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businesses running
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2015 Economic Planning Study Results

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ATC Economic Planning
February 24, 2016

Introduction

- Economic Planning Analysis Metrics
  - Customer Benefit Metric
  - Loss Evaluation – Not Available
- Project Review
  - Forest Junction 345 kV area
  - Janesville 138 kV area
- Project Analysis and Results

PROMOD Energy Benefits Description

- PROMOD used to analyze 2025 study year
- Difference analysis performed to determine project savings
- All Futures analyzed using ATC Customer Benefit (CB) Metric:

Settlements Format for CB Metric

Load Pays local Locational Marginal Price (LMP)
\- Generator Revenues Received at local Gen LMP
\+ Cost of Utility Generation (Production Cost)
\- FTR Revenue to the Utility
\- Loss Refund Revenues for over-collection
= Impact to Ratepayers

Customer Benefit Metric Components

Customer Benefit Metric Components:

- Net Production Cost excluding IPPs within ATC
- IPP Purchase Cost to Utilities
- Import Cost
- Export Revenue
- Congestion Cost
- Revenue from Existing External FTRs
- ATC Internal FTR Value
- Marginal Loss Cost
- Loss Refund on Internal Transactions and Imports
- “Credit” for Losses Already Captured in Production Cost
- Cost of Load Changes due to Losses
- Cost due to CO_2 Emissions (CO_2 Tax)

Loss Savings Description

- Loss evaluation is an important component of economic project analysis
- PROMOD difference analysis performed to determine system loss savings ($)
  - Loss savings (MWHrs) calculated from PROMOD
  - Economic value of loss savings determined by pricing losses (MWHrs) at PROMOD area LMPs ($/MWHrs)
- ATC is currently working to update internal tools that are used to perform this analysis
- ATC does not use losses as a sole determinant when evaluating the benefits of a project

ATC 2025 – Analysis Results

- Single-Year PROMOD Savings
  - Shown in Millions of Dollars for 2025 ($M – 2025)
  - Savings based on difference analysis using Customer Benefit Metric
- 40-Year PROMOD Savings
  - Shown in Millions of Dollars for 2016 ($M – 2016)
  - Savings based on difference analysis using Customer Benefit Metric
  - Estimated in-service date: 2023
  - Calculations based on:
    - Assumed 40-Year Economic Life of Project
    - 3.0% Inflation Rate
    - 6.5% Nominal Discount Rate

ATC 2025 – PROMOD Modeling Updates

- ATC's Economic Planning Team strives to use the most accurate and updated modeling assumptions
- Updates made to MISO MTEP16 models:
  - Update small distributed generation mapping
  - Added 676 Distributed Resources to model future potential EE and DR (totaling 6,653 MW)
  - Include new Riverside CC in all futures (modeled at 138 kV Townline Rd bus)
    - Potential POI projects and other upgrades not included in base case

MISO MTEP16 Futures Definitions

Future	Narrative
Business As Usual	*The baseline, or Business as Usual, future captures all current policies and trends in place at the time of futures development and assumes they continue, unchanged, throughout the duration of the study period. Demand and energy growth rates are modeled at a level equivalent to the 50/50 forecasts submitted into the Module E Capacity Tracking (MECT) tool. All current state-level Renewable Portfolio Standard (RPS) and Energy Efficiency Resource Standard (EERS) mandates are modeled. All applicable and enforceable EPA regulations governing electric power generation, transmission and distribution (NAICS 2211) are modeled. To capture the expected effects of environmental regulations on the coal fleet, a total of 12.6 GW of coal unit retirements are modeled, including units which have either already retired or publicly announced they will retire.*
Low Demand	*The Low Demand future is designed to capture the effects of reduced economic growth resulting in lower energy costs and medium – low gas prices. The magnitude of demand and energy growth is determined by using the lower bound of the Load Forecast Uncertainty metric. All current state-level Renewable Portfolio Standard (RPS) and Energy Efficiency Resource Standard (EERS) mandates are modeled. All applicable EPA regulations governing electric power generation, transmission and distribution (NAICS 2211) are modeled. To capture the expected effects of environmental regulations on the coal fleet, 12.6 GW of coal unit retirements are modeled, including units which have either already retired or publicly announced they will retire. Additional, age-related retirements are captured using 60 years of age as a cutoff for non-coal, non-nuclear thermal units and 100 years for conventional hydroelectric.*
High Demand	*The High Demand future is designed to capture the effects of increased economic growth resulting in higher energy costs and medium – high gas prices. The magnitude of demand and energy growth is determined by using the upper bound of the Load Forecast Uncertainty metric and also includes forecasted load increases in the South region. All current state-level Renewable Portfolio Standard (RPS) and Energy Efficiency Resource Standard (EERS) mandates are modeled. All existing EPA regulations governing electric power generation, transmission and distribution (NAICS 2211) are incorporated. To capture the expected effects of environmental regulations on the coal fleet, 12.6 GW of coal unit retirements are modeled, including units which have either already retired or publicly announced they will retire. Additional, age-related retirements are captured using 60 years of age as a cutoff for non-coal, non-nuclear thermal units and 100 years for conventional hydroelectric.*
Regional Clean Power Plan Compliance	*The Regional Clean Power Plan future focuses on several key items from a footprint wide level which in combination result in significant carbon reductions over the course of the study period. Assumptions are consistent with MISO CPP Phase I & II analyses, and include the following:* • *To capture the expected effects of existing environmental regulations on the coal fleet, 12.6 GW of coal unit retirements are modeled, including existing or announced retirements.* • *14 GW of additional coal unit retirements, coupled with a $25/ton carbon cost, state mandates for renewables, and half of the EE annual growth used by the EPA, result in a significant reduction in carbon emissions by 2030.* • *Additional, age-related retirements are captured using 60 years of age as a cutoff for noncoal, non-nuclear thermal units and 100 years for conventional hydroelectric.* • *Solar and wind include an economic maturity curve to reflect declining costs over time.* • *Demand and energy growth rates are modeled at levels as reported in Module E.*
Sub-Regional Clean Power Plan Compliance	*"The Sub-Regional Clean Power Plan future focuses on several key items from a zonal or state level which combine to result in significant carbon reductions over the course of the study period. Assumptions are consistent with MISO CPP Phase I & II analyses, and include the following:* • *To capture the expected effects of existing environmental regulations on the coal fleet, 12.6 GW of coal unit retirements are modeled, existing or announced retirements.* • *20 GW of additional coal unit retirements, coupled with a $40/ton carbon cost, state mandates for renewables, and half of the EE annual growth used by the EPA, result in a significant reduction in carbon emissions by 2030.* ◦ *These increased retirements and carbon cost levels from the Regional CPP Future are consistent with regional/subregional CPP assessments performed by MISO and other organizations since the CPP's introduction* • *Additional, age-related retirements are captured using 60 years of age as a cutoff for non-coal, nonnuclear thermal units and 100 years for conventional hydroelectric.* • *Solar and wind include an economic maturity curve to reflect declining costs over time.* • *Demand and energy growth rates are modeled at levels as reported in Module E.*

Source: MISO 3-18-2015 MTEP16 MTEP16 Futures (https://www.misoenergy.org/Events/Pages/PAC20150318.aspx)

MISO MTEP16 Future Matrix

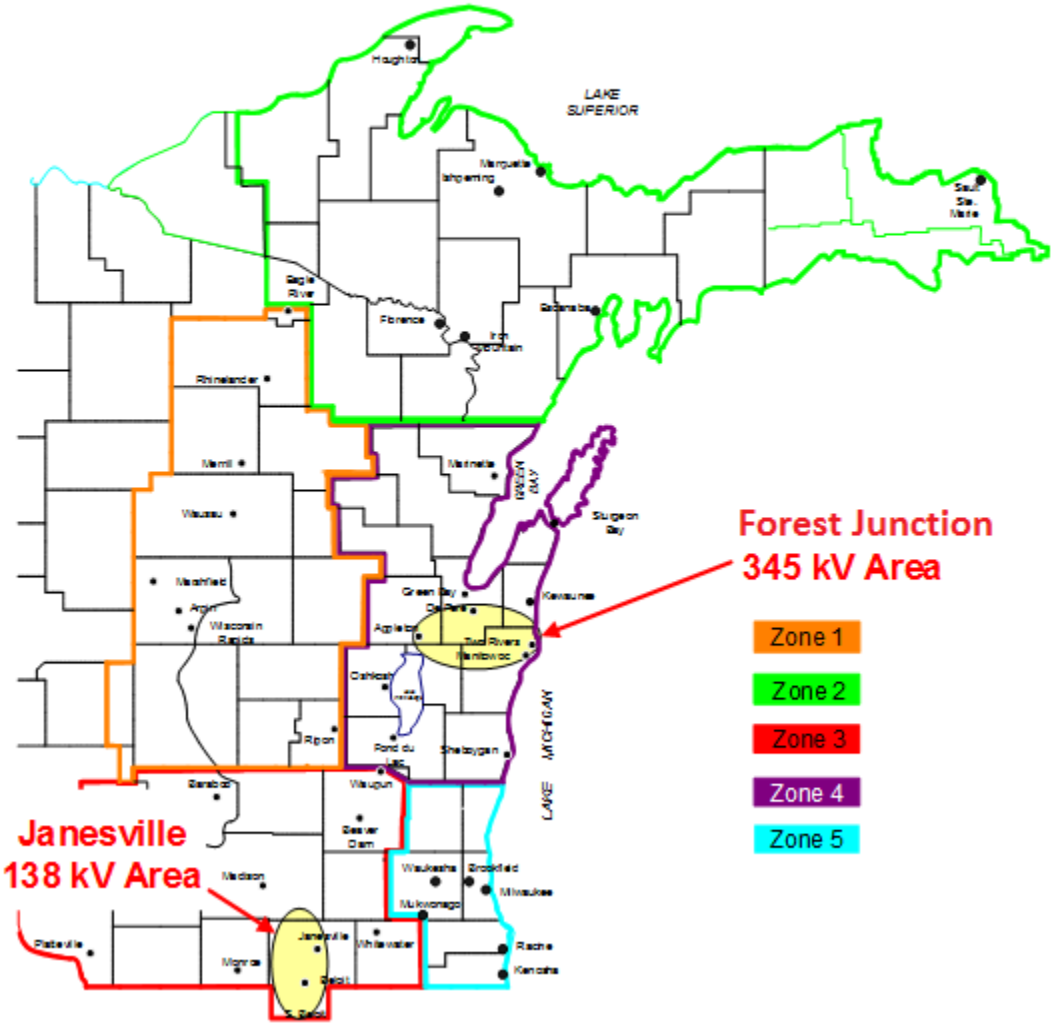
Future	Baseline Demand / Energy Growth (20-year)	Retirements Level* (GW)	Natural Gas Price (2015$/MMBTu)	Incremental Renewables (GW) N/C: North/Central MISO S: South MISO	CO_2 Cost (2015$/ton)
Business as Usual	0.75% / 0.82%	No Additional	$4.11	N/C: 4.2 Wind/ 1.4 Solar S: 0 Wind/ 0 Solar	None
Low Demand	0.11% / 0.19%	Age-Related	$3.29	N/C: 2.4 Wind/ 1.3 Solar S: 0 Wind/ 0 Solar	None
High Demand	1.55% / 1.61%	Age-Related	$4.11	N/C: 7.2 Wind/ 1.6 Solar S: 0 Wind/ 0 Solar	None
Regional CPP Compliance	0.75% / 0.82%	14 GW coal + Age-Related	$4.93	N/C: 4.2 Wind/ 1.4 Solar S: 0 Wind/ 0 Solar + cost maturity curves	$25 / ton
Sub-Regional CPP Compliance	0.75% / 0.82%	20 GW coal + Age-Related	$4.93	N/C: 4.2 Wind/ 1.4 Solar S: 0 Wind/ 0 Solar + cost maturity curves	$40 / ton

12 GW of MATS related coal-retirements are assumed in all futures
Age-related retirement assumption applies to non-coal generation only

Source: MISO 7-29-2015 MTEP16 EGEAS Results (https://www.misoenergy.org/Events/Pages/PAC20150729.aspx)

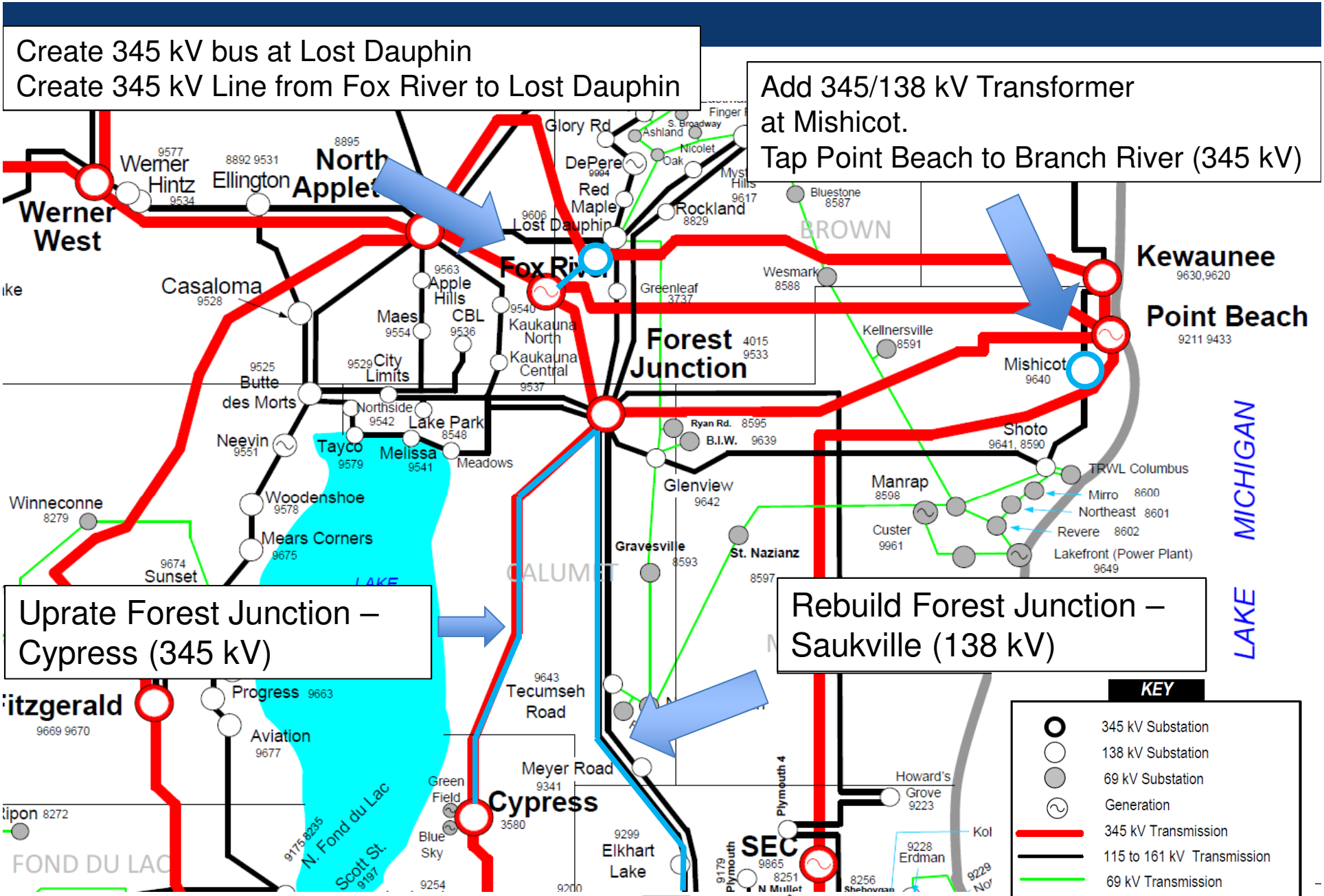
ATC 2015 Economic Planning Analysis – Potential Study Areas

Constrained Area
Forest Junction 345 kV Area
Janesville 138 kV Area

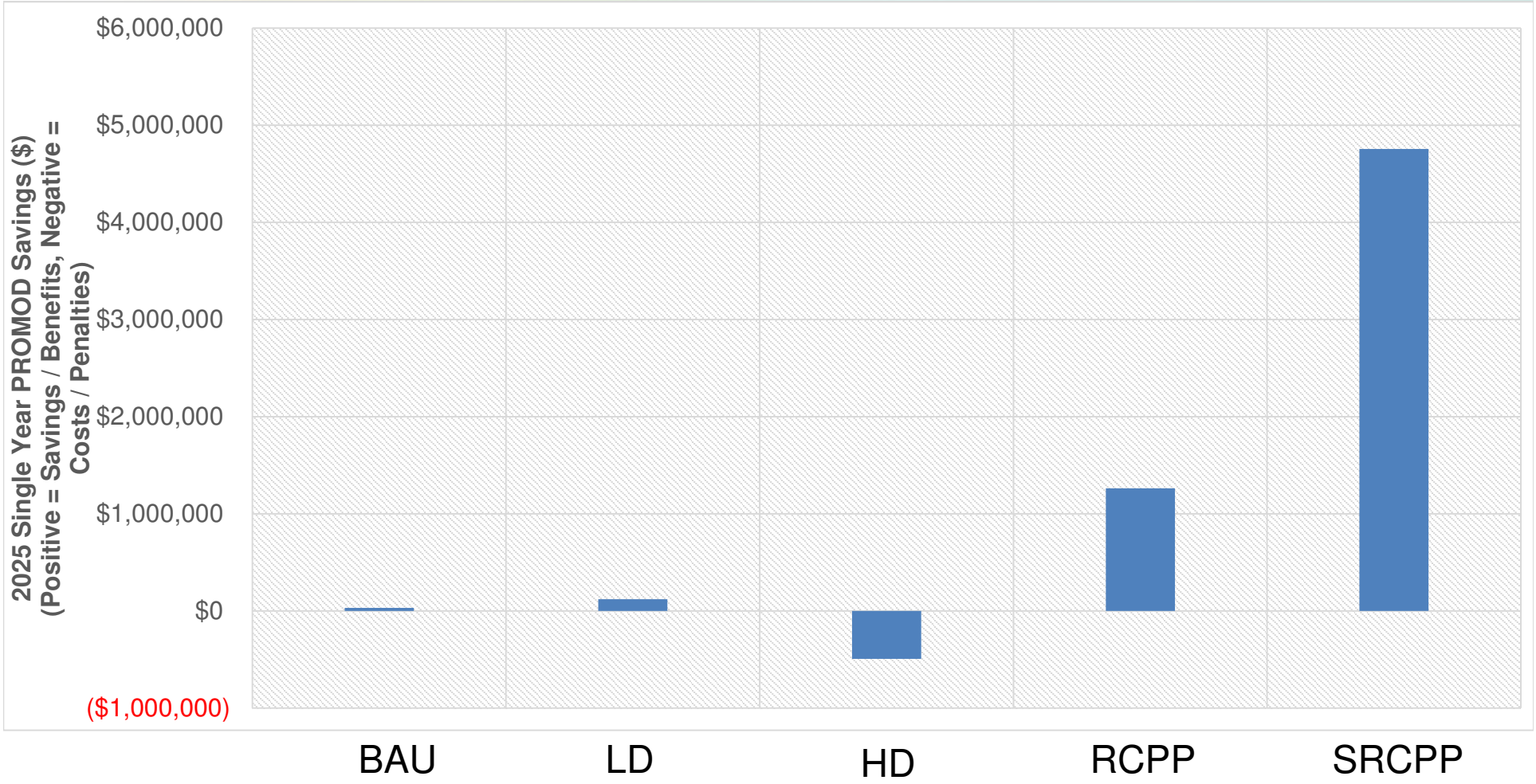


Create 345 kV bus at Lost Dauphin
Create 345 kV Line from Fox River to Lost Dauphin

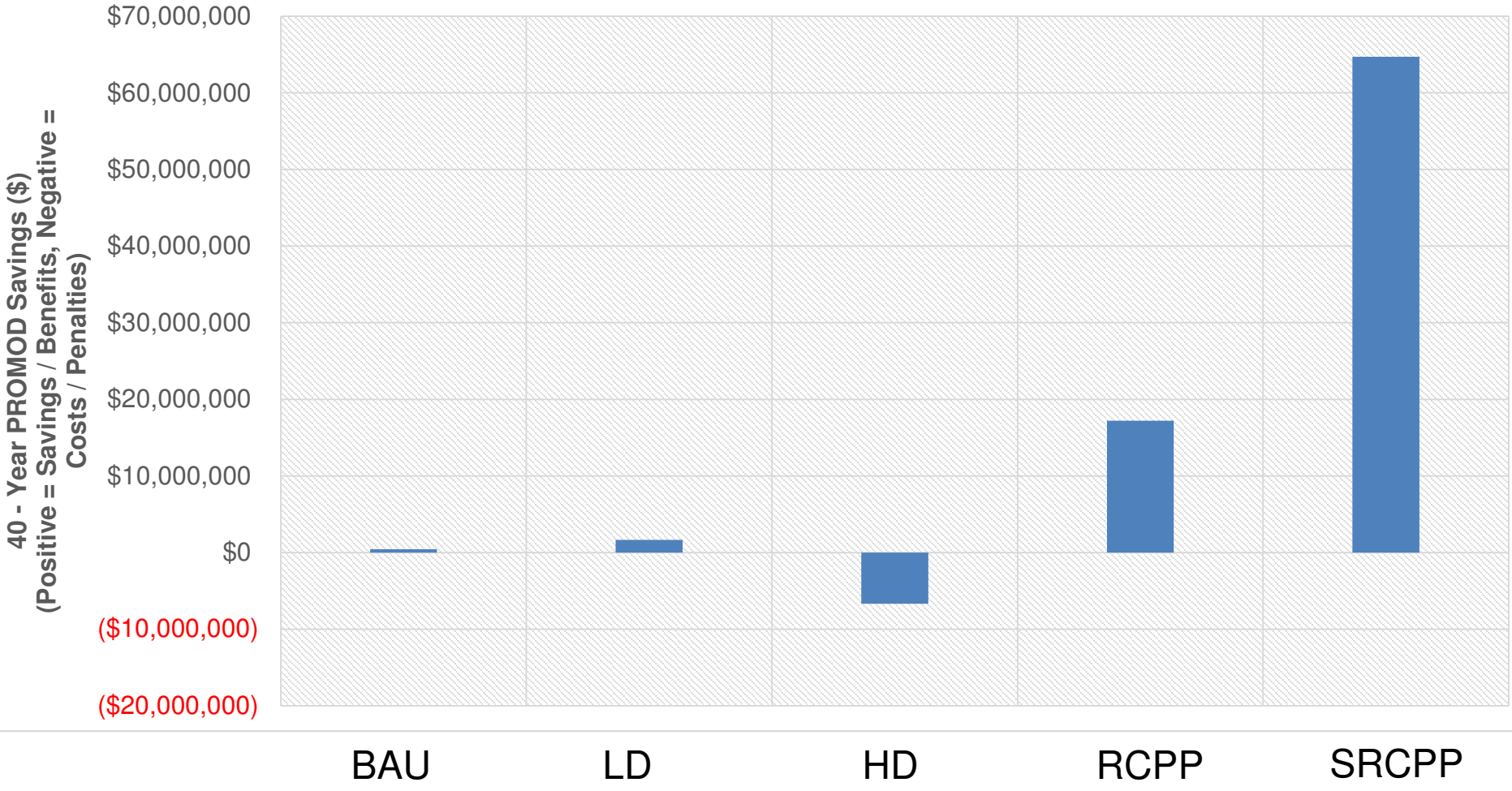
Add 345/138 kV Transformer
at Mishicot.
Tap Point Beach to Branch River (345 kV)



2025 Single Year Benefits
Forest Junction - Saukville 138 kV reconductor alternative



40 Year Benefits
Forest Junction - Saukville 138 kV reconductor alternative



Forest Junction – Saukville 138 kV reconductor Congestion Summary – Business As Usual

Legend (Additional Congestion)
No Congestion in Current Future

2025 Business As Usual Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
N. Fond du Lac – Aviation (138 kV)	20	$0.51
Kewaunee – Point Beach (345 kV)	1	($0.19)
N. Appleton – Fox River (345 kV)	(1)	($0.01)
Elkhart Lake – Forest Junction (138 kV)	0	$0.00
Werner – N. Appleton (345 kV)	0	$0.00
Cypress – Forest Junction (345 kV)	0	$0.00

Forest Junction – Saukville 138 kV reconductor Congestion Summary – Low Demand

Legend (Additional Congestion)
No Congestion in Current Future

2025 Low Demand Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
N. Fond du Lac – Aviation (138 kV)	15	$0.50
Elkhart Lake – Forest Junction (138 kV)	2	$0.04
Kewaunee – Point Beach (345 kV)	0	$0.00
N. Appleton – Fox River (345 kV)	0	$0.00
Werner – N. Appleton (345 kV)	0	$0.00
Cypress – Forest Junction (345 kV)	0	$0.00

Forest Junction – Saukville 138 kV reconductor Congestion Summary – High Demand

Legend
(Additional Congestion)
No Congestion in Current Future

2025 High Demand Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
N. Appleton – Fox River (345 kV)	26	($0.27)
Elkhart Lake – Forest Junction (138 kV)	11	$2.07
Kewaunee – Point Beach (345 kV)	(25)	($1.21)
N. Fond du Lac – Aviation (138 kV)	0	$0.00
Werner – N. Appleton (345 kV)	0	$0.00
Cypress – Forest Junction (345 kV)	0	$0.00

Forest Junction – Saukville 138 kV reconductor Congestion Summary – Regional Clean Power Plan

Legend (Additional Congestion)
No Congestion in Current Future

2025 Regional Clean Power Plan Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
Elkhart Lake – Forest Junction (138 kV)	63	$12.26
N. Fond du Lac – Aviation (138 kV)	5	$0.16
Kewaunee – Point Beach (345 kV)	4	($0.07)
N. Appleton – Fox River (345 kV)	0	($0.14)
Werner – N. Appleton (345 kV)	0	$0.00
Cypress – Forest Junction (345 kV)	0	$0.00

Forest Junction – Saukville 138 kV reconductor
Congestion Summary – Sub-Regional Clean Power Plan

Legend
(Additional Congestion)
No Congestion in Current Future

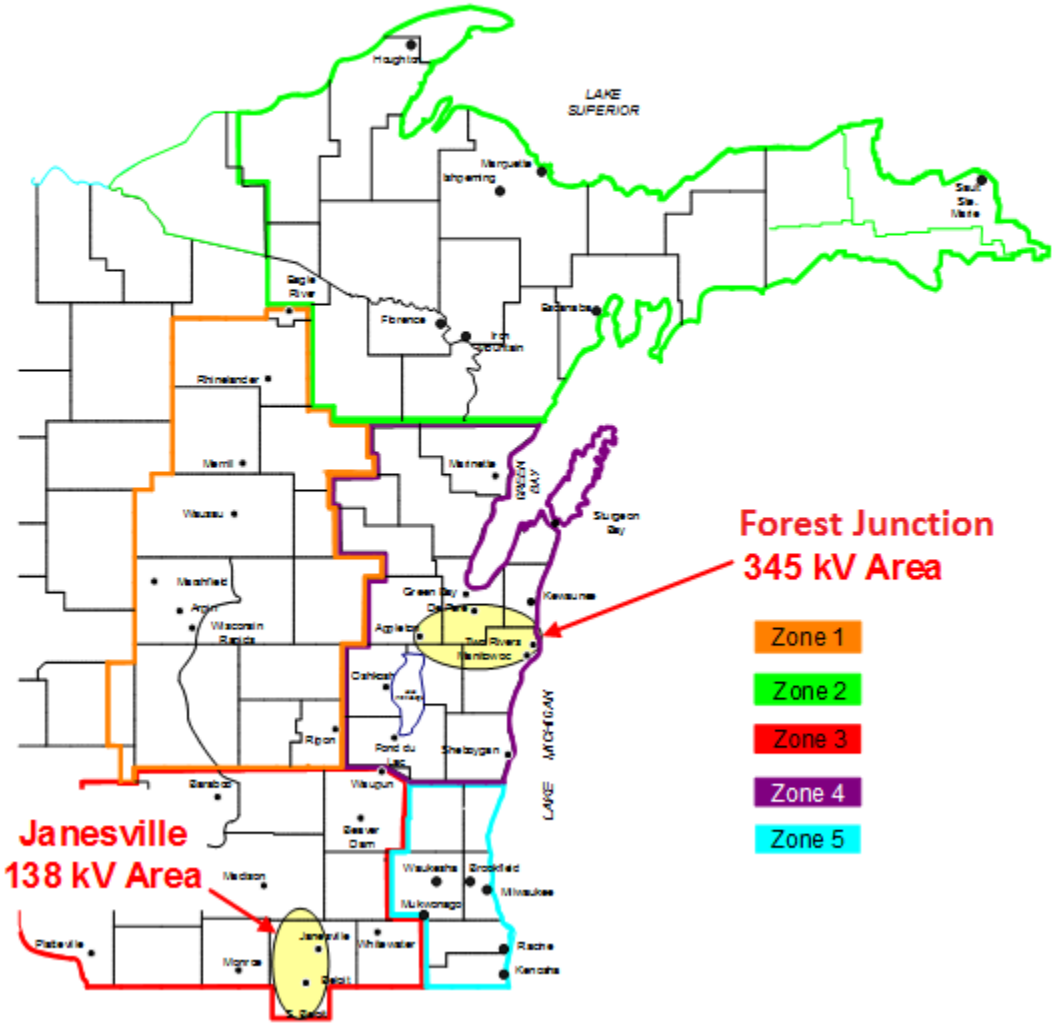
2025 Sub-Regional Clean Power Plan Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
Elkhart Lake – Forest Junction (138 kV)	386	$76.49
N. Appleton – Fox River (345 kV)	1	($0.05)
Werner – N. Appleton (345 kV)	0	($0.01)
N. Fond du Lac – Aviation (138 kV)	0	$0.08
Kewaunee – Point Beach (345 kV)	0	($0.02)
Cypress – Forest Junction (345 kV)	(5)	($0.10)

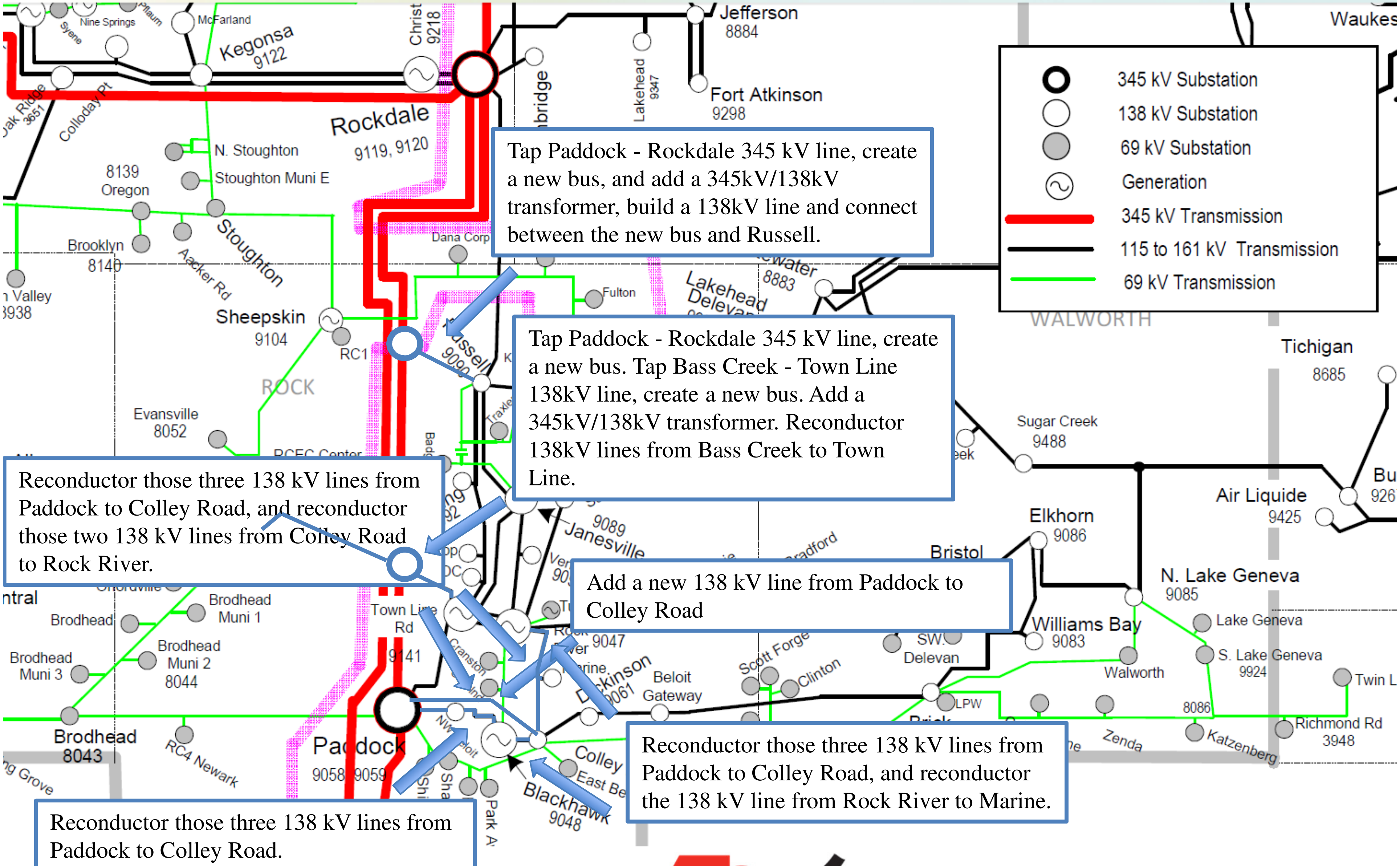
Forest Junction 345 kV Area Conclusions

- Not as much as congestion in last year's model.
- Benefits exist in the area, but may not outweigh the costs of projects

ATC 2015 Economic Planning Analysis – Potential Study Areas

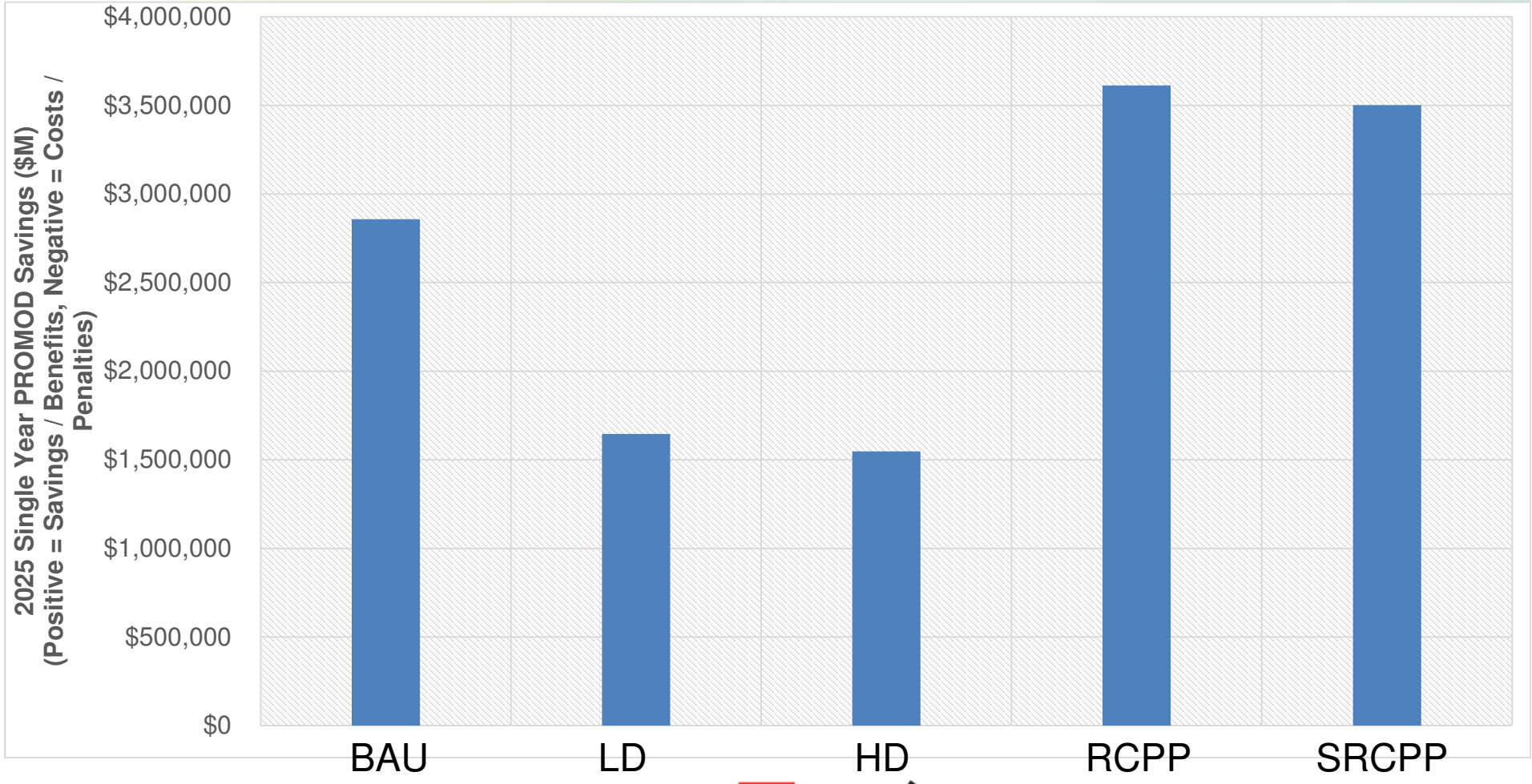
Constrained Area
Forest Junction 345 kV Area
Janesville 138 kV Area



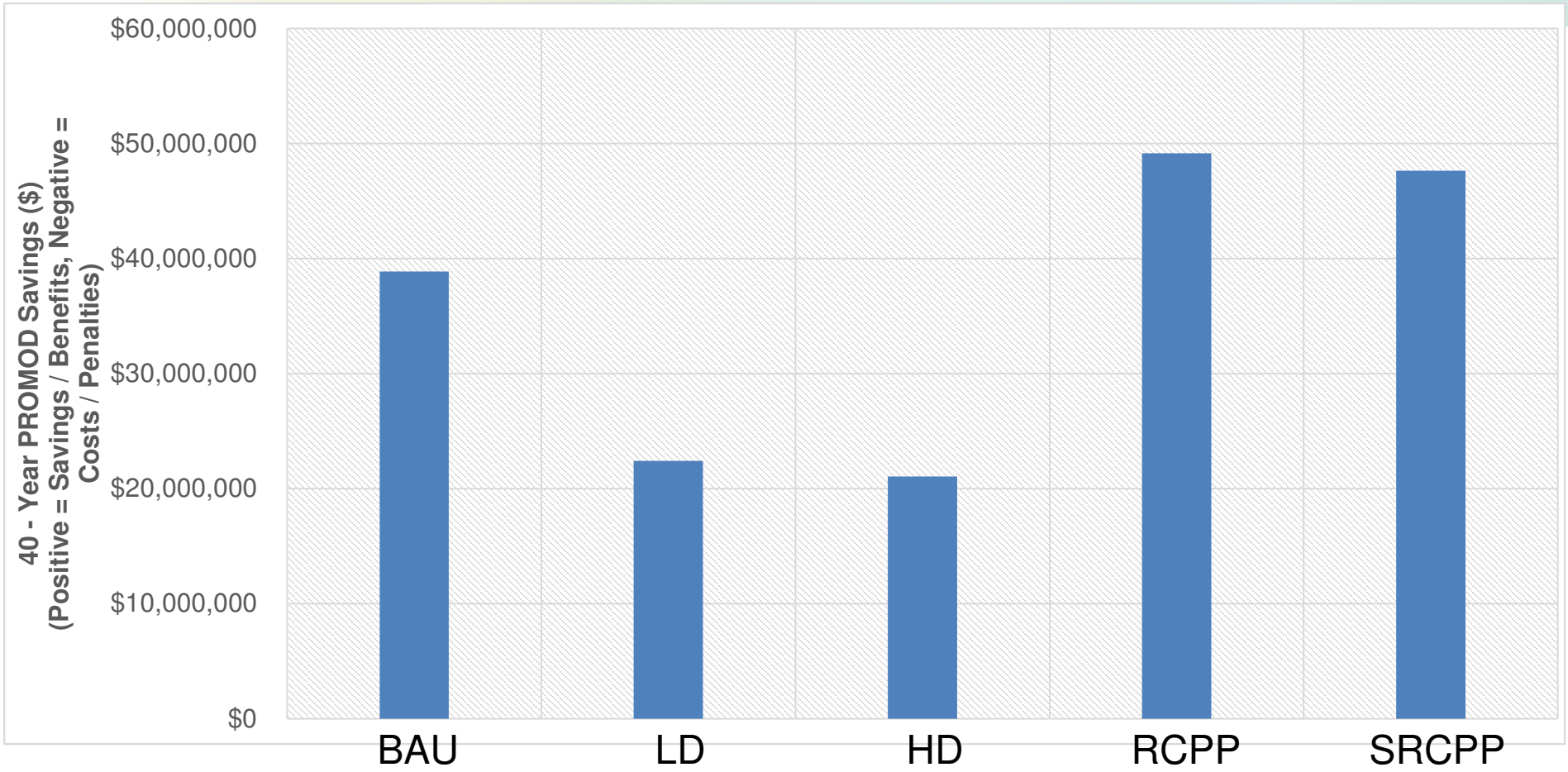


Tap Paddock - Rockdale 345 kV line, create a new bus, and add a 345kV/138kV transformer, build a 138kV line and connect between the new bus and Russell.
Tap Paddock - Rockdale 345 kV line, create a new bus. Tap Bass Creek - Town Line 138kV line, create a new bus. Add a 345kV/138kV transformer. Reconductor 138kV lines from Bass Creek to Town Line.
Reconductor those three 138 kV lines from Paddock to Colley Road, and reconductor those two 138 kV lines from Colley Road to Rock River.
Add a new 138 kV line from Paddock to Colley Road
Reconductor those three 138 kV lines from Paddock to Colley Road, and reconductor the 138 kV line from Rock River to Marine.
Reconductor those three 138 kV lines from Paddock to Colley Road.
345 kV Substation
138 kV Substation
69 kV Substation
Generation
345 kV Transmission
115 to 161 kV Transmission
69 kV Transmission
Rockdale
9119, 9120
Kegonsa
9122
McFarland
Jefferson
8884
Fort Atkinson
9298
N. Stoughton
Stoughton Muni E
8139
Oregon
Brooklyn
8140
Stoughton
Sheepskin
9104
ROCK
Evansville
8052
Dana Corp
Fulton
Sugar Creek
9488
Tichigan
8685
Air Liquide
9425
Elkhorn
9086
Bristol
N. Lake Geneva
9085
Williams Bay
9083
Lake Geneva
S. Lake Geneva
9924
Walworth
Delevan
Beloit Gateway
Clinton
Scott Forge
Brodhead
Brodhead Muni 1
Brodhead Muni 2
8044
Brodhead Muni 3
Brodhead
8043
RC4 Newark
Paddock
9058 9059
Town Line Rd
Colley
Blackhawk
9048
Janesville
Richmond Rd
3948
Katzenberg
Zenda
WALWORTH

2025 Single Year Benefits
Reconductor Paddock – Colley Rd – Rock River 138kV lines alternative



40 Year Benefits
Reconductor Paddock – Colley Rd – Rock River alternative



Reconductor Paddock – Colley Rd – Rock River 138kV lines Congestion Summary – Business As Usual

Legend
(Additional Congestion)
No Congestion in Current Future

2025 Business As Usual Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
Rock River – Marine (138 kV)	117	$3.53
Paddock – NW Beloit (138 kV)	115	$17.62
Blackhawk – Colley Road (138 kV)	67	$12.33
Rock River – Townline (138 kV)	7	($0.60)
N. Lake Geneva – Elkhorn (138 kV)	(2)	($1.43)
Bristol – Elkhorn (138 kV)	(2)	($0.35)
Sunrise – Lakehead (138 kV)	(2)	($0.08)
Suger Creek – Bluff Creek (138 kV)	(3)	($0.09)
Burlington – N. Lake Geneva (138 kV)	(8)	($0.24)
Townline – Bass Creek (138 kV)	(10)	($3.03)
Paddock – Townline(138 kV)	(16)	($0.57)
Suger Creek – N. Lake Geneva (138 kV)	(17)	($0.23)
Rockdale – Lakehead (138 kV)	(2)	($0.11)
Rockdale – Lakehead (138 kV)	0	$0.00
Colley Road 69 kV – Colley Road 138 kV Transformer	0	$0.00

Reconductor Paddock – Colley Rd – Rock River 138kV lines Congestion Summary – Low Demand

Legend
(Additional Congestion)
No Congestion in Current Future

2025 Low Demand Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
Blackhawk – Colley Road (138 kV)	71	$3.96
Paddock – NW Beloit (138 kV)	45	$5.14
Rock River – Marine (138 kV)	38	$0.48
Paddock – Townline(138 kV)	(1)	($0.01)
Rock River – Townline (138 kV)	(2)	($0.03)
Townline – Bass Creek (138 kV)	(18)	($1.93)
Burlington – N. Lake Geneva (138 kV)	(2)	($0.07)
Suger Creek – N. Lake Geneva (138 kV)	(7)	($0.20)
N. Lake Geneva – Elkhorn (138 kV)	0	$0.00
Bristol – Elkhorn (138 kV)	0	$0.00
Sunrise – Lakehead (138 kV)	0	$0.00
Suger Creek – Bluff Creek (138 kV)	0	$0.00
Rockdale – Lakehead (138 kV)	0	$0.00
Colley Road 69 kV – Colley Road 138 kV Transformer	0	$0.00

Reconductor Paddock – Colley Rd – Rock River 138kV lines Congestion Summary – High Demand

Legend
(Additional Congestion)
No Congestion in Current Future

2025 High Demand Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
Paddock – NW Beloit (138 kV)	227	$36.77
Blackhawk – Colley Road (138 kV)	53	$8.11
Rockdale – Lakehead (138 kV)	(2)	($0.11)
Colley Road 69 kV – Colley Road 138 kV Transformer	(4)	($0.25)
Rock River – Marine (138 kV)	0	$0.00
Rock River – Townline (138 kV)	0	$0.00
N. Lake Geneva – Elkhorn (138 kV)	0	$0.00
Bristol – Elkhorn (138 kV)	0	$0.00
Sunrise – Lakehead (138 kV)	0	$0.00
Suger Creek – Bluff Creek (138 kV)	0	$0.00
Burlington – N. Lake Geneva (138 kV)	0	$0.00
Townline – Bass Creek (138 kV)	0	$0.00
Paddock – Townline(138 kV)	0	$0.00
Suger Creek – N. Lake Geneva (138 kV)	0	$0.00

Reconductor Paddock – Colley Rd – Rock River 138kV lines Congestion Summary – Regional Clean Power Plan

Legend (Additional Congestion)
No Congestion in Current Future

2025 Regional Clean Power Plan Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
Rock River – Marine (138 kV)	433	$21.73
Paddock – NW Beloit (138 kV)	186	$27.49
Blackhawk – Colley Road (138 kV)	180	$25.19
Rock River – Townline (138 kV)	82	$0.07
Colley Road – Marine (138 kV)	1	$0.00
Bristol – Elkhorn (138 kV)	(1)	($0.15)
Townline – Bass Creek (138 kV)	(15)	($5.08)
N. Lake Geneva – Elkhorn (138 kV)	(16)	($1.62)
Burlington – N. Lake Geneva (138 kV)	(27)	($2.59)
Paddock – Townline(138 kV)	(109)	($4.17)
Suger Creek – N. Lake Geneva (138 kV)	(127)	($8.28)
Sunrise – Lakehead (138 kV)	0	$0.00
Suger Creek – Bluff Creek (138 kV)	0	$0.00
Rockdale – Lakehead (138 kV)	0	$0.00
Colley Road 69 kV – Colley Road 138 kV Transformer	0	$0.00

Reconductor Paddock – Colley Rd – Rock River 138kV lines Congestion Summary – Sub-Regional Clean Power Plan

Legend
(Additional Congestion)
No Congestion in Current Future

2025 Sub-Regional Clean Power Plan Future		
Constraints	**Annual Binding Hours Change**	**Annual Shadow Price ($k) Change**
Rock River – Marine (138 kV)	573	$26.28
Blackhawk – Colley Road (138 kV)	273	$42.01
Paddock – NW Beloit (138 kV)	260	$40.44
Bristol – Elkhorn (138 kV)	(4)	($0.31)
Townline – Bass Creek (138 kV)	(8)	($2.97)
N. Lake Geneva – Elkhorn (138 kV)	(23)	($1.89)
Rock River – Townline (138 kV)	(27)	($1.39)
Burlington – N. Lake Geneva (138 kV)	(46)	($3.73)
Suger Creek – N. Lake Geneva (138 kV)	(162)	($12.78)
Paddock – Townline(138 kV)	(190)	($5.48)
Sunrise – Lakehead (138 kV)	0	$0.00
Suger Creek – Bluff Creek (138 kV)	0	$0.00
Colley Road – Marine (138 kV)	0	$0.00
Rockdale – Lakehead (138 kV)	0	$0.00
Colley Road 69 kV – Colley Road 138 kV Transformer	0	$0.00

Janesville 138 kV Area Conclusions

- More precise modeling of proposed Riverside generation may impact benefits

Questions?

ATC Economic Planning

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Thank you for your time!