

Michigan's 21st Century Energy Plan

Electric Capacity Needs

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Michigan's 21st Century Energy Plan

Capacity Needs Forum (CNF)

- Emerging electric reliability need in Southeast Michigan
- Broad portfolio of resources including energy efficiency and renewables needed to supply power and manage risk
- Need for baseload power when available
 - Energy production
 - Fuel diversity
- Traditional revenue recovery method needed modification



Executive Directive 2006-2

- Provide safe, reliable, clean, and affordable supply of electric power
- Enhance State's economy and provide affordable rates
- Utilize energy efficiency, renewable and emerging energy production technologies
- Protect the State's natural resources and environment, as well as mitigate future fossil fuel risks
- Identify new technologies
- Foster State's interest in continued growth of alternative and renewable energy
- Recommend legislative and regulatory changes



21st Century Energy Plan Process

- Develop a plan to meet Michigan's short and long-term electric energy needs
 - Confirm or modify CNF results
 - Modified Forecasts
 - New generation plant costs
 - Further investigate resource options
 - Identify emerging technologies
- Develop a robust set of policy recommendations designed to address Michigan's electric energy resource needs



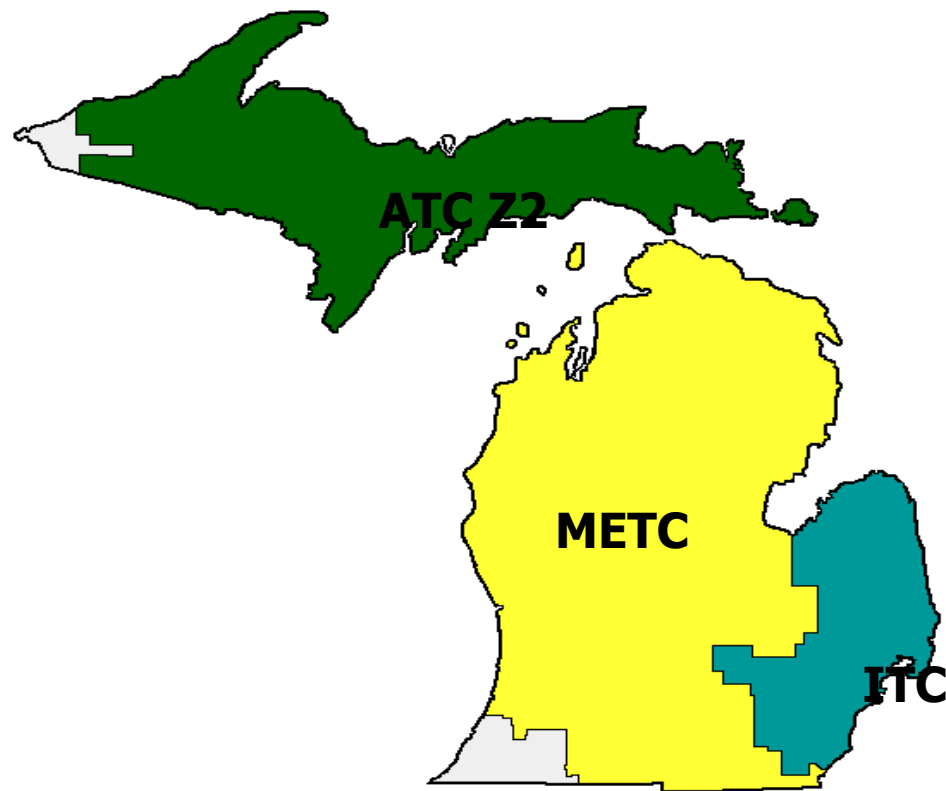
Electric Generation Adequacy

Process of Assessing Adequacy

- Forecast of energy and demand growth over short-, intermediate-, and long-term future
- Inventory of current assets (generation and transmission)
- Assessment of adequacy of current assets
- If needed, determination of best resources to acquire

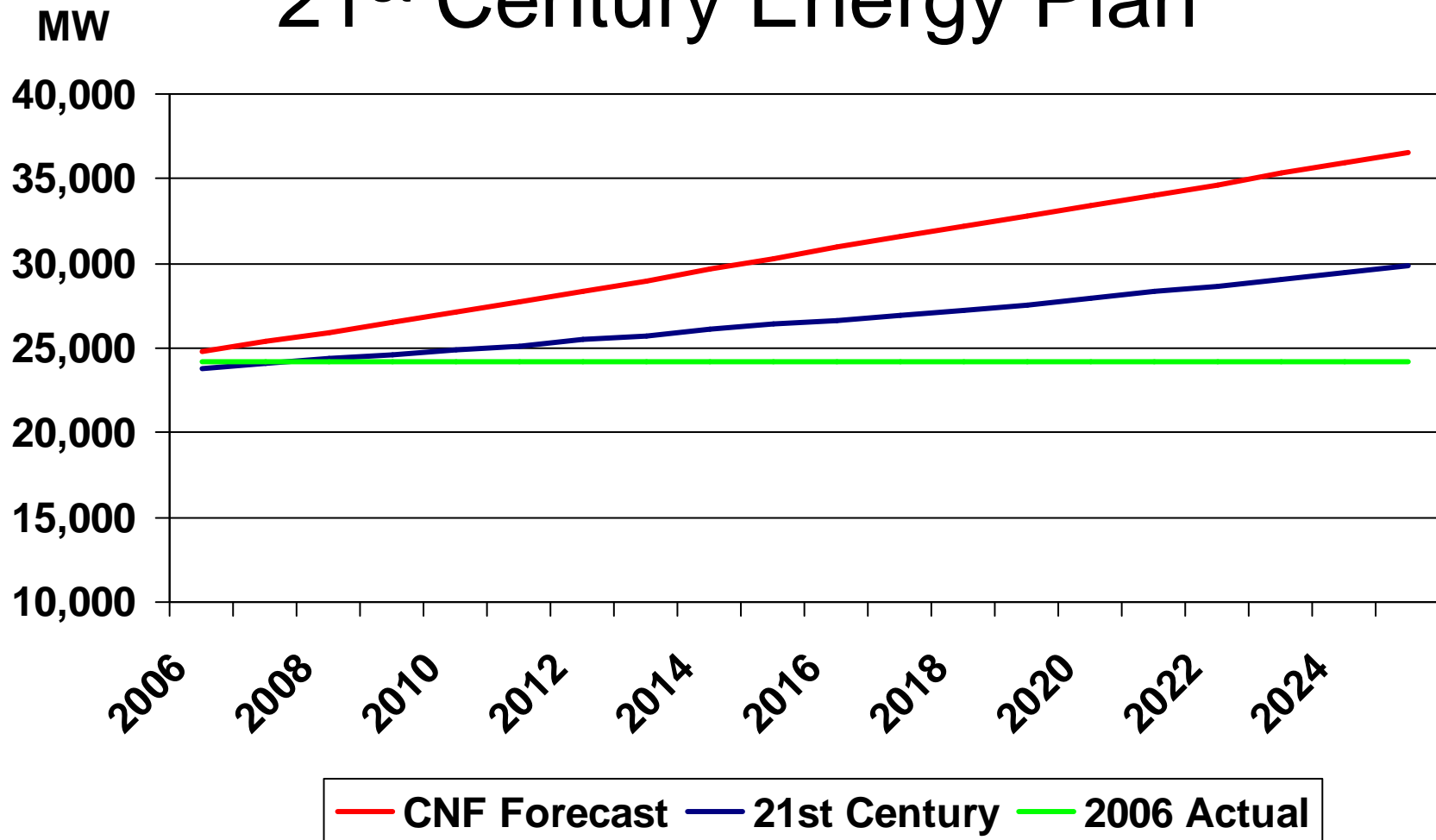


Michigan Electric Transmission Company Regions



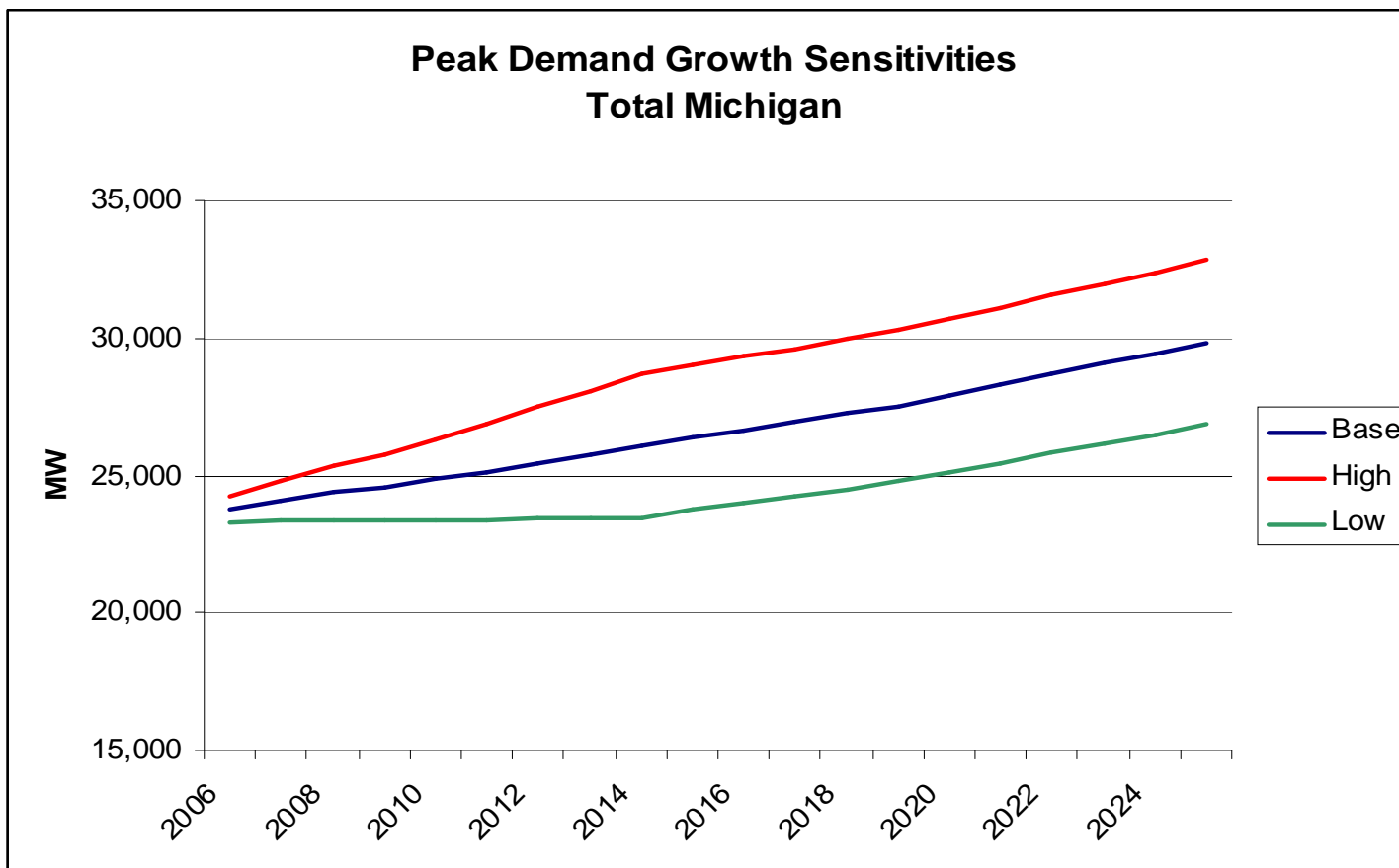
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Comparative Demand Forecasts CNF and 21st Century Energy Plan



Michigan's 21st Century Energy Plan

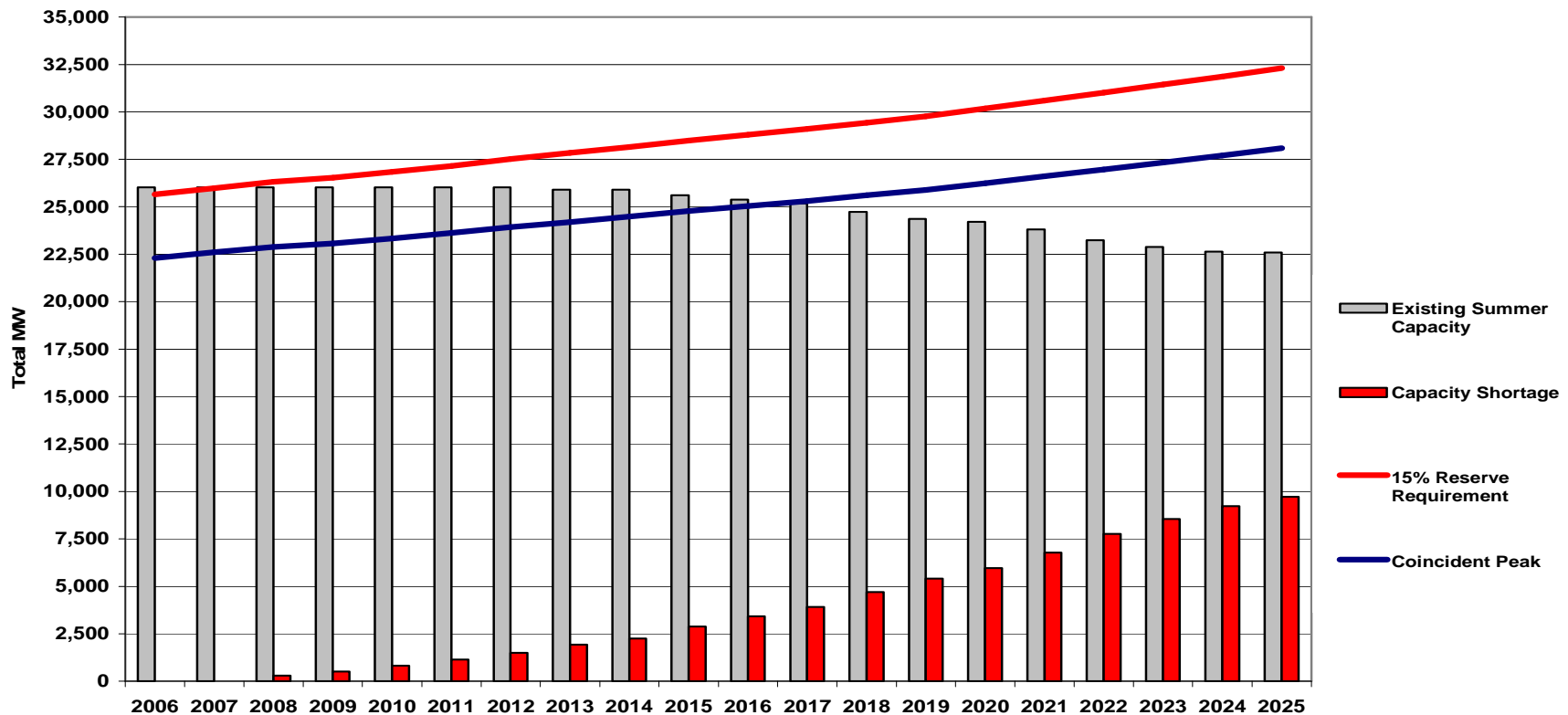
Peak Demand Forecast Sensitivities



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Overview of Michigan Generating Resource Needs

MECS Resource Gap Analysis
Summer Peak Load and Resource Balance of Existing System



* Excludes Upper Peninsula



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Central Station Technology Options

• Technology	Size	\$/Kw/	FOM	VOM	Heat Rate
• Sub-critical PC	500	1,478	44.26	1.86	9,496
• Super-critical PC	500	1,551	44.91	1.75	8,864
• CFB	300	1,628	46.11	4.37	9,996
• IGCC	500	1,785	61.30	.98	9,000
• IGCC-PRB	500	1,999	61.30	.98	10,080
• Nuclear	1,000	2,352	70.04	.55	10,400
• Combined Cycle	500	529	5.57	2.19	7,200
• Combustion Turbine	160	425	2.19	3.83	10,450



Renewable Energy Options

Renewable Energy System Type	Portfolio Contribution In 2016 (MW)	Cost (\$)
Wind	525	0.072
LFG	131	0.074 (New) 0.070 (Existing)
Anaerobic Digestion	82	0.082
Celluloid Biomass	385	0.069
Total	1,123	



Energy Efficiency Program

- High penetration (more aggressive) energy efficiency program
 - 2015
 - 7,436 Gwh's
 - 1,065 Mw's
 - 2025
 - 14,383 Gwh's
 - 2,037 Mw's
- Low penetration (less aggressive) energy efficiency program
 - 2015
 - 4,331 Gwh's
 - 583 Mw's
 - 2025
 - 8,280 Gwh's
 - 1,156 Mw's
- Active load Management 569 Mw's
- Commercial Building Code 195 Mw's



New Transmission Options

- TIER I Transmission upgrades into Lower Peninsula
 - 1,000 MW
 - \$100 Million
- TIER II Transmission upgrades into Lower Peninsula
 - 2,000 to 2,500 MW
 - \$800 Million (DC)



Planning Contingencies

- Fuel cost volatility
- Clean Air Act
- Transmission capability
- Demand growth



Planning Scenarios

- Traditional Generation
- Emissions
- Energy efficiency
- Renewable energy
- Combined energy efficiency and renewables
- Combustion turbines only



Sensitivities

- High demand growth
- Low demand growth
- Expanded transmission capability
- Low energy efficiency penetration



Planning Parameters

- Objective Function
 - Minimize Present Worth of incremental Utility Costs
- System and Area Constraints
 - 15% Minimum Reserve Margin for MECS
 - 10% Minimum Reserve Margin for METC and ITC by 2015
 - 15% Minimum Reserve Margin for Upper Peninsula
 - No additional units added once minimum reserve targets are met
- Other Constraints
 - No more than one “Large” unit per area commissioned at a time



Central Station Base Case Results

- | | | | |
|----------------------|---------------|----------------------|---------------|
| • 2006 to 2015 | | • 2006 to 2025 | |
| • Capacity Additions | | • Capacity Additions | |
| – CT | 1,440 mw | – CT | 1,760 mw |
| – CC | 0 mw | – CC | 500 mw |
| – PC | 2,000 mw | – PC | 9,000 mw |
| – Nuclear | 0 mw | – Nuclear | 0 mw |
| – Renewable | 0 mw | – Renewable | 0 mw |
| – Conservation | 0 mw | – Conservation | 0 mw |
| • Total | 3,440 mw | • Total | 11,260 mw |
| • Demand Growth | 1.17 % | • Demand Growth | 1.21 % |
| • Reserve Margin | 15.26 % | • Reserve Margin | 15.52 % |
| • Plan Costs | | • Plan Costs | |
| – NPV Utility Cost | \$ 32,073.0 M | – NPV Utility Cost | \$ 56,716.9 M |
| – NPV Emissions | \$ 3,385.6 M | – NPV Emissions | \$ 5,602.8 M |
| – NPV CO2 | \$ 0.00 M | – NPV CO2 | \$ 0.00 M |



Base Case Resource Schedule

Traditional Generation		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2	CT - METC	-	-	1	1	-	-	-	-	-	-
7	CT - ITC	-	-	2	-	2	2	-	-	-	-
2	CT - ATC2	-	-	-	-	-	-	1	-	-	-
0	CC - METC	-	-	-	-	-	-	-	-	-	-
1	CC - ITC	-	-	-	-	-	-	-	-	-	-
0	CC - ATC2	-	-	-	-	-	-	-	-	-	-
6	COAL - METC	-	-	-	-	-	-	-	-	-	-
12	COAL - ITC	-	-	-	-	-	-	1	1	1	1
0	COAL - ATC2	-	-	-	-	-	-	-	-	-	-
0	CFB - ATC	-	-	-	-	-	-	-	-	-	-

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
CT - METC	-	-	-	-	-	-	-	-	-	-
CT - ITC	-	-	-	-	-	-	-	-	-	1
CT - ATC2	1	-	-	-	-	-	-	-	-	-
CC - METC	-	-	-	-	-	-	-	-	-	-
CC - ITC	-	-	-	-	-	-	-	-	-	1
CC - ATC2	-	-	-	-	-	-	-	-	-	-
COAL - METC	1	1	-	1	-	1	1	1	-	-
COAL - ITC	1	-	1	1	1	1	1	1	1	-
COAL - ATC2	-	-	-	-	-	-	-	-	-	-
CFB - ATC	-	-	-	-	-	-	-	-	-	-



Energy Efficiency Scenario Resource Addition Schedule

Energy Efficiency	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
3 CT - METC						1				
3 CT - ITC						1				1
2 CT - ATC2							1			
0 CC - METC										
0 CC - ITC										
0 CC - ATC2										
4 COAL - METC										
9 COAL - ITC							1			1
0 COAL - ATC2										
0 CFB - ATC2										

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
CT - METC									1	1
CT - ITC										1
CT - ATC2								1		
CC - METC										
CC - ITC										
CC - ATC2										
COAL - METC					1	1	1		1	
COAL - ITC	1	1	1	1		1	1	1		
COAL - ATC2										
CFB - ATC2										



Emission Scenario Base Growth

- | | | | |
|----------------------|--------------|----------------------|--------------|
| • 2006 to 2015 | | • 2006 to 2025 | |
| • Capacity Additions | | • Capacity Additions | |
| – CT | 1,440 mw | – CT | 1,760 mw |
| – CC | 500 mw | – CC | 1,000 mw |
| – PC | 1,500 mw | – PC | 2,000 mw |
| – Nuclear | 0 mw | – Nuclear | 6,000 mw |
| – Renewable | 0 mw | – Renewable | 0 mw |
| – Conservation | 0 mw | – Conservation | 0 mw |
| • Total | 3,440 mw | • Total | 10,760 mw |
| • Demand Growth | 1.17 % | • Demand Growth | 1.21 % |
| • Reserve Margin | 15.26 % | • Reserve Margin | 16.04 % |
| • Plan Costs | | • Plan Costs | |
| – NPV Utility Cost | \$36,956.6 M | – NPV Utility Cost | \$70,752.2 M |
| – NPV Emissions | \$ 8,150.5 M | – NPV Emissions | \$18,991.7 M |
| – NPV CO2 | \$ 4,688.2 M | – NPV CO2 | \$13,358.9 M |



Twenty Year Planning Results

Plan Name	Total Capacity Added mW	CT Capacity mW	CC Capacity mW	PC Capacity mW	Nuclear Capacity mW	Renewable Capacity mW	Energy Efficiency mW	Ending Reserve Margin %	Ending Peak Demand mW	PVRR \$M
Central Station	11,260	1,760	500	9,000	0	0	0	15.52%	29,856	\$56,716.9
CS High Load	15,040	3,040	2,000	10,000	0	0	0	15.63%	32,841	\$64,116.8
CS Low Load	7,640	640	500	6,500	0	0	0	15.95%	26,870	\$49,811.6
CS Reduce Import	11,220	2,720	1,000	7,500	0	0	0	15.40%	29,856	\$57,004.8
CS Expanded Trans	10,300	800	1,000	8,500	0	0	0	12.56%	29,856	\$57,085.5
Emissions	10,760	1,760	1,000	2,000	6,000	0	0	16.04%	29,856	\$70,752.2
Emissions High Load	14,240	2,240	2,000	4,000	6,000	0	0	15.26%	32,841	\$79,492.7
Emissions Low Load	7,480	480	0	1,000	6,000	0	0	17.69%	26,870	\$62,254.7
Emissions Renew & EE	10,079	480	500	500	5,000	798	2,801	16.89%	26,404	\$66,179.2
Emissions EE Only	11,261	960	0	1,500	5,000	0	2,801	16.53%	26,404	\$66,707.5
Renewable Generation	11,218	1,920	500	8,000	0	798	0	16.28%	29,856	\$58,081.4
Renewable High Load	14,698	2,400	2,000	9,500	0	798	0	15.48%	32,841	\$65,343.3
Renewable Low Load	7,238	1,440	0	5,000	0	798	0	15.55%	26,870	\$51,382.5
Energy Efficiency	10,581	1,280	0	6,500	0	0	2,801	15.73%	26,404	\$53,794.5
EE High Load	14,241	1,440	2,000	8,000	0	0	2,801	15.45%	29,320	\$61,040.0
EE Low Load	6,781	480	0	3,500	0	0	2,801	15.53%	23,488	\$47,384.1
EE Reduce Pen	10,700	1,280	0	7,500	0	0	1,920	15.36%	27,269	\$55,765.2
EE & Renew	10,359	1,760	0	5,000	0	798	2,801	15.95%	26,404	\$55,207.9
EE&R High Load	13,899	800	2,000	7,500	0	798	2,801	15.28%	29,320	\$62,365.1
EE&R Low Load	6,579	480	0	2,500	0	798	2,801	15.86%	23,488	\$48,992.6
EE&R Reduce Penetration	10,518	800	500	6,500	0	798	1,920	15.70%	27,269	\$57,130.8
CTs Only	11,200	11,200	0	0	0	0	0	15.34%	29,856	\$58,987.6
CTs Only High Load	14,880	14,880	0	0	0	0	0	15.18%	32,841	\$68,096.6
CTs Only Low Load	7,680	7,680	0	0	0	0	0	16.09%	26,870	\$50,737.5



Michigan's 21st Century Energy Plan

Policy Initiatives

- Central Station
- Renewable Energy options
- Energy Efficiency
 - Efficiency measures
 - Load management
- Distributed generation



Central Station

- Originally four Strawman proposals
- Utility files need assessment with Commission
 - Determines need for additional generating resources
 - Examines all resource types
 - Produces resource plan identifying resources needed
 - Adopts solicitation parameters and media
 - Results in Certificate or Pre-recognition of need and resource type



Central Station (Continued)

- Scope of utility filing
- Rate impact prior to operations
- Utility participation
- Competitive bidding
- Customer choice



Renewable and Alternative Energy Strawman Proposals

- Renewable Energy Portfolio
 - Scope of applicability
 - Mandatory or voluntary
 - Adjustment process
 - Qualifying options
 - Renewable Energy Credits
 - Statewide purchasing entity
- Distributed generation technologies policy: Tax credits, zoning issues, and distributed generation credits, standby rates, financial incentives, net metering limit



Energy Efficiency

- Permanent, long-term program
- Utility or third party delivery
- Scope of programming
- Cost recovery
- Revenue decoupling
- Relationship with renewable energy standards
- Building and appliance standards
- Demand response pilots



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