Grant PSC-23-16
Michigan Nuclear Feasibility Study

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

ENERCON
SERVICES EAST, P.C.

September 8, 2023

Agenda

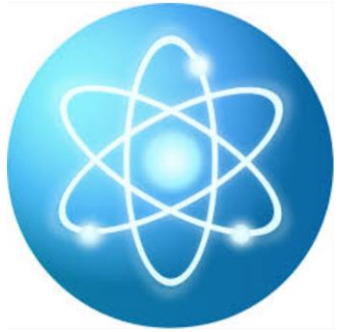
ENERCON
SERVICES EAST, P.C.

- Welcome and Introductions
- Overview of Goals for Stakeholder Meeting
- Michigan Resources and Expertise
- Nuclear Technologies Evaluation
- Economic Impacts Assessment
- Benefit Assessment
- Schedule Assessment
- Coordination with Other Technologies
- Policy Assessment
- Supporting Studies Summary
- Process of Location Selection
- Palisades Nuclear Plant Discussion
- Closing Remarks

Welcome and Introductions

ENERCON
SERVICES EAST, P.C.

- Define the purpose of the report
  - Summarize findings regarding feasibility of nuclear generation in Michigan – from numerous angles
- Provide an overview of Nuclear Energy (later slides)
- Provide overview of current/decommissioned Michigan Plants (later slides)



- Describe the methodology of the report
  - Evaluate nuclear generation feasibility from the aspects outlined by Public Act 218
  - Solicit public stakeholder feedback via a series of meetings & incorporate items within the scope
- Identify any limitations or assumptions (non-public info; costs are almost all estimates at this point, though they have some basis)

Overview of the Goals for Stakeholder Meeting

ENERCON SERVICES EAST, P.C.

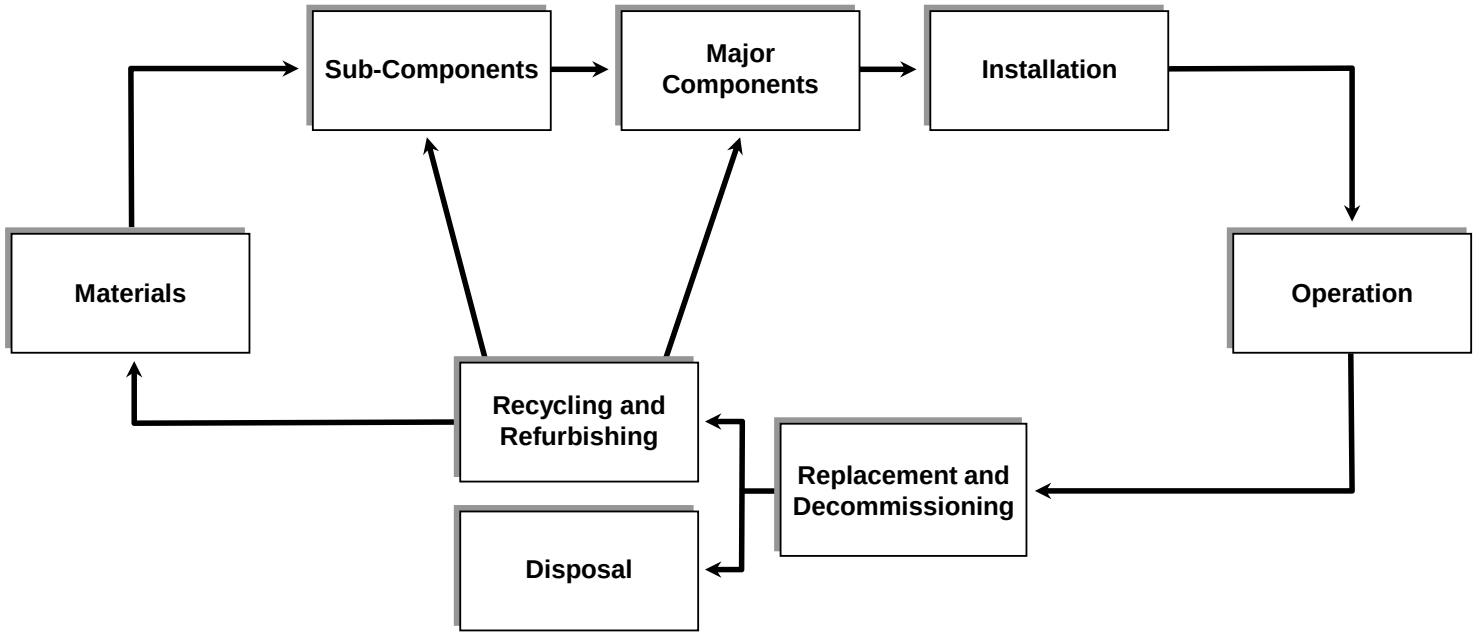
- Provide Update on Study Progress
  - Summarize High-Level Findings
  - Solicit Feedback from the Public
  - Consider the Public Feedback w/ PSC input
  - Incorporate Feedback Items within the Scope of the Report into the Final version

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

Michigan Resources and Expertise

ENERCON SERVICES EAST, P.C.

- Use of Michigan Workers
- Workforce Education, Training, and Development
- Use of Michigan Products
- Supply Chain Development
  - Timeline and Outlays
  - Manufacturing
  - Employment



Nuclear Energy Plant Lifecycle Supply Chain

Economic Impacts

The economic impacts of constructing and operating a new small modular reactor in Michigan include the following:

- Economic Impact to the People of Michigan
  - Jobs during every phase from construction, operation, to decommissioning
  - Employee compensation during construction is estimated to be ~$530 million
- Economic Impact to Michigan Businesses
  - Total economic impacts from ~$2.5 billion in expenditures results in ~$4.7 billion in direct, indirect, and induced effects
- Economic Impact to Michigan State Government
  - Total State Tax Impacts of >$250M

ENERCON
SERVICES EAST, P.C.

Evaluation of Current Nuclear Technology and Designs

- Design characteristics, including existing and potential modifications
- Environmental, ecological, health, and climate impacts
- Engineering and cost related criteria, including, but not limited to:
  - Extension of current NRC licenses
  - D.C. Cook Units 1 & 2
  - DTE – Fermi Unit 2

ENERCON SERVICES EAST, P.C.

Evaluation of New Nuclear Technology and Designs

- Design characteristics, including but not limited to reactor types, sizes, and fuel
  - EPRI, NEA, and NIA reports
- Environmental, ecological, health, and climate impacts
  - NRC processes relating to these reviews; No CO2 emissions from operation
- Land and siting criteria
- Safety and on-site security criteria
  - Potential for reduced EPZ sizes & versatility for siting
- Engineering and readily available cost-related criteria
  - FOAK vs. NOAK unit cost, w/ learning curves
- Small-scale nuclear reactor capability
  - Comparable capacity factors expected; Some designs have improved efficiency and flexibility beyond electricity

Benefit Assessment

- Energy Requirements and Goals
  - New Nuclear would be expected to operate at high capacity factors, operating >90% of the time, providing reliable, dispatchable electricity
- Environmental Requirements and Goals
  - EPA Requitements will ensure the environment is protected with any new nuclear generation; nuclear will not emit CO2
- Safety Requirements and Goals
  - NRC Licensing Processes will ensure safety

Open Discussion

ENERCON
SERVICES EAST, P.C.

Q & A

Schedule Assessment

ENERCON SERVICES EAST, P.C.

Determine the timeline for development of nuclear energy generation facilities within the State of Michigan

- DOE Liftoff Report Timeline →
- Potentially improved Timeline

Table 7 Best case scenario for completion of a nuclear power plant in the U.S. [52, 199].

Year	Y-1	Y-2	Y-3	Y-4	Y-5	Y+6	Y+7	Y+8	Y+9
Feasibility Study & Project Plan	Detailed Site Survey Eviron. Impact Assessment; Project Planning								
License			Apply for Permit; Permit Review	Construction Permit Issued		If part 50, apply for OL	Review by Reg.	Operating License Issued	
Design& Procurement		Procurement; Engineering Design (site specific)							
Construction		Contract with EPC	Site Preparation	Excavation	Construction			Commissioning / Start up	

Table 6 Illustrative major steps for building a nuclear power plant adapted from DOE [52].

Year	Y-1	Y-2	Y-3	Y-4	Y-5	Y+6	Y+7	Y+8	Y+9	Y+10	Y+11
Feasibility Study & Project Plan	Project Planning	Detailed Site Survey Eviron. Impact Assessment									
License			Apply for Permit	Permit Review	Construction Permit Issued			If part 50, apply for OL	Review by Reg.	Operating License Issued	
Design& Procurement		Procurement	Engineering Design (site specific)								
Construction			Contract with EPC	Site Preparation		Excavation	Construction				Commissioning / Start up

Coordination with Other Technologies

ENERCON
SERVICES EAST, P.C.

Address gains made by coordinating new gen with retired nuclear, coal, gas, or other plants.

Address efficiencies by coordinating with other advanced, clean technologies, including:

- Re-Purposing Power Plant Sites
- Energy Potential Beyond Electricity
- Hydrogen Production
- District Heating
- Desalination (Not needed in Michigan)
- Direct air capture of carbon dioxide
- Energy storage
- Chemical/Petroleum Applications

Policy Assessment

- Infrastructure and Jobs Act (2021)
  - Civil Nuclear Credit Program provides up to $6 Billion incentives to preserve current US nuclear fleet
  - Holtec applied for this credit to restart Palisades, but was denied
  - Financial incentives available for other nuclear plants that can demonstrate at risk of closure for economic reasons
- Inflation Reduction Act (2022)
  - Production tax credit of up to $15/MWH available for operating nuclear plants from 2024 through 2032 (labor and wage requirements
  - Production tax credits and investment tax credits available for deployment of advanced reactors designs (additional incentives for siting nuclear plants near existing coal facilities)
  - Provides financial support for domestic supply of Highly Assay Low-Enriched Uranium (HALEU)

Policy Assessment

- ADVANCE Act (Proposed Federal Legislation)
  - Proposed legislation passed in bipartisan manner by the US Senate in July 2023
  - Develop and Deploy New Nuclear Technologies
    - Reduce regulatory costs associated with new reactor designs
    - Create incentives to deploy the next generator of nuclear reactors
    - Require NRC to develop pathway to review licensing of nuclear facilities at brownfield locations
  - Improve NRC efficiency
    - Provide tools to hire and retain staff
    - Require the NRC to schedule performance metric metrics for review of applications
  - Strengthen US nuclear fuel cycle and supply chain infrastructure

Policy Assessment

- Nuclear Energy Innovation and Modernization Act (2019)
  - Requires NRC to develop a risk-informed performance-based evaluation technique for review of reactor design applications by 2027
  - Stakeholder recently provided significant comments on the NRC's proposed 10CFR53 rulemaking
  - In parallel with proposed rulemaking, a number of advanced reactor vendors in coordination with the Department of Energy and one existing nuclear utility developed the Licensing Modernization Program (LMP) that provides risk-based techniques for evaluating the hazards to be considered in advanced reactors
  - The NRC Commissioners concluded that the methodology in LMP is a reasonable approach for the design of advanced reactors
  - Many of the reactor designs are currently utilizing the LMP methodology
  - Delays in the final issuance of the 10CFR53 rule making is not expected to impact many of the advanced reactors currently being designed

Policy Assessment

- Other Proposed Regulatory Changes
  - Advanced Nuclear Reactor Generic Environmental Impact Statement (GEIS) – 2025
    - Generic environmental impacts will reduce effort for each site specific environmental assessment

- Recent State Policies
  - Michigan
    - Provided $150 Million to support restart of Palisades
  - Tennessee
    - Developed $50 Million nuclear fund to supporting businesses in the nuclear industry that grow or relocate to Tennessee
  - Virginia
    - Nuclear Innovation Fund and Nuclear Education Grant Fund

Policy Assessment

- Bipartisan federal support for nuclear
  - Reduce carbon emissions
  - Regain U.S. dominance in nuclear technology is world
    - Russia and China aggressively marketing their nuclear technology around the world
- Expect additional federal policy changes to support the nuclear industry
- Recommended Policy Actions for Michigan
  - Policies that support first mover nuclear deployments
    - Utilities and power project developers continue to be concerned with the potentially high cost of the initial reactor deployments
  - Polices that support work force and supply chain development
  - Coordination with other states interested in nuclear may be advisable.

Supporting Studies Summary

- Perform Literature Review
  - Complete analysis of national and international studies where development of nuclear energy is supported
  - Describe recent US nuclear generation studies
- The report currently has over 200 total references, including summaries of studies from DOE (particularly recent “Liftoff” reports for Advanced Nuclear and for Clean Hydrogen), The Union of Concerned Scientists, the Electric Power Research Institute (EPRI), TerraPraxis, Nuclear Energy Assembly (2 volume SMR dashboard), and the Nuclear Innovation Alliance (Advanced Reactor Primer)

Open Discussion

ENERCON
SERVICES EAST, P.C.

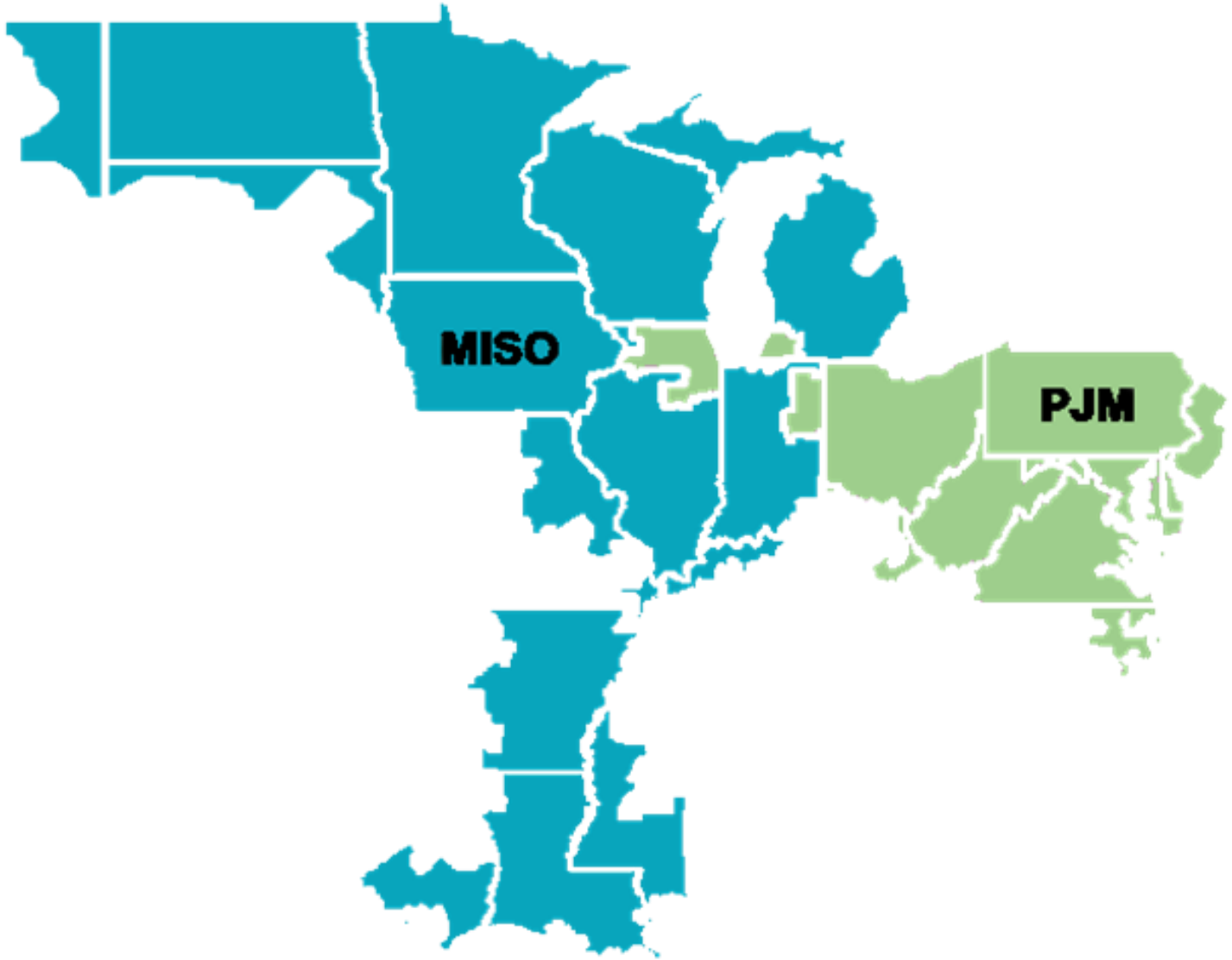
Q & A

Process of Location Selection

- Look at current grid regions/system operator territories
  - MISO and PJM both operate “the grid” in portions of Michigan
  - Consider existing transmission infrastructure
- Note existing electric utilities within Michigan
- Select a hypothetical site for new nuclear generation for modeling purposes (economic and power system)

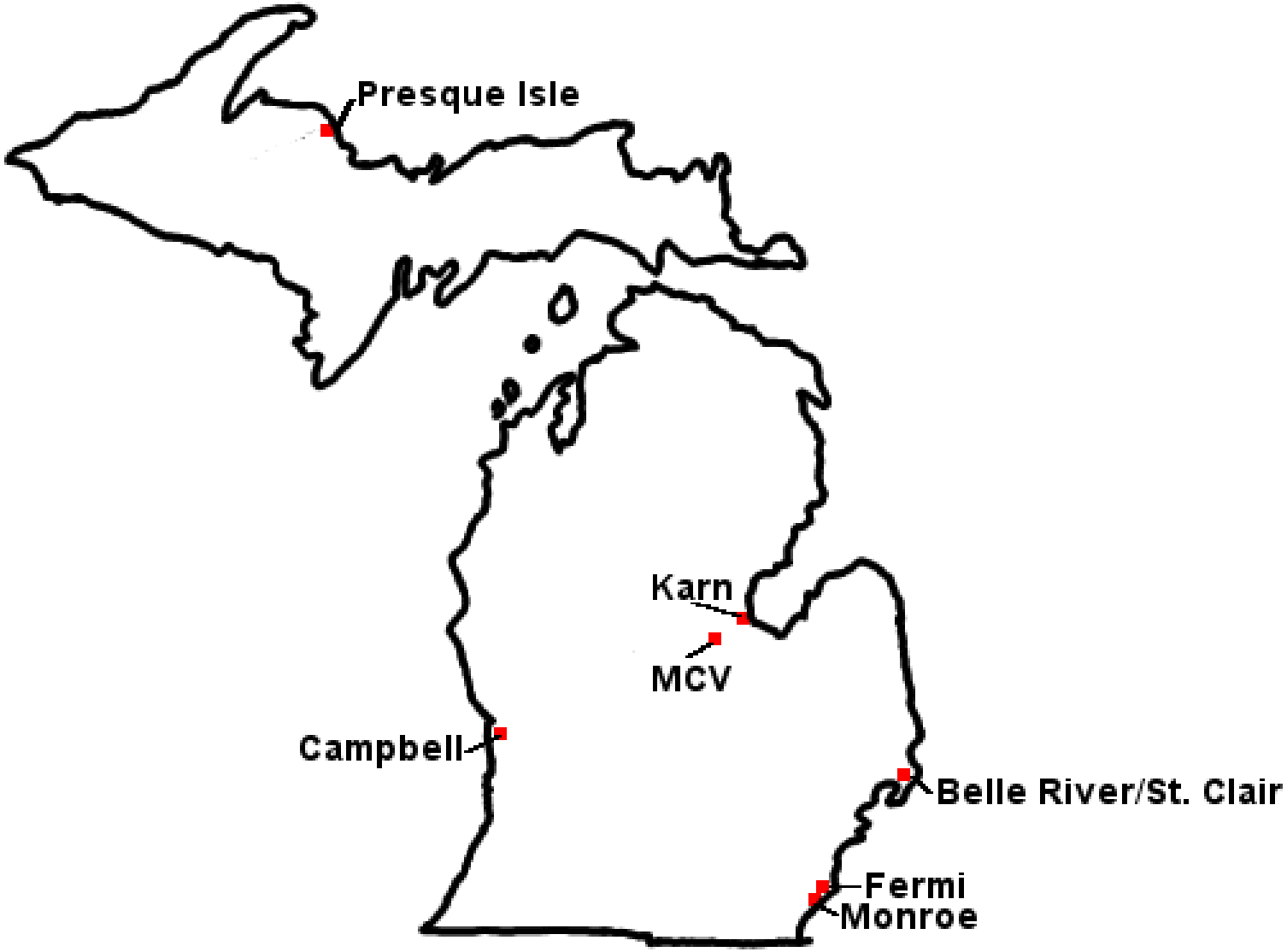
Michigan Independent System Operators

ENERCON
SERVICES EAST, P.C.

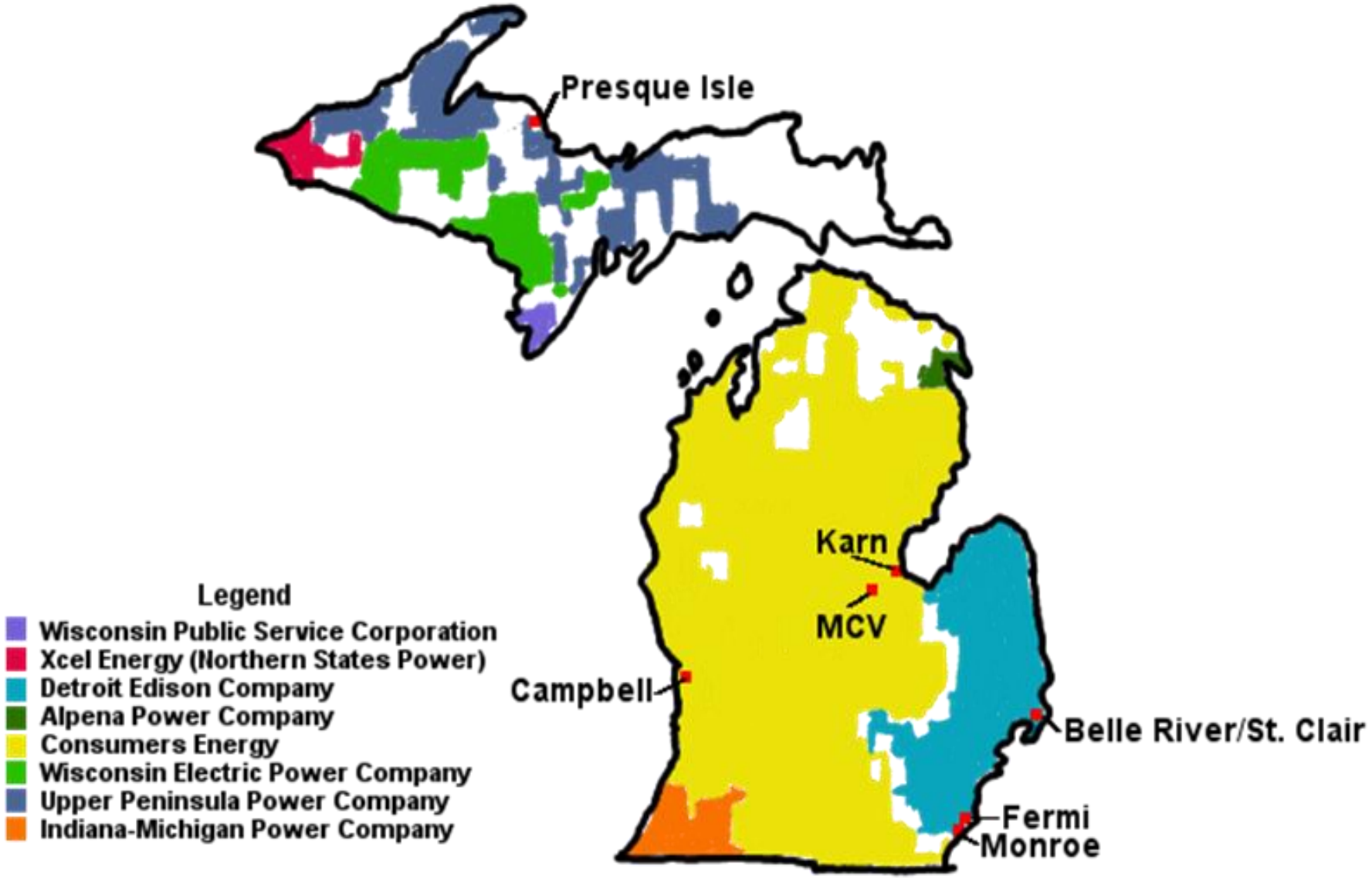


Evaluated Grid Connection Sites

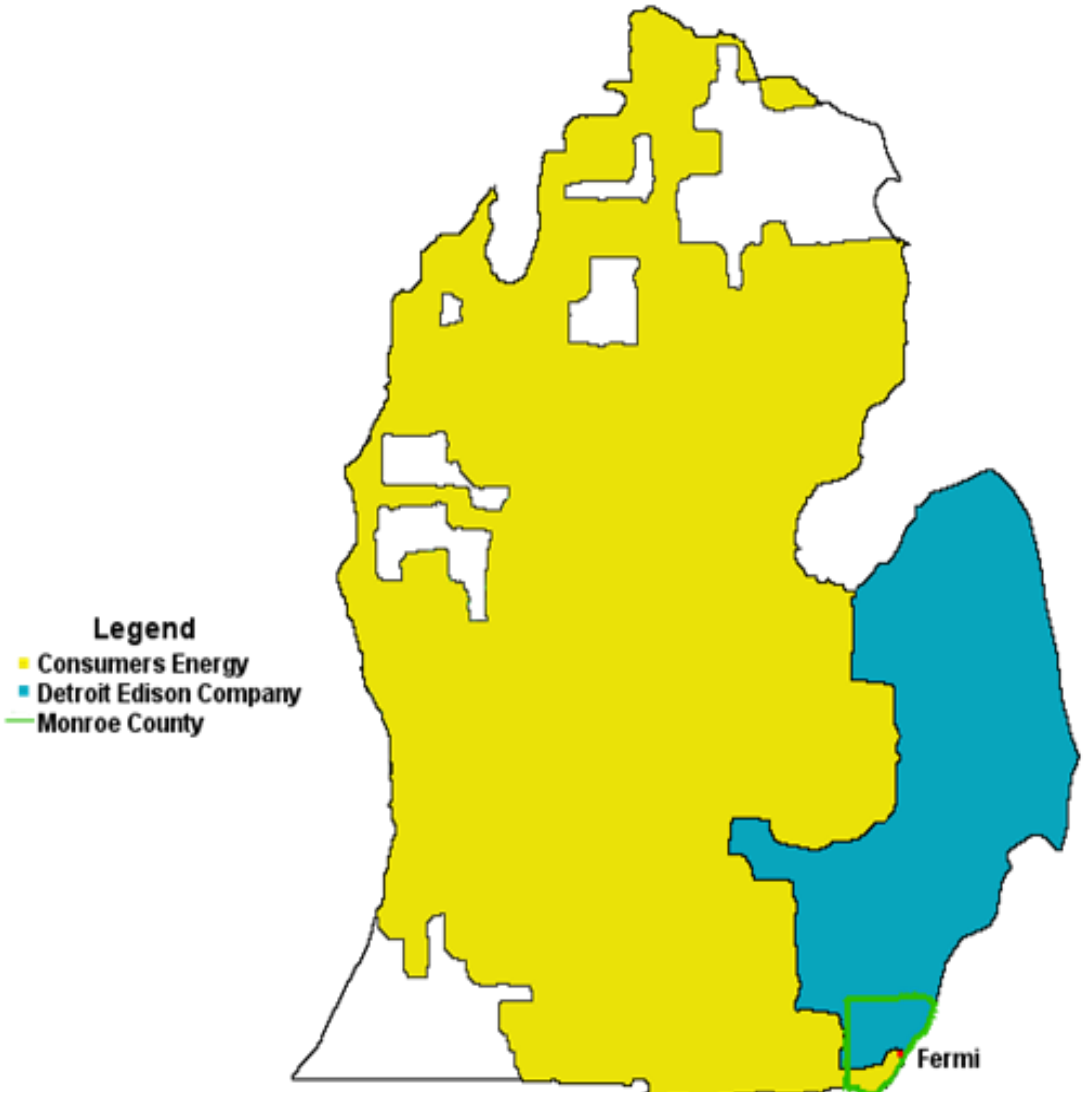
ENERCON
SERVICES EAST, P.C.



Michigan Utilities



Hypothetical Locations



Open Discussion

ENERCON
SERVICES EAST, P.C.

Q & A

Palisades Nuclear Plant Discussion

ENERCON
SERVICES EAST, P.C.

- Today, the site remains in the early stage of the decommissioning process
- In March 2023, site owner Holtec filed an application for federal loan funding through the U.S. Department of Energy's Loan Programs Office to support the repowering.
- In August 2023, Governor Whitmer signed into law the Fiscal Year 2024 budget, which includes $150 million for restart
- Holtec is in the process of developing a small modular reactor design and has indicated that decommissioning nuclear sites like Palisades would make ideal locations for future reactors.

Open Discussion

ENERCON
SERVICES EAST, P.C.

Q & A

Closing Remarks

ENERCON
SERVICES EAST, P.C.