Phase 1
Access Analysis

April 7, 2004

Recently Completed Projects to Address Chronic Access Limiters

- Rockdale 345/138 kV Transformer
- Whitewater – Mukwonago 138 kV
- Forest Junction 345/138 kV Transformer
- Saukville – Granville 138 kV
- Blackhawk – Colley Road 138 kV
- Christiana – Kegonsa 138 kV
- Highway V – Preble 138 kV

Planned Future Projects to Improve Access

- Arrowhead – Weston 345 kV
- Wempletown – Paddock 345 kV
- Plains – Stiles 138 kV
- Hiawatha – Indian Lake 69 kV
- Morgan – Werner West 345 kV
- Lannon Junction – Rockdale 345 kV
- Morgan – White Clay 138 kV
- Morgan – Stiles 138 kV

Next Steps for External Access

- The planned future projects address some of the internal and external access constraints
- To maintain or improve external access long term, an additional tie to neighboring systems is needed
- Additional internal projects will also be needed to support a higher level of external access
- 10 Year Assessment process is evolving to consider long term import capability needs

2003 10-Year Assessment

- "Increasing Import Capability" in Section 5
  - Examined what projects might be needed to increase import capability by 1k, 2k or 3k over existing (2k)
  - Projects chosen were based on heuristics
  - Primary project needed to achieve 2k additional imports was a 345 kV line from CE to southern WI
  - Primary projects needed to achieve 3k additional imports were an extension of the CE line to the Madison area plus a new 345kV line from NSP to Lake Winnebago

2003 10-Year Assessment

- Presentation of these projects in the 2003 10 Year Assessment was designed to indicate the magnitude of the projects needed to achieve the targets indicated
- This presentation did not cover:
  - Reliability benefits
  - Economic benefits
  - Strategic benefits

2003 10-Year Assessment Update

- Preliminary comparison of the effect the direction of system expansion has on external access
- Focused on five potential "build-out" directions for next tie line:
  - West (Minnesota)
  - Southwest (Iowa)
  - South (Illinois)
  - East (Michigan)
  - Northeast (Canada)

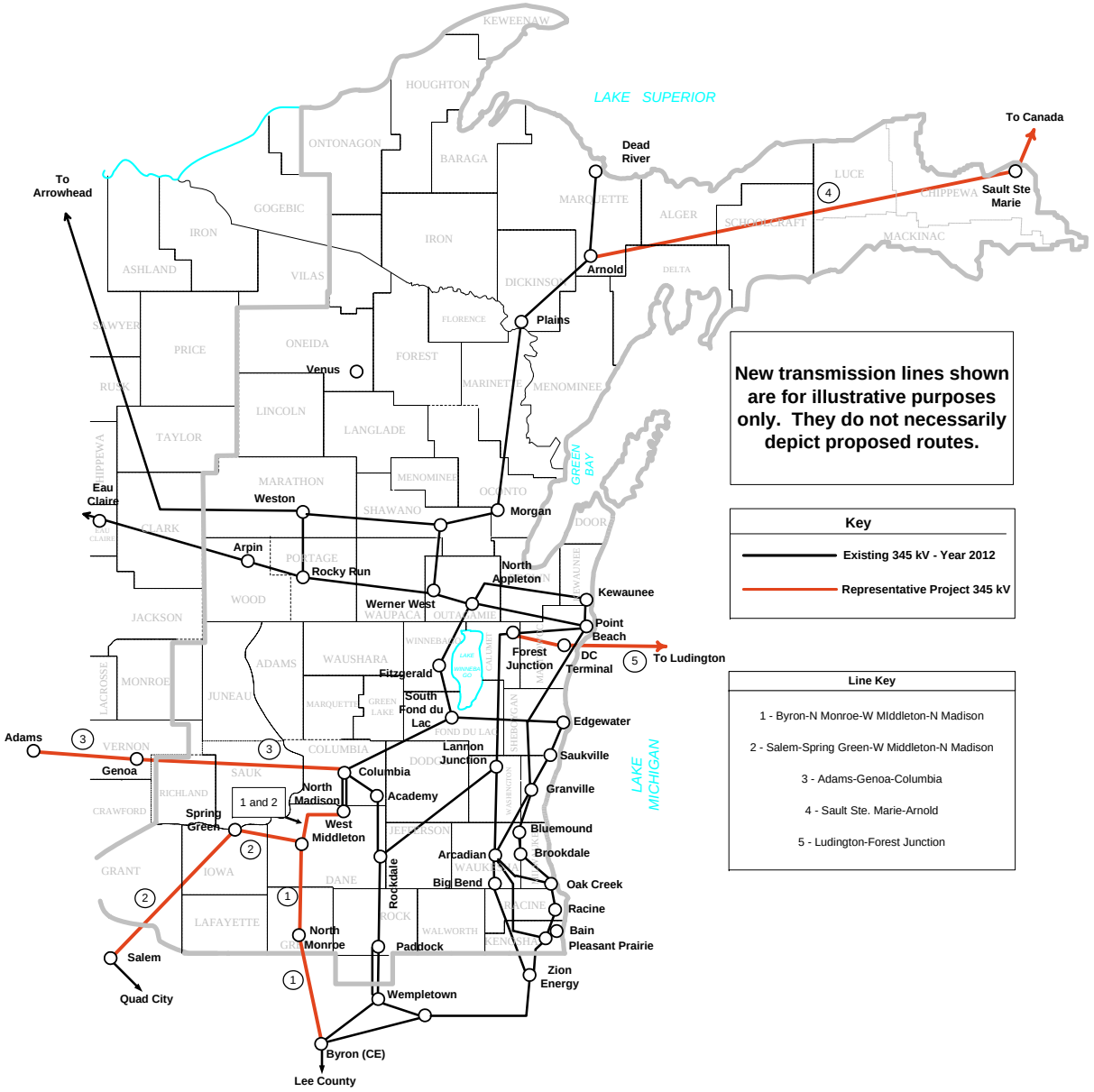
Representative Projects

- One major proxy project was considered for each of the five directions
- All projects used the same construction and rights-of-way assumptions for comparison
- All projects involved 345 kV connections; future analysis will consider relevant alternatives as well
- Each project does not necessarily represent the best terminations for each direction

Representative Projects

- (West) Adams – Genoa – Columbia 345 kV
- (Southwest) Salem – Spring Green – West Middleton – North Madison 345 kV
- (South) Byron – North Monroe – West Middleton – North Madison 345 kV
- (East) Ludington – Forest Junction combined DC & 345 kV AC project
- (Northeast) Sault Ste. Marie – Arnold 345 kV [assumes DC tie to Canada]

Representative Access Projects



Study Methodology

- DC Analysis using PTI MUST
- Transfer distribution factor cut-offs
  - Network Analysis: 3% for all facilities 50kV and above
  - All MISO-monitored flowgates:
    - 3% for single outage flowgates (OTDF)
    - 5% for no outage flowgates (PTDF)
- Control areas examined: WUMS, MECS, CE, ALTW, DPC, NSP, GRE, MP

Cost Estimates

- Major project assumptions
  - Single circuit steel structures
  - 2156 ACSR conductor
  - 150’ new right-of-way
- Gross estimating tool for substations and transmission lines
- External systems
  - Same basis or from discussions with relevant transmission owner

Study Methodology

- Comparison between base case scenario (i.e. no strategic project added) and each representative project
- Transfers were not control area to control area
- Summer 2012 base case from 2003 10-Year Assessment
- First two valid limits were identified and solutions were applied for each scenario

Key Study Assumptions

- Base case included all projects required to mitigate Summer 2012 overload and voltage violations except for:
  - West Middleton – Rockdale 345 kV
  - West Middleton 345/138 kV transformer
  - Duplicate Blount – Ruskin 69kV
- Increased import capability depends on the inclusion of these “base case” projects

Key Study Assumptions

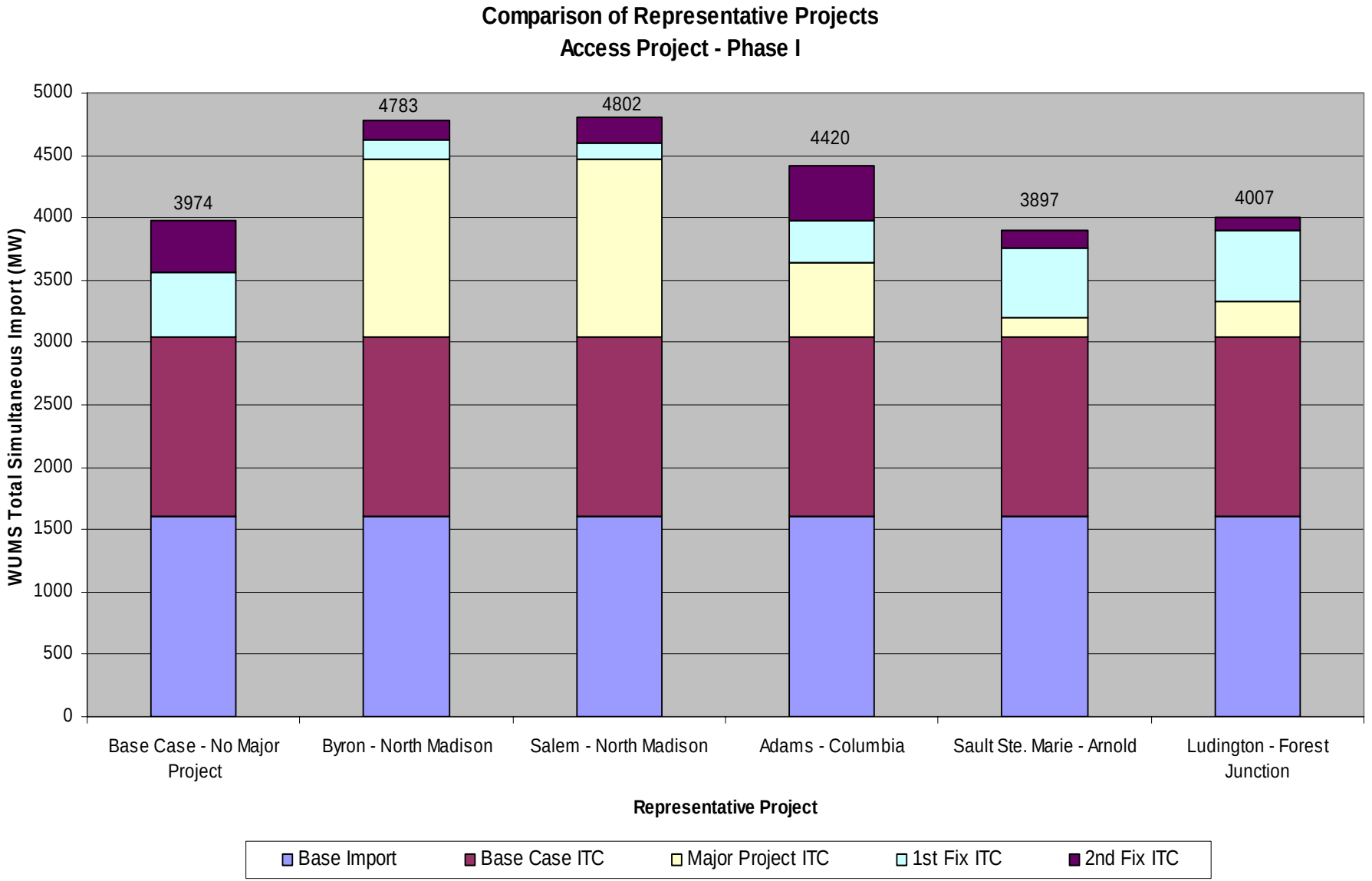
- The model was updated with nine major transmission projects
- These projects include facilities required for confirmed transmission service requests included in the model

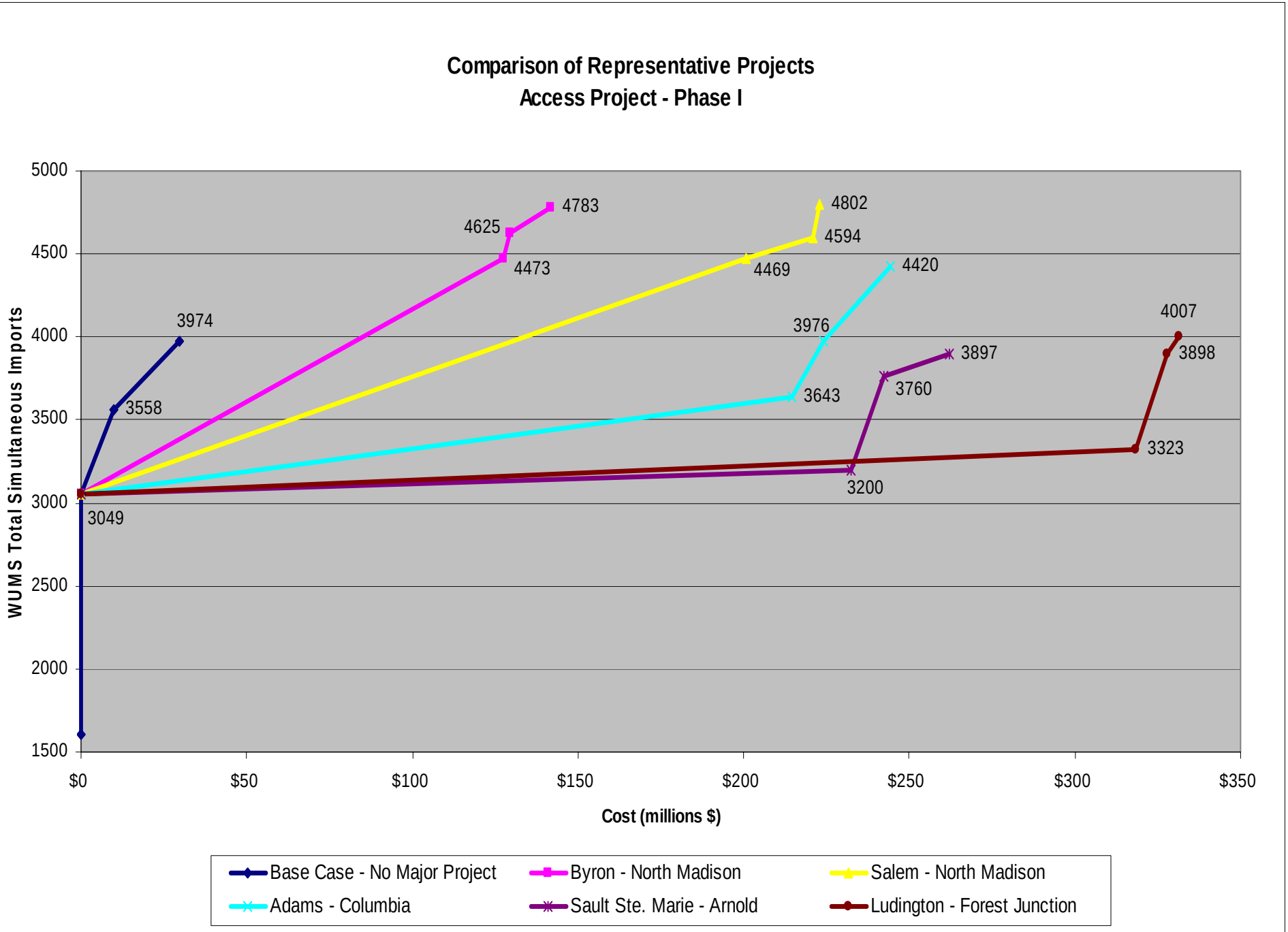
Facilities Added

- 2nd Wempletown-Paddock 345kV
- Rockdale-Lannon Junction 345kV
- Weston U4 and Gardner Park-Central Wisconsin 345kV
- Fox Energy and Fox Energy-Forest Junction 345kV
- West Marinette-White Rapids-Amberg 138kV
- Plains-Stiles 138kV
- Cranberry-Conover 138kV with Xfmr
- Conover-Twin Lakes-Iron River-Plains 138kV
- Morgan-White Clay 138kV

Network Analysis Results

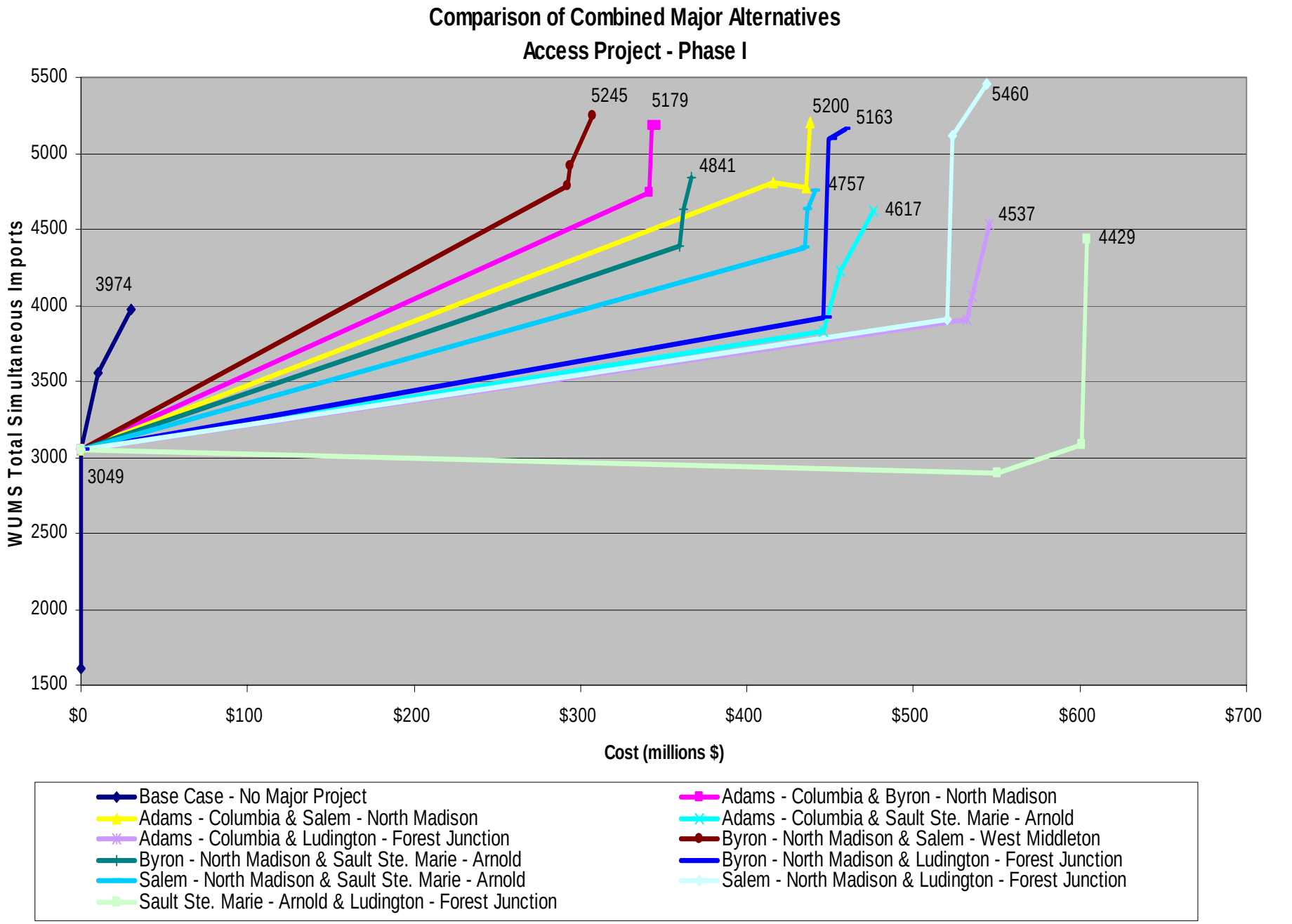
Project	Total Cost (millions)	Total WUMS Simultaneous Import Capability (MW)
Base case – no major project	$30	3974
#1 Byron – N. Madison (South)	$142	4783
#2 Salem – N. Madison (Southwest)	$223	4802
#3 Adams – Columbia (West)	$244	4420
#4 Sault Ste. Marie – Arnold (Northeast)	$262	3897
#5 Ludington – Forest Junction (East)	$332	4007


Comparison of Representative Projects
Access Project - Phase I
WUMS Total Simultaneous Import (MW)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
3974
4783
4802
4420
3897
4007
Base Case - No Major Project
Byron - North Madison
Salem - North Madison
Adams - Columbia
Sault Ste. Marie - Arnold
Ludington - Forest Junction
Representative Project
Base Import
Base Case ITC
Major Project ITC
1st Fix ITC
2nd Fix ITC


Comparison of Representative Projects
Access Project - Phase I
WUMS Total Simultaneous Imports
5000
4500
4000
3500
3000
2500
2000
1500
$0
$50
$100
$150
$200
$250
$300
$350
Cost (millions $)
3974
3558
3049
4783
4625
4473
4802
4594
4469
4420
3976
3643
4007
3898
3897
3760
3323
3200
Base Case - No Major Project
Byron - North Madison
Salem - North Madison
Adams - Columbia
Sault Ste. Marie - Arnold
Ludington - Forest Junction

Combined Project Analysis

Project	Total Cost (Millions)	Total WUMS Simultaneous Import Capability (MW)
Base Case – No major project	$30	3,974
Adams-Columbia & Byron-N. Madison	$346	5,179
Adams-Columbia & Salem-N. Madison	$438	5,200
Adams-Columbia & Sault Ste. Marie-Arnold	$476	4,617
Adams-Columbia & Ludington-Forest Junction	$546	4,537
Byron-N. Madison & Salem-West Middleton	$307	5,245
Byron-N. Madison & Sault Ste. Marie-Arnold	$367	4,841
Byron-N. Madison & Ludington - Forest Junction	$459	5,163
Salem-N. Madison & Sault Ste. Marie-Arnold	$441	4,757
Salem-N. Madison & Ludington-Forest Junction	$544	5,460
Sault Ste. Marie-Arnold & Ludington-Forest Junction	$604	4,429


Comparison of Combined Major Alternatives
Access Project - Phase I
WUMS Total Simultaneous Imports
5500
5000
4500
4000
3500
3000
2500
2000
1500
$0
$100
$200
$300
$400
$500
$600
$700
Cost (millions $)
5245
5179
5200
5163
5460
4841
4757
4617
4537
4429
3974
3049
Base Case - No Major Project
Adams - Columbia & Byron - North Madison
Adams - Columbia & Salem - North Madison
Adams - Columbia & Sault Ste. Marie - Arnold
Adams - Columbia & Ludington - Forest Junction
Byron - North Madison & Salem - West Middleton
Byron - North Madison & Sault Ste. Marie - Arnold
Byron - North Madison & Ludington - Forest Junction
Salem - North Madison & Sault Ste. Marie - Arnold
Salem - North Madison & Ludington - Forest Junction
Sault Ste. Marie - Arnold & Ludington - Forest Junction

Initial Plans for Phase 2 Access Analysis

- Further examination of the two top candidates from the 2003 10-Year Assessment Update analysis
  - Byron – North Madison 345 kV
  - Salem – North Madison 345 kV
- Evaluate reliability, economic and strategic benefits

Discussion

Scenario Analyses

- Several factors influence how Access projects will perform
  - Load growth
  - Topology changes
  - Generation developments
- Generation developments have significant potential to influence
- Looking for input/guidance on what scenarios to evaluate

Generation Scenario Considerations

- Generation additions within ATC footprint
- Generation additions outside ATC footprint
- Generation retirements within ATC footprint
- Generation retirements outside ATC footprint
- Legislative initiatives affecting operation of existing generation/development of new generation
- Variation in reserve margin to be met with internal generation

Generation Scenarios Preliminary Ideas

Generation additions within ATC footprint

- Unit additions at existing sites
- Development where gas pipelines and transmission intersect
- Wind turbines at optimal wind locations
- Cogeneration

Generation Scenarios Preliminary Ideas

Additions outside of ATC footprint

- Coal in the Dakotas
- Wind in Iowa/Minnesota
- Hydro in Manitoba
- Nuclear makes a comeback

Generation Scenarios Preliminary Ideas

Generation retirements

- Aging coal-fired units
- Nuclear units
- Older, smaller units to be replaced on site by new larger units
- Aging peaking units (gas/oil)

Generation Scenarios Preliminary Ideas

Legislative initiatives

- Affecting coal-fired unit operation
- Affecting nuclear unit operation
- Affecting renewable resource development

Generation Scenarios Preliminary Ideas

Variation in Reserve Margin Met with Internal Generation

- Scenarios with range of internal generation development
  - High: 20% ?
  - Low: 10% ?

Discussion

Next Steps

Next Steps

- April 21 – Initial customer and stakeholder Access meeting
- May-July – Phase 2 Access studies and customer/stakeholder discussion
- August – “Consensus” target and associated projects
- September-November – Refinements, project plan integration and further study/discussion

Next Steps

- September 27 – 2004 10-Year Assessment report target release date
- October – 2004 Planning Zone Meetings
- December 9 – Present consensus status, Access targets, and associated plans to ATC Board
- December – Plan for 2005 Access activities