Michigan.

This study is being conducted by Dr. Shardul Tiwari & Dr. Chelsea Schelly, from the Department of Social Sciences at Michigan Technological University.

You were selected as a possible participant in this study because you are a hospital manager in the Western Upper Peninsula.

There are no known risks if you decide to participate in this research study. There are no costs to you for participating in the study. This survey is confidential. Do not write your name on the survey. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study. Should the data be published, no individual information will be disclosed.

Your participation in this study is voluntary. You are free to decline to answer any particular question you do not wish to answer for any reason. If you participate in the research, you are eligible for a \$50 gift coupon.

If you have any questions about the study, please contact Dr. Shardul Tiwari, Department of Social Sciences, Michigan Technological University, 1400 Townsend Drive, Houghton MI 49931, email: Shardult@mtu.edu, 906 -370-7129. You may also contact Dr. Chelsea Schelly, email: cschelly@mtu.edu

Introductory Questions

We'd like to start by asking you about your health facility.

1. What are the total number of beds in your health care facility?

0-10 beds 10-25 beds 25-50 beds 50-100 beds 100-200 beds 201+ beds

2. What are the total number of employees working in the facility?

Less than 50 50- 100 people 101+ people

3. Approximately how many people does the hospital provide care for?

0-1,000 people 1,001-5,000 people 5,001-10,000 people 10,001+ people

4. For what time period on an average does a care patient stay in the hospital

0-2 days 2-5 days 5-10 days 11+ days

5. Can you access information to provide the total monthly/yearly electricity consumption of the hospital?

Yes No

6. Would you be willing to provide the total monthly/yearly electricity consumption of the hospital for the last one year?

Yes No

7. In your experience, how often does your facility suffer from power outages in a year?

Never Less than 5 times Less than 10 times a year More than 10 times a year

8. How long is the average duration of the outage?

Less than 5 minutes 5 – 15 minutes 15 – 30 minutes 31+ minutes

9. Do you have power back up at the hospital to provide electricity in case of an outage?

Yes No

10. If you answered yes to the previous question, what kind of power back up do you have in the hospital?

Diesel Generator Battery storage Renewable energy storage Other

11. To the best of your knowledge, has your facility ever considered an on site energy generation and storage system?

Yes No

12. What are your most pressing energy needs during and after a disaster?

Lighting Thermal comfort Refrigeration Emergency operation Patient care others

13. Do you think facility administration would be interested in developing a solar/wind power plant to provide electricity to the facility, if it was technically feasible and if cost were not a concern?

Yes No

14. To what extent are you concerned about the following issues?

Very Unconcerned **Somewhat Unconcerned** **Neither** **Somewhat Concerned** **Very Concerned** **Not Relevant**

Loss of electricity supply to the facility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited backup generator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Potential for disaster	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

hitting the facility

Impact of disaster

Lack of electricity service during disaster

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Demographics

The following information will ask for your demographic information.

1. In which age group do you belong?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18-30 yrs	31-45yrs	46-60yrs	61+ yrs

2. What is your gender?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Female	Male	Other	Decline to Say

3. What is your highest level of education?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less than High School	High School	Associate's Degree	Bachelor's Degree	Graduate Degree	Decline to Say

4. Please indicate how long have you worked at the health facility

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less than 1 year	1 to 5 year	5- 10 years	11+ years

Thank you for taking the time to complete this survey. Is there anything else you would like to share with us about the energy services needs and/or vulnerabilities at your medical facility?
