# section 6 Summary of Planned and Proposed Facility Additions in the 2003 Assessment

## Summary

- *Need categories (definitions of project need drivers)*
- *Planned, proposed and conceptual projects (tables showing projects by year, by project type and by zone)*
- *Estimated capital costs of projects*

### Summary of Planned, Proposed and Conceptual Additions, 2003-2012

The facilities proposed by the ATC based on this 2003 Assessment are listed in Tables VI-1 through VI-19, and shown graphically by zone in Figures VI-1 through VI-5. In addition, alternatives for some the primary alternatives shown in Tables VI-1 through VI-19 are listed in Table VI-20. Also, portions of the plan in the 2002 Update Assessment that are not included in this plan are listed in Table VI-21.

In each of these tables, there is a column indicating the planned in service year for each particular facility and a column indicating the year the facility is needed. There are numerous facilities for which the year it is needed precedes the planned in service year. There are a variety of reasons for this, including:

- The preferred alternative to address a particular need may take several years to implement.
- The need may have existed but had been addressed with operating procedures that are becoming less effective or ineffective.
- The preferred alternative to address a particular need may need to be implemented in phases, thus delaying certain phases.
- New data or information became available that affected the nature of the need or limitation, which necessitated a change in the alternative to be implemented, introducing a delay in implementation.
- The need for a project was based on load or generation development that was uncertain.
- Stakeholder input necessitated a change in the alternative to be implemented, introducing a delay in implementation.

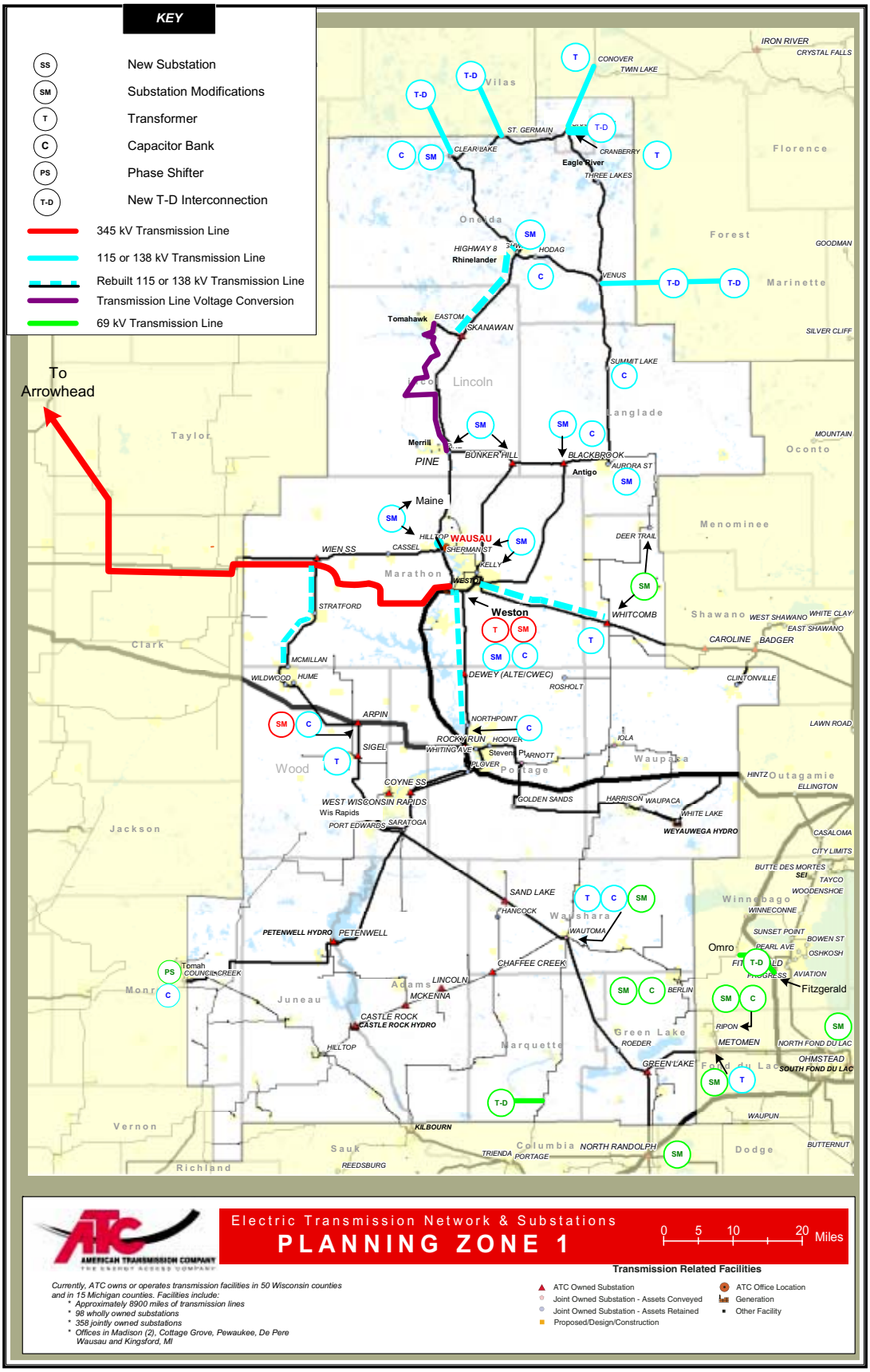
Tables VI-1 through VI-10 show the facilities planned by year for 2003-2012 respectively. Tables VI-11 through VI-15 show the facilities planned by zone. Table V-16 provides a list of planned transmission lines involving new right-of-way for 2004-2012. Since ATC intends to solicit public input on the identification of ultimate solutions through its iterative planning process, these particular projects may be modified in the future. Table V-17 provides a list of proposed transmission line rebuilds, reconductoring and uprates on existing right-of-way. Table V-18 provides a list of proposed new substations and transformer additions (excluding transmission-to-distribution transformers). Table V-19 provides a list of other proposed substation equipment additions or replacements.

### Need Categories

Within the above tables, the need for each project is identified. Need categories include the following:

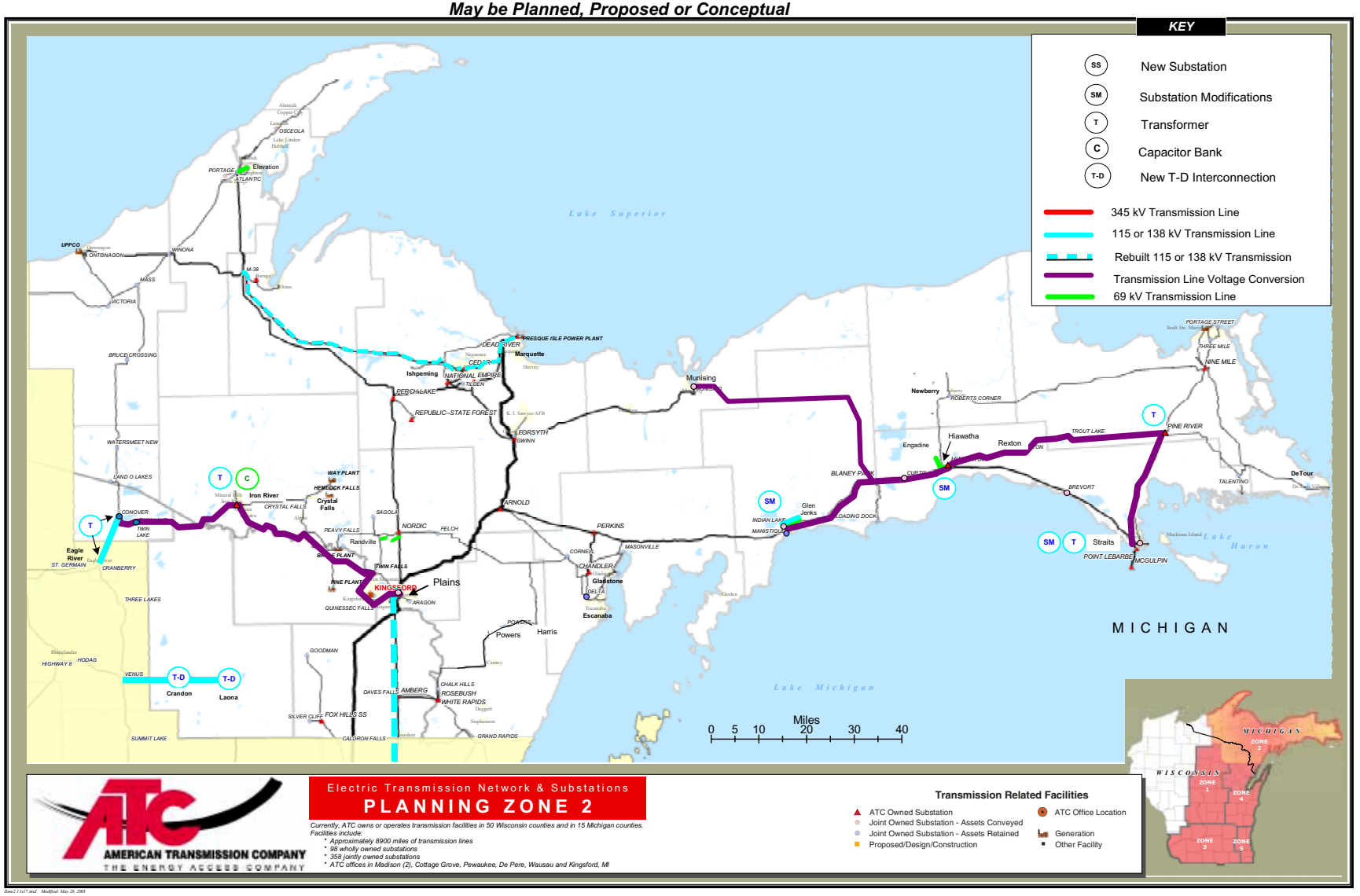
| | |
|---|---|
| Reliability: | Facility (line, transformer, substation equipment) normal rating is exceeded under normal system conditions or emergency rating is exceeded under single contingency conditions, or bus voltage is not within 5% of nominal voltage under normal system conditions or is not within 10% of nominal voltage under single contingency conditions. (see Appendix C) Impending overload or voltage violations are noted as appropriate. |
| New generation: | Facility has been identified as necessary to accommodate new generation in generation interconnection studies and related transmission service studies conducted by ATC. |
| TLR: | Facility has been identified by ATC Operations or ATC Transmission Service as a chronic cause for interrupting, curtailing, limiting or denying transmission service in real time. |
| T-D interconnection: | Facility is required to interconnect to a new transmission-distribution substation needed by a distribution company served by ATC. |
| Condition: | Facility has been identified by ATC Maintenance as being in need of repair or replacement. |
| Stability: | Facility has been identified by ATC Stability and Special Studies as needed to ensure ATC dynamic stability criteria is met (see Appendix C), or will improve stability response of generation. |
| Import capability: | Facility will enhance import capability of the ATC transmission system. |

# Figure VI-1
# Zone 1 Transmission System Additions
## *May be Planned, Proposed or Conceptual*

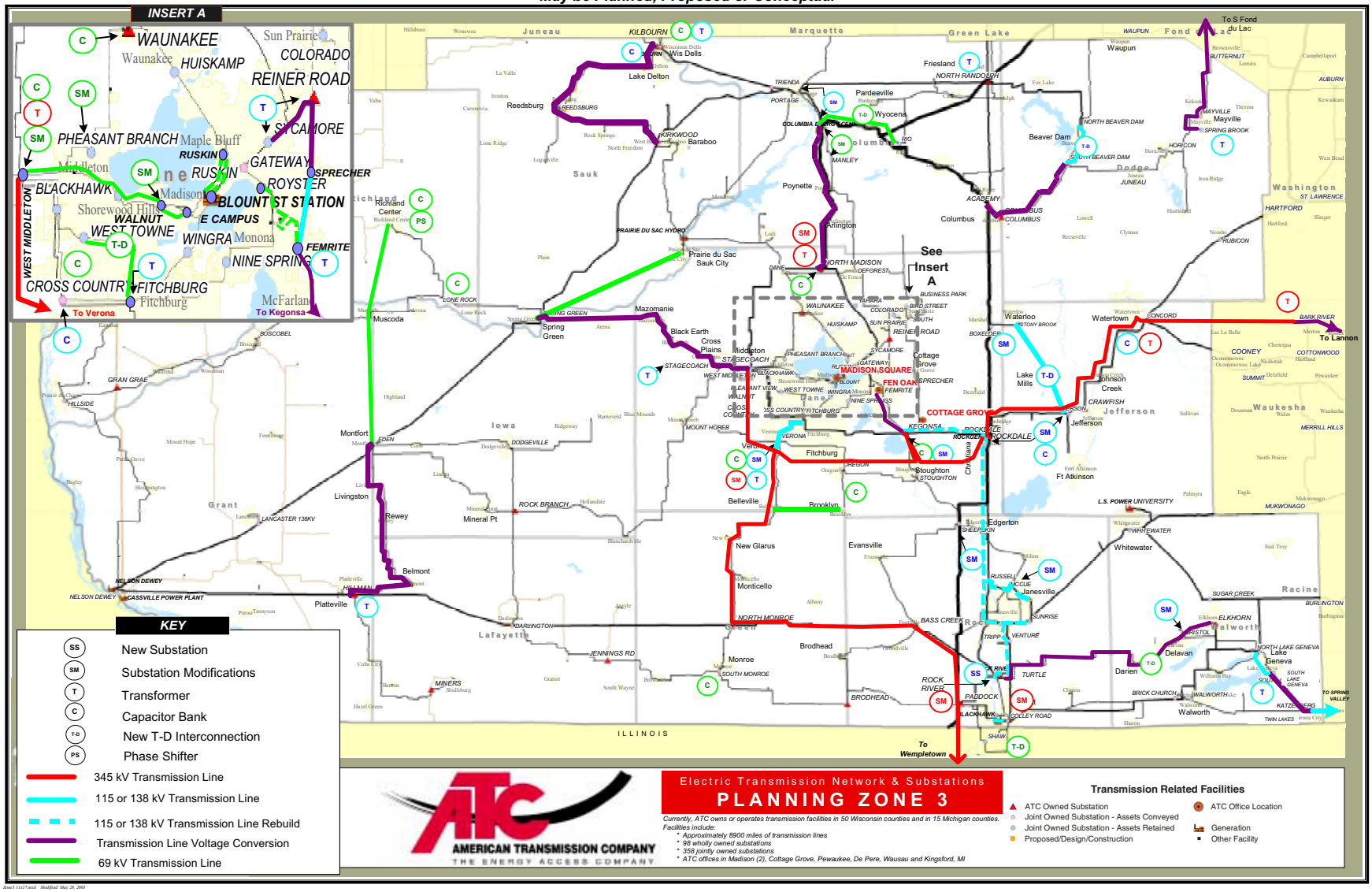



Zone1 11x17.mxd Modified: May 20, 2003

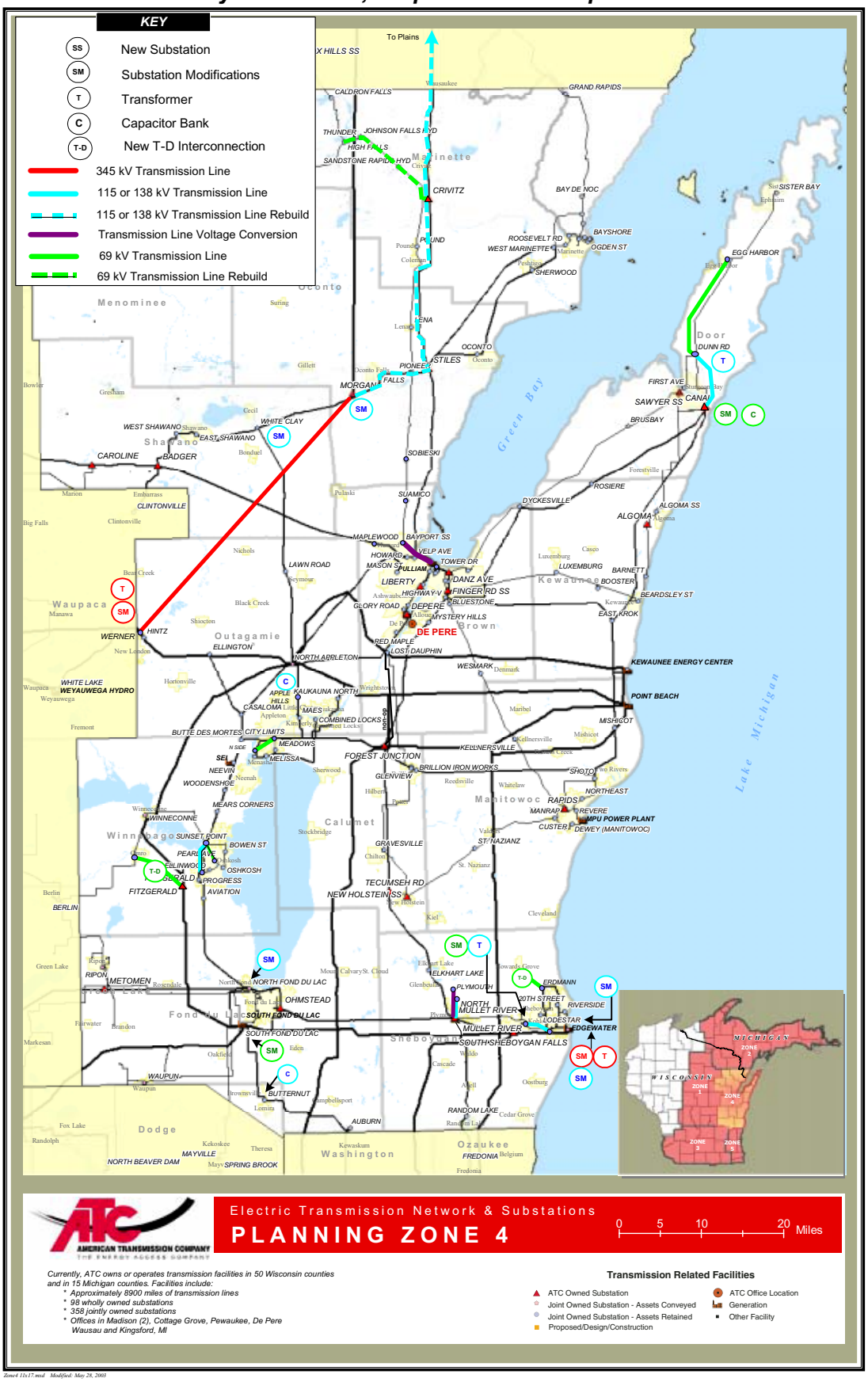
# Figure VI-2
# Zone 2 Transmission System Additions
***May be Planned, Proposed or Conceptual***



# Figure VI-3
## Zone 3 Transmission System Additions
***May be Planned, Proposed or Conceptual***



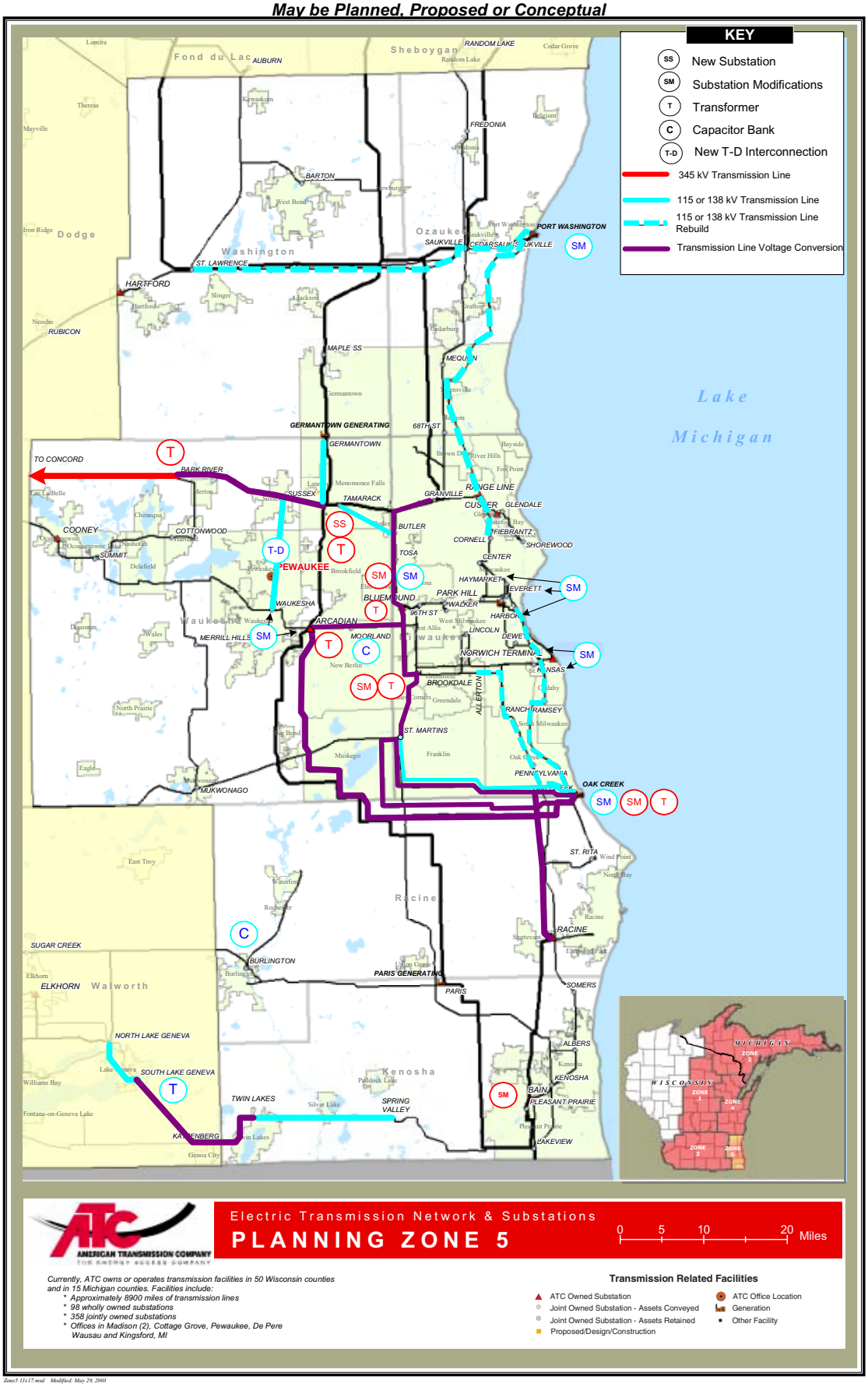
# Figure VI-4
# Zone 4 Transmission System Additions
## *May be Planned, Proposed or Conceptual*




Zone4 11x17.mxd Modified: May 28, 2003

# Figure VI-5
# Zone 5 Transmission System Additions

***May be Planned, Proposed or Conceptual***




Zone5 11x17.mxd Modified: May 29, 2003

Table VI-1 Transmission System Additions for 2003

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct an Endeavor-Wautoma/Portage Tap 69 kV line | 2003 | 2003 | 1 | T-D Interconnection | Planned | 0.74 |
| Uprate Whitcomb 115/69 kV transformer | 2002 | 2003 | 1 | reliability | Planned | 0.02 |
| Construct Elevation Tap-Elevation 69 kV line | 2003 | 2003 | 2 | T-D Interconnection | Planned | 0.53 |
| Reconductor Christiana-Kegonsa portion of Christiana to Fitchburg 138 kV line | 2005 | 2003 | 3 | reliability | Planned | 8.00 |
| Reconfigure 69/138 kV circuits between Rock River and Janesville to create Rock River-Janesville and Rock River-Sunrise 138 kV circuits | 2004 | 2003 | 3 | reliability, new generation | Planned | 2.80 |
| Reconductor Colley Road-Blackhawk 138 kV line | 2003 | 2003 | 3 | reliability, service limitation | Planned | 0.21 |
| Construct 138 kV switchyard at Riverside generation site (Townline Road Substation) | 2003 | 2003 | 3 | reliability, new generation | Planned | 12.00 |
| Construct 138 kV double circuit line from Townline Road to Rock River | 2003 | 2003 | 3 | reliability, new generation | Planned | 2.00 |
| Reconnect NW Beloit 69 kV load to Paddock-Blackhawk 138 kV line | 2003 | 2003 | 3 | reliability | Planned | 0.92 |
| Replace 200 A metering CT at Sheboygan Falls 69 kV | 2003 | 2003 | 4 | reliability | Planned | 0.05 |
| Replace 400 A CT at S Fond du Lac 69 kV | 2003 | 2003 | 4 | reliability | Planned | 0.03 |
| Retap metering CT at Lodestar 138 kV | 2003 | 2003 | 4 | reliability | Planned | 0.00 |
| Construct 138 kV line from Mullet River to N Mullet River and convert N Mullet River to Plymouth Sub #1 from 69 kV to 138 kV | 2003 | 2003 | 4 | reliability | Planned | 0.60 |

**Defined in previous 10-Year Assessment**
**Revised in scope from previous 10-Year Assessment**
**New to this 10-Year Assessment**

## Table VI-2 Transmission System Additions for 2004

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct an Omro Industrial-Berlin/Omro 69 kV line | 2004 | 2004 | 1 | T-D Interconnection | Planned | 0.83 |
| Move Reedsburg 6 MVA D-SMES unit to Clear Lake 115 kV | 2004 | 2004 | 1 | reliability | Proposed | 0.10 |
| Install 69 kV phase shifter or fixed reactor at Council Creek | 2002 | 2004 | 1 | reliability | Proposed | 1.90 |
| Convert Pine-Grandfather-Tomahawk-Eastom 46 kV lines to 115 kV | 2001 | 2004 | 1 | reliability | Planned | 2.50 |
| Uprate North Randolph-Ripon 69 kV line terminal equipment | 2002 | 2004 | 1 | reliability | Planned | 1.50 |
| Install 4.1 MVAR capacitor bank at Ripon 69 kV | 2003 | 2004 | 1 | reliability | Planned | 1.09 |
| Install additional 4.1 MVAR capacitor bank at Berlin 69 kV | 2004 | 2004 | 1 | reliability | Planned | 0.44 |
| Rebuild Indian Lake to Glen Jenks to four circuits - two 138 kV, two 69 kV | 2003 | 2004 | 2 | reliability, service limitation | Planned | 2.66 |
| Expand Indian Lake 69 kV to accommodate Indian Lake-Glen Jenks 69 kV line | 2003 | 2004 | 2 | reliability, service limitation | Planned | 1.04 |
| Uprate Cedar-M38 138 kV line (167 degrees) | 2004 | 2004 | 2 | reliability, service limitation | Planned | 1.63 |
| Uprate Cedar-Freeman 138 kV line (167 degrees) | 2004 | 2004 | 2 | reliability | Planned | 0.29 |
| Uprate Freeman-Presque Isle 138 kV line (167 degrees) | 2004 | 2004 | 2 | reliability | Planned | 0.11 |
| Uprate Presque Isle-Cedar 138 kV line (167 degrees) | 2004 | 2004 | 2 | reliability | Planned | 0.31 |

Table VI-2 (continued) Transmission System Additions for 2004

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct Hiawatha-Engadine 69 kV line | 2003 | 2004 | 2 | reliability | Planned | 0.05 |
| Uprate Stiles-Plains double circuit 138 kV line | 1996 | 2004 | 2 and 4 | reliability, service limitation, condition | Proposed | 45.00 |
| Install 16.32 MVAR capactor bank at Oregon or Brooklyn 69 kV | 2004 | 2004 | 3 | reliability | Proposed | 0.46 |
| Convert Kilbourn-Zobel 69 kV line to 138 kV | 2004 | 2004 | 3 | reliability | Planned | 5.08 |
| Construct Artesian-Zobel 138 kV line | 2004 | 2004 | 3 | reliability | Planned | 1.92 |
| Construct second East Campus-Walnut 69 kV line | 2003 | 2004 | 3 | new generation, reliability | Planned | 2.73 |
| Replace McCue-Sheepskin 69 kV line terminal equipment and increase conductor clearance | 2004 | 2004 | 3 | reliability, new generation | Planned | 0.15 |
| Replace the existing 187 MVA 138/69 kV transformer at Sycamore with two 100 MVA transformers and reconfigure 138 kV bus | 2004 | 2004 | 3 | new generation, reliability | Planned | 3.47 |
| Construct 69 kV switchyard at Tokay | 2004 | 2004 | 3 | T-D interconnection | Planned | 0.99 |
| Construct Fitchburg-Tokay-Westowne 69 kV underground line | 2004 | 2004 | 3 | T-D interconnection | Planned | 13.00 |
| Rebuild Russell-Janesville 138 kV line | 2004 | 2004 | 3 | new generation, service limitation | Planned | 2.15 |
| Reconductor Russell-Rockdale 138 kV line | 2004 | 2004 | 3 | new generation, service limitation | Planned | 4.08 |
| Install a second 138/69 kV transformer at North Randolph | 2004 | 2004 | 3 | reliability | Planned | 2.30 |
| Install 24 MVAR capacitor bank at new Birchwood 138 kV | 2004 | 2004 | 3 | reliability | Planned | 0.30 |
| Reconductor Blount-Ruskin 69 kV line | 2003 | 2004 | 3 | reliability, new generation | Planned | 1.43 |
| Reconductor Blount-Ruskin Tap 69 kV line | 2003 | 2004 | 3 | reliability, new generation | Proposed | 1.43 |

Table VI-2 (continued) Transmission System Additions for 2004

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Rebuild Kegonsa-McFarland-Femrite 69 kV line to 138 kV and operate at 69 kV | 2004 | 2004 | 3 | reliability, new generation | Planned | 3.41 |
| Rebuild Femrite-Royster 69 kV line | 2004 | 2004 | 3 | reliability, new generation | Planned | 2.44 |
| Install 16.32 MVAR capacitor bank at Lone Rock | 2004 | 2004 | 3 | reliability | Planned | 0.46 |
| Expand Walnut Substation to interconnect IC029 generation | 2004 | 2004 | 3 | new generation | Planned | 8.86 |
| Install 16.3 MVAR capacitor bank at Kegonsa 69 kV | 2004 | 2004 | 3 | new generation | Planned | 0.33 |
| Install 20.4 MVAR capacitor bank at North Madison 69 kV | 2004 | 2004 | 3 | new generation | Planned | 0.39 |
| Install 24.5 MVAR capacitor bank at Cross Country 138 kV | 2004 | 2004 | 3 | new generation | Planned | 0.44 |
| Install 12.2 MVAR capacitor bank at Waunakee 69 kV | 2004 | 2004 | 3 | new generation | Planned | 0.34 |
| Install 7.2 MVAR capacitor banks on distribution system at/near Tokay | 2004 | 2004 | 3 | new generation | Planned | --- |
| Install 7.2 MVAR capacitor banks on distribution system at/near West Middleton | 2004 | 2004 | 3 | new generation | Planned | --- |
| Replace 138/69 kV transformers at Fitchburg with 187 MVA units | 2003 | 2004 | 3 | reliability, new generation | Planned | 5.59 |
| Construct second Wempletown-Paddock 345 kV circuit; reconfigure existing circuit | 2004 | 2004 | 3 | reliability, service limitation | Proposed | 4.50 |
| Construct/rebuild double circuit 138/69 kV line from Pulliam to Bayport | 2004 | 2004 | 4 | reliability, T-D interconnection | Planned | 2.20 |
| Install 2-16.3 MVAR capacitor bank at Canal 69 kV | 2003 | 2004 | 4 | reliability | Proposed | 1.12 |
| Rebuild the Morgan-Falls-Pioneer-Stiles 138 kV line | 2003 | 2004 | 4 | service limitation, facility condition | Planned | 6.28 |

Table VI-2 (continued) Transmission System Additions for 2004

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Install 345 kV breaker for Edgewater 345/138 kV transformer (TR-22) | 2003 | 2004 | 4 | reliability | Planned | 2.00 |
| Replace two 800 A line traps at Edgewater 138 kV | 2003 | 2004 | 4 | reliability | Planned | 1.20 |
| Rebuild Port Washington-Range Line double circuit 138 kV line | 2004 | 2004 | 5 | new generation | Planned | 10.33 |

**Defined in previous 10-Year Assessment**
**Revised in scope from previous 10-Year Assessment**
**New to this 10-Year Assessment**

## Table VI-3 Transmission System Additions for 2005

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct an Eagle River-Cranberry/Three Lakes 115 kV line | 2005 | 2005 | 1 | T-D interconnection | Proposed | 0.30 |
| Install 2-8.2 MVAR capacitor banks at Council Creek 138 kV | 2004 | 2005 | 1 | reliability | Proposed | 0.50 |
| Rebuild Skanawan-Highway 8 115 kV line to double circuit 115 kV | 2005 | 2005 | 1 | reliability | Planned | 8.90 |
| Uprate Bunker Hill-Pine 115 kV line terminal equipment | 2005 | 2005 | 1 | reliability | Planned | 0.48 |
| Move 10 MVAR capacitor bank from Highway 8 to Hodag 115 kV | 2005 | 2005 | 1 | reliability | Planned | 0.50 |
| Reconductor Wien-McMillan 115 kV (ATC,MEWD) | 2005 | 2005 | 1 | reliability | Proposed | 3.00 |
| Uprate Metomen-N Fond du Lac 69 kV line terminal equipment | 2005 | 2005 | 1 | reliability | Proposed | 0.30 |
| Construct 138 kV line from Venus to new Crandon Substation (operate at 115 kV) | 2005 | 2005 | 1 | T-D interconnections | Proposed | 5.00 |
| Install a second 138/69 kV transformer at Straits | 2005 | 2005 | 2 | reliability | Proposed | 2.58 |
| Rebuild from Nordic SS to Randville SS (5 miles) of single ckt 69 kV line to double circuit 69 kV | 2005 | 2005 | 2 | reliability, condition | Proposed | 1.60 |
| Rebuild and convert one Hiawatha-Indian Lake 69 kV circuit to double circuit 138 kV standards, string one circuit initially and operate at 69 kV | 2004 | 2005 | 2 | reliability, service limitation | Planned | 18.00 |
| Uprate Portage-Columbia double circuit 138 kV line terminal equipment | 2004 | 2005 | 3 | reliability | Planned | 0.40 |
| Rebuild Turtle-Bristol 69 kV line to 138 kV and operate at 69 kV | 2004 | 2005 | 3 | condition, reliability, new generation | Planned | 5.66 |
| Construct new 69 kV line from Columbia to Rio to feed the proposed Wyocena substation | 2004 | 2005 | 3 | T-D interconnection, reliability | Proposed | 1.30 |

Table VI-3 (continued) Transmission System Additions for 2005

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct new line from West Darien to Southwest Delavan to Delavan at 138 kV, operate at 69 kV | 2005 | 2005 | 3 | T-D interconnection | Planned | 8.57 |
| Uprate Rockdale to Jefferson 138 kV line | 2005 | 2005 | 3 | reliability, service limitation | Proposed | 0.30 |
| Uprate Rockdale to Boxelder 138 kV line | 2005 | 2005 | 3 | reliability | Proposed | 0.30 |
| Construct 138 kV bus at Kegonsa and terminate both Christiana-Fitchburg circuits into Kegonsa | 2005 | 2005 | 3 | reliability, new generation | Planned | 5.60 |
| Replace 345/138 kV transformer at Edgewater | 2005 | 2005 | 4 | reliability | Planned | 3.46 |
| Replace 600 A CT at N Fond du Lac 138 kV | 2005 | 2005 | 4 | reliability | Planned | 0.17 |
| Uprate Morgan-White Clay 138 kV line | 2005 | 2005 | 4 | reliability, service limitation | Proposed | 1.06 |
| Construct a Waukesha-Duplainville-Sussex 138 kV line | 2005 | 2005 | 5 | T-D interconnection | Planned | 11.30 |
| Rebuild the Port Washington 138 kV switchyard (ring bus) to accommodate IC027 generation | 2005 | 2005 | 5 | new generation | Planned | 6.50 |
| Rebuild Port Washington-Saukville double circuit 138 kV line | 2005 | 2005 | 5 | new generation | Planned | 3.60 |
| Rebuild Port Washington-Saukville single circuit 138 kV line | 2005 | 2005 | 5 | new generation | Planned | 2.01 |
| Replace substation equipment at both Arcadian 138 kV and Waukesha 138 kV (for line KK9942) | 2005 | 2005 | 5 | new generation, T-D Interconnection | Proposed | 0.22 |

Table VI-3 (continued) Transmission System Additions for 2005

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Install 50 MVAR capacitor bank at Burlington 138 kV | 2005 | 2005 | 5 | reliability | Proposed | 1.00 |
| Reconfigure 345 kV bus at Pleasant Prairie | 2004 | 2005 | 5 | reliability | Proposed | 0.42 |
| Install 40 MVAR capacitor bank at Moorland 138 kV | 2004 | 2005 | 5 | reliability | Proposed | 0.75 |

**Defined in previous 10-Year Assessment**
**Revised in scope from previous 10-Year Assessment**
**New to this 10-Year Assessment**

Table VI-4 Transmission System Additions for 2006

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct Clear Lake-Arnett Road 115 kV line | 2005 | 2006 | 1 | T-D interconnection | Proposed | 2.14 |
| Construct Weston-Stone Lake 345 kV line, Weston 345 kV switchyard, and replace the 200 MVA 345/115 kV transformer with two 500 MVA transformers | 1997 | 2006 | 1 | service limitation, reliability, import capability and Weston stability | Planned | 262.10 |
| Uprate Weston-Kelly 115 kV line - scope TBD | 2006 | 2006 | 1 | new generation, reliability | Proposed | 1.70 |
| Construct 138 kV line from Crandon to new Laona and operate at 115 kV | 2005 | 2006 | 1 | T-D interconnection | Proposed | 5.00 |
| Install 2-16.3 MVAR capacitor banks at Wautoma 138 kV | 2006 | 2006 | 1 | reliability | Proposed | 0.50 |
| Install 2-6.8 MVAR capacitor banks at Antigo 115 kV | 2006 | 2006 | 1 | reliability | Proposed | 1.82 |
| Install 2-5.4 MVAR capacitor banks at Iron River 69 kV | 2006 | 2006 | 2 | reliability | Proposed | 0.68 |
| Build new breaker and a half 345/138 kV substation on site adjacent to existing North Madison substation and replace existing transformers with two new 500 MVA units | 2005 | 2006 | 3 | reliability, new generation | Planned | 8.00 |
| Install 16.32 MVAR capacitor bank at Verona 69 kV | 2006 | 2006 | 3 | reliability | Proposed | 0.50 |
| Install replacement 16.32 MVAR capacitor bank at Richland Center substation | 2006 | 2006 | 3 | reliability | Proposed | 0.51 |
| Convert Columbia-North Madison 138 kV line to 345 kV | 2005 | 2006 | 3 | reliability, new generation | Planned | 5.00 |
| Install/upgrade capacitor bank at South Monroe 69 kV to 24 MVAR | 2006 | 2006 | 3 | reliability | Proposed | 0.46 |
| Construct a Jefferson-Lake Mills-Stony Brook 138 kV line | 2005 | 2006 | 3 | reliability, T-D interconnection | Proposed | 11.26 |
| Construct 138 kV line from Erdman to Howard's Grove | 2006 | 2006 | 4 | T-D interconnection | Planned | 8.20 |

Table VI-4 (continued) Transmission System Additions for 2006

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct a 345/138 kV switchyard at a new Werner West SS; install a 345/138 kV transformer. Loop existing Rocky Run to North Appleton 345 kV and existing Werner to White Lake 138 kV lines into Werner West | 2004 | 2006 | 4 | reliability, service limitation | Proposed | 13.50 |
| Construct 2.5 miles of 138 kV line from Lodestar to Sheboygan Falls | 2003 | 2006 | 4 | reliability | Proposed | 1.04 |
| Install a 138/69 kV, 60 MVA transformer at Sheboygan Falls | 2003 | 2006 | 4 | reliability | Proposed | 2.25 |

**Defined in previous 10-Year Assessment**
**Revised in scope from previous 10-Year Assessment**
**New to this 10-Year Assessment**

Table VI-5 Transmission System Additions for 2007

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Uprate Weston-Morrison-Sherman St. 115 kV line - scope TBD | 2007 | 2007 | 1 | reliability | Proposed | 0.50 |
| Uprate Weston-Sherman St. 115 kV line - scope TBD | 2007 | 2007 | 1 | reliability | Proposed | 0.50 |
| Construct Cranberry-Conover 138 kV line | 2007 | 2007 | 1 | transfer capability, reliability | Proposed | 7.00 |
| Install 138/115 kV 100 MVA transformer at Cranberry | 2007 | 2007 | 1 | transfer capability, reliability | Proposed | 2.77 |
| Rebuild/convert Conover-Iron River-Plains 69 kV line to 138 kV | 2007 | 2007 | 2 | transfer capability, reliability | Proposed | 27.00 |
| Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Conover | 2007 | 2007 | 2 | transfer capability, reliability | Proposed | 2.86 |
| Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Iron River | 2007 | 2007 | 2 | transfer capability, reliability | Proposed | 2.86 |
| Loop the Femrite to Royster 69 kV line into AGA Gas | 2007 | 2007 | 3 | reliability | Proposed | --- |
| Convert Kegonsa-McFarland-Femrite 69 kV line to 138 kV | 2007 | 2007 | 3 | reliability, new generation | Proposed | 3.41 |
| Construct South Beaver Dam-North Beaver Dam 138 kV line | 2007 | 2007 | 3 | reliability | Proposed | 10.75 |
| Convert Academy-South Beaver Dam 69 kV line to 138 kV | 2007 | 2007 | 3 | reliability | Proposed | 4.50 |
| Construct Sprecher-Femrite 138 kV line | 2007 | 2007 | 3 | reliability, new generation | Proposed | 7.42 |
| Install 138/69 kV transformer at Femrite | 2007 | 2007 | 3 | reliability, new generation | Proposed | 3.52 |
| Install 138/69 kV transformer at Reiner | 2007 | 2007 | 3 | reliability, new generation | Proposed | 3.52 |
| Convert Sycamore-Reiner-Sprecher from 69 kV to 138 kV | 2007 | 2007 | 3 | reliability | Proposed | 2.50 |
| Construct new 138 kV bus and 138/69 kV 100 MVA transformer at Verona Substation | 2007 | 2007 | 3 | reliability | Conceptual | 1.40 |

Table VI-5 (continued) Transmission System Additions for 2007

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct new 138 kV line from Verona to Southeast Fitchburg Substation | 2007 | 2007 | 3 | reliability | Conceptual | 5.15 |
| Install 10 MVAR capacitor bank at Jefferson 138 kV | 2007 | 2007 | 3 | reliability | Proposed | 0.40 |
| Install 2-13 MVAR capacitor banks at Concord 138 kV | 2007 | 2007 | 3 | reliability | Proposed | 1.00 |
| Reconductor 2.37 miles of 69 kV from Sunset Point to Pearl Ave with 477 ACSR | 2007 | 2007 | 4 | reliability | Proposed | 0.85 |
| Rebuild Crivitz-High Falls 69 kV double circuit line | 2007 | 2007 | 4 | reliability | Conceptual | 5.59 |
| Construct 138 kV line from Canal to Dunn Rd | 2007 | 2007 | 4 | reliability | Proposed | 4.20 |
| Install 60 MVA 138/69 kV transformer at Dunn Rd | 2007 | 2007 | 4 | reliability | Proposed | 2.20 |
| Install 28.8 MVAR capacitor bank at Butternut 138 kV | 2007 | 2007 | 4 | reliability | Proposed | 1.05 |
| Construct a new Lannon Junction substation at intersection of Granville-Arcadian 345 kV, Forest Junction-Arcadian 345 kV, Sussex-Tamarack 138 kV and Sussex-Germantown 138 kV lines; install a 345/138 kV, 500 MVA transformer | 2007 | 2007 | 5 | reliability and Germantown generation stability | Proposed | 4.49 |
| Construct a second Germantown-Lannon 138 kV line | 2007 | 2007 | 5 | Germantown generation stability | Proposed | 4.73 |
| Reconductor a segment of the Oak Creek-Ramsey6 138 kV line | 2007 | 2007 | 5 | new generation | Proposed | 0.13 |
| Reconductor underground segment of Ramsey5-Harbor 138 kV line | 2007 | 2007 | 5 | new generation | Proposed | 11.50 |
| Construct an Oak Creek-Brookdale 345 kV line installing 4 mi. new structures, converting 16.2 mi. of non-operative 230 kV and 5 mi. 138 kV | 2007 | 2007 | 5 | new generation | Proposed | 17.30 |

Table VI-5 (continued) Transmission System Additions for 2007

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct Oak Creek-St Martins 138 kV circuit #2 installing 4 mi. new structures and conductor, plus 12.6 mi. conductor on existing towers | 2007 | 2007 | 5 | new generation | Proposed | 3.40 |
| Reconductor Oak Creek-Allerton 138 kV line | 2007 | 2007 | 5 | new generation | Proposed | 2.00 |
| Convert and reconductor Oak Creek-Bluemound 230 kV line K873 to 345 kV | 2007 | 2007 | 5 | new generation | Proposed | 19.00 |
| Construct a Brookdale-Granville 345 kV line converting/reconductoring 5.6 mi. 138 kV, rebuilding 7 mi. 138 kV double circuit tower line and converting/reconductoring 3 mi. 138 kV on existing 345 kV structures | 2007 | 2007 | 5 | new generation | Proposed | 19.30 |
| Restring Bluemound-Butler 138 kV line (KK5051) on new 345 kV structures installed with Brookdale-Granville line | 2007 | 2007 | 5 | new generation | Proposed | 1.10 |
| Construct Butler-Tamarack (Carmen) 138 kV line on new 345 kV structures installed with Brookdale-Granville line | 2007 | 2007 | 5 | new generation | Proposed | 1.00 |
| Construct a 345/138 kV switchyard at Brookdale to accommodate two 345 kV lines, a 500 MVA 345/138 kV transformer and 4-138 kV lines plus two 138-26.2 kV transformers | 2007 | 2007 | 5 | new generation | Proposed | 14.80 |
| Construct 345 kV Bluemound switchyard to accommodate 1-345 kV line and a 500 MVA 345/138 kV transformer | 2007 | 2007 | 5 | new generation | Proposed | 4.83 |
| Expand Oak Creek 345 kV switchyard to interconnect one new generator, unit #7 plus two 345 kV lines and 138 kV switchyard to accommodate new St. Martins line | 2007 | 2007 | 5 | new generation | Proposed | 18.80 |

Table VI-5 (continued) Transmission System Additions for 2007

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Reconnect Oak Creek unit #7 to 345 kV switchyard | 2007 | 2007 | 5 | new generation | Proposed | 0.40 |
| Install two 345 kV series breakers at Pleasant Prairie on lines to Racine (L631) and Zion (L2221) | 2007 | 2007 | 5 | new generation | Proposed | 2.10 |
| Replace seven 138 kV overdutied breakers at Bluemound | 2007 | 2007 | 5 | new generation | Proposed | 2.45 |

**Defined in previous 10-Year Assessment**

**Revised in scope from previous 10-Year Assessment**

**New to this 10-Year Assessment**

Table VI-6 Transmission System Additions for 2008

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct Stone Lake-Arrowhead 345 kV line | 1997 | 2008 | 1 | service limitation, reliability, import capability and Weston stability | Planned | 158.20 |
| Rebuild Weston-Northpoint 115 kV line | 2008 | 2008 | 1 | achieve transfer capability associated with Arrowhead-Weston | Proposed | 3.30 |
| Rebuild Kelly-Whitcomb 115 kV line | 2008 | 2008 | 1 | achieve transfer capability associated with Arrowhead-Weston | Proposed | 4.16 |
| Install 2-25 MVAR capacitor banks at Arpin 138 kV | 2008 | 2008 | 1 | transfer capability | Proposed | 0.50 |
| Install 2-25 MVAR capacitor banks at Arpin 115 kV | 2008 | 2008 | 1 | transfer capability | Proposed | 0.50 |
| Install 2-40 MVAR capacitor banks at Weston 115 kV | 2008 | 2008 | 1 | transfer capability | Proposed | 7.96 |
| Install 3-52 MVAR capacitor banks at Rocky Run 115 kV | 2008 | 2008 | 1 | transfer capability | Proposed | 1.00 |
| Install 65 MVAR capacitor bank at Arrowhead 230 kV | 2008 | 2008 | 1 | transfer capability | Proposed | 2.00 |
| Replace 138/69 kV transformer at Sigel | 2008 | 2008 | 1 | reliability | Proposed | 1.00 |
| Install additional 4.1 MVAR capacitor bank at Ripon 69 kV | 2008 | 2008 | 1 | reliability | Proposed | 0.20 |
| Replace 138/69 kV transformer at Metomen | 2008 | 2008 | 1 | reliability | Conceptual | 1.00 |
| Construct St. Germain-Boulder Junction 115 kV line | 2008 | 2008 | 1 | T-D interconnection | Conceptual | 8.19 |
| Install a second 138/69 kV transformer at Hillman | 2008 | 2008 | 3 | reliability | Proposed | 3.90 |
| Rebuild/convert South Fond du Lac-Springbrook 69 kV to 138 kV | 2008 | 2008 | 3 | reliability | Conceptual | 8.20 |

Table VI-6 (continued) Transmission System Additions for 2008

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct 138 kV bus and install a 138/69 kV transformer at Springbrook | 2008 | 2008 | 3 | reliability | Conceptual | 2.00 |
| Convert Rock River to Bristol to 138 kV operation; rebuild Bristol with a new 138 kV bus | 2008 | 2008 | 3 | reliability | Conceptual | 5.50 |
| Reconductor Pleasant Valley-Saukville 138 kV line | 2008 | 2008 | 5 | new generation | Proposed | 3.00 |
| Reconductor Pleasant Valley-St Lawrence 138 kV line | 2008 | 2008 | 5 | new generation | Proposed | 2.81 |
| Reconductor Cornell-Range Line 138 kV line | 2008 | 2008 | 5 | new generation | Proposed | 6.00 |
| Uprate Kansas-Ramsey6 138 kV line | 2008 | 2008 | 5 | new generation, reliability | Proposed | 0.13 |
| Uprate Oak Creek-Ramsey6 138 kV line | 2008 | 2008 | 5 | new generation, reliability | Proposed | 0.13 |

**Defined in previous 10-Year Assessment**
**Revised in scope from previous 10-Year Assessment**
**New to this 10-Year Assessment**

## Table VI-7 Transmission System Additions for 2009

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct Fitzgerald-Omro Industrial 69 kV line | 2009 | 2009 | 1 | reliability | Conceptual | 5.30 |
| Uprate Wautoma-Berlin 69 kV line terminal equipment | 2009 | 2009 | 1 | reliability | Proposed | 0.15 |
| Rebuild Hiawatha-Pine River-Straits 69 kV to 138 kV | 2009 | 2009 | 2 | reliability, condition | Proposed | 40.10 |
| Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Pine River | 2009 | 2009 | 2 | reliability | Proposed | 6.09 |
| String second Hiawatha-Indian Lake 138 kV circuit on existing structures | 2009 | 2009 | 2 | reliability, service limitation | Planned | 0.20 |
| Convert rebuilt Hiawatha-Indian Lake circuit (operated at 69 kV) to 138 kV | 2009 | 2009 | 2 | reliability, service limitation | Planned | 2.10 |
| Install 138 kV ring bus at Hiawatha SS | 2009 | 2009 | 2 | reliability, service limitation | Planned | 1.91 |
| Install 138 kV substation modifications at Indian Lake SS | 2009 | 2009 | 2 | reliability, service limitation | Planned | 1.85 |
| Install 138 kV ring bus at Straits SS | 2009 | 2009 | 2 | reliability, service limitation | Planned | 1.91 |
| Convert South Lake Geneva to Twin Lakes 69 kV line to 138 kV | 2009 | 2009 | 3 | reliability | Conceptual | 3.00 |
| Construct new 138 kV bus and install a 138/69 kV 100 MVA transformer at South Lake Geneva | 2009 | 2009 | 3 | reliability | Conceptual | 6.00 |
| Construct new 138 kV line from Twin Lakes to Spring Valley | 2009 | 2009 | 3 | reliability | Conceptual | 15.00 |
| Construct new 138 kV line from South Lake Geneva to North Lake Geneva | 2009 | 2009 | 3 | reliability | Conceptual | 6.00 |
| Replace Columbia-Manley Sand 69 kV line terminal equipment | 2009 | 2009 | 3 | reliability | Conceptual | 0.30 |
| Convert Hillman to Eden 69 kV line to 138 kV | 2009 | 2009 | 3 | reliability | Proposed | 13.00 |

Table VI-7 (continued) Transmission System Additions for 2009

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Construct new 69 kV line from Brooklyn to Belleville Substation | 2009 | 2009 | 3 | reliability | Proposed | 5.00 |
| Construct 345 kV line from Rockdale through Kegonsa to West Middleton | 2009 | 2009 | 3 | reliability | Proposed | 38.45 |
| Construct a 345 kV bus and install a 345/138 kV 500 MVA transformer at substation at West Middleton | 2009 | 2009 | 3 | reliability | Proposed | 12.00 |
| Construct a second West Middleton-Walnut 69 kV circuit, use spare pipe from Walnut to Terrace Avenue riser and double circuit the overhead line the remainder of the circuit run to West Middleton | 2009 | 2009 | 3 | reliability | Proposed | 11.00 |
| Rebuild and convert West Middleton-Spring Green 69 kV line to 138 kV | 2009 | 2009 | 3 | reliability | Proposed | 20.00 |
| Construct 138 kV bus and install a 138/69 kV 100 MVA transformer at Stagecoach | 2009 | 2009 | 3 | reliability | Conceptual | 3.00 |
| Construct Spring Green-Prairie du Sac 69 kV line | 2009 | 2009 | 3 | reliability, T-D interconnection | Proposed | 12.00 |
| Rebuild Rockdale-Jefferson-Concord 138 kV line to double circuit 345/138 kV on existing right of way | 2007 | 2009 | 3 and 5 | reliability, service limitation | Proposed | 22.18 |
| Construct a 345 kV bus and install a 345/138 kV, 500 MVA transformer at Concord | 2007 | 2009 | 3 and 5 | reliability | Proposed | 12.95 |
| String a new Ellinwood-Sunset Pt 138 kV line on existing structures | 2009 | 2009 | 4 | reliability | Proposed | 2.50 |
| Construct Morgan-Werner West 345 kV line | 2004 | 2009 | 4 | reliability, service limitation | Proposed | 99.73 |
| Install second 500 MVA 345/138 kV transformer at Oak Creek | 2009 | 2009 | 5 | new generation | Proposed | 8.40 |

Table VI-7 (continued) Transmission System Additions for 2009

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Expand 345 kV switchyard at Oak Creek to interconnect one new generator | 2009 | 2009 | 5 | new generation | Proposed | 4.20 |

**Defined in previous 10-Year Assessment**
**Revised in scope from previous 10-Year Assessment**
**New to this 10-Year Assessment**

## Table VI-8 Transmission System Additions for 2010

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Uprate Sherman Street-Hilltop-Maine 115 kV line - scope TBD | 2010 | 2010 | 1 | reliability | Conceptual | 1.12 |
| Uprate Whitcomb-Deer Trail 69 kV line terminal equipment | 2010 | 2010 | 1 | reliability | Proposed | 0.97 |
| Uprate Paddock-Shirland 69 kV line terminal equipment | 2010 | 2010 | 3 | reliability | Conceptual | 0.20 |
| Uprate Colley Road 138/69 kV transformer to 116 MVA summer emergency | 2010 | 2010 | 3 | reliability | Conceptual | 0.25 |
| Install a 69 kV 16.32 MVAR capacitor bank at Kilbourn Substation | 2010 | 2010 | 3 | reliability | Conceptual | 0.50 |
| Reconnect the 138/69 kV transformers at Kilbourn on separate breakers to operate individually and replace the 47 MVA transformer with a 93 MVA transformer | 2010 | 2010 | 3 | reliability | Conceptual | 2.00 |
| Convert Bark River-Lannon 138 kV line to 345 kV | 2009 | 2010 | 3 and 5 | reliability | Proposed | 0.55 |
| Construct a Concord-Bark River 345 kV line | 2009 | 2010 | 3 and 5 | reliability | Proposed | 24.39 |

**Defined in previous 10-Year Assessment**

**Revised in scope from previous 10-Year Assessment**

**New to this 10-Year Assessment**

Table VI-9 Transmission System Additions for 2011

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Uprate Weston-Black Brook 115 kV line - scope TBD | 2011 | 2011 | 1 | reliability | Conceptual | 1.50 |
| Uprate West Middleton-Pheasant Branch 69 kV line | 2011 | 2011 | 3 | reliability | Conceptual | 1.00 |
| Install 2-16.3 MVAR capacitor bank at Apple Hills 138 kV | 2011 | 2011 | 4 | reliability | Proposed | 1.18 |
| Construct a second Dunn Rd-Egg Harbor 69 kV line | 2011 | 2011 | 4 | reliability | Proposed | 6.15 |
| Construct a Northside-City Limits 138 kV line | 2011 | 2011 | 4 | reliability | Proposed | 3.07 |
| Replace substation equipment at both Arcadian 138 kV and Waukesha 138 kV associated with KK9962 | 2011 | 2011 | 5 | new generation, T-D Interconnection | Proposed | 5.70 |
| Replace two existing 345/138 transformers at Arcadian with 500 MVA units | 2011 | 2011 | 5 | reliability, new generation, T-D Interconnection | Proposed | 4.01 |
| Expand Oak Creek 138 kV switchyard to reconnect units #6 and #9 | 2011 | 2011 | 5 | new generation | Proposed | 6.85 |
| Expand 345 kV switchyard at Bluemound to accommodate three additional 345 kV lines and two additional 500 MVA 345/138 kV transformers | 2011 | 2011 | 5 | new generation | Proposed | 16.90 |
| Reconnect Oak Creek unit #8 to 345 kV switchyard | 2011 | 2011 | 5 | new generation | Proposed | 0.40 |
| Convert and reconductor Oak Creek-Bluemound 230 kV line K862 to 345 kV and loop into Arcadian 345 kV substation | 2011 | 2011 | 5 | new generation | Proposed | 34.80 |
| Construct Oak Creek-Racine 345 kV line with 4 mi new structures and conductor, plus convert 9.6 mi. 138 kV line KK812 to 345 kV | 2011 | 2011 | 5 | new generation | Proposed | 8.10 |

Table VI-9 (continued) Transmission System Additions for 2011

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Reroute Brookdale-Granville 345 kV line into expanded Bluemound 345 kV switchyard | 2011 | 2011 | 5 | new generation | Proposed | 0.30 |
| Replace 22-138 kV overdutied breakers at Harbor, Everett and Haymarket Substations | 2011 | 2011 | 5 | new generation | Proposed | 7.65 |
| Expand Oak Creek 345 kV switchyard to interconnect three new generators, unit #8 and two 345 kV lines, plus installation of eight 345 kV series breakers for stability purposes | 2011 | 2011 | 5 | new generation | Proposed | 21.50 |

**Defined in previous 10-Year Assessment**

**Revised in scope from previous 10-Year Assessment**

**New to this 10-Year Assessment**

Table VI-10 Transmission System Additions for 2012

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual | Cost Estimate (Millions) |
|---|---|---|---|---|---|---|
| Install additional 13.6 MVAR capacitor bank at Clear Lake 115 kV | 2012 | 2012 | 1 | reliability | Conceptual | 0.49 |
| Uprate Metomen-Ripon 69 kV line - scope TBD | 2012 | 2012 | 1 | reliability | Conceptual | 1.50 |
| Install a second 138/69, 47 MVA transformer at Wautoma | 2012 | 2012 | 1 | reliability | Conceptual | 1.20 |
| Rebuild Blaney Park-Munising 69 kV to 138 kV | 2012 | 2012 | 2 | reliability, condition | Conceptual | 19.31 |
| Construct 345 kV line from Paddock to new Verona 345 kV switchyard; loop Kegonsa-West Middleton 345 kV line into Verona | 2012 | 2012 | 3 | reliability, transfer capability | Conceptual | 119.30 |
| Construct 69 kV line Eden through Muscoda to Richland Center | 2012 | 2012 | 3 | reliability | Conceptual | 12.00 |
| Move Lone Rock 69 kV phase shifter to Richland Center | 2012 | 2012 | 3 | reliability | Conceptual | 0.50 |

**Defined in previous 10-Year Assessment**

**Revised in scope from previous 10-Year Assessment**

**New to this 10-Year Assessment**

## Table VI-11 Transmission System Additions for Zone 1

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Construct an Endeavor-Wautoma/Portage Tap 69 kV line | 2003 | 2003 | 1 | T-D Interconnection | Planned |
| Uprate Whitcomb 115/69 kV transformer | 2002 | 2003 | 1 | reliability | Planned |
| Construct an Omro Industrial-Berlin/Omro 69 kV line | 2004 | 2004 | 1 | T-D Interconnection | Planned |
| Move Reedsburg 6 MVA D-SMES unit to Clear Lake 115 kV | 2004 | 2004 | 1 | reliability | Proposed |
| Install 69 kV phase shifter or fixed reactor at Council Creek | 2002 | 2004 | 1 | reliability | Proposed |
| Convert Pine-Grandfather-Tomahawk-Eastom 46 kV lines to 115 kV | 2001 | 2004 | 1 | reliability | Planned |
| Uprate North Randolph-Ripon 69 kV line terminal equipment | 2002 | 2004 | 1 | reliability | Planned |
| Install 4.1 MVAR capacitor bank at Ripon 69 kV | 2003 | 2004 | 1 | reliability | Planned |
| Install additional 4.1 MVAR capacitor bank at Berlin 69 kV | 2004 | 2004 | 1 | reliability | Planned |
| Construct an Eagle River-Cranberry/Three Lakes 115 kV line | 2005 | 2005 | 1 | T-D interconnection | Proposed |
| Install two-8.2 MVAR capacitor banks at Council Creek 138 kV | 2004 | 2005 | 1 | reliability | Proposed |
| Rebuild Skanawan-Highway 8 115 kV line to double circuit 115 kV | 2005 | 2005 | 1 | reliability | Planned |
| Uprate Bunker Hill-Pine 115 kV line terminal equipment | 2005 | 2005 | 1 | reliability | Planned |
| Move 10 MVAR capacitor bank from Highway 8 to Hodag 115 kV | 2005 | 2005 | 1 | reliability | Planned |
| Reconductor Wien-McMillan 115 kV (ATC,MEWD) | 2005 | 2005 | 1 | reliability | Proposed |

Table VI-11 (continued) Transmission System Additions for Zone 1

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Uprate Metomen-N Fond du Lac 69 kV line terminal equipment | 2005 | 2005 | 1 | reliability | Proposed |
| Construct 138 kV line from Venus to new Crandon Substation (operate at 115 kV) | 2005 | 2005 | 1 | T-D interconnections | Proposed |
| Construct Clear Lake-Arnett Road 115 kV line | 2005 | 2006 | 1 | T-D interconnection | Proposed |
| Construct Weston-Stone Lake 345 kV line, Weston 345 kV switchyard, and replace the 200 MVA 345/115 kV transformer with two 500 MVA transformers | 1997 | 2006 | 1 | service limitation, reliability, import capability and Weston stability | Planned |
| Uprate Weston-Kelly 115 kV line - scope TBD | 2006 | 2006 | 1 | new generation, reliability | Proposed |
| Construct 138 kV line from Crandon to new Laona and operate at 115 kV | 2005 | 2006 | 1 | T-D interconnection | Proposed |
| Install two-16.3 MVAR capacitor banks at Wautoma 138 kV | 2006 | 2006 | 1 | reliability | Proposed |
| Install two-6.8 MVAR capacitor banks at Antigo 115 kV | 2006 | 2006 | 1 | reliability | Proposed |
| Uprate Weston-Morrison-Sherman St. 115 kV line - scope TBD | 2007 | 2007 | 1 | reliability | Proposed |
| Uprate Weston-Sherman St. 115 kV line - scope TBD | 2007 | 2007 | 1 | reliability | Proposed |
| Construct Cranberry-Conover 138 kV line | 2007 | 2007 | 1 | transfer capability, reliability | Proposed |
| Install 138/115 kV 100 MVA transformer at Cranberry | 2007 | 2007 | 1 | transfer capability, reliability | Proposed |
| Construct Stone Lake-Arrowhead 345 kV line | 1997 | 2008 | 1 | service limitation, reliability, import capability and Weston stability | Proposed |

Table VI-11 (continued) Transmission System Additions for Zone 1

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Rebuild Weston-Northpoint 115 kV line | 2008 | 2008 | 1 | achieve transfer capability associated with Arrowhead-Weston | Proposed |
| Rebuild Kelly-Whitcomb 115 kV line | 2008 | 2008 | 1 | achieve transfer capability associated with Arrowhead-Weston | Proposed |
| Install two-25 MVAR capacitor banks at Arpin 138 kV | 2008 | 2008 | 1 | transfer capability | Proposed |
| Install two-25 MVAR capacitor banks at Arpin 115 kV | 2008 | 2008 | 1 | transfer capability | Proposed |
| Install two-40 MVAR capacitor banks at Weston 115 kV | 2008 | 2008 | 1 | transfer capability | Proposed |
| Install three-52 MVAR capacitor banks at Rocky Run 115 kV | 2008 | 2008 | 1 | transfer capability | Proposed |
| Install 65 MVAR capacitor bank at Arrowhead 230 kV | 2008 | 2008 | 1 | transfer capability | Proposed |
| Replace 138/69 kV transformer at Sigel | 2008 | 2008 | 1 | reliability | Proposed |
| Install additional 4.1 MVAR capacitor bank at Ripon 69 kV | 2008 | 2008 | 1 | reliability | Proposed |
| Replace 138/69 kV transformer at Metomen | 2008 | 2008 | 1 | reliability | Conceptual |
| Construct St. Germain-Boulder Junction 115 kV line | 2008 | 2008 | 1 | T-D interconnection | Conceptual |
| Construct Fitzgerald-Omro Industrial 69 kV line | 2009 | 2009 | 1 | reliability | Conceptual |
| Uprate Wautoma-Berlin 69 kV line terminal equipment | 2009 | 2009 | 1 | reliability | Proposed |
| Uprate Sherman Street-Hilltop-Maine 115 kV line - scope TBD | 2010 | 2010 | 1 | reliability | Conceptual |

Table VI-11 (continued) Transmission System Additions for Zone 1

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Uprate Whitcomb-Deer Trail 69 kV line terminal equipment | 2010 | 2010 | 1 | reliability | Proposed |
| Uprate Weston-Black Brook 115 kV line - scope TBD | 2011 | 2011 | 1 | reliability | Conceptual |
| Install additional 13.6 MVAR capacitor bank at Clear Lake 115 kV | 2012 | 2012 | 1 | reliability | Conceptual |
| Uprate Metomen-Ripon 69 kV line - scope TBD | 2012 | 2012 | 1 | reliability | Conceptual |
| Install a second 138/69, 47 MVA transformer at Wautoma | 2012 | 2012 | 1 | reliability | Conceptual |

## Table VI-12 Transmission System Additions for Zone 2

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Construct Elevation Tap-Elevation 69 kV line | 2003 | 2003 | 2 | T-D Interconnection | Planned |
| Rebuild Indian Lake to Glen Jenks to four circuits - two 138 kV, two 69 kV | 2003 | 2004 | 2 | reliability, service limitation | Planned |
| Expand Indian Lake 69 kV to accommodate Indian Lake-Glen Jenks 69 kV line | 2003 | 2004 | 2 | reliability, service limitation | Planned |
| Uprate Cedar-M38 138 kV line (167 degrees) | 2004 | 2004 | 2 | reliability, service limitation | Planned |
| Uprate Cedar-Freeman 138 kV line (167 degrees) | 2004 | 2004 | 2 | reliability | Planned |
| Uprate Freeman-Presque Isle 138 kV line (167 degrees) | 2004 | 2004 | 2 | reliability | Planned |
| Uprate Presque Isle-Cedar 138 kV line (167 degrees) | 2004 | 2004 | 2 | reliability | Planned |
| Construct Hiawatha-Engadine 69 kV line | 2003 | 2004 | 2 | reliability | Planned |
| Uprate Stiles-Plains double circuit 138 kV line | 1996 | 2004 | 2 and 4 | reliability, service limitation, condition | Proposed |
| Install a second 138/69 kV transformer at Straits | 2005 | 2005 | 2 | reliability | Proposed |
| Rebuild from Nordic SS to Randville SS (5 miles) of single ckt 69 kV line to double circuit 69 kV | 2005 | 2005 | 2 | reliability, condition | Proposed |
| Rebuild and convert one Hiawatha-Indian Lake 69 kV circuit to double circuit 138 kV standards, string one circuit initially and operate at 69 kV | 2004 | 2005 | 2 | reliability, service limitation | Planned |

Table VI-12 (continued) Transmission System Additions for Zone 2

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Install two-5.4 MVAR capacitor banks at Iron River 69 kV | 2006 | 2006 | 2 | reliability | Proposed |
| Rebuild/convert Conover-Iron River-Plains 69 kV line to 138 kV | 2007 | 2007 | 2 | transfer capability, reliability | Proposed |
| Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Conover | 2007 | 2007 | 2 | transfer capability, reliability | Proposed |
| Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Iron River | 2007 | 2007 | 2 | transfer capability, reliability | Proposed |
| Rebuild Hiawatha-Pine River-Straits 69 kV to 138 kV | 2009 | 2009 | 2 | reliability, condition | Proposed |
| Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Pine River | 2009 | 2009 | 2 | reliability | Proposed |
| String second Hiawatha-Indian Lake 138 kV circuit on existing structures | 2009 | 2009 | 2 | reliability, service limitation | Planned |
| Convert rebuilt Hiawatha-Indian Lake circuit (operated at 69 kV) to 138 kV | 2009 | 2009 | 2 | reliability, service limitation | Planned |
| Install 138 kV ring bus at Hiawatha SS | 2009 | 2009 | 2 | reliability, service limitation | Planned |
| Install 138 kV substation modifications at Indian Lake SS | 2009 | 2009 | 2 | reliability, service limitation | Planned |
| Install 138 kV ring bus at Straits SS | 2009 | 2009 | 2 | reliability, service limitation | Planned |
| Rebuild Blaney Park-Munising 69 kV to 138 kV | 2012 | 2012 | 2 | reliability, condition | Conceptual |

## Table VI-13 Transmission System Additions for Zone 3

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Reconductor Christiana-Kegonsa portion of Christiana to Fitchburg 138 kV line | 2005 | 2003 | 3 | reliability | Planned |
| Reconfigure 69/138 kV circuits between Rock River and Janesville to create Rock River-Janesville and Rock River-Sunrise 138 kV circuits | 2004 | 2003 | 3 | reliability, new generation | Planned |
| Reconductor Colley Road-Blackhawk 138 kV line | 2003 | 2003 | 3 | reliability, service limitation | Planned |
| Construct 138 kV switchyard at Riverside generation site (Townline Road Substation) | 2003 | 2003 | 3 | reliability, new generation | Planned |
| Construct 138 kV double circuit line from Townline Road to Rock River | 2003 | 2003 | 3 | reliability, new generation | Planned |
| Reconnect NW Beloit 69 kV load to Paddock-Blackhawk 138 kV line | 2003 | 2003 | 3 | reliability | Planned |
| Install 16.32 MVAR capactor bank at Oregon or Brooklyn 69 kV | 2004 | 2004 | 3 | reliability | Planned |
| Convert Kilbourn-Zobel 69 kV line to 138 kV | 2004 | 2004 | 3 | reliability | Planned |
| Construct Artesian-Zobel 138 kV line | 2004 | 2004 | 3 | reliability | Planned |
| Construct second East Campus-Walnut 69 kV line | 2003 | 2004 | 3 | new generation, reliability | Planned |
| Replace McCue-Sheepskin 69 kV line terminal equipment and increase conductor clearance | 2004 | 2004 | 3 | reliability, new generation | Planned |
| Replace the existing 187 MVA 138/69 kV transformer at Sycamore with two 100 MVA transformers and reconfigure 138 kV bus | 2004 | 2004 | 3 | new generation, reliability | Planned |
| Construct 69 kV switchyard at Tokay | 2004 | 2004 | 3 | T-D interconnection | Planned |

Table VI-13 (continued) Transmission System Additions for Zone 3

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Construct Fitchburg-Tokay-Westowne 69 kV underground line | 2004 | 2004 | 3 | T-D interconnection | Planned |
| Rebuild Russell-Janesville 138 kV line | 2004 | 2004 | 3 | new generation, service limitation | Planned |
| Reconductor Russell-Rockdale 138 kV line | 2004 | 2004 | 3 | new generation, service limitation | Planned |
| Install a second 138/69 kV transformer at North Randolph | 2004 | 2004 | 3 | reliability | Planned |
| Install 24 MVAR capacitor bank at new Birchwood 138 kV | 2004 | 2004 | 3 | reliability | Planned |
| Reconductor Blount-Ruskin 69 kV line | 2003 | 2004 | 3 | reliability, new generation | Planned |
| Reconductor Blount-Ruskin Tap 69 kV line | 2003 | 2004 | 3 | reliability, new generation | Planned |
| Rebuild Kegonsa-McFarland-Femrite 69 kV line to 138 kV and operate at 69 kV | 2004 | 2004 | 3 | reliability, new generation | Planned |
| Rebuild Femrite-Royster 69 kV line | 2004 | 2004 | 3 | reliability, new generation | Planned |
| Install 16.32 MVAR capacitor bank at Lone Rock | 2004 | 2004 | 3 | reliability | Planned |
| Expand Walnut Substation to interconnect IC029 generation | 2004 | 2004 | 3 | new generation | Planned |
| Install 16.3 MVAR capacitor bank at Kegonsa 69 kV | 2004 | 2004 | 3 | new generation | Planned |
| Install 20.4 MVAR capacitor bank at North Madison 69 kV | 2004 | 2004 | 3 | new generation | Planned |
| Install 24.5 MVAR capacitor bank at Cross Country 138 kV | 2004 | 2004 | 3 | new generation | Planned |
| Install 12.2 MVAR capacitor bank at Waunakee 69 kV | 2004 | 2004 | 3 | new generation | Planned |
| Install 7.2 MVAR capacitor banks on distribution system at/near Tokay | 2004 | 2004 | 3 | new generation | Planned |

Table VI-13 (continued) Transmission System Additions for Zone 3

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Install 7.2 MVAR capacitor banks on distribution system at/near West Middleton | 2004 | 2004 | 3 | new generation | Planned |
| Replace 138/69 kV transformers at Fitchburg with 187 MVA units | 2003 | 2004 | 3 | reliability, new generation | Planned |
| Construct second Wempletown-Paddock 345 kV circuit; reconfigure existing circuit | 2004 | 2004 | 3 | reliability, service limitation | Proposed |
| Uprate Portage-Columbia double circuit 138 kV line terminal equipment | 2004 | 2005 | 3 | reliability | Planned |
| Rebuild Turtle-Bristol 69 kV line to 138 kV and operate at 69 kV | 2004 | 2005 | 3 | condition, reliability, new generation | Planned |
| Construct new 69 kV line from Columbia to Rio to feed the proposed Wyocena substation | 2004 | 2005 | 3 | T-D interconnection, reliability | Proposed |
| Construct new line from West Darien to Southwest Delavan to Delavan at 138 kV, operate at 69 kV | 2005 | 2005 | 3 | T-D interconnection | Planned |
| Uprate Rockdale to Jefferson 138 kV line | 2005 | 2005 | 3 | reliability, service limitation | Proposed |
| Uprate Rockdale to Boxelder 138 kV line | 2005 | 2005 | 3 | reliability | Proposed |
| Construct 138 kV bus at Kegonsa and terminate both Christiana-Fitchburg circuits into Kegonsa | 2005 | 2005 | 3 | reliability, new generation | Planned |
| Build new breaker and a half 345/138 kV substation on site adjacent to existing North Madison substation and replace existing transformers with two new 500 MVA units | 2005 | 2006 | 3 | reliability, new generation | Planned |
| Install 16.32 MVAR capacitor bank at Verona 69 kV | 2006 | 2006 | 3 | reliability | Proposed |

Table VI-13 (continued) Transmission System Additions for Zone 3

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Install replacement 16.32 MVAR capacitor bank at Richland Center substation | 2006 | 2006 | 3 | reliability | Proposed |
| Convert Columbia-North Madison 138 kV line to 345 kV | 2005 | 2006 | 3 | reliability, new generation | Planned |
| Install/upgrade capacitor bank at South Monroe 69 kV to 24 MVAR | 2006 | 2006 | 3 | reliability | Proposed |
| Construct a Jefferson-Lake Mills-Stony Brook 138 kV line | 2005 | 2006 | 3 | reliability, T-D interconnection | Proposed |
| Loop the Femrite to Royster 69 kV line into AGA Gas | 2007 | 2007 | 3 | reliability | Proposed |
| Convert Kegonsa-McFarland-Femrite 69 kV line to 138 kV | 2007 | 2007 | 3 | reliability, new generation | Proposed |
| Construct South Beaver Dam-North Beaver Dam 138 kV line | 2007 | 2007 | 3 | reliability | Proposed |
| Convert Academy-South Beaver Dam 69 kV line to 138 kV | 2007 | 2007 | 3 | reliability | Proposed |
| Construct Sprecher-Femrite 138 kV line | 2007 | 2007 | 3 | reliability, new generation | Proposed |
| Install 138/69 kV transformer at Femrite | 2007 | 2007 | 3 | reliability, new generation | Proposed |
| Install 138/69 kV transformer at Reiner | 2007 | 2007 | 3 | reliability, new generation | Proposed |
| Convert Sycamore-Reiner-Sprecher from 69 kV to 138 kV | 2007 | 2007 | 3 | reliability | Proposed |
| Construct new 138 kV bus and 138/69 kV 100 MVA transformer at Verona Substation | 2007 | 2007 | 3 | reliability | Conceptual |
| Construct new 138 kV line from Verona to Southeast Fitchburg Substation | 2007 | 2007 | 3 | reliability | Conceptual |
| Install 10 MVAR capacitor bank at Jefferson 138 kV | 2007 | 2007 | 3 | reliability | Proposed |

Table VI-13 (continued) Transmission System Additions for Zone 3

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Install two-13 MVAR capacitor banks at Concord 138 kV | 2007 | 2007 | 3 | reliability | Proposed |
| Install a second 138/69 kV transformer at Hillman | 2008 | 2008 | 3 | reliability | Proposed |
| Rebuild/convert South Fond du Lac-Springbrook 69 kV to 138 kV | 2008 | 2008 | 3 | reliability | Conceptual |
| Construct 138 kV bus and install a 138/69 kV transformer at Springbrook | 2008 | 2008 | 3 | reliability | Conceptual |
| Convert Rock River to Bristol to 138 kV operation; rebuild Bristol with a new 138 kV bus | 2008 | 2008 | 3 | reliability | Conceptual |
| Convert South Lake Geneva to Twin Lakes 69 kV line to 138 kV | 2009 | 2009 | 3 | reliability | Conceptual |
| Construct new 138 kV bus and install a 138/69 kV 100 MVA transformer at South Lake Geneva | 2009 | 2009 | 3 | reliability | Conceptual |
| Construct new 138 kV line from Twin Lakes to Spring Valley | 2009 | 2009 | 3 | reliability | Conceptual |
| Construct new 138 kV line from South Lake Geneva to North Lake Geneva | 2009 | 2009 | 3 | reliability | Conceptual |
| Replace Columbia-Manley Sand 69 kV line terminal equipment | 2009 | 2009 | 3 | reliability | Conceptual |
| Convert Hillman to Eden 69 kV line to 138 kV | 2009 | 2009 | 3 | reliability | Proposed |
| Construct new 69 kV line from Brooklyn to Belleville Substation | 2009 | 2009 | 3 | reliability | Proposed |
| Construct 345 kV line from Rockdale through Kegonsa to West Middleton | 2009 | 2009 | 3 | reliability | Proposed |
| Construct a 345 kV bus and install a 345/138 kV 500 MVA transformer at West Middleton | 2009 | 2009 | 3 | reliability | Proposed |

Table VI-13 (continued) Transmission System Additions for Zone 3

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Construct a second West Middleton-Walnut 69 kV circuit, use spare pipe from Walnut to Terrace Avenue riser and double circuit the overhead line the remainder of the circuit run to West Middleton | 2009 | 2009 | 3 | reliability | Proposed |
| Rebuild and convert West Middleton-Spring Green 69 kV line to 138 kV | 2009 | 2009 | 3 | reliability | Proposed |
| Construct 138 kV bus and install a 138/69 kV 100 MVA transformer at Stagecoach | 2009 | 2009 | 3 | reliability | Conceptual |
| Construct Spring Green-Prairie du Sac 69 kV line | 2009 | 2009 | 3 | reliability, T-D interconnection | Proposed |
| Rebuild Rockdale-Jefferson-Concord 138 kV line to double circuit 345/138 kV on existing right-of-way | 2007 | 2009 | 3 and 5 | reliability, service limitation | Proposed |
| Construct a 345 kV bus and install a 345/138 kV, 500 MVA transformer at Concord | 2007 | 2009 | 3 and 5 | reliability | Proposed |
| Uprate Paddock-Shirland 69 kV line terminal equipment | 2010 | 2010 | 3 | reliability | Conceptual |
| Uprate Colley Road 138/69 kV transformer to 116 MVA summer emergency | 2010 | 2010 | 3 | reliability | Conceptual |
| Install a 69 kV 16.32 MVAR capacitor bank at Kilbourn Substation | 2010 | 2010 | 3 | reliability | Conceptual |
| Reconnect the 138/69 kV transformers at Kilbourn on separate breakers to operate individually and replace the 47 MVA transformer with a 93 MVA transformer | 2010 | 2010 | 3 | reliability | Conceptual |
| Convert Bark River-Lannon 138 kV line to 345 kV | 2009 | 2010 | 3 and 5 | reliability | Proposed |
| Construct a Concord-Bark River 345 kV line | 2009 | 2010 | 3 and 5 | reliability | Proposed |
| Uprate West Middleton-Pheasant Branch 69 kV line | 2011 | 2011 | 3 | reliability | Conceptual |

Table VI-13 (continued) Transmission System Additions for Zone 3

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Construct 345 kV line from Paddock to new Verona 345 kV switchyard; loop Kegonsa-West Middleton 345 kV line into Verona | 2012 | 2012 | 3 | reliability, transfer capability | Conceptual |
| Construct 69 kV line Eden through Muscoda to Richland Center | 2012 | 2012 | 3 | reliability | Conceptual |
| Move Lone Rock 69 kV phase shifter to Richland Center | 2012 | 2012 | 3 | reliability | Conceptual |

## Table VI-14 Transmission System Additions for Zone 4

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Replace 200 A metering CT at Sheboygan Falls 69 kV | 2003 | 2003 | 4 | reliability | Planned |
| Replace 400 A CT at S Fond du Lac 69 kV | 2003 | 2003 | 4 | reliability | Planned |
| Retap metering CT at Lodestar 138 kV | 2003 | 2003 | 4 | reliability | Planned |
| Construct 138 kV line from Mullet River to N Mullet River and convert N Mullet River to Plymouth Sub #1 from 69 kV to 138 kV | 2003 | 2003 | 4 | reliability | Planned |
| Uprate Stiles-Plains double circuit 138 kV line | 1996 | 2004 | 2 and 4 | reliability, service limitation, condition | Proposed |
| Construct/rebuild double circuit 138/69 kV line from Pulliam to Bayport | 2004 | 2004 | 4 | reliability, T-D interconnection | Planned |
| Install two-16.3 MVAR capacitor bank at Canal 69 kV | 2003 | 2004 | 4 | reliability | Proposed |
| Rebuild the Morgan-Falls-Pioneer-Stiles 138 kV line | 2003 | 2004 | 4 | service limitation, facility condition | Planned |
| Install 345 kV breaker for Edgewater 345/138 kV transformer (TR-22) | 2003 | 2004 | 4 | reliability | Planned |
| Replace two 800 A line traps at Edgewater 138 kV | 2003 | 2004 | 4 | reliability | Planned |
| Replace 345/138 kV transformer at Edgewater | 2005 | 2005 | 4 | reliability | Planned |
| Replace 600 A CT at N Fond du Lac 138 kV | 2005 | 2005 | 4 | reliability | Planned |
| Uprate Morgan-White Clay 138 kV line | 2005 | 2005 | 4 | reliability, service limitation | Proposed |
| Construct 138 kV line from Erdman to Howard's Grove | 2006 | 2006 | 4 | T-D interconnection | Planned |

Table VI-14 (continued) Transmission System Additions for Zone 4

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Construct a 345/138 kV switchyard at a new Werner West SS; install a 345/138 kV transformer. Loop existing Rocky Run to North Appleton 345 kV and existing Werner to White Lake 138 kV lines into Werner West | 2004 | 2006 | 4 | reliability, service limitation | Proposed |
| Construct 2.5 miles of 138 kV line from Lodestar to Sheboygan Falls | 2003 | 2006 | 4 | reliability | Proposed |
| Install a 138/69 kV, 60 MVA transformer at Sheboygan Falls | 2003 | 2006 | 4 | reliability | Proposed |
| Reconductor 2.37 miles of 69 kV from Sunset Point to Pearl Ave with 477 ACSR | 2007 | 2007 | 4 | reliability | Proposed |
| Rebuild Crivitz-High Falls 69 kV double circuit line | 2007 | 2007 | 4 | reliability | Conceptual |
| Construct 138 kV line from Canal to Dunn Rd | 2007 | 2007 | 4 | reliability | Proposed |
| Install 60 MVA 138/69 kV transformer at Dunn Rd | 2007 | 2007 | 4 | reliability | Proposed |
| Install 28.8 MVAR capacitor bank at Butternut 138 kV | 2007 | 2007 | 4 | reliability | Proposed |
| String a new Ellinwood-Sunset Pt 138 kV line on existing structures | 2009 | 2009 | 4 | reliability | Proposed |
| Construct Morgan-Werner West 345 kV line | 2004 | 2009 | 4 | reliability, service limitation | Proposed |
| Install two-16.3 MVAR capacitor bank at Apple Hills 138 kV | 2011 | 2011 | 4 | reliability | Proposed |
| Construct a second Dunn Rd-Egg Harbor 69 kV line | 2011 | 2011 | 4 | reliability | Proposed |
| Construct a Northside-City Limits 138 kV line | 2011 | 2011 | 4 | reliability | Proposed |

Table VI-15 Transmission System Additions for Zone 5

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Rebuild Port Washington-Range Line double circuit 138 kV line | 2004 | 2004 | 5 | new generation | Planned |
| Construct a Waukesha-Duplainville-Sussex 138 kV line | 2005 | 2005 | 5 | T-D interconnection | Planned |
| Rebuild the Port Washington 138 kV switchyard (ring bus) to accommodate IC027 generation | 2005 | 2005 | 5 | new generation | Planned |
| Rebuild Port Washington-Saukville double circuit 138 kV line | 2005 | 2005 | 5 | new generation | Planned |
| Rebuild Port Washington-Saukville single circuit 138 kV line | 2005 | 2005 | 5 | new generation | Planned |
| Replace substation equipment at both Arcadian 138 kV and Waukesha 138 kV (for line KK9942) | 2005 | 2005 | 5 | new generation, T-D Interconnection | Proposed |
| Install 50 MVAR capacitor bank at Burlington 138 kV | 2005 | 2005 | 5 | reliability | Proposed |
| Reconfigure 345 kV bus at Pleasant Prairie | 2004 | 2005 | 5 | reliability | Proposed |
| Install 40 MVAR capacitor bank at Moorland 138 kV | 2004 | 2005 | 5 | reliability | Proposed |
| Construct a new Lannon Junction substation at intersection of Granville-Arcadian 345 kV, Forest Junction-Arcadian 345 kV, Sussex-Tamarack 138 kV and Sussex-Germantown 138 kV lines; install a 345/138 kV, 500 MVA transformer | 2007 | 2007 | 5 | reliability and Germantown generation stability | Proposed |
| Construct a second Germantown-Lannon 138 kV line | 2007 | 2007 | 5 | Germantown generation stability | Proposed |
| Reconductor a segment of the Oak Creek-Ramsey6 138 kV line | 2007 | 2007 | 5 | new generation | Proposed |

Table VI-15 (continued) Transmission System Additions for Zone 5

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Reconductor underground segment of Ramsey5-Harbor 138 kV line | 2007 | 2007 | 5 | new generation | Proposed |
| Construct an Oak Creek-Brookdale 345 kV line installing 4 mi. new structures, converting 16.2 mi. of non-operative 230 kV and 5 mi. 138 kV | 2007 | 2007 | 5 | new generation | Proposed |
| Construct Oak Creek-St Martins 138 kV circuit #2 installing 4 mi. new structures and conductor, plus 12.6 mi. conductor on existing towers | 2007 | 2007 | 5 | new generation | Proposed |
| Reconductor Oak Creek-Allerton 138 kV line | 2007 | 2007 | 5 | new generation | Proposed |
| Convert and reconductor Oak Creek-Bluemound 230 kV line K873 to 345 kV | 2007 | 2007 | 5 | new generation | Proposed |
| Construct a Brookdale-Granville 345 kV line converting/reconductoring 5.6 mi. 138 kV, rebuilding 7 mi. 138 kV double circuit tower line and converting/reconductoring 3 mi. 138 kV on existing 345 kV structures | 2007 | 2007 | 5 | new generation | Proposed |
| Restring Bluemound-Butler 138 kV line (KK5051) on new 345 kV structures installed with Brookdale-Granville line | 2007 | 2007 | 5 | new generation | Proposed |
| Construct Butler-Tamarack (Carmen) 138 kV line on new 345 kV structures installed with Brookdale-Granville line | 2007 | 2007 | 5 | new generation | Proposed |
| Construct a 345/138 kV switchyard at Brookdale to accommodate two 345 kV lines, a 500 MVA 345/138 kV transformer and four-138 kV lines plus two 138-26.2 kV transformers | 2007 | 2007 | 5 | new generation | Proposed |
| Construct 345 kV Bluemound switchyard to accommodate one-345 kV line and a 500 MVA 345/138 kV transformer | 2007 | 2007 | 5 | new generation | Proposed |

Table VI-15 (continued) Transmission System Additions for Zone 5

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Expand Oak Creek 345 kV switchyard to interconnect one new generator, unit #7 plus two 345 kV lines and 138 kV switchyard to accommodate new St. Martins line | 2007 | 2007 | 5 | new generation | Proposed |
| Reconnect Oak Creek unit #7 to 345 kV switchyard | 2007 | 2007 | 5 | new generation | Proposed |
| Install two 345 kV series breakers at Pleasant Prairie on lines to Racine (L631) and Zion (L2221) | 2007 | 2007 | 5 | new generation | Proposed |
| Replace seven 138 kV overdutied breakers at Bluemound | 2007 | 2007 | 5 | new generation | Proposed |
| Reconductor Pleasant Valley-Saukville 138 kV line | 2008 | 2008 | 5 | new generation | Proposed |
| Reconductor Pleasant Valley-St Lawrence 138 kV line | 2008 | 2008 | 5 | new generation | Proposed |
| Reconductor Cornell-Range Line 138 kV line | 2008 | 2008 | 5 | new generation | Proposed |
| Uprate Kansas-Ramsey6 138 kV line | 2008 | 2008 | 5 | new generation, reliability | Proposed |
| Uprate Oak Creek-Ramsey6 138 kV line | 2008 | 2008 | 5 | new generation, reliability | Proposed |
| Rebuild Rockdale-Jefferson-Concord 138 kV line to double circuit 345/138 kV on existing right-of-way | 2007 | 2009 | 3 and 5 | reliability, service limitation | Proposed |
| Construct a 345 kV bus and install a 345/138 kV, 500 MVA transformer at Concord | 2007 | 2009 | 3 and 5 | reliability | Proposed |
| Install second 500 MVA 345/138 kV transformer at Oak Creek | 2009 | 2009 | 5 | new generation | Proposed |
| Expand 345 kV switchyard at Oak Creek to interconnect one new generator | 2009 | 2009 | 5 | new generation | Proposed |
| Convert Bark River-Lannon 138 kV line to 345 kV | 2009 | 2010 | 3 and 5 | reliability | Proposed |

Table VI-15 (continued) Transmission System Additions for Zone 5

| Planned Additions | System Need Year | Projected In-Service Year | Planning Zone | Need Category | Planned, Proposed or Conceptual |
|---|---|---|---|---|---|
| Construct a Concord-Bark River 345 kV line | 2009 | 2010 | 3 and 5 | reliability | Proposed |
| Replace substation equipment at both Arcadian 138 kV and Waukesha 138 kV associated with KK9962 | 2011 | 2011 | 5 | new generation, T-D Interconnection | Proposed |
| Replace two existing 345/138 transformers at Arcadian with 500 MVA units | 2011 | 2011 | 5 | reliability, new generation, T-D Interconnection | Proposed |
| Expand Oak Creek 138 kV switchyard to reconnect units #6 and #9 | 2011 | 2011 | 5 | new generation | Proposed |
| Expand 345 kV switchyard at Bluemound to accommodate three additional 345 kV lines and two additional 500 MVA 345/138 kV transformers | 2011 | 2011 | 5 | new generation | Proposed |
| Reconnect Oak Creek unit #8 to 345 kV switchyard | 2011 | 2011 | 5 | new generation | Proposed |
| Convert and reconductor Oak Creek-Bluemound 230 kV line K862 to 345 kV and loop into Arcadian 345 kV substation | 2011 | 2011 | 5 | new generation | Proposed |
| Construct Oak Creek-Racine 345 kV line with 4 mi new structures and conductor, plus convert 9.6 mi. 138 kV line KK812 to 345 kV | 2011 | 2011 | 5 | new generation | Proposed |
| Reroute Brookdale-Granville 345 kV line into expanded Bluemound 345 kV switchyard | 2011 | 2011 | 5 | new generation | Proposed |
| Replace 22-138 kV overdutied breakers at Harbor, Everett and Haymarket Substations | 2011 | 2011 | 5 | new generation | Proposed |
| Expand Oak Creek 345 kV switchyard to interconnect three new generators, unit #8 and two 345 kV lines, plus installation of eight 345 kV series breakers for stability purposes | 2011 | 2011 | 5 | new generation | Proposed |

## Table VI-16 Identified Needs and Transmission Lines Requiring New Right-of-Way

| | | Approx. Line Mileage | | System | Projected | Planning |
|---|---|---|---|---|---|---|
| **Identified Need** | **Potential Solutions** | **Total** | **New ROW** | **Need Year** | **In-Service Year** | **Zone** |
| T-D interconnection request | Construct an Endeavor-Wautoma/Portage Tap 69 kV line | 4 | 4 | 2003 | 2003 | 1 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Construct 138 kV double circuit line from Townline Road to Rock River | 0.75 | 0.75 | 2003 | 2003 | 3 |
| T-D interconnection request | Construct an Omro Industrial-Berlin/Omro 69 kV line | 2.5 | 2.5 | 2004 | 2004 | 1 |
| Relieve overloads or low voltages under contingency | Construct Artesian-Zobel 138 kV line | 0.75 | 0.75 | 2004 | 2004 | 3 |
| T-D interconnection | Construct Fitchburg-Tokay-Westowne 69 kV underground line | 5.5 | 5.5 | 2004 | 2004 | 3 |
| T-D interconnection | Construct an Eagle River-Cranberry/Three Lakes 115 kV line | 0.75 | 0.75 | 2005 | 2005 | 1 |
| Relieve overloads or low voltages under contingency | Rebuild Skanawan-Highway 8 115 kV line to double circuit 115 kV | 21 | 21 | 2005 | 2005 | 1 |
| T-D interconnections | Construct 138 kV line from Venus to new Crandon Substation (operate at 115 kV) | 10 | 10 | 2005 | 2005 | 1 |
| T-D interconnection, relieve overloads or low voltages under contingency | Construct new 69 kV line from Columbia to Rio to feed the proposed Wyocena substation | 8.16 | 8.16 | 2004 | 2005 | 3 |
| T-D interconnection | Construct new line from West Darien to Southwest Delavan to Delavan at 138 kV, operate at 69 kV | 5 | 5 | 2005 | 2005 | 3 |
| T-D interconnection | Construct a Waukesha-Duplainville-Sussex 138 kV line | 8 | 8 | 2005 | 2005 | 5 |
| T-D interconnection | Construct Clear Lake-Arnett Road 115 kV line | 5 | 5 | 2005 | 2006 | 1 |

Table VI-16 (continued) Identified Needs and Transmission Lines Requiring New Right-of-Way

| | | Approx. Line Mileage | | System | Projected | Planning |
|---|---|---|---|---|---|---|
| **Identified Need** | **Potential Solutions** | **Total** | **New ROW** | **Need Year** | **In-Service Year** | **Zone** |
| Reduce service limitations, relieve overloads or low voltages under contingency, improve transfer capability and Weston stability | Construct Weston-Stone Lake 345 kV line | 140 | 73.4 | 1997 | 2006 | 1 |
| T-D interconnection | Construct 138 kV line from Crandon to new Laona and operate at 115 kV | 15 | 15 | 2005 | 2006 | 1 |
| Relieve overloads or low voltages under contingency, T-D interconnection | Construct a Jefferson-Lake Mills-Stony Brook 138 kV line | 12 | 12 | 2005 | 2006 | 3 |
| T-D interconnection | Construct 138 kV line from Erdman to Howard's Grove | 5 | 5 | 2006 | 2006 | 4 |
| Relieve overloads or low voltages under contingency | Construct 2.5 miles of 138 kV line from Lodestar to Sheboygan Falls | 2.5 | 2.5 | 2003 | 2006 | 4 |
| Transfer capability, relieve overloads or low voltages under contingency | Construct Cranberry-Conover 138 kV line | 14 | 14 | 2007 | 2007 | 1 |
| Relieve overloads or low voltages under contingency | Loop the Femrite to Royster 69 kV line into AGA Gas | 1 | 1 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency | Construct South Beaver Dam-North Beaver Dam 138 kV line | 6 | 6 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Construct Sprecher-Femrite 138 kV line | 2 | 2 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency | Construct new 138 kV line from Verona to Southeast Fitchburg Substation | 9 | 3 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency | Construct 138 kV line from Canal to Dunn Rd | 7.64 | 7.64 | 2007 | 2007 | 4 |
| Accommodate new generation | Construct an Oak Creek-Brookdale 345 kV line installing 4 mi. new structures, converting 16.2 mi. of non-operative 230 kV and 5 mi. 138 kV | 25.2 | 4* | 2007 | 2007 | 5 |

*same four miles of new right-of-way that is utilized for the Oak Creek-Racine 345 kV line on page 154

Table VI-16 (continued) Identified Needs and Transmission Lines Requiring New Right-of-Way

| | | Approx. Line Mileage | | System | Projected | Planning |
|---|---|---|---|---|---|---|
| **Identified Need** | **Potential Solutions** | **Total** | **New ROW** | **Need Year** | **In-Service Year** | **Zone** |
| Accommodate new generation | Construct Oak Creek-St Martins 138 kV circuit #2 installing 4 mi. new structures and conductor, plus 12.6 mi. conductor on existing towers | 16.6 | 4 | 2007 | 2007 | 5 |
| Reduce service limitations, relieve overloads or low voltages under contingency, improve transfer capability and Weston stability | Construct Stone Lake-Arrowhead 345 kV line | 70 | 36.6 | 1997 | 2008 | 1 |
| T-D interconnection | Construct St. Germain-Boulder Junction 115 kV line | 15 | 15 | 2008 | 2008 | 1 |
| Relieve overloads or low voltages under contingency | Construct Fitzgerald-Omro Industrial 69 kV line | 7 | 7 | 2009 | 2009 | 1 |
| Relieve overloads or low voltages under contingency | Construct new 138 kV line from Twin Lakes to Spring Valley | 9 | 9 | 2009 | 2009 | 3 |
| Relieve overloads or low voltages under contingency | Construct new 138 kV line from South Lake Geneva to North Lake Geneva | 3 | 3 | 2009 | 2009 | 3 |
| Relieve overloads or low voltages under contingency | Construct new 69 kV line from Brooklyn to Belleville Substation | 7 | 7 | 2009 | 2009 | 3 |
| Relieve overloads or low voltages under contingency | Construct 345 kV line from Rockdale through Kegonsa to West Middleton | 35 | 35 | 2009 | 2009 | 3 |
| Relieve overloads or low voltages under contingency, T-D interconnection | Construct Spring Green-Prairie du Sac 69 kV line | 22 | 22 | 2009 | 2009 | 3 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Construct Morgan-Werner West 345 kV line | 47 | 47 | 2004 | 2009 | 4 |
| Relieve overloads or low voltages under contingency | Construct a Concord-Bark River 345 kV line | 15 | 10 | 2009 | 2010 | 3 and 5 |

Table VI-16 (continued) Identified Needs and Transmission Lines Requiring New Right-of-Way

| | | Approx. Line Mileage | | System | Projected | Planning |
|---|---|---|---|---|---|---|
| **Identified Need** | **Potential Solutions** | **Total** | **New ROW** | **Need Year** | **In-Service Year** | **Zone** |
| Accommodate new generation | Construct Oak Creek-Racine 345 kV line with 4 mi new structures and conductor, plus convert 9.6 mi. 138 kV line KK812 to 345 kV | 13.6 | 4* | 2011 | 2011 | 5 |
| Relieve overloads or low voltages under contingency, transfer capability | Construct 345 kV line from Paddock to new Verona 345 kV switchyard; loop Kegonsa-West Middleton 345 kV line into Verona | 40 | 10 | 2012 | 2012 | 3 |
| Relieve overloads or low voltages under contingency | Construct 69 kV line Eden through Muscoda to Richland Center | 35 | 35 | 2012 | 2012 | 3 |

*same four miles of new right-of-way that is utilized for the Oak Creek-Brookdale 345 kV line on page 152

## Table VI-17 Transmission Line Rebuilds/Reconductors, New Circuits and Voltage Conversions on Existing Right-of-Way

| Identified Need | Lines to be Rebuilt/Reconductored on Existing ROW | Approx. Mileage of Rebuilt, Reconductored or Uprated Lines | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| T-D interconnection request | Construct Elevation Tap-Elevation 69 kV line | 0.5 | 2003 | 2003 | 2 |
| Relieve overloads or low voltages under contingency | Reconductor Christiana-Kegonsa portion of Christiana to Fitchburg 138 kV line | 9.82 | 2005 | 2003 | 3 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Reconfigure 69/138 kV circuits between Rock River and Janesville to create Rock River-Janesville and Rock River-Sunrise 138 kV circuits | 20 | 2004 | 2003 | 3 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Reconductor Colley Road-Blackhawk 138 kV line | 1.29 | 2003 | 2003 | 3 |
| Relieve overloads or low voltages under contingency | Construct 138 kV line from Mullet River to N Mullet River and convert N Mullet River to Plymouth Sub #1 from 69 kV to 138 kV | 0.9 | 2003 | 2003 | 4 |
| Relieve overloads or low voltages under contingency | Convert Pine-Grandfather-Tomahawk-Eastom 46 kV lines to 115 kV | 30 | 2001 | 2004 | 1 |
| Relieve overloads or low voltages under contingency | Construct Hiawatha-Engadine 69 kV line | 0.2 | 2003 | 2004 | 2 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Rebuild Indian Lake to Glen Jenks to four circuits - two 138 kV, two 69 kV | 2.09 | 2003 | 2004 | 2 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Uprate Cedar-M38 138 kV line (167 degrees) | 56.44 | 2004 | 2004 | 2 |
| Relieve overloads or low voltages under contingency | Uprate Cedar-Freeman 138 kV line (167 degrees) | 8.68 | 2004 | 2004 | 2 |
| Relieve overloads or low voltages under contingency | Uprate Freeman-Presque Isle 138 kV line (167 degrees) | 8.9 | 2004 | 2004 | 2 |
| Relieve overloads or low voltages under contingency | Uprate Presque Isle-Cedar 138 kV line (167 degrees) | 16.65 | 2004 | 2004 | 2 |

Table VI-17 Transmission Line Rebuilds/Reconductors, New Circuits and Voltage Conversions on Existing Right-of-Way (continued)

| Identified Need | Lines to be Rebuilt/Reconductored on Existing ROW | Approx. Mileage of Rebuilt, Reconductored or Uprated Lines | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Relieve overloads or low voltages under contingency, reduce service limitations, replace aging facilities | Uprate Stiles-Plains double circuit 138 kV line | 65.5 | 1996 | 2004 | 2 and 4 |
| Relieve overloads or low voltages under contingency | Convert Kilbourn-Zobel 69 kV line to 138 kV | 18.41 | 2004 | 2004 | 3 |
| Accommodate new generation, relieve overloads or low voltages under contingency | Construct second East Campus-Walnut 69 kV line | 1.3 | 2003 | 2004 | 3 |
| Accommodate new generation, reduce service limitations | Rebuild Russell-Janesville 138 kV line | 6.3 | 2004 | 2004 | 3 |
| Accommodate new generation, reduce service limitations | Reconductor Russell-Rockdale 138 kV line | 16.52 | 2004 | 2004 | 3 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Reconductor Blount-Ruskin 69 kV line | 2.19 | 2003 | 2004 | 3 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Reconductor Blount-Ruskin Tap 69 kV line | 2.19 | 2003 | 2004 | 3 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Rebuild Kegonsa-McFarland-Femrite 69 kV line to 138 kV and operate at 69 kV | 5.9 | 2004 | 2004 | 3 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Rebuild Femrite-Royster 69 kV line | 3.52 | 2004 | 2004 | 3 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Construct second Wempletown-Paddock 345 kV circuit; reconfigure existing circuit | 3.76 | 2004 | 2004 | 3 |

Table VI-17 Transmission Line Rebuilds/Reconductors, New Circuits and Voltage Conversions on Existing Right-of-Way (continued)

| Identified Need | Lines to be Rebuilt/Reconductored on Existing ROW | Approx. Mileage of Rebuilt, Reconductored or Uprated Lines | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Relieve overloads or low voltages under contingency, T-D interconnection | Construct/rebuild double circuit 138/69 kV line from Pulliam to Bayport | 5 | 2004 | 2004 | 4 |
| Reduce service limitations, facility replace aging facilities | Rebuild the Morgan-Falls-Pioneer-Stiles 138 kV line | 10.69 | 2003 | 2004 | 4 |
| Accommodate new generation | Rebuild Port Washington-Range Line double circuit 138 kV line | 21 | 2004 | 2004 | 5 |
| Relieve overloads or low voltages under contingency | Reconductor Wien-McMillan 115 kV (ATC,MEWD) | 20 | 2005 | 2005 | 1 |
| Relieve overloads or low voltages under contingency, replace aging facilities | Rebuild from Nordic SS to Randville SS (5 miles) of single ckt 69 kV line to double circuit 69 kV | 5 | 2005 | 2005 | 2 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Rebuild and convert one Hiawatha-Indian Lake 69 kV circuit to double circuit 138 kV standards, string one circuit initially and operate at 69 kV | 40 | 2004 | 2005 | 2 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Uprate Morgan-White Clay 138 kV line | 12.22 | 2005 | 2005 | 4 |
| Accommodate new generation | Rebuild Port Washington-Saukville double circuit 138 kV line | 5 | 2005 | 2005 | 5 |
| Accommodate new generation | Rebuild Port Washington-Saukville single circuit 138 kV line | 5 | 2005 | 2005 | 5 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Convert Columbia-North Madison 138 kV line to 345 kV | 17.41 | 2005 | 2006 | 3 |
| Transfer capability, relieve overloads or low voltages under contingency | Rebuild/convert Conover-Iron River-Plains 69 kV line to 138 kV | 73 | 2007 | 2007 | 2 |

Table VI-17 Transmission Line Rebuilds/Reconductors, New Circuits and Voltage Conversions on Existing Right-of-Way (continued)

| Identified Need | Lines to be Rebuilt/Reconductored on Existing ROW | Approx. Mileage of Rebuilt, Reconductored or Uprated Lines | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Relieve overloads or low voltages under contingency, accommodate new generation | Convert Kegonsa-McFarland-Femrite 69 kV line to 138 kV | 5.9 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency | Convert Academy-South Beaver Dam 69 kV line to 138 kV | 12.8 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency | Convert Sycamore-Reiner-Sprecher from 69 kV to 138 kV | 6.5 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency | Reconductor 2.37 miles of 69 kV from Sunset Point to Pearl Ave with 477 ACSR | 2.37 | 2007 | 2007 | 4 |
| Relieve overloads or low voltages under contingency | Rebuild Crivitz-High Falls 69 kV double circuit line | 14.5 | 2007 | 2007 | 4 |
| Germantown generation stability | Construct a second Germantown-Lannon 138 kV line | 4.7 | 2007 | 2007 | 5 |
| Accommodate new generation | Reconductor a segment of the Oak Creek-Ramsey6 138 kV line | 0.8 | 2007 | 2007 | 5 |
| Accommodate new generation | Reconductor underground segment of Ramsey5-Harbor 138 kV line | 5.72 | 2007 | 2007 | 5 |
| Accommodate new generation | Reconductor Oak Creek-Allerton 138 kV line | 5.41 | 2007 | 2007 | 5 |
| Accommodate new generation | Convert and reconductor Oak Creek-Bluemound 230 kV line K873 to 345 kV | 29 | 2007 | 2007 | 5 |
| Accommodate new generation | Construct a Brookdale-Granville 345 kV line converting/reconductoring 5.6 mi. 138 kV, rebuilding 7 mi. 138 kV double circuit tower line and converting/reconductoring 3 mi. 138 kV on existing 345 kV structures | 15.6 | 2007 | 2007 | 5 |
| Accommodate new generation | Restring Bluemound-Butler 138 kV line (KK5051) on new 345 kV structures installed with Brookdale-Granville line | 5.41 | 2007 | 2007 | 5 |

Table VI-17 Transmission Line Rebuilds/Reconductors, New Circuits and Voltage Conversions on Existing Right-of-Way (continued)

| Identified Need | Lines to be Rebuilt/Reconductored on Existing ROW | Approx. Mileage of Rebuilt, Reconductored or Uprated Lines | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Accommodate new generation | Construct Butler-Tamarack (Carmen) 138 kV line on new 345 kV structures installed with Brookdale-Granville line | 4.12 | 2007 | 2007 | 5 |
| Achieve transfer capability associated with Arrowhead-Weston | Rebuild Weston-Northpoint 115 kV line | 24 | 2008 | 2008 | 1 |
| Achieve transfer capability associated with Arrowhead-Weston | Rebuild Kelly-Whitcomb 115 kV line | 24 | 2008 | 2008 | 1 |
| Relieve overloads or low voltages under contingency | Rebuild/convert South Fond du Lac-Springbrook 69 kV to 138 kV | 6 | 2008 | 2008 | 3 |
| Relieve overloads or low voltages under contingency | Convert Rock River to Bristol to 138 kV operation; rebuild Bristol with a new 138 kV bus | 27.74 | 2008 | 2008 | 3 |
| Accommodate new generation | Reconductor Pleasant Valley-Saukville 138 kV line | 12 | 2008 | 2008 | 5 |
| Accommodate new generation | Reconductor Pleasant Valley-St Lawrence 138 kV line | 7 | 2008 | 2008 | 5 |
| Accommodate new generation | Reconductor Cornell-Range Line 138 kV line | 2.43 | 2008 | 2008 | 5 |
| Relieve overloads or low voltages under contingency, replace aging facilities | Rebuild Hiawatha-Pine River-Straits 69 kV to 138 kV | 75 | 2009 | 2009 | 2 |
| Relieve overloads or low voltages under contingency, reduce service limitations | String second Hiawatha-Indian Lake 138 kV circuit on existing structures | 40 | 2009 | 2009 | 2 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Convert rebuilt Hiawatha-Indian Lake circuit (operated at 69 kV) to 138 kV | 40 | 2009 | 2009 | 2 |
| Relieve overloads or low voltages under contingency | Convert South Lake Geneva to Twin Lakes 69 kV line to 138 kV | 11.5 | 2009 | 2009 | 3 |
| Relieve overloads or low voltages under contingency | Convert Hillman to Eden 69 kV line to 138 kV | 28.13 | 2009 | 2009 | 3 |

Table VI-17 Transmission Line Rebuilds/Reconductors, New Circuits and Voltage Conversions on Existing Right-of-Way (continued)

| Identified Need | Lines to be Rebuilt/Reconductored on Existing ROW | Approx. Mileage of Rebuilt, Reconductored or Uprated Lines | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Relieve overloads or low voltages under contingency | Construct a second West Middleton-Walnut 69 kV circuit, use spare pipe from Walnut to Terrace Avenue riser and double circuit the overhead line the remainder of the circuit run to West Middleton | 7.83 | 2009 | 2009 | 3 |
| Relieve overloads or low voltages under contingency | Rebuild and convert West Middleton-Spring Green 69 kV line to 138 kV | 5.71 | 2009 | 2009 | 3 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Rebuild Rockdale-Jefferson-Concord 138 kV line to double circuit 345/138 kV on existing right-of-way | 29.75 | 2007 | 2009 | 3 and 5 |
| Relieve overloads or low voltages under contingency | String a new Ellinwood-Sunset Pt 138 kV line on existing structures | 3.58 | 2009 | 2009 | 4 |
| Relieve overloads or low voltages under contingency | Convert Bark River-Lannon Junction 138 kV line to 345 kV | 5 | 2009 | 2010 | 3 and 5 |
| Relieve overloads or low voltages under contingency | Construct a second Dunn Rd-Egg Harbor 69 kV line | 12.66 | 2011 | 2011 | 4 |
| Relieve overloads or low voltages under contingency | Construct a Northside-City Limits 138 kV line | 3.16 | 2011 | 2011 | 4 |
| Accommodate new generation | Convert and reconductor Oak Creek-Bluemound 230 kV line K862 to 345 kV and loop into Arcadian 345 kV substation | 39 | 2011 | 2011 | 5 |
| Accommodate new generation | Reroute Brookdale-Granville 345 kV line into expanded Bluemound 345 kV switchyard | N/A | 2011 | 2011 | 5 |
| Relieve overloads or low voltages under contingency, replace aging facilities | Rebuild Blaney Park-Munising 69 kV to 138 kV | 50 | 2012 | 2012 | 2 |

## Table VI-18 New Substations, Transformer Additions and Replacements

| Identified Need | Proposed Additions or Replacements | Transformer Capacity (MVA) | | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|---|
| | | Install | Replace | | | |
| | | | | | | |
| Relieve overloads under contingency | Uprate Whitcomb 115/69 kV transformer | N/A | N/A | 2002 | 2003 | 1 |
| Relieve overloads under contingency | Reconnect NW Beloit 69 kV load to Paddock-Blackhawk 138 kV line | N/A | N/A | 2003 | 2003 | 3 |
| Accommodate new generation, relieve overloads under contingency | Replace the existing 187 MVA 138/69 kV transformer at Sycamore with two 100 MVA transformers and reconfigure 138 kV bus | 200 | 187 | 2004 | 2004 | 3 |
| T-D interconnection | Construct 69 kV switchyard at Tokay | N/A | N/A | 2004 | 2004 | 3 |
| Relieve overloads under contingency | Install a second 138/69 kV transformer at North Randolph | 47 | 0 | 2004 | 2004 | 3 |
| Relieve overloads under contingency, accommodate new generation | Replace 138/69 kV transformers at Fitchburg with 187 MVA units | 374 | 202 | 2003 | 2004 | 3 |
| Relieve overloads under contingency | Install a second 138/69 kV transformer at Straits | 63 | 0 | 2005 | 2005 | 2 |
| Relieve overloads under contingency | Replace 345/138 kV transformer at Edgewater | 500 | 223 | 2005 | 2005 | 4 |
| Reduce service limitations, relieve overloads under contingency, improve transfer capability and Weston stability | Construct 345 kV switchyard at Weston and replace the 200 MVA 345/115 kV transformer with 500 MVA transformers | 1000 | 200 | 2002 | 2006 | 1 |
| Relieve overloads under contingency, accommodate new generation | Build new breaker and a half 345/138 kV substation on site adjacent to existing North Madison substation and replace existing transformers with two new 500 MVA units | 1000 | 510 | 2005 | 2006 | 3 |
| Relieve overloads under contingency, reduce service limitations | Construct a 345/138 kV switchyard at a new Werner West SS; install a 345/138 kV transformer. Loop existing Rocky Run to North Appleton 345 kV and existing Werner to White Lake 138 kV lines into Werner West | 500 | 0 | 2004 | 2006 | 4 |

Table VI-18 New Substations, Transformer Additions and Replacements (continued)

| Identified Need | Proposed Additions or Replacements | Transformer Capacity (MVA) | | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|---|
| | | Install | Replace | | | |
| | | | | | | |
| Relieve overloads under contingency | Install a 138/69 kV, 60 MVA transformer at Sheboygan Falls | 60 | 0 | 2003 | 2006 | 4 |
| Transfer capability, relieve overloads under contingency | Install 138/115 kV 100 MVA transformer at Cranberry | 100 | 0 | 2007 | 2007 | 1 |
| Transfer capability, relieve overloads under contingency | Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Conover | 50 | 0 | 2007 | 2007 | 2 |
| Transfer capability, relieve overloads under contingency | Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Iron River | 50 | 0 | 2007 | 2007 | 2 |
| Relieve overloads under contingency, accommodate new generation | Install 138/69 kV transformer at Femrite | 100 | 0 | 2007 | 2007 | 3 |
| Relieve overloads under contingency, accommodate new generation | Install 138/69 kV transformer at Reiner | 100 | 0 | 2007 | 2007 | 3 |
| Relieve overloads under contingency | Construct new 138 kV bus and 138/69 kV 100 MVA transformer at Verona Substation | 100 | 0 | 2007 | 2007 | 3 |
| Relieve overloads under contingency | Install 60 MVA 138/69 kV transformer at Dunn Rd | 60 | 0 | 2007 | 2007 | 4 |
| Relieve overloads under contingency and Germantown generation stability | Construct a new Lannon Junction substation at intersection of Granville-Arcadian 345 kV, Forest Junction-Arcadian 345 kV, Sussex-Tamarack 138 kV and Sussex-Germantown 138 kV lines; install a 345/138 kV, 500 MVA transformer | 500 | 0 | 2007 | 2007 | 5 |
| Accommodate new generation | Construct a 345/138 kV switchyard at Brookdale to accommodate two 345 kV lines, a 500 MVA 345/138 kV transformer and four-138 kV lines plus two 138-26.2 kV transformers | 500 | 0 | 2007 | 2007 | 5 |
| Accommodate new generation | Construct 345 kV Bluemound switchyard to accommodate one-345 kV line and a 500 MVA 345/138 kV transformer | 500 | 365 | 2007 | 2007 | 5 |

Table VI-18 New Substations, Transformer Additions and Replacements (continued)

| Identified Need | Proposed Additions or Replacements | Transformer Capacity (MVA) | | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|---|
| | | Install | Replace | | | |
| | | | | | | |
| Relieve overloads under contingency | Replace 138/69 kV transformer at Sigel | 60 | 47 | 2008 | 2008 | 1 |
| Relieve overloads under contingency | Replace 138/69 kV transformer at Metomen | 80 | 47 | 2008 | 2008 | 1 |
| Relieve overloads under contingency | Install a second 138/69 kV transformer at Hillman | 47 | 0 | 2008 | 2008 | 3 |
| Relieve overloads under contingency | Construct 138 kV bus and install a 138/69 kV transformer at Springbrook | 100 | 0 | 2008 | 2008 | 3 |
| Relieve overloads under contingency | Construct 138 kV bus and install a 138/69 kV, 50 MVA transformer at Pine River | 50 | 0 | 2009 | 2009 | 2 |
| Relieve overloads under contingency | Construct new 138 kV bus and install a 138/69 kV 100 MVA transformer at South Lake Geneva | 100 | 0 | 2009 | 2009 | 3 |
| Relieve overloads under contingency | Construct a 345 kV bus and install a 345/138 kV 500 MVA transformer at substation at West Middleton | 500 | 0 | 2009 | 2009 | 3 |
| Relieve overloads under contingency | Construct 138 kV bus and install a 138/69 kV 100 MVA transformer at Stagecoach | 100 | 0 | 2009 | 2009 | 3 |
| Relieve overloads under contingency | Construct a 345 kV bus and install a 345/138 kV, 500 MVA transformer at Concord | 500 | 0 | 2007 | 2009 | 3 and 5 |
| Accommodate new generation | Install second 500 MVA 345/138 kV transformer at Oak Creek | 500 | 0 | 2009 | 2009 | 5 |
| Relieve overloads under contingency | Reconnect the 138/69 kV transformers at Kilbourn on separate breakers to operate individually and replace the 47 MVA transformer with a 93 MVA transformer | 93 | 47 | 2010 | 2010 | 3 |

Table VI-18 New Substations, Transformer Additions and Replacements (continued)

| Identified Need | Proposed Additions or Replacements | Transformer Capacity (MVA) | | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|---|
| | | Install | Replace | | | |
| | | | | | | |
| Relieve overloads under contingency, accommodate new generation, T-D interconnection request | Replace two existing 345/138 transformers at Arcadian with 500 MVA units | 1000 | 600 | 2011 | 2011 | 5 |
| Accommodate new generation | Expand 345 kV switchyard at Bluemound to accommodate three additional 345 kV lines and two additional 500 MVA 345/138 kV transformers | 1000 | 685 | 2011 | 2011 | 5 |
| Relieve overloads under contingency | Install a second 138/69, 47 MVA transformer at Wautoma | 47 | 0 | 2012 | 2012 | 1 |

## Table VI-19 Substation Equipment Additions and Replacements

| Identified Need | Proposed Additions or Replacements | Capacitor Bank Capacity (MVAR) | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Relieve overloads or low voltages under contingency, accommodate new generation | Construct 138 kV switchyard at Riverside generation site (Townline Road Substation) | N/A | 2003 | 2003 | 3 |
| relieve overloads or low voltages under contingency | Replace 200 A metering CT at Sheboygan Falls 69 kV | N/A | 2003 | 2003 | 4 |
| Relieve overloads or low voltages under contingency | Replace 400 A CT at S Fond du Lac 69 kV | N/A | 2003 | 2003 | 4 |
| Relieve overloads or low voltages under contingency | Retap metering CT at Lodestar 138 kV | N/A | 2003 | 2003 | 4 |
| Relieve overloads or low voltages under contingency | Move Reedsburg 6 MVA D-SMES unit to Clear Lake 115 kV | N/A | 2004 | 2004 | 1 |
| Relieve overloads or low voltages under contingency | Install 69 kV phase shifter or fixed reactor at Council Creek | N/A | 2002 | 2004 | 1 |
| Relieve overloads or low voltages under contingency | Uprate North Randolph-Ripon 69 kV line terminal equipment | N/A | 2002 | 2004 | 1 |
| Relieve overloads or low voltages under contingency | Install 4.1 MVAR capacitor bank at Ripon 69 kV | 4.1 | 2003 | 2004 | 1 |
| Relieve overloads or low voltages under contingency | Install additional 4.1 MVAR capacitor bank at Berlin 69 kV | 4.1 | 2004 | 2004 | 1 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Expand Indian Lake 69 kV to accommodate Indian Lake-Glen Jenks 69 kV line | N/A | 2003 | 2004 | 2 |
| Relieve overloads or low voltages under contingency | Install 16.32 MVAR capactor bank at Oregon or Brooklyn 69 kV | 16.3 | 2004 | 2004 | 3 |
| Relieve overloads or low voltages under contingency, accommodate new generation | Replace McCue-Sheepskin 69 kV line terminal equipment and increase conductor clearance | N/A | 2004 | 2004 | 3 |
| Relieve overloads or low voltages under contingency | Install 24 MVAR capacitor bank at new Birchwood 138 kV | 24 | 2004 | 2004 | 3 |
| Relieve overloads or low voltages under contingency | Install 16.32 MVAR capacitor bank at Lone Rock | 16.32 | 2004 | 2004 | 3 |
| accommodate new generation | Expand Walnut Substation to interconnect IC029 generation | N/A | 2004 | 2004 | 3 |

Table VI-19 Substation Equipment Additions and Replacements (continued)

| Identified Need | Proposed Additions or Replacements | Capacitor Bank Capacity (MVAR) | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Accommodate new generation | Install 16.3 MVAR capacitor bank at Kegonsa 69 kV | 16.3 | 2004 | 2004 | 3 |
| Accommodate new generation | Install 20.4 MVAR capacitor bank at North Madison 69 kV | 20.4 | 2004 | 2004 | 3 |
| Accommodate new generation | Install 24.5 MVAR capacitor bank at Cross Country 138 kV | 24.5 | 2004 | 2004 | 3 |
| Accommodate new generation | Install 12.2 MVAR capacitor bank at Waunakee 69 kV | 12.2 | 2004 | 2004 | 3 |
| Accommodate new generation | Install 7.2 MVAR capacitor banks on distribution system at/near Tokay | 7.2 | 2004 | 2004 | 3 |
| Accommodate new generation | Install 7.2 MVAR capacitor banks on distribution system at/near West Middleton | 7.2 | 2004 | 2004 | 3 |
| Relieve overloads or low voltages under contingency | Install two-16.3 MVAR capacitor bank at Canal 69 kV | 32.6 | 2003 | 2004 | 4 |
| Relieve overloads or low voltages under contingency | Install 345 kV breaker for Edgewater 345/138 kV transformer (TR-22) | N/A | 2003 | 2004 | 4 |
| Relieve overloads or low voltages under contingency | Replace two 800 A line traps at Edgewater 138 kV | N/A | 2003 | 2004 | 4 |
| Relieve overloads or low voltages under contingency | Install two-8.2 MVAR capacitor banks at Council Creek 138 kV | 16.4 | 2004 | 2005 | 1 |
| Relieve overloads or low voltages under contingency | Uprate Bunker Hill-Pine 115 kV line terminal equipment | N/A | 2005 | 2005 | 1 |
| Relieve overloads or low voltages under contingency | Move 10 MVAR capacitor bank from Highway 8 to Hodag 115 kV | 10 | 2005 | 2005 | 1 |
| Relieve overloads or low voltages under contingency | Uprate Metomen-N Fond du Lac 69 kV line terminal equipment | N/A | 2005 | 2005 | 1 |
| Relieve overloads or low voltages under contingency | Uprate Portage-Columbia double circuit 138 kV line terminal equipment | N/A | 2004 | 2005 | 3 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Uprate Rockdale to Jefferson 138 kV line | N/A | 2005 | 2005 | 3 |
| Relieve overloads or low voltages under contingency | Uprate Rockdale to Boxelder 138 kV line | N/A | 2005 | 2005 | 3 |

Table VI-19 Substation Equipment Additions and Replacements (continued)

| Identified Need | Proposed Additions or Replacements | Capacitor Bank Capacity (MVAR) | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Relieve overloads or low voltages under contingency, accommodate new generation | Construct 138 kV bus at Kegonsa and terminate both Christiana-Fitchburg circuits into Kegonsa | N/A | 2005 | 2005 | 3 |
| Relieve overloads or low voltages under contingency | Replace 600 A CT at N Fond du Lac 138 kV | N/A | 2005 | 2005 | 4 |
| Accommodate new generation | Rebuild the Port Washington 138 kV switchyard (ring bus) to accommodate IC027 generation | N/A | 2005 | 2005 | 5 |
| Accommodate new generation, T-D interconnection request | Replace substation equipment at both Arcadian 138 kV and Waukesha 138 kV (for line KK9942) | N/A | 2005 | 2005 | 5 |
| Relieve overloads or low voltages under contingency | Install 50 MVAR capacitor bank at Burlington 138 kV | 50 | 2005 | 2005 | 5 |
| Relieve overloads or low voltages under contingency | Reconfigure 345 kV bus at Pleasant Prairie | N/A | 2004 | 2005 | 5 |
| Relieve overloads or low voltages under contingency | Install 40 MVAR capacitor bank at Moorland 138 kV | 40 | 2004 | 2005 | 5 |
| Accommodate new generation, relieve overloads or low voltages under contingency | Uprate Weston-Kelly 115 kV line - scope TBD | N/A | 2006 | 2006 | 1 |
| Relieve overloads or low voltages under contingency | Install two-16.3 MVAR capacitor banks at Wautoma 138 kV | 32.6 | 2006 | 2006 | 1 |
| Relieve overloads or low voltages under contingency | Install two-6.8 MVAR capacitor banks at Antigo 115 kV | 13.6 | 2006 | 2006 | 1 |
| Relieve overloads or low voltages under contingency | Install two-5.4 MVAR capacitor banks at Iron River 69 kV | 10.8 | 2006 | 2006 | 2 |
| Relieve overloads or low voltages under contingency | Install 16.32 MVAR capacitor bank at Verona 69 kV | 16.3 | 2006 | 2006 | 3 |
| Relieve overloads or low voltages under contingency | Install replacement 16.32 MVAR capacitor bank at Richland Center substation | 0 | 2006 | 2006 | 3 |

Table VI-19 Substation Equipment Additions and Replacements (continued)

| Identified Need | Proposed Additions or Replacements | Capacitor Bank Capacity (MVAR) | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Relieve overloads or low voltages under contingency | Install/upgrade capacitor bank at South Monroe 69 kV to 24 MVAR | 24 | 2006 | 2006 | 3 |
| Relieve overloads or low voltages under contingency | Uprate Weston-Morrison-Sherman St. 115 kV line - scope TBD | N/A | 2007 | 2007 | 1 |
| Relieve overloads or low voltages under contingency | Uprate Weston-Sherman St. 115 kV line - scope TBD | N/A | 2007 | 2007 | 1 |
| Relieve overloads or low voltages under contingency | Install 10 MVAR capacitor bank at Jefferson 138 kV | 10 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency | Install two-13 MVAR capacitor banks at Concord 138 kV | 26 | 2007 | 2007 | 3 |
| Relieve overloads or low voltages under contingency | Install 28.8 MVAR capacitor bank at Butternut 138 kV | 28.8 | 2007 | 2007 | 4 |
| Accommodate new generation | Expand Oak Creek 345 kV switchyard to interconnect one new generator, unit #7 plus two 345 kV lines and 138 kV switchyard to accommodate new St. Martins line | N/A | 2007 | 2007 | 5 |
| Accommodate new generation | Reconnect Oak Creek unit #7 to 345 kV switchyard | N/A | 2007 | 2007 | 5 |
| Accommodate new generation | Install two 345 kV series breakers at Pleasant Prairie on lines to Racine (L631) and Zion (L2221) | N/A | 2007 | 2007 | 5 |
| Accommodate new generation | Replace seven 138 kV overdutied breakers at Bluemound | N/A | 2007 | 2007 | 5 |
| transfer capability | Install two-25 MVAR capacitor banks at Arpin 138 kV | 50 | 2008 | 2008 | 1 |
| transfer capability | Install two-25 MVAR capacitor banks at Arpin 115 kV | 50 | 2008 | 2008 | 1 |
| transfer capability | Install two-40 MVAR capacitor banks at Weston 115 kV | 80 | 2008 | 2008 | 1 |
| transfer capability | Install three-52 MVAR capacitor banks at Rocky Run 115 kV | 156 | 2008 | 2008 | 1 |

Table VI-19 Substation Equipment Additions and Replacements (continued)

| Identified Need | Proposed Additions or Replacements | Capacitor Bank Capacity (MVAR) | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| transfer capability | Install 65 MVAR capacitor bank at Arrowhead 230 kV | 65 | 2008 | 2008 | 1 |
| Relieve overloads or low voltages under contingency | Install additional 4.1 MVAR capacitor bank at Ripon 69 kV | 4.1 | 2008 | 2008 | 1 |
| Accommodate new generation, relieve overloads or low voltages under contingency | Uprate Kansas-Ramsey6 138 kV line | N/A | 2008 | 2008 | 5 |
| Accommodate new generation, relieve overloads or low voltages under contingency | Uprate Oak Creek-Ramsey6 138 kV line | N/A | 2008 | 2008 | 5 |
| Relieve overloads or low voltages under contingency | Uprate Wautoma-Berlin 69 kV line terminal equipment | N/A | 2009 | 2009 | 1 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Install 138 kV ring bus at Hiawatha SS | N/A | 2009 | 2009 | 2 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Install 138 kV substation modifications at Indian Lake SS | N/A | 2009 | 2009 | 2 |
| Relieve overloads or low voltages under contingency, reduce service limitations | Install 138 kV ring bus at Straits SS | N/A | 2009 | 2009 | 2 |
| Relieve overloads or low voltages under contingency | Replace Columbia-Manley Sand 69 kV line terminal equipment | N/A | 2009 | 2009 | 3 |
| Accommodate new generation | Expand 345 kV switchyard at Oak Creek to interconnect one new generator | N/A | 2009 | 2009 | 5 |
| Relieve overloads or low voltages under contingency | Uprate Sherman Street-Hilltop-Maine 115 kV line - scope TBD | N/A | 2010 | 2010 | 1 |
| Relieve overloads or low voltages under contingency | Uprate Whitcomb-Deer Trail 69 kV line terminal equipment | N/A | 2010 | 2010 | 1 |
| Relieve overloads or low voltages under contingency | Install a 69 kV 16.32 MVAR capacitor bank at Kilbourn Substation | 16.32 | 2010 | 2010 | 3 |
| Relieve overloads under contingency | Uprate Colley Road 138/69 kV transformer to 116 MVA summer emergency | N/A | 2010 | 2010 | 3 |

Table VI-19 Substation Equipment Additions and Replacements (continued)

| Identified Need | Proposed Additions or Replacements | Capacitor Bank Capacity (MVAR) | System Need Year | Projected In-Service Year | Planning Zone |
|---|---|---|---|---|---|
| Relieve overloads under contingency | Uprate Paddock-Shirland 69 kV line terminal equipment | N/A | 2010 | 2010 | 3 |
| Relieve overloads or low voltages under contingency | Uprate Weston-Black Brook 115 kV line - scope TBD | N/A | 2011 | 2011 | 1 |
| Relieve overloads or low voltages under contingency | Uprate West Middleton-Pheasant Branch 69 kV line | N/A | 2011 | 2011 | 3 |
| Relieve overloads or low voltages under contingency | Install two-16.3 MVAR capacitor bank at Apple Hills 138 kV | 32.6 | 2011 | 2011 | 4 |
| Accommodate new generation, T-D interconnection request | Replace substation equipment at both Arcadian 138 kV and Waukesha 138 kV associated with KK9962 | N/A | 2011 | 2011 | 5 |
| Accommodate new generation | Expand Oak Creek 138 kV switchyard to reconnect units #6 and #9 | N/A | 2011 | 2011 | 5 |
| Accommodate new generation | Reconnect Oak Creek unit #8 to 345 kV switchyard | N/A | 2011 | 2011 | 5 |
| Accommodate new generation | Replace 22-138 kV overdutied breakers at Harbor, Everett and Haymarket Substations | N/A | 2011 | 2011 | 5 |
| Accommodate new generation | Expand Oak Creek 345 kV switchyard to interconnect three new generators, unit #8 and two 345 kV lines, plus installation of eight 345 kV series breakers for stability purposes | N/A | 2011 | 2011 | 5 |
| Relieve overloads or low voltages under contingency | Install additional 13.6 MVAR capacitor bank at Clear Lake 115 kV | 13.6 | 2012 | 2012 | 1 |
| Relieve overloads or low voltages under contingency | Uprate Metomen-Ripon 69 kV line - scope TBD | N/A | 2012 | 2012 | 1 |
| Relieve overloads or low voltages under contingency | Move Lone Rock 69 kV phase shifter to Richland Center | N/A | 2012 | 2012 | 3 |

## Table VI-20 Alternative Solutions to Planned, Potential or Conceptual Additions

| Primary Solution(s) | Alternate Solution(s) | Projected In-Service Year | Planning Zone |
|---|---|---|---|
| | | | |
| Convert Pine-Grandfather-Tomahawk-Eastom 46 kV system to 115 kV and construct new Skanawan-Highway 8 115 kV line | 1.) Weston-Venus 345 kV line.<br>2.) Venus-Crandon-Laona-Goodman-Amberg 138 kV line.<br>3.) Venus-Crandon-Laona-Goodman-Plains 138 kV line.<br>4.) Cranberry-Conover 138 kV line and convert Conover-Iron River-Plains to 138 kV.<br>5.) Cranberry-Conover 138 kV line and convert Conover-Winona to 138 kV.<br>6.) Rebuild Bunker Hill-Blackbrook 115 kV line and rebuild Blackbrook-Aurora St. with double circuit 115 kV lines.<br>7.) Generation in upper portion of Rhinelander Loop. | 2004 and 2005 | 1 |
| New Cranberry-Conover 138 kV line and Convert Conover-Iron River-Plains 69 kV to 138 kV | 1.) Weston-Venus 345 kV line.<br>2.) Weston-Venus-Plains 345 kV line.<br>3.) Cranberry-Conover 138 kV line and convert Conover-Winona to 138 kV.<br>4.) Venus-Crandon-Laona-Goodman-Plains 138 kV line.<br>5.) Venus-Crandon-Laona-Goodman-Amberg 138 kV line.<br>6.) Generation in upper portion Rhinelander Loop<br>7.) Park Falls-Clear Lake 115 kV line<br>8.) Convert Whitcomb-Aurora St. 69 kV to 115 kV | 2007 | 1 |
| Two T-D interconnections: Arnett Road and Boulder Junction. New Clear Lake-Arnett Road 115 kV line and a new St. Germain-Boulder Junction 115 kV line. Both lines to be radial. | 1.) Loop new T-D substations with a Clear Lake-Arnett Rd-Boulder Junction-Conover 115 kV line.<br>2.) Loop new T-D substations with a Clear Lake-Arnett Rd-Boulder Junction-St. Germain 69 kV line.<br>3.) Construct new 69 kV radial lines to Arnett Rd and Boulder Junction with 115/69 kV xfmrs at Clear Lake and St. Germain.<br>4.) New Clear Lake-Arnett Rd 115 kV line and extend 115 kV line west to NSP's Park Falls substation.<br>5.) Distribution fixes. | 2006 and 2008 | 1 |

## Table VI-20 Alternative Solutions to Planned, Potential or Conceptual Additions (continued)

| Primary Solution(s) | Alternate Solution(s) | Projected In-Service Year | Planning Zone |
|---|---|---|---|
| | | | |
| Install 69 kV series reactor at Council Creek | 1.) Install a 69 kV phase shifter Council Creek. | 2004 | 1 |
| Berlin area reinforcements: New Omro-Fitzgerald 69 kV line. Install capacitor banks at Ripon and Berlin. | 1.) Reconfigure N. Randolph-Ripon 69 kV line to N. Randolph-Metomen and Metomen-Ripon 69 kV lines. Cap bank installations at Berlin, Ripon and Winneconne and 2nd 138/69 kV transformer at Metomen.<br>2.) Convert Metomen-Ripon-Berlin 69 kV line to 138 kV with a new 138/69 kV xfmr at Berlin.<br>3.) Rebuild the Metomen-Ripon-Berlin 69 kV line to a 138-69 kV double circuit with new 138/69 kV transformer at Berlin. | 2004 - 2009 | 1 |
| Uprate Weston-Sherman St., Weston-Morrison-Sherman St., and Sherman St.-Hilltop 115 kV lines | 1). Convert WPS's 46 kV system from Maine-Brokaw-Strowbridge-Wausau Hydro-Townline-Kelly to 115 kV.<br>2.) Convert WPS's 46 kV system from Sherman St.-Wausau Hydro-Strowbridge-Townline-Kelly to 115 kV | 2007 | 1 |
| Uprate Weston-Kelly 115 kV line | 1.) Convert WPS's 46 kV system from Weston-Rothschild-Kelly to 115 kV.<br>2.) Reroute/Reterminate Weston end of line to new Weston 345-115 kV substation.<br>2.) Install a new 161/138 kV transformer at Monroe County and convert DPC's Monroe County-Council Creek 69 kV system to 138 kV. | 2006 | 1 |
| Rebuild Weston-Northpoint 115 kV line | Construct another parallel-path 115 kV line | 2008 | 1 |
| Rebuild Kelly-Whitcomb 115 kV line | Construct second Weston-Badger 115 kV line<br>Construct another parallel-path 115 kV line | 2008 | 1 |
| Construct a 0.2 mile Hiawatha to Engadine 69 kV line to relieve low voltages under contingency by removing load from the end of a 71 mile, 69 kV line. | Add capacitor bank near Newberry SS | 2003 | 2 |
| Uprate Cedar-Freeman 138 kV line<br>Uprate Cedar-M38 138 kV line<br>Uprate Freeman-Presque Isle 138 kV line<br>Uprate Presque Isle-Cedar 138 kV line | Alternative solutions to be defined after scope of the uprates is developed. | 2003 | 2 |
| Add a second 138/69 kV transformer at Straits | Replace the Straits 138/69 kV transformer with a larger size | 2004 | 2 |
| Rebuild and convert one Hiawatha-Indian Lake 69 kV circuit to double circuit 138 kV | Rebuild at 69 kV and limit flows with a Phase Shifter | 2004 | 2 |
| Construct second Hiawatha-Straits 138 kV line | Limit flows with a Phase Shifter and add 138 kV capacitors at Brevort or Lakehead | 2007 | 2 |

## Table VI-20 Alternative Solutions to Planned, Potential or Conceptual Additions (continued)

| Primary Solution(s) | Alternate Solution(s) | Projected In-Service Year | Planning Zone |
|---|---|---|---|
| Rebuild/reconductor Plains-Amberg-Stiles double circuit 138 kV line | 1. Double circuit with portions of existing 69 kV and convert portions of existing 69 kV line from West Marinette to Amberg to 138 kV (45 miles) line<br><br>2. Double circuit with portions of existing 69 kV and convert portions of existing 69 kV line from Amberg to Chandler to 138 kV (54 miles) | 2004 | 2 and 4 |
| Construct second Wempletown-Paddock 345 kV line | Install 67 MVA transformer at Galena as an interim measure | 2004 | 3 |
| Construct a new 345 kV line from Rockdale to West Middleton | Uprate Christiana to Fitchburg 138 kV line to 319 MVA | 2005 | 3 |
| Construct a new 345 kV line from Rockdale to West Middleton | Reconductor Kegonsa to Christiana 138 kV line | 2005 | 3 |
| Convert Columbia-North Madison 138 kV line to 345 kV | Construct a new 345 kV double circuit from the Rockdale-Columbia line to a new substation east of Sprecher; install a 345/138 kV transformer at the new substation; construct a new double circuit 138 kV line to Sprecher/Femrite | 2006 | 3 |
| Construct a Jefferson-Lake Mills-Stony Brook 138 kV line | Construct single 138 kV radial line from Jefferson to Lake Mills; Install 345 kV bus and 345/138 kV transformer at North Randolph; Install capacitor bank at Jefferson, construct a third distribution line extension into Lake Mills | 2006 | 3 |
| Build new breaker and a half 345/138 kV substation on site adjacent to existing North Madison substation and replace existing transformers with two new 500 MVA units | Reconfigure 345 kV bus at North Madison and replace existing transformers with 500 MVA units | 2006 | 3 |
| Construct South Beaver Dam-North Beaver Dam 138 kV line | Rebuild and convert North Beaver Dam to South Beaver Dam 69 kV line to 138 kV | 2007 | 3 |
| Construct Sprecher-Femrite 138 kV line | Construct new 138 kV double circuit line from Rockdale to Sprecher/Femrite | 2007 | 3 |
| Construct new 138 kV line from Verona to Southeast Fitchburg Substation | Convert 69 kV line from West Middleton to Stagecoach to Mount Horeb to Verona to 138 kV, Install 138/69 kV transformer at Mount Horeb | 2007 | 3 |
| Construct a new 345 kV line from Rockdale to West Middleton | 1.) Convert Kegonsa to Femrite to 138 kV, close the 138 kV loop from Femrite to Sprecher, convert the Sycamore to Sprecher line to 138 kV<br>2.) Install Rockdale to Sprecher/Femrite 138 kV double circuit | 2008 | 3 |
| Convert 69 kV line from West Middleton to Spring Green to 138 kV and Construct a new 345 kV line from Rockdale to West Middleton | Install several capacitor banks on 69 kV buses and on 138 kV buses | 2008 | 3 |
| Construct new 138 kV line from Twin Lakes to Spring Valley | Construct new 345 kV from Paddock to Paris | 2009 | 3 |
| Construct new 69 kV line from Brooklyn to Belleville Substation | Construct new 69 kV line from Brooklyn to Evansville, Install 138 kV bus and 138 /69 kV transformer at Bass Creek | 2009 | 3 |

## Table VI-20 Alternative Solutions to Planned, Potential or Conceptual Additions (continued)

| Primary Solution(s) | Alternate Solution(s) | Projected In-Service Year | Planning Zone |
|---|---|---|---|
| Construct a new 345 kV line from Rockdale to West Middleton | 1.) Construct a new 345 kV line from North Madison to West Middleton<br>2.) Rockdale to Sprecher/Femrite 138 kV double circuit<br>3) Numerous 138 kV and 69 kV capacitor banks, reconductor Kegonsa to Christiana, reconductor Fitchburg to Christiana, add a second 138/69 kV transformer at North Madison, add a third 345/138 kV transformer at North Madison, reconductor or uprate North Madison to Sycamore 138 kV line, install a second 138/69 kV transformer at Kegonsa, reconductor all three East Campus to Blount 69 kV lines, reconductor Blount to Gateway 69 kV line. | 2009 | 3 |
| Install line between Spring Green and Prairie du Sac to off load this line | Install parallel transformers at Portage and North Madison | 2009 | 3 |
| Construct a second West Middleton-Walnut 69 kV circuit, use spare pipe from Walnut to Terrace Avenue riser and double circuit the overhead line the remainder of the circuit run to West Middleton | Use existing spare pipe from Walnut to Terrace Avenue riser for oil circulation and forced external cooling on the existing 69 kV circuit between Walnut and West Middleton; convert the North Madison to Dane to Waunakee to Blount 69 kV circuit to 138 kV; add 138 kV bus and 138/69 kV transformer at a new substation site near Waunakee; construct 138/69 kV double circuit from Dane to new Waunakee substation | 2009 | 3 |
| Construct 345 kV line from Paddock to new Verona 345 kV switchyard; loop Kegonsa-West Middleton 345 kV line into Verona | 1.) Construct 345 kV line from Byron to West Middleton<br>2.) Construct 345 kV line from Salem to West Middleton | 2012 | 3 |
| Construct 69 kV line from Eden through Muscoda to Richland Center | Install a 138 kV bus and 161/138 kV transformer at Gran Grae; Convert Gran Grae to Spring Green 69 kV line to 138 kV; install 138 kV bus and 138/69 kV transformer at Lone Rock | 2012 | 3 |
| Construct a Canal-Dunn Rd 138 kV line and add a 138/69 kV transformer at Dunn Rd | 1.) Add a third 138/69 kV transformer at Canal<br>2.) Add generation to the 69 kV system in Northern Door County<br>3.) Replace Canal 138/69 kV transformers 1 and 2 | 2003 | 4 |
| Add two 16.3 MVAR capacitor bank at Canal 69 kV in 2004 | 1.) Rebuild Pulliam-Brusbay-Sawyer-Canal 69 kV line for 138 kV<br>2.) Construct a 138 kV line from Egg Harbor to Menominee under the bay of Green Bay and operate at 69 kV<br>3.) Construct a 138 kV line from Sister Bay to Escanaba under the bay of Green Bay and operate at 69 kV<br>4.) Add generation to the 69 kV system in Door County | 2004 | 4 |

## Table VI-20 Alternative Solutions to Planned, Potential or Conceptual Additions (continued)

| Primary Solution(s) | Alternate Solution(s) | Projected In-Service Year | Planning Zone |
|---|---|---|---|
| Rebuild the Morgan-Falls-Pioneer-Stiles 138 kV line | Construct second 138 kV line in parallel to existing Morgan-Falls-Pioneer-Stiles | 2004 | 4 |
| Add 138 kV conductor for Ellinwood-Sunset Point 138 kV on existing structures | 1.) Replace Ellinwood 138/69 kV transformer<br>2.) Add a third Ellinwood 138/69 kV transformer | 2005 | 4 |
| Construct a 138 kV line from Erdman to Howard's Grove | 1.) Construct 138 kV line from Forest Junction-Cedarsauk to Howard's Grove<br>2.) Construct a 69 kV line from Erdman to Howard's Grove | 2006 | 4 |
| Construct the Morgan-Werner West 345 kV line and construct a 345/138 kV switchyard at a new Werner West SS; install a 345/138 kV transformer. Loop existing Rocky Run to North Appleton 345 kV and existing Werner to White Lake 138 kV lines into Werner West | 1.) Construct a 345 kV line from Morgan to N. Appleton, add a fourth 345/138 kV transformer at N. Appleton, uprate the Kaukauna Central Tap-Melissa-Tayco 138 kV line, uprate Butte des Morts 138 kV bus tie, uprate Casaloma-Ellington-N Appleton 138 kV line.<br>2.) Add a fourth 345/138 kV transformer at N. Appleton, uprate the Kaukauna Central Tap-Melissa-Tayco 138 kV line uprate Butte des Morts 138 kV bus, uprate Casaloma-Ellington-N Appleton 138 kV line, uprate Ellington 138 kV bus, uprate Morgan-White Clay 138 kV line, and add a 14.4 MVAR capacitor bank at Casaloma 138 kV | 2009 | 4 |
| Construct a second Dunn Rd-Egg Harbor 69 kV line | 1.) Construct a new 138 kV line from Dunn Rd to Egg Harbor<br>2.) Add generation to the 69 kV system in northern Door County<br>3.) Construct a 138 kV line from Egg Harbor to Menominee under the bay of Green Bay and operate at 69 kV.<br>4.) Construct a 138 kV line from Sister Bay to Escanaba under the bay of Green Bay and operate at 69 kV. | 2007 | 4 |
| Rebuild Crivitz-High Falls 69 kV double circuit line | 1.) Construct 25.5 mile 138 kV line from Amberg to Goodman<br>2.) Increase clearances on the Crivitz-High Falls 69 kV double circuit line and add a 5.4 MVAR capacitor bank at High Falls<br>3.) Construct the Laona-Goodman-Amberg 138 kV line | 2007 | 4 |
| Construct 2.5 miles of 138 kV line from Lodestar to Sheboygan Falls and Install a 138/69 kV, 60 MVA transformer at Sheboygan Falls | 1.) Tap the Forest Junction-Cedarsauk 138 kV line to Sheboygan Falls and add a 138/69 kV transformer.<br>2.) Construct a 138 kV line to the 69 kV Plymouth Sub #2 and convert Plymouth Sub#2 to 138 kV<br>3.) Replace Mullet River and Sheboygan Falls 138/69 kV transformers with 100 MVA units | 2005 | 4 |

## Table VI-20 Alternative Solutions to Planned, Potential or Conceptual Additions (continued)

| Primary Solution(s) | Alternate Solution(s) | Projected In-Service Year | Planning Zone |
|---|---|---|---|
| Construct a Northside-City Limits 138 kV line | Construct a Kaukauna Central Tap-Kaukauna Combined Locks Tap 138 kV line and develop a new 138 kV switching station at Kaukauna Central Tap | 2011 | 4 |
| Install two 345 kV series breakers at Pleasant Prairie on lines to Racine (L631) and Zion (L2221) | Reconfigure 345 kV lines on bus sections 3 and 4. Reconfigure Pleasant Prairie 345 kV straight bus into ring bus. Construct a 345 kV bus at Bain SS. | 2007 | 5 |
| Construct Rockdale-Concord-Bark River-Lannon 345 kV line with 345/138 kV transformers at Concord, Bark River and Lannon, with second 138 kV line from Germantown-Lannon | 1.) Construct a 345 kV line from Rockdale-Concord-St Lawrence<br>2.) Add a 345/138 kV transformer at St. Lawrence<br>3.) Add a 345/138 kV transformer at Concord<br>4.) Add a 138 kV switching station at Lannon (Wanaki) site<br>5.) Construct a second Germantown-Lannon Junction 138 kV line | 2008/10 | 3 and 5 |
| Construct Rockdale-Concord-Bark River-Lannon 345 kV line with 345/138 kV transformers at Concord, Bark River and Lannon, with second 138 kV line from Germantown-Lannon | 1.) Construct a Bark River-Concord 138 kV line<br>2.) Construct a Bark River- Hartford 138 kV line<br>3.) Add a 138 kV switching station at Lannon Junction<br>4.) Construct a second Germantown-Lannon Junction 138 kV line<br>5.) Install 26 MVAR capacitor banks at Summit and Hartford 138 kV | 2008/10 | 3 and 5 |
| Replace two existing 345/138 kV transformers at Arcadian with 500 MVA units | Construct a new 345/138 kV substation in the Arcadian area | 2011 | 5 |

Table VI-21 Additions Removed From Plan Since Last Assessment

| Formerly Planned Additions | Projected In-Service Year | Planning Zone | Reason for Removal |
|---|---|---|---|
| Replace 138/69 kV transformer at Petenwell | 2005 | 1 | TSR withdrawn |
| Uprate Port Edwards-Sand Lake 138 kV – scope TBD | 2005 | 1 | TSR withdrawn |
| Construct Eastom-Lake Nokomis 115 kV line | 2005 | 1 | Lake Nokomis T-D interconnection request withdrawn |
| Construct Lake Nokomis-Highway 8 115 kV line | 2005 | 1 | Lake Nokomis T-D interconnection request withdrawn |
| Install additional 6.3 MVAR capacitor bank at McKenna 69 kV | 2006 | 1 | Revised load/model information |
| Construct a Laona-Goodman-Plains 138 kV line | 2007 | 1 and 2 | Another project alternative selected |
| Install additional 5.4 MVAR capacitor bank at New Glarus 69 kV | 2004 | 3 | Another project alternative selected |
| Install 24 MVAR capacitor bank at Dickinson 138 kV | 2004 | 3 | Revised load/model information |
| Install 24 MVAR capacitor bank at Elkhorn 138 kV | 2004 | 3 | Revised load/model information |
| Install 12.2 MVAR capacitor bank at Burke 69 kV | 2004 | 3 | Revised load/model information |
| Install additional 5.4 MVAR capacitor bank at Mayville 69 kV | 2004 | 3 | Another project alternative selected |
| Rebuild Janesville-Riverside 138 kV line | 2005 | 3 | Revised load/model information |
| Construct a 345 kV switchyard at North Randolph; install a 345/138 kV transformer | 2006 | 3 | Another project alternative selected |
| Install a second 138/69 kV, 47 MVA transformer at Rock River | 2007 | 3 | Revised load/model information |
| Install a second 138/69 kV transformer at Janesville | 2007 | 3 | Another project alternative selected |
| Install 10.8 MVAR capacitor bank at Lake Geneva 69 kV | 2007 | 3 | Another project alternative selected |
| Construct Elkhorn-Sugar Creek 138 kV line | 2007 | 3 | Another project alternative selected |

Table VI-21 Additions Removed From Plan Since Last Assessment (continued)

| Formerly Planned Additions | Projected In-Service Year | Planning Zone | Reason for Removal |
|---|---|---|---|
| Reconductor Reiner-Burke Tap 69 kV line | 2009 | 3 | Revised load/mocel information |
| Uprate Brick Church-Zenda 69 kV line terminal equipment | 2009 | 3 | Another project alternative selected |
| Reconductor Colley Road-Clinton 69 kV line | 2009 | 3 | Another project alternative selected |
| Install 10.8 MVAR capacitor bank at Waunakee 69 kV | 2010 | 3 | Another project alternative selected |
| Install 8.16 MVAR capacitor bank at Rio 69 kV | 2004 | 3 | Another project alternative selected |
| Uprate Edgewater-Cedarsauk 345 kV line | 2004 | 4 | Revised load/model information |
| Uprate Point Beach-Forest Junction 345 kV line | 2004 | 4 | Revised load/model information |
| Uprate Kaukauna Central Tap-Melissa 138 kV line – scope TBD | 2006 | 4 | Deferred by Werner West Substation |
| Replace Tecumseh 138/69 kV transformer | 2007 | 4 | Revised load/model information |
| Install 28.8 MVAR capacitor bank at Fitzgerald 138 kV | 2007 | 4 | Revised load/model information |
| Install 5.4 MVAR capacitor bank at Rosebush 69 kV | 2008 | 4 | Revised load/model information |
| Construct Clintonville-Werner West 138 kV line | 2007 | 4 | Revised load/model information |
| Uprate Pleasant Prairie-Arcadian 345 kV line | 2004 | 5 | Revised load/model information |
| Install 20 MVAR capacitor bank at Tichigan 138 kV | 2007 | 5 | Another project alternative selected |
| Install three-75 MVAR capacitor banks at Bluemound 138 kV | 2007 | 5 | Revised load/model information |
| Install 20 MVAR capacitor bank at Summit 138 kV | 2007 | 5 | Revised load/model information |

### Typical Transmission Line and Substation Capital Costs

To provide some perspective of the cost implications of project alternatives included in this Assessment, ATC has compiled capital costs for various types of projects that are representative of the magnitude of such types of projects. These typical capital costs are listed in Table VI-22.

It should be noted that the costs listed are merely representative for projects within each category. Actual project costs can vary, in some cases dramatically, based on the scope, location and particular design of the project. Capital costs include material, labor, licensing, design, land acquisition, environmental mitigation fees if applicable and project close-out. While some projects require additional costs of generator redispatch during construction outages, such cost are very project specific and have not been included in the estimates below. Regarding the categories below:

- New transmission line cost is shown per mile.
- Rebuilt transmission line cost is shown per mile.
- Reconductored transmission line cost is shown per mile.
- New substation costs are shown as per terminal at each voltage. Routing an existing transmission line into a new substation typically requires two terminals, particularly at 100 kV and above. Installing a new transformer in a substation requires two terminals, one at the higher voltage and one at the lower voltage. Thus, a new 345-138 kV substation that incorporates an existing 345 kV line and two 138 kV transmission lines, all of which exist near the new substation site, would require three 345 kV terminals and five 138 kV terminals.
- Transformer costs are shown for typical transformer sizes in each class (500 MVA for 345/138 kV and 345/115 kV; 100 MVA for 138/69 kV and 115/69 kV).

### Table VI-22 Typical Transmission Line and Substation Project Capital Costs

| TRANSMISSION FACILITY | TYPICAL CAPITAL COST | UNIT |
|---|---|---|
| New 345 kV single circuit line | $ 915,000 | Mile |
| New 345 kV double circuit line | $1,710,000 | Mile |
| New 345 kV single circuit underground line (w/o terminals) | $4,000,000 | Mile |
| New 138 kV single circuit line | $ 390,000 | Mile |
| New 138 kV double circuit line | $ 540,000 | Mile |
| New 138 kV single circuit underground line (w/o terminals) | $2,000,000 | Mile |
| New 69 kV single circuit line | $ 285,000 | Mile |
| New 69 kV double circuit line | $ 380,000 | Mile |
| New 69 kV single circuit underground line (w/o terminals) | $1,500,000 | Mile |
| Rebuild 138 kV at 138 kV (larger conductor) double circuit | $ 530,000 | Mile |
| Rebuild 69 kV to 138 kV, single circuit | $ 400,000 | Mile |
| Reconductor 138 kV or 115 kV line, single circuit | $ 90,000 | Mile |
| Reconductor 69 kV line, single circuit | $ 75,000 | Mile |
| 345 kV substation terminal[1] | $1,290,000 | Each |
| 138 kV or 115 kV substation terminal[1] | $ 740,000 | Each |
| 69 kV substation terminal[1] | $ 525,000 | Each |
| 345/138 kV transformer[2] | $3,500,000 | Each |
| 138/69 kV transformer[3] | $1,650,000 | Each |

Notes:

All substation costs are inflated out one year from time of estimate.

[1] includes line breaker and maintenance switches

[2] assumes 500 MVA unit, includes high and low side breakers

[3] assumes 100 MVA unit, includes high side breaker/circuit switcher and low side breaker