ATC Energy Collaborative - Michigan
Strategic Analysis Approach

Introductory Materials

May 2008

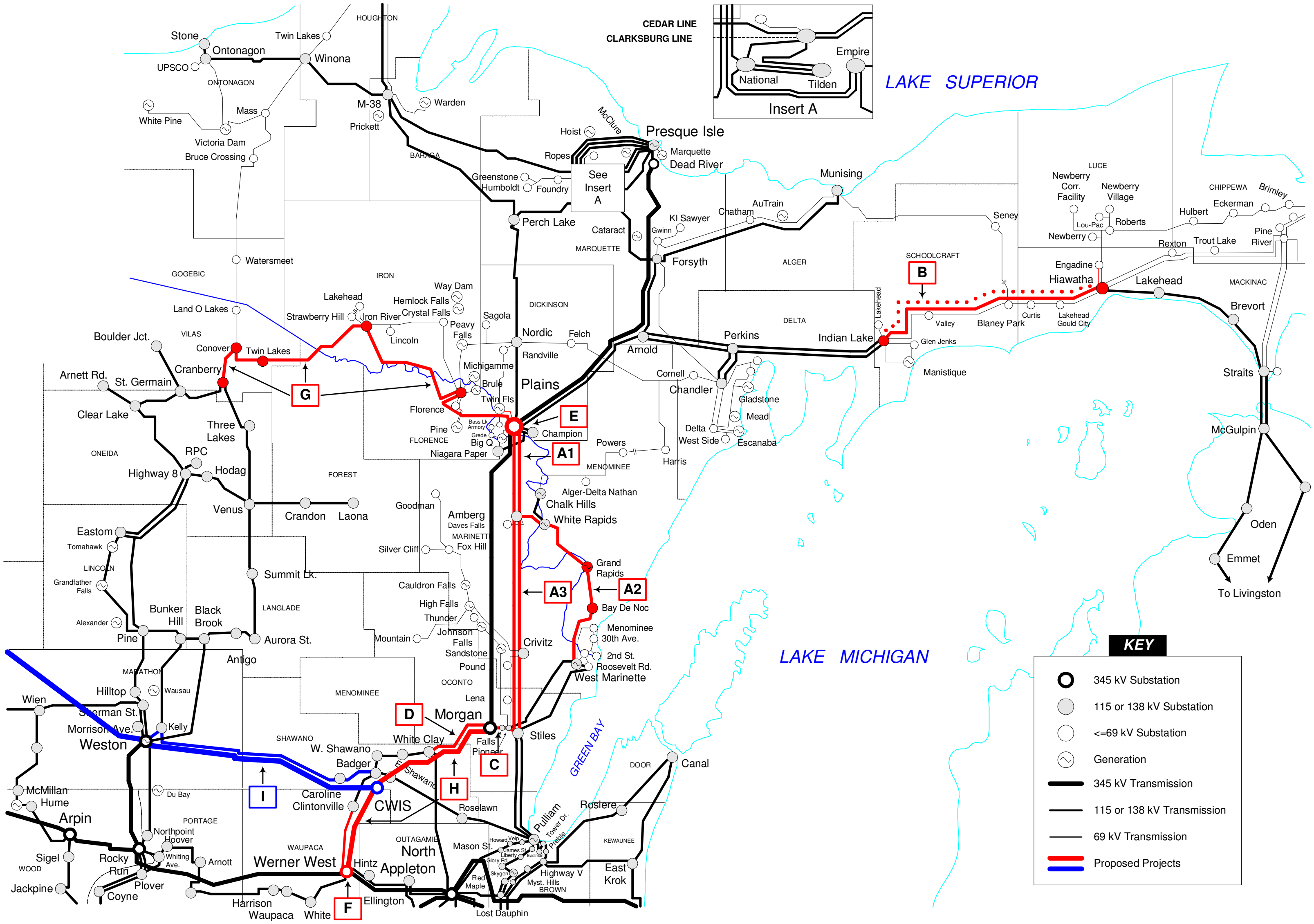
Agenda

- Collaborative Objectives, Deliverables, Approach
- Upper Peninsula Situation Review
- Strategic Flexibility Introduction
  - Concepts
  - ATC Corporate Futures
- Customizing Scenarios for UP
  - Review proposed micro drivers
  - Identify micro driver bounds
  - Identify behavior of micro drivers within ATC futures
- Overall Timeline
- Next Steps

ATC Energy Collaborative - Michigan Objective, Deliverables and Approach

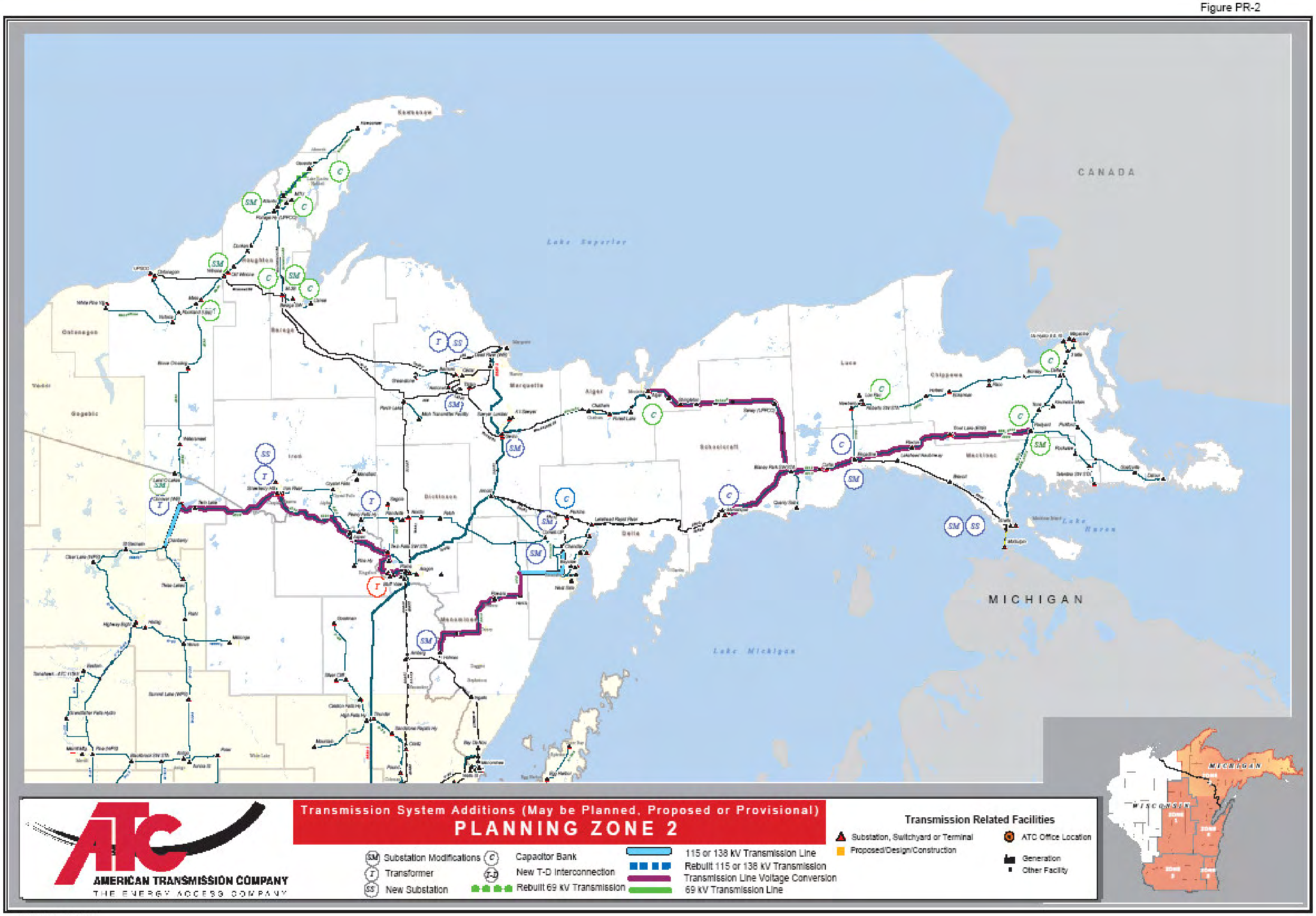
- Objective
  - To evaluate needs of Upper Peninsula using strategic flexibility approach and considering:
    - “Plausible Futures” in the Upper Peninsula
    - Range of alternative options available
    - Risks associated with options
- Deliverables
  - Plan for Upper Peninsula that meets the intermediate and long term needs of the area with an understanding of the range of plausible futures and risk created by those futures
- Approach
  - Work closely with stakeholders to customize ATC corporate futures for UP, brainstorm alternatives, evaluate alternatives with reliability and economic models as appropriate, make recommendations for overall solutions

Upper Peninsula Situation Review
Existing Projects



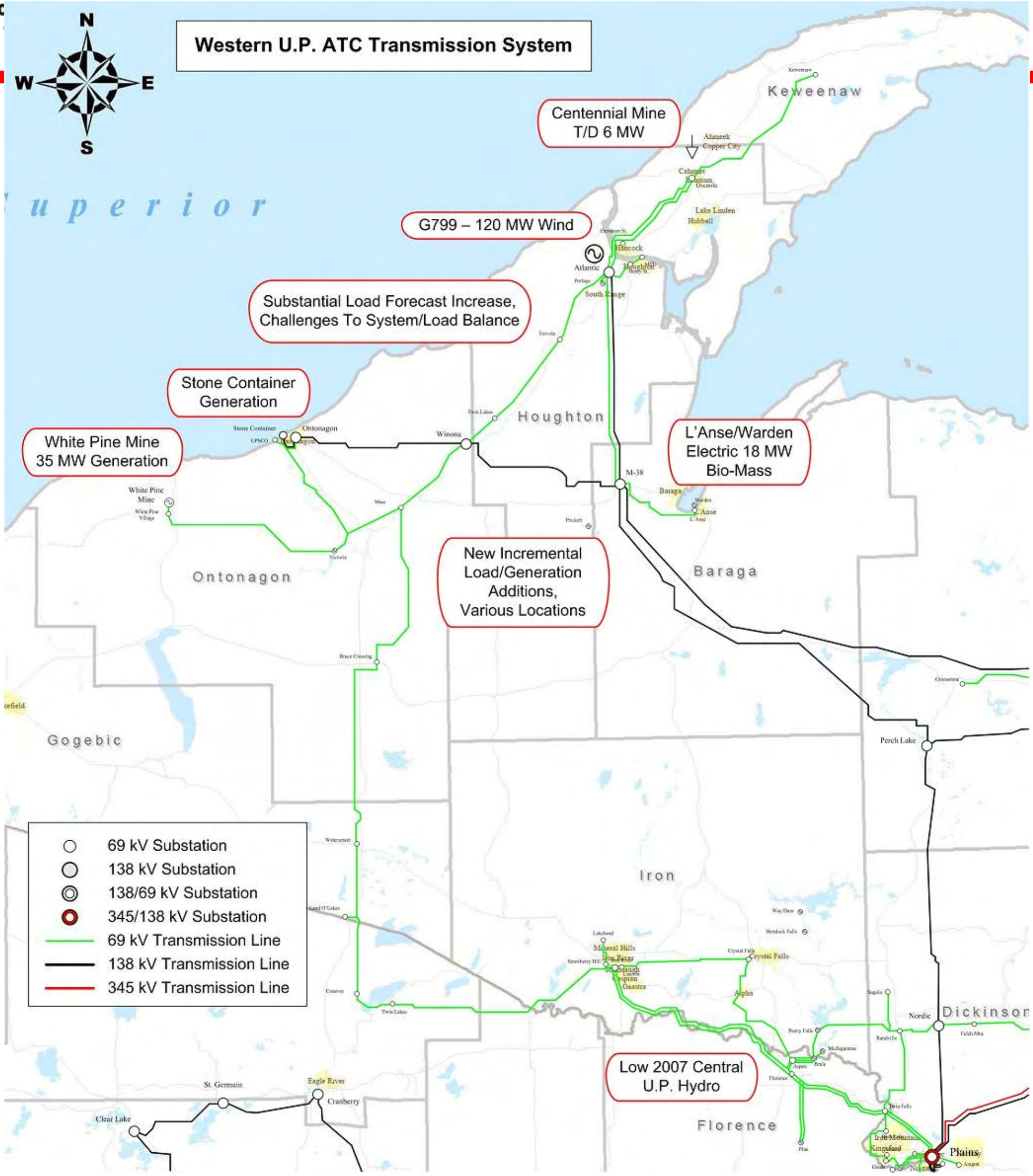
Upper Peninsula Situation Review
Existing Projects (cont)

Figure PR-2

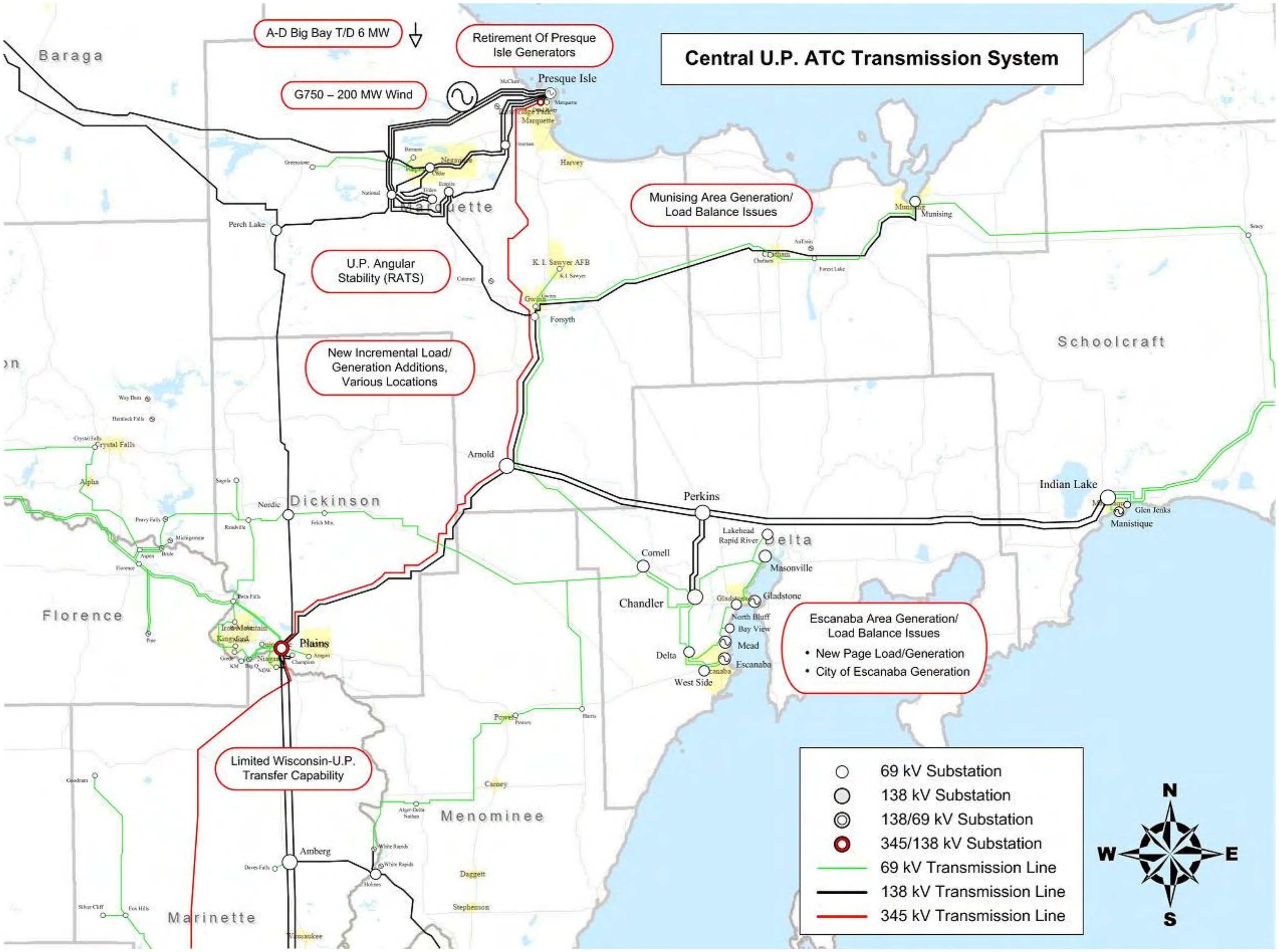


Updated 11/26/2007

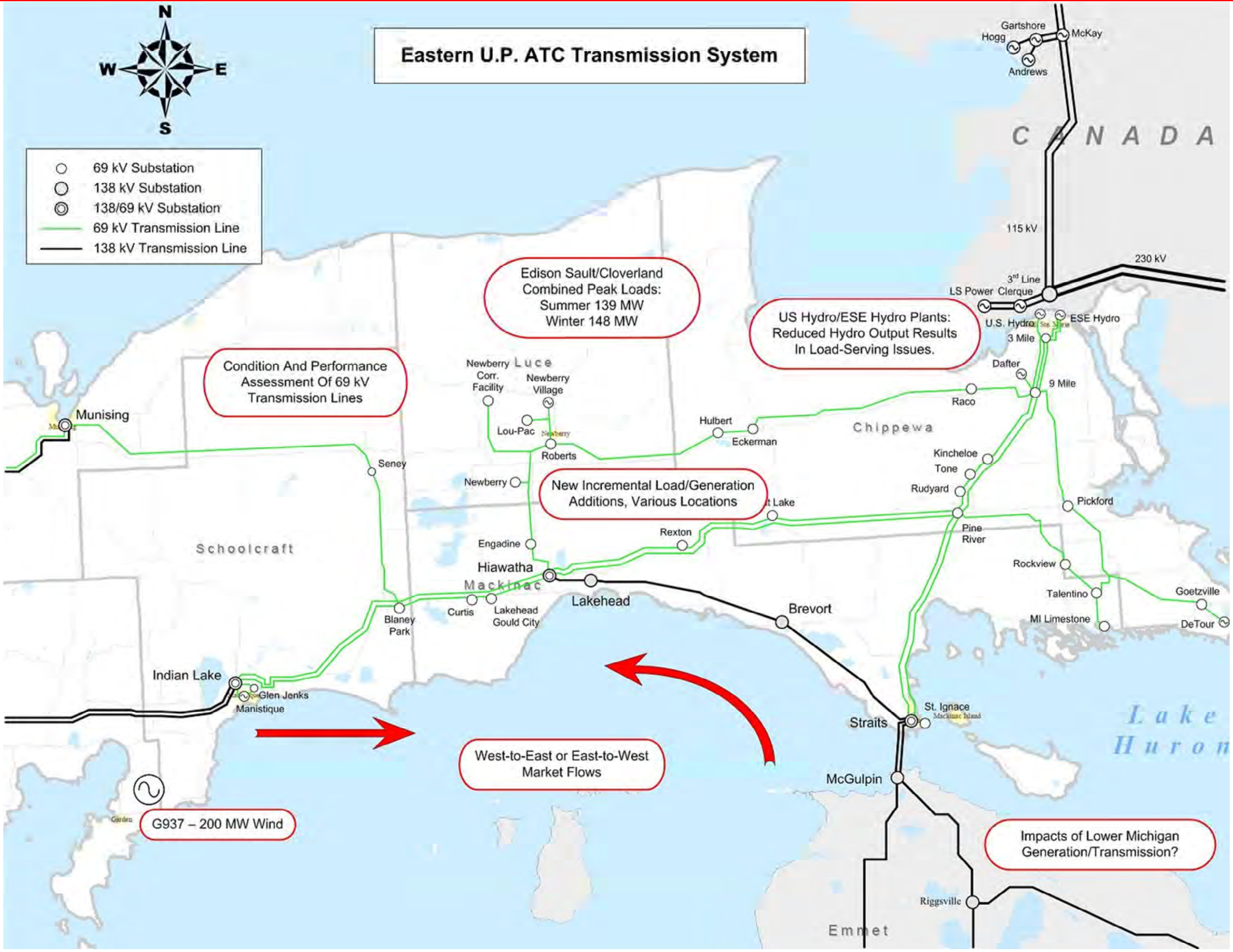
Upper Peninsula Situation Review
Western UP



Upper Peninsula Situation Review
Central UP

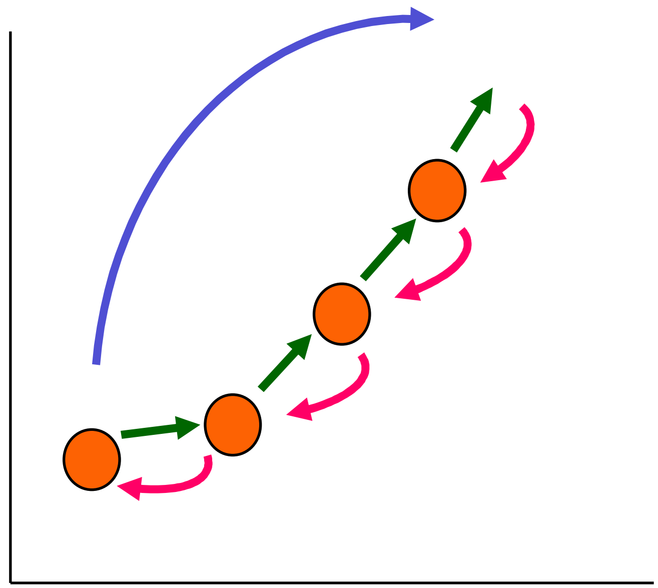


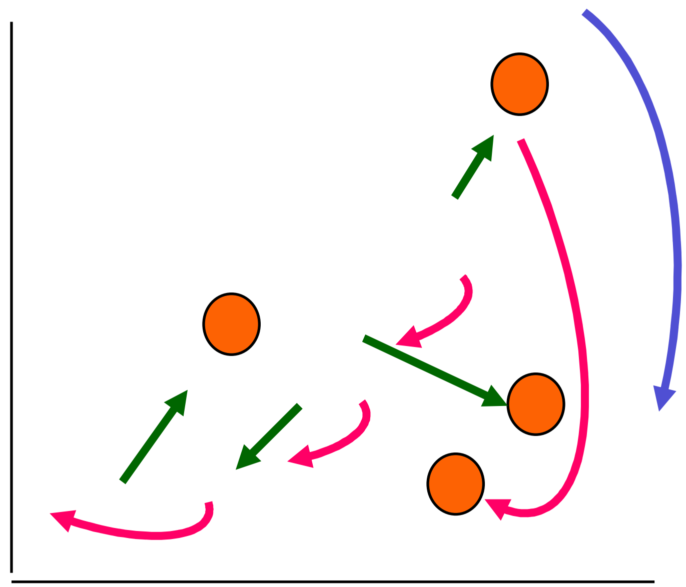
Upper Peninsula Situation Review
Eastern UP



Why Strategic Flexibility?

Traditional Planning Process





Traditional strategic planning depends on linkages between actions and outcomes

Unexpected events undermine the best strategic plan by corrupting assumed connections

The Problem with Prediction-Based Strategy

- Traditional strategic planning requires accurate predictions of the future, but these predictions are almost always wrong
  - So you'd like to remain flexible BUT
- Utilities are large complex businesses
  - Need to make complex decisions
  - Need to make large capital investments over long periods of time

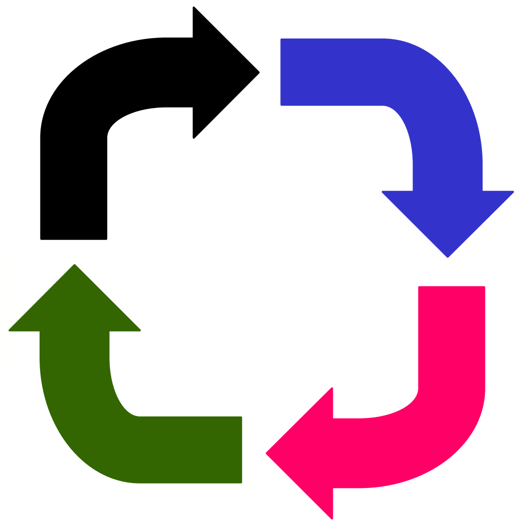
The Strategic Flexibility framework

Anticipate

- Identify drivers of change
- Define the range of possible futures
- “Scenario building”

Formulate

- Develop an optimal strategy for each scenario
- Compare optimal strategies to define “core” and “contingent” elements



Operate

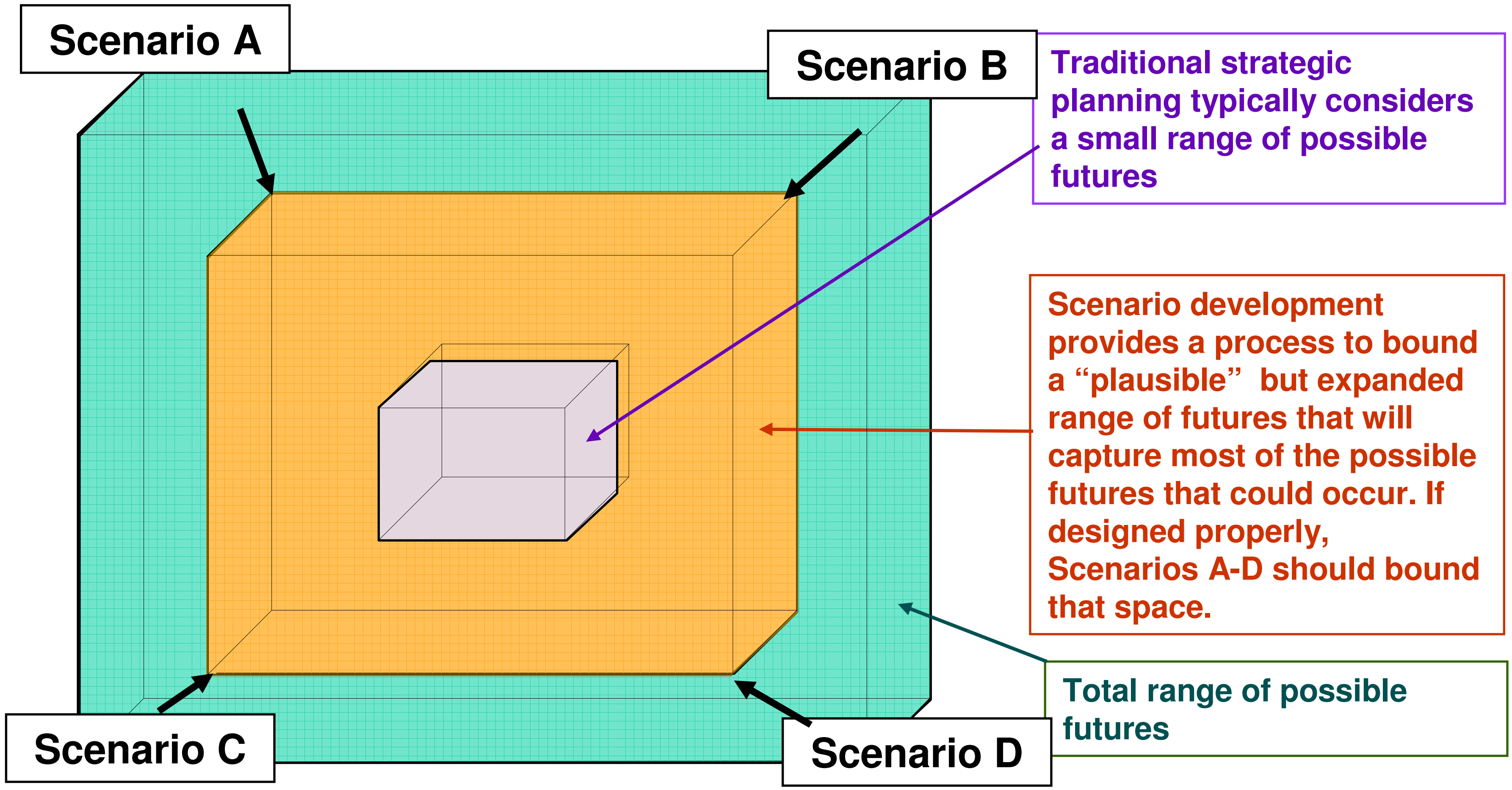
- Implement the core strategy
- Monitor the environment
- Exercise or abandon options as appropriate

Accumulate

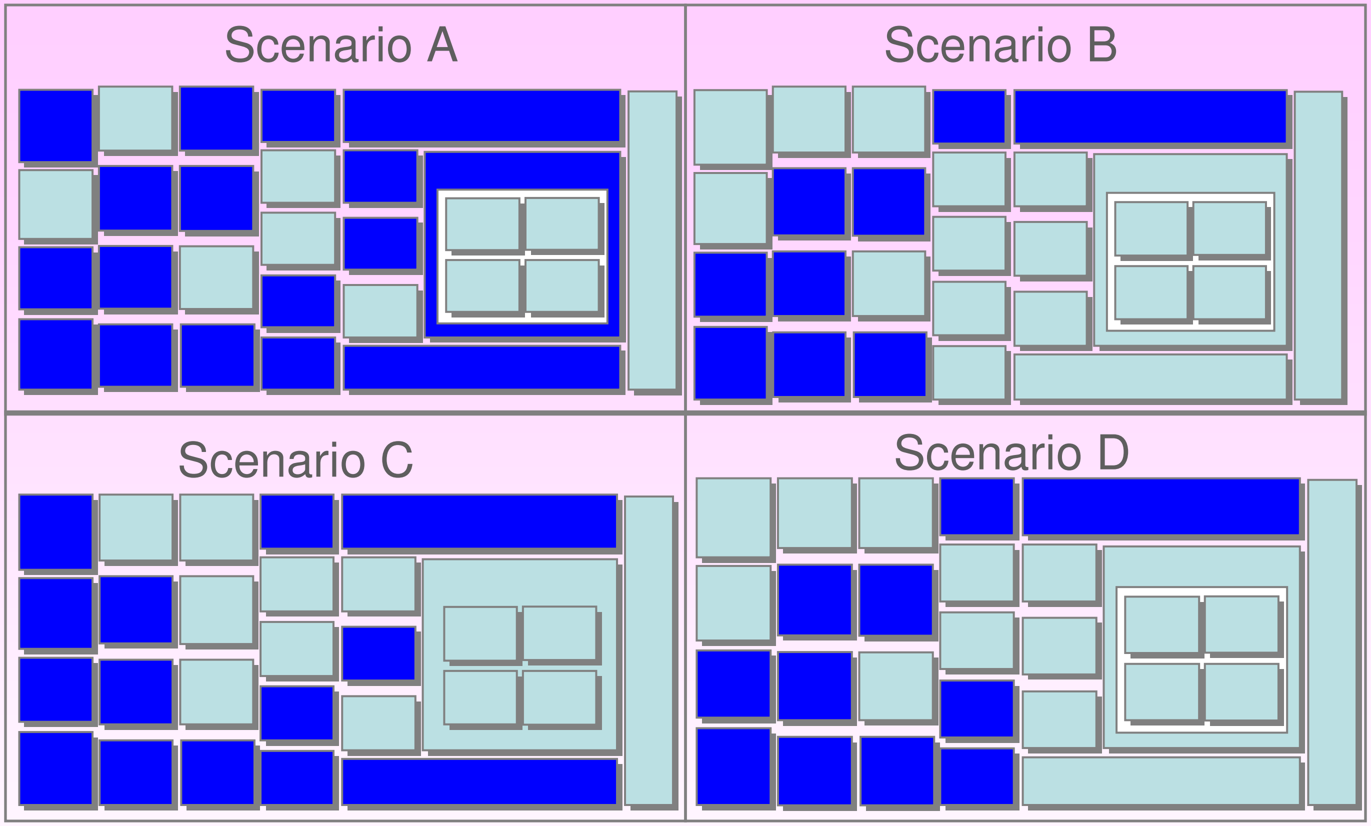
- Acquire those capabilities needed to implement the core strategy
- Take real options on capabilities needed for contingent strategies

Prepare for a future you cannot predict.

Anticipate the Future by Bounding It



"Core" and "contingent" strategic options



- Strategic options highlighted in all scenarios are "core" elements of the strategic plan
- Strategic options highlighted in some scenarios are contingent elements of the plan
- Options should be taken on contingent elements

Strategic Analysis Approach
Strategic Flexibility

1. Review ATC Corporate Futures
2. Customize the futures for UP
   1. Brainstorm UP-specific drivers for futures
   2. Set bounds for UP-specific drivers
   3. Determine behavior of UP-specific drivers in ATC corporate futures
3. Identify needs created by each future
   1. Reliability analysis
   2. Economic benefit/cost analysis if appropriate
   3. Review needs with stakeholders; brainstorm solutions
4. Evaluate performance of solutions in each future
5. Review results with stakeholders
   1. Identify solutions that work in all futures – prepare to implement
   2. Identify solutions that work in some futures – develop real options that can be exercised if solution is needed
   3. Identify solutions that don't work in any future - abandon
6. Present recommendations to ATC executives

ATC Futures
Robust Economy

Peak Growth Inside ATC	3% (Upper)
Energy Growth Inside ATC	3% (Upper)
Peak Growth Outside ATC	3% (Upper)
Energy Growth Outside ATC	3% (Upper)
Generation Inside ATC	Upper (see notes)
Generation Outside ATC	MISO's Reference
RPS % Inside ATC	Mid (8% in 2013)
Renewable Source for ATC	Mid
General Environ Regs	Mid
Natural Gas Prices	Mid-Upper (+25%)
Coal Prices	Upper (20%)

- ATC footprint energy and peak demand grow at a fast rate (1.5% above the rate over the past 5 years) because of a fast growing economy.
- To help keep up with growing demand, 500 MW of coal-fired units are added within the ATC footprint in 2018 and 2024, respectively. These units could include provisions for carbon sequestration assuming that a \$25/ton CO2 tax makes it cost-effective to do so. Nelson Dewey, a new 280 MW coal-fired generator under PSC review, also helps to meet the higher demand levels. There are no generation retirements within the ATC footprint, other than those that have been announced. The generation expansion plans both inside and outside of ATC come from MISO's Reference Future. However, plant capacities are scaled up on new units to serve the higher peak demand and maintain 15% reserve margins.
- The percent of energy in ATC from renewables in 2018 and 2024 is 15%, which is higher than required by current Wisconsin Renewable Portfolio Standard (RPS) standards (i.e., 10% by 2015). The Governor's Task Force on Global Warming has suggested that the RPS standard be increased from its current level. A robust economy could help encourage greater investment in renewable resources, even if their direct costs were somewhat higher. A \$25/ton CO2 tax is imposed and mercury costs are 25% higher.
- The combination of a \$25/ton CO2 tax, 25% higher mercury costs and higher energy requirements results in higher demand and costs for natural gas. There is also upward pressure on coal costs because of high energy requirements.

ATC Futures
High Retirements

Peak Growth Inside ATC	1.5% (Mid)
Energy Growth Inside ATC	1.5% (Mid)
Peak Growth Outside ATC	1.5% (Mid)
Energy Growth Outside ATC	1.5% (Mid)
Generation Inside ATC	Lower (see notes)
Generation Outside ATC	MISO's Reference
RPS % Inside ATC	Mid (8% in 2013)
Renewable Source for ATC	Mid
General Environ Regs	Mid
Natural Gas Prices	Mid-Low (-20%)
Coal Prices	Mid

- ATC footprint energy and peak demand grow at a rate similar to that over the past five years, which is about 1.5% for the period 2002 to 2007.
- The combination of a \$25/ton CO2 tax and 25% higher mercury costs plus the high (and potentially increasing) cost of retrofitting coal-fired plants to meet Federal Clean Air Interstate Rule (CAIR) and Clean Air Mercury Rule (CAMR) regulations cause smaller aging coal-fired units within the ATC footprint to be retired for economic reasons (270 MW in 2013, 880 MW in 2018 and 2024). Nelson Dewey, a new 280 MW coal-fired generator under PSC review, helps to meet internal demand no longer met by retired units. The generation expansion plans both inside and outside of ATC come from MISO's Reference Future.
- The percent of energy in ATC from renewables in 2018 and 2024 is 15%, which is higher than required by current Wisconsin RPS standards (i.e., 10% by 2015). Additional wind power could help replace the loss of local, relatively low energy cost generation due to the retirement of smaller and aging coal-fired units, especially if wind-power tax incentives continue. A \$25/ton CO2 tax is imposed and mercury costs are higher.
- Additional wind power and higher building standards (requiring better insulation, windows, furnaces, air conditioning, etc.) could also help temper demand for natural gas, somewhat reducing costs from historically high levels. Coal prices – MISO MAIN \$2/MMBTU – delivered in 2010 and 2%/yr (\$2.34 in 2018 and \$2.59 in 2024)

ATC Futures
High Environmental

Peak Growth Inside ATC	Lower-Mid
Energy Growth Inside ATC	Lower-Mid
Peak Growth Outside ATC	Lower-Mid
Energy Growth Outside ATC	Lower-Mid
Generation Inside ATC	Lower
Generation Outside ATC	MISO's Environmental
RPS % Inside ATC	10% and 20%
Renewable Source for ATC	Mid
General Environ Regs	Upper
Natural Gas Prices	Upper (50%)
Coal Prices	Lower (-10%)

- Load growth within ATC (2013 =1.2%, 2018 and 2024= 1.0%)
- Energy growth within ATC (2013 =1.2%, 2018 and 2024=0.8%)
- Load Growth outside ATC(2013 =1.2%, 2018 and 2024 =1.1%).
- Energy growth outside ATC (2013=1.2%, 2018 and 2024 =1.1%
- Increased conservation programs help reduce ATC footprint energy and peak demand growth rates below the most recent 5-year rate. These rates decline further in 2018 as conservation programs ramp up, particularly in WI. The WI Governor's Task Force on Global Warming has proposed conservation programs that have a greater impact on energy than peak demand growth. As a result, the reduction in energy growth rate is somewhat greater than the peak demand rate.
- The combination of a $44/ton CO2 tax and 25% higher mercury costs plus the high (and potentially increasing) cost of retrofitting coal-fired plants to meet CAIR and CAMR regulations cause smaller, aging and less efficient coal-fired units to be retired within the ATC footprint ((270 MW in 2013, 880 MW in 2018 and 2024). The generation expansion plans both inside and outside of ATC come from MISO's Environmental Future
- The percent of energy in ATC from renewables in 2013 is 10%, and 20% in 2018 and 2024, which is higher than required by current Wisconsin RPS standards (10% by 2015). Additional wind power could help replace retired coal fired units, especially if wind-power tax incentives continue or are increased.
- The higher CO2 tax encourages greater use of natural gas and less use of coal, which puts increasing and decreasing pressure on the cost of these fuels, respectively. Additional wind power could result in more frequent dispatch of fast-start natural gas-fired combustion turbines due to the variability of wind. This could also cause some upward pressure on natural gas costs.

ATC Futures
Slow Growth

Peak Growth Inside ATC	Lower (0.5%)
Energy Growth Inside ATC	Lower (0.5%)
Peak Growth Outside ATC	Lower (0.5%)
Energy Growth Outside ATC	Lower (0.5%)
Generation Inside ATC	Mid
Generation Outside ATC	MISO's Reference
RPS % Inside ATC	Lower
Renewable Source for ATC	Mid
General Environ Regs	Low
Natural Gas Prices	Lower (-40%)
Coal Prices	Mid

- ATC footprint energy and peak demand grow at a slow rate (1.0% below the 5-year rate) because of a slow growing economy.
- Lower demand and the high (and potentially increasing) cost of retrofitting coal-fired plants to meet CAIR and CAMR regulations cause some smaller and aging coal-fired units within the ATC footprint to be retired for economic reasons (130 MW in 2013, 440 MW in 2018 and 2024). Nelson Dewey, a new 280 MW coal-fired generator under PSC review, helps to meet internal demand no longer met by retired units. The generation expansion plans both inside and outside of ATC come from MISO's Reference Future. However, plant capacities are scaled down on new units because of lower demand levels and reduced need for reserves.
- The percent of energy in ATC from renewables meets the current Wisconsin RPS standards (10% by 2015). 8% of energy from renewables in 2013, 10% in 2018 and 2024.
- The combination of no CO2 tax and lower energy requirements results in lower demand and costs for natural gas. Without a CO2 tax, coal-fired plants serve proportionally more of the lower demand levels (than natural gas-fired generators), resulting in enough demand for coal to maintain "mid" level cost projections. Coal prices – MISO MAIN $2/MMBTU – delivered in 2010 and 2%/yr ($2.34 in 2018 and $2.59 in 2024)

ATC Futures
DOE 20% Wind

Peak Growth Inside ATC	Mid-Upper - 2%
Energy Growth Inside ATC	Mid-Upper -2%
Peak Growth Outside ATC	Mid-Upper -2%
Energy Growth Outside ATC	Mid-Upper -2%
Generation Inside ATC	Lower
Generation Outside ATC	MISO's 20% Wind
RPS % Inside ATC	Upper
Renewable Source for ATC	Mid
General Environ Regs	Mid
Natural Gas Prices	Mid
Coal Prices	Lower (-10%)

- ATC footprint energy and peak demand grow at a somewhat faster rate (0.5% above the 5-year rate) because of a somewhat faster growing economy.
- The combination of a $25/ton CO2 tax, 25% higher mercury costs, substantial amounts of power from renewables and high (and potentially increasing) costs for retrofitting coal-fired plants to meet CAIR and CAMR regulations cause smaller, aging coal-fired units within the ATC footprint to be retired for economic reasons (270 MW in 2013, 880 MW in 2018 and 2024). Substantial wind power could help replace the retired smaller and aging coal-fired units. The generation expansion plans both inside and outside of ATC come from MISO's 20% Wind Future.
- The percent of energy in ATC from renewables in 2013 is 20% and is 25% in 2018 and 2024, which is higher than required by current Wisconsin RPS standards (10% by 2015). The percent of energy outside ATC from renewables is 20%. A $25/ton CO2 tax is imposed and mercury costs are 25% higher.
- Additional wind power could result in more frequent dispatch of fast-start natural gas-fired combustion turbines because of the variability of wind. This could provide steady demand for natural gas and result in "mid" level costs. Because of the substantial amounts of energy coming from renewable resources, less low energy-cost generation, primarily coal-fired generation, would be needed, reducing the demand for and cost of coal.

ATC Futures
Fuel & Regulatory Regulations

Peak Growth Inside ATC	Lower-Mid-1.3%
Energy Growth Inside ATC	Lower-Mid-1.3%
Peak Growth Outside ATC	Lower-Mid-1.3%
Energy Growth Outside ATC	Lower-Mid-1.3%
Generation Inside ATC	Mid
Generation Outside ATC	MISO's Reg. Limitation
RPS % Inside ATC	Mid (8% in 2013)
Renewable Source for ATC	Mid
General Environ Regs	Mid
Natural Gas Prices	Mid-Upper (+25%)
Coal Prices	Mid

- Lengthy regulatory proceedings for approval of new coal-fired generation and transmission delay some generation and transmission siting. There is a 5-year delay for new coal/IGCC permitting, These coal-fired generators are replaced by combustion turbine (CT) and combined cycle (CC) plants located near loads. Greater reliance on natural gas-fired units results in 20% higher costs. Furthermore, there is some disruption in fuel deliveries. Under these conditions, it would not be unusual to have somewhat more conservation with somewhat lower demand and energy growth rates.
- The combination of a $25/ton CO2 tax and 25% higher mercury costs plus the high (and potentially increasing) cost of retrofitting coal-fired plants to meet CAIR and CAMR regulations cause some smaller aging coal-fired units within the ATC footprint to be retired for economic reasons (130 MW in 2013, 440 MW in 2018 and 2024). Nelson Dewey, a new 280 MW coal-fired generator under PSC review, helps to meet internal demand no longer met by retired units. The generation expansion plans both inside and outside of ATC come from MISO's Regulatory Limitation Future.
- The percent of energy in ATC from renewables in 2018 and 2024 is 15%, which is higher than required by current Wisconsin RPS standards (10% by 2015). A $25/ton CO2 tax is imposed and mercury costs are higher.
- Additional wind power and higher building standards (requiring better insulation, windows, furnaces, air conditioning, etc.) could also help temper demand for natural gas, somewhat reducing costs from historically high levels. Coal prices – MISO MAIN $2/MMBTU – delivered in 2010 and 2%/yr ($2.34 in 2018 and $2.59 in 2024)

UP Micro-Driver Introduction

- Question: How do the UP micro-drivers behave in each of the six futures?
- Load Assumptions
  - Demand and Energy Growth
  - Point Load Step Changes
- Generation Assumptions
  - Consider all sources
    - IOU/Co-Op/ Municipal Owned
    - End use customer owned (Behind the meter)
  - Existing Local Generation Availability (Hydro, CTs, diesels)
  - New Additions
  - Retirements

UP Micro-Driver Introduction (cont.)

- Outside Factors
  - Market Flows
    - Lower Peninsula 765kV
    - Regional Generation
  - External Generation Committed to the UP

Stakeholder Feedback for Today

- Review the Upper, Lower and Mid levels for each UP Micro Driver
  - Focus on the Eastern Section of the UP
- Describe how each UP Micro Driver behaves in the Six Futures
  - Focus on the 2018 Future

Overall Timeline

- May/July 08
  – Initial meetings plus follow-up data gathering/ verification meetings
- June/July 08
  – Develop U.P. area futures based on customer and ATC executive feedback
- August 08
  – Develop Planning study models for each of these futures for 2009, 2013, 2018, 2023
- October 08
  – Complete load flow studies on all the planning models, summarize findings/needs
  – Update executives on needs
- November 08
  – Brainstorm project alternatives to meet needs with stakeholders
  – Determine sets of project alternatives for each of the futures
  – Update/receive feedback from executives on possible alternatives

Overall Timeline (cont.)

- December 08/ January 09
  - Analyze, select primary and secondary alternatives for each future
  - Determine if we need economic analysis of alternatives – Dec 08-Jan 09
  - Review findings of need and proposed alternatives with stakeholders and executives
- February 09
  - Get cost estimates, constructability/ environmental/ other issues
  - Make final recommendations for strategy to ATC executives
  - Share results with stakeholders/customers
- February-April 09 – Develop PRFs/Scope documents needed for projects

Next Steps

- Obtain feedback from other stakeholders, including MI PSC staff on the futures
- Post results of meetings, allowing for final input from all stakeholders
- Make final decision on scenarios
- Work with stakeholders to define alternatives
- More fully develop analysis methodology
- We will be continue to meet with stakeholders and MI PSC staff throughout the analysis process

ATC Futures - ATC Energy Collaborative - Michigan

Draft - May 15, 2008

	Load Assumptions											Generation Assumptions													Outside Factors			
UP Micro-Drivers	**Demand Growth within UP (Demand MWs)**			**Energy Growth within ATC (Energy MWHrs)**			**Point loads (5 to 10MW assumed) added in the UP**			**Demand Growth outside UP (MWs)**	**Energy Growth outside UP (MWHrs)**	**Existing UP Generation Profile (Hydro, diesels and CTs)**			**UP Generation Additions**			**UP Generation retirements**			**Wind Generation**			**Generation in Northern Lower Michigan (See Market Flows)**	**Market Flows (Measured at the Eastern UP)**	**Incremental External Generation committed to the UP**		
Bounds	**West**	**Central**	**East**	**West**	**Central**	**East**	**West**	**Central**	**East**			**West**	**Central**	**East**	**West**	**Central**	**East**	**West**	**Central**	**East**	**West**	**Central**	**East**			**West**	**Central**	**East**
Lower	-0.10%	-0.10%	-0.10%	-0.10%	-0.10%	-0.10%	Reduce 5MW ea 10 YR	Reduce 10MW ea 10YR	Reduce 5MW ea 10YR	0.5%	0.5%	Rely on local CTs for voltage support	Rely on local CTs for voltage support	40MW Hydro, 11.4MW Diesel	(Blank)	(Blank)	None	50MW	300MW	11.4MW Diesel	Zero	Zero	Zero	Zero	No Bias	Zero	Zero	Zero
Mid	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	5MW ea 10YR	10MW ea 10YR	5MW ea 10YR	1.5%	1.5%	Rely on local CTs for voltage support only for peak loads or maintenance	Rely on local CTs for voltage support only for peak loads or maintenance	20MW Hydro, 9.4MW diesel	(Blank)	(Blank)	25MW Renewable	25MW	116MW	5MW Diesel	25MW	50MW	25MW	100MW	System Split	UPPCo share of Weston 4 Output		25MW
Upper	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	Two @ 5MW ea 5YR	Two @ 10MW ea 5 YR	Two @ 5 MW ea 5YR	3.0%	3.0%	No local CT generation support needed	No local CT generation support needed	0Hydro, 0 Diesel			80MW CT	None	None	None	100MW	200MW	200MW	600MW	130MW E-W (Just before splitting)			75MW

2018 Futures Descriptions

Robust Economy			Upper (2.5%)			Upper (2.5%)			4@ 5MW	Upper 3%	Upper 3%			Mid (20MW)Hydro + 9.4MW Diesel,			Upper 80MW			Upper None			Mid 25MW	Upper 600MW	Upper (130MW)			Upper (75MW)
High Retirements			Mid (.75%)			Mid (.75%)			Mid 1@5MW	Mid 1.5%	Mid 1.5%			Mid-Upper (20MW)Hydro			Low None			Low 11.4MW			Mid 25MW	Upper 600MW	Upper (100MW)			Mid (25MW)
High Environmental			Mid-Low (0.5%)			Mid-Low (0.5%)			Mid 1@5MW	Mid-Low 1%	Mid-Low 1%			Mid (20MW)Hydro + 9.4MW Diesel,			Low None			Low 11.4MW			Upper 200MW	Lower Zero	Low (No-Bias) More RPS from the west			Low (Zero) (Local)
Slow Growth			Low (-0.10%)			Low (-0.10%)			Lower 1@	Lower 0.5%	Lower 0.5%			Lower(40MW)Hydro + 11.4MW Diesel,			Mid 25MW			Mid 5MW			Low Zero	Lower Zero	Mid (Split)			Mid (25MW)
DOE 20% Wind			Mid (.75%)			Mid (.75%)			Mid-Upper 3@5MW	Mid-Upper 2%	Mid-Upper 2%			Mid (20MW)Hydro + 9.4MW Diesel,			Low None			Low 11.4MW			Upper 200MW (500MW??)	Mid 100MW	Low (No-Bias) More RPS from the west			Upper (75MW)
Fuel and Regulatory Limitations			Mid (.75%)			Mid (.75%)			Mid-Lower	Mid-Lower 1.3%	Mid-Lower 1.3%			Upper(Zero)			Mid 25MW			Mid 5MW			Mid 25MW	Lower Zero	Mid (Split) (Volatile)			Upper (75MW)
UP Special Future???																												
Notes	***Eastern Zone*** Mid .75% growth equals ESELCo published projections. 2.5% is just above the actual 20 year growth of 2%						***Western Zone:*** Point loads possible at Houghton, Ontonagon and Baraga ***Central Zone:*** Point loads possible at Marquette/ Ishpeming, Escanaba and Munising. ***Eastern Zone:*** Point loads possible at Manistique, Sault Ste. Marie and Newberry					***Eastern Zone*** 2009 Hydro projections assume that the 2007 weather pattern persists and dominates the hydro availabilityand that diesel output remains a key reliability factor. 2018 these can vary across the futures.						***Central Zone*** Presque Isle Units 3 & 4 committed to retire by 2012 (116MW)			500 MW of off shore Lake Michigan wind generation being discussed in MPSC Michigan Wind Energy Transmission Study							