ATC Energy Collaborative – Michigan High Retirements #2 Future

Summary of Results

September 21, 2010

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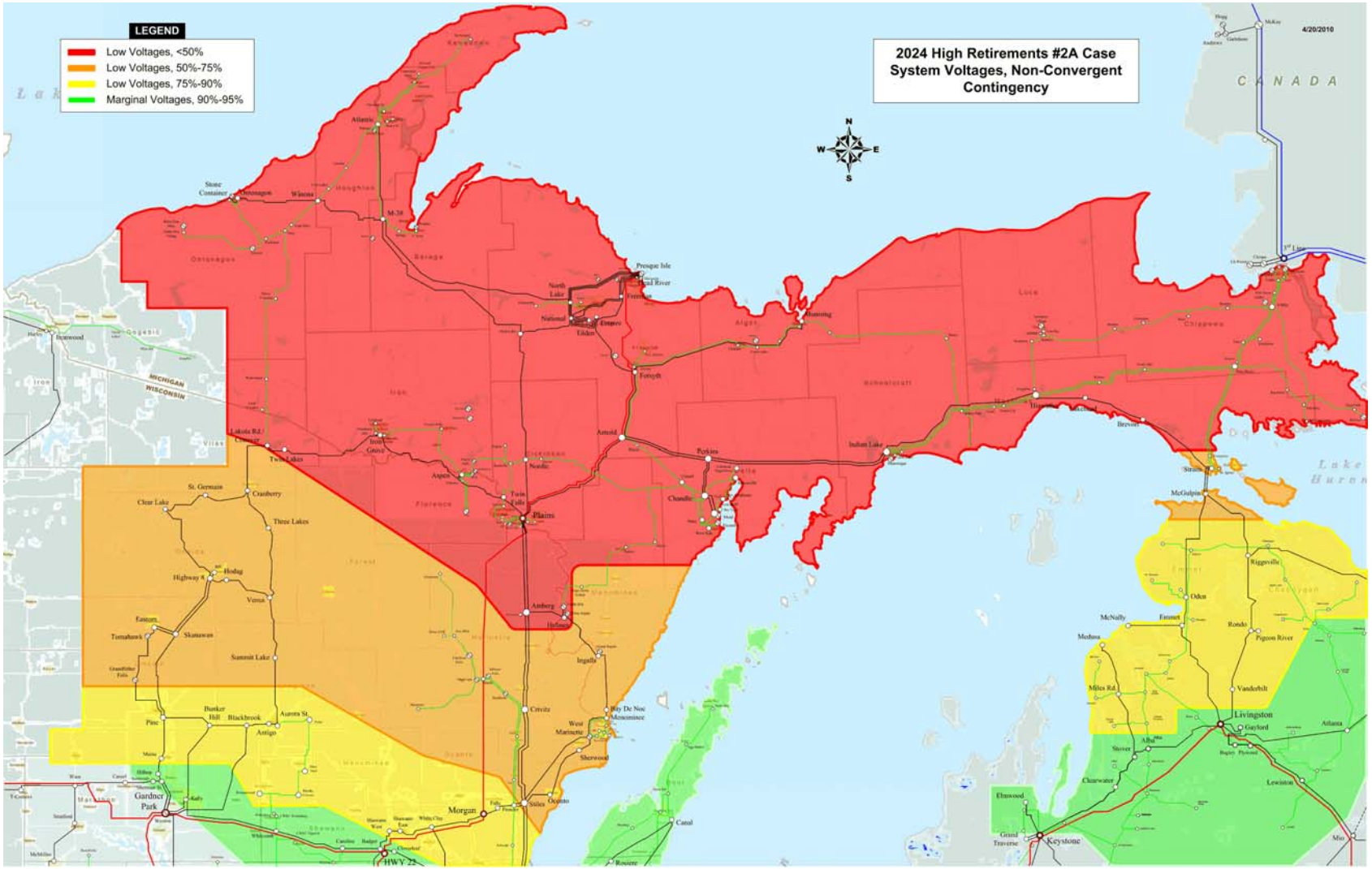
Agenda

- Background
- Needs
- Option types tested
- Other assumptions and limitations
- Contingent solutions

Background

- High Retirements future starting case
- Respond to stakeholder feedback from the Collaborative process
  - 2024 study year
  - Summer peak case
  - Increase load levels to 1.5% growth/year
  - Very low U.P. generation
    - Scenario 2A – 350 MW assumed retired
    - Scenario 2B – 500 MW assumed retired

Needs: System Voltages in Scenario 2A



Conceptual Options Studied

- 345-kV transmission
- 138-kV transmission
- 345/138-kV transmission
- Synchronous condensers
- Generation at another site
- SVC or other reactive support
- Combinations

2A Conceptual Solutions

350 MW generation retired

- Option 1 - 345-kV transmission
  - Two 345-kV lines, 160 total miles
  - $330 million capital
- Option 2 - 138-kV transmission
  - Seven 138-kV lines, 676 total miles
  - 345/138-kV transformer
  - $460 million capital
- Option 3 - Generation
  - 250 MW generation (2@100, 1@50)
  - 35 MVAR synchronous condenser
  - Uprate existing 138-kV line ($5M estimated)
  - $170 - $240 million capital
- Option 4 - Synchronous condensers
  - Did not work as a stand-alone option

2B Conceptual Solutions

500 MW generation retired

- Option 1 - 345-kV transmission
  - Two lines, 160 miles
  - 105 MVAR synchronous condenser
  - $340 million capital
- Option 2 - 345/138-kV transmission
  - One 345-kV line, 143 miles
  - Two 138-kV lines, 113 miles
  - 345/138-kV transformer
  - 167 MVAR synchronous condenser
  - $390 million capital
- Option 3 - Generation
  - 400 MW generation (4@100 MW)
  - 167 MVAR synchronous condenser
  - 80 MVAR SVC
  - Rebuild/uprate two existing lines ($22M estimated)
  - $330 - $440 million capital

High Level Cost Assumptions

- Overhead 345 kV transmission - $2.1M / mile
- Overhead 138 kV transmission - $1.2M / mile
- 345/138 kV transformer -- $8M / unit
- Generation costs
  - $0.7M (CT) - $0.9M / MW (Combined cycle)
- SVC costs - $0.3M / MVAR
- Convert existing generating units to synchronous condensers - $3M / unit

Limitations of Screening Study

- No comparative operating cost analysis
  - Does not include forecast of operating costs and/or revenues of generators or synchronous condensers
  - Does not include maintenance costs
  - Does not include line loss savings
- Does not consider impact on existing Special Protection Systems
- Only one generator location studied
- No generator stability analysis
- No detailed voltage stability analysis
- Minimal multiple outage analysis

Study Limitation Implications

- Greater uncertainty with generation options
  - Previous G-T studies in UP indicate:
    - Additional infrastructure could be needed to support generation options
    - Stability analysis of generation options takes a long time to complete
  - Highly location-dependent
- Preliminary multiple outage analysis suggests more reactive power support needed than included in costs

- This is a contingent set of solutions as part of the overall ATC Energy Collaborative – Michigan
  - This is one of six futures studied.
- For more information
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