

Michigan's 21st Century Energy Plan

Assessing Michigan's Future Electric Energy Requirements

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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
 - Assess retirement of units 1-4 at Presque Isle
 - Further investigate resource options
 - Identify emerging technologies
- Develop a robust set of policy recommendations designed to implement Michigan's electric energy resource needs

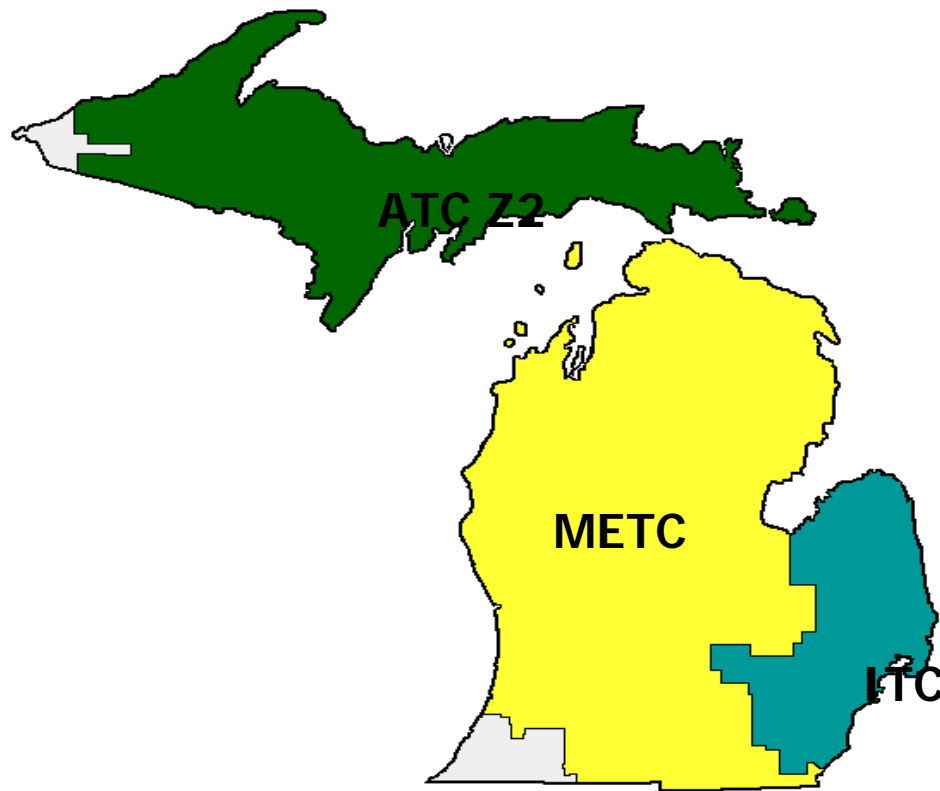


Assessing Resource Adequacy

- 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

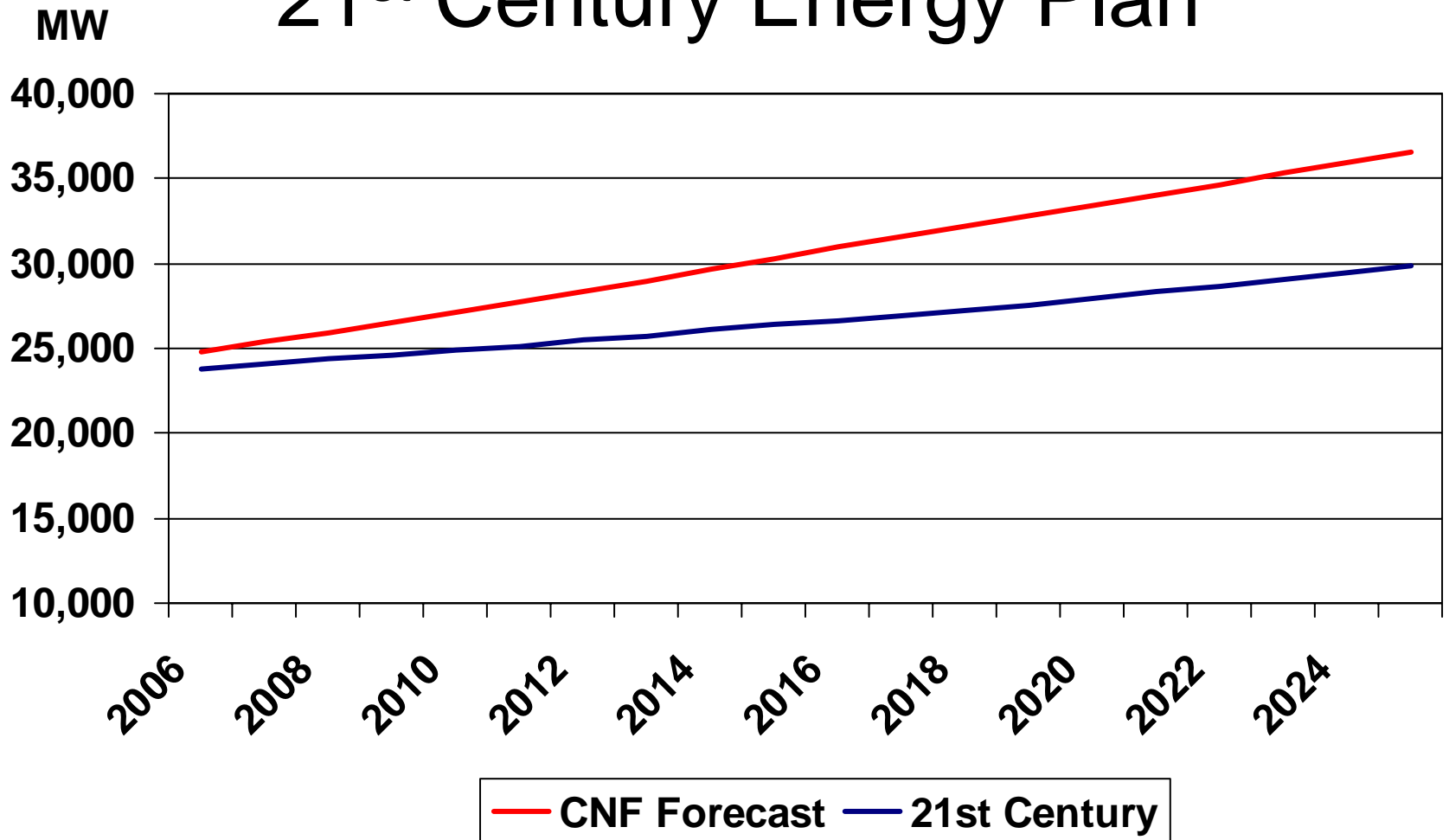


Michigan Electric Transmission Company Regions

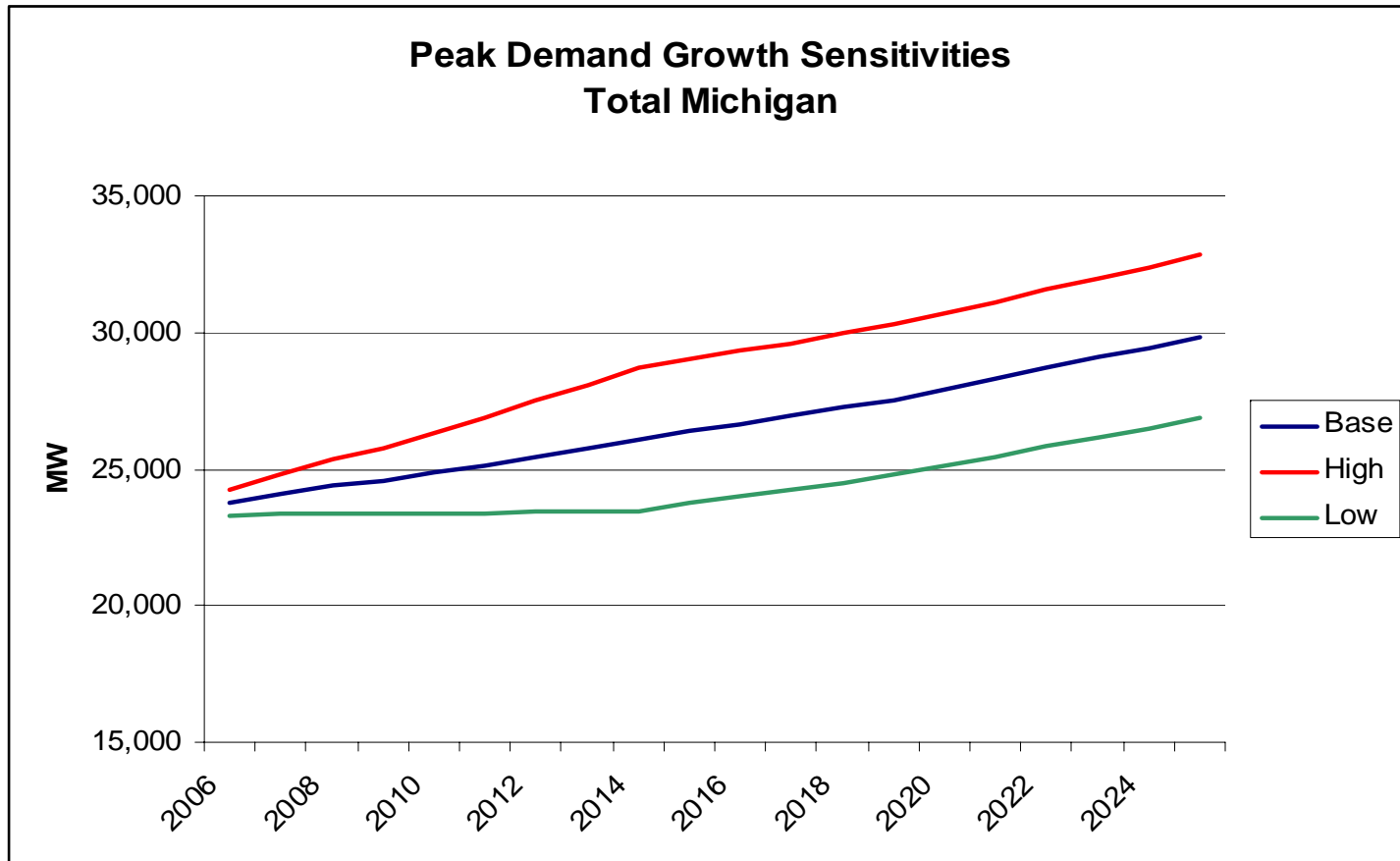


Comparative Demand Forecasts

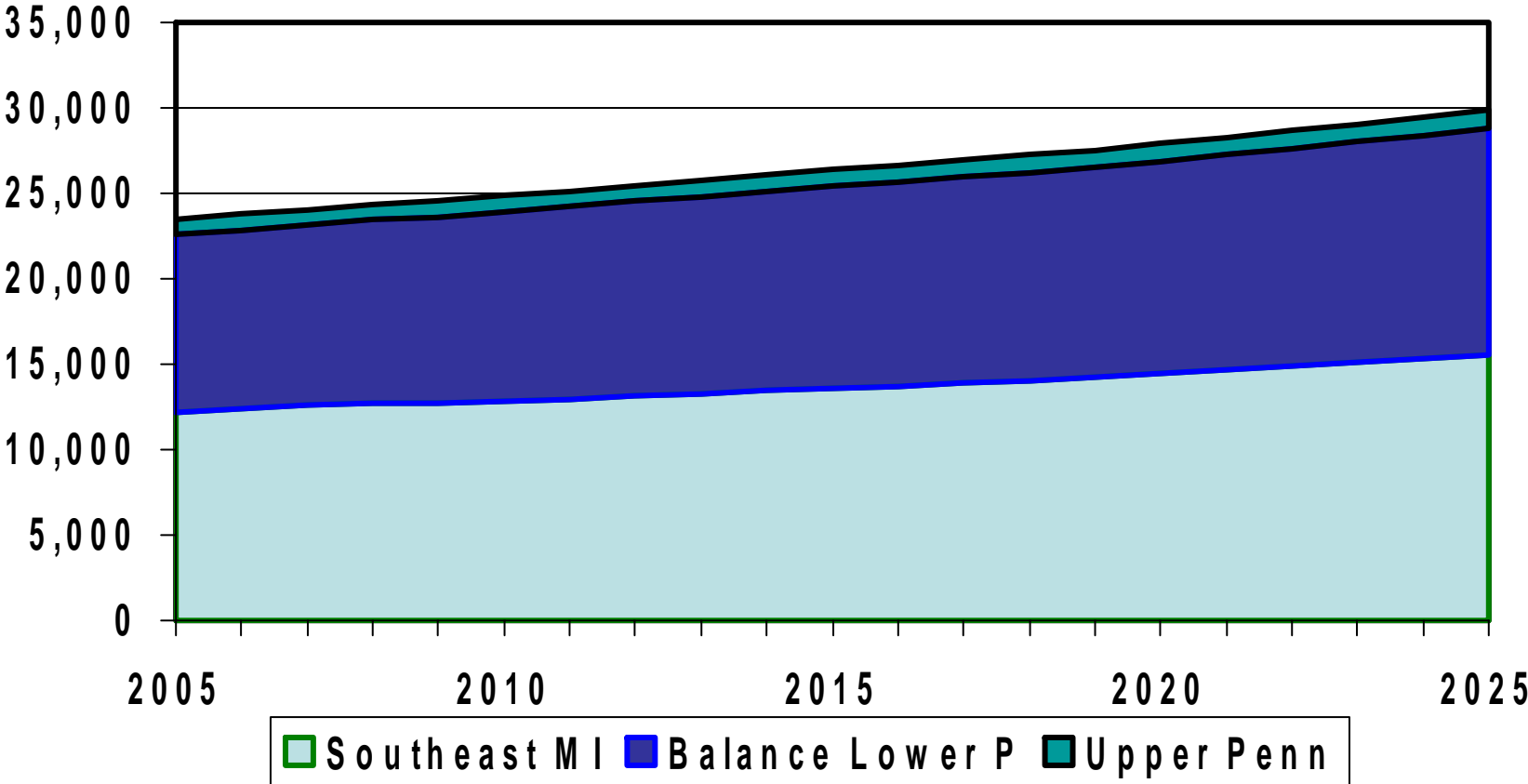
Michigan Total, CNF and 21st Century Energy Plan



Peak Demand Forecast Sensitivities

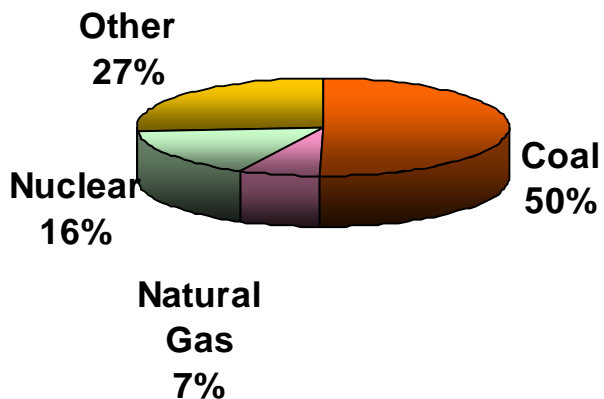


Michigan Demand Forecast by Region

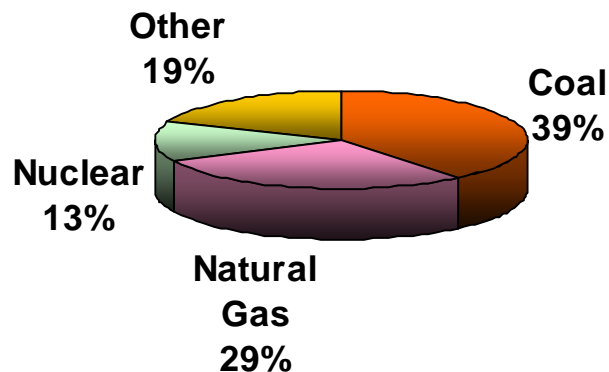


Michigan Electric Generation Capacity by Fuel Source

1990



2004



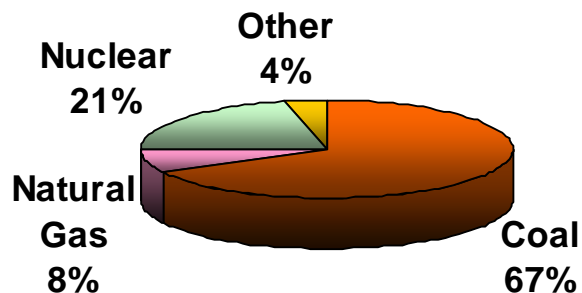
Gas up 22%, Coal down 11%

Source DOE EIA

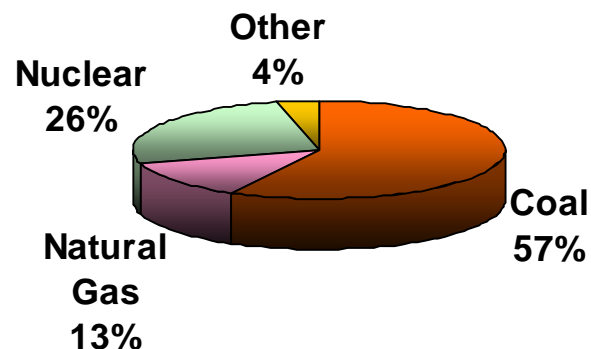


Michigan Electric Generation by Fuel Source

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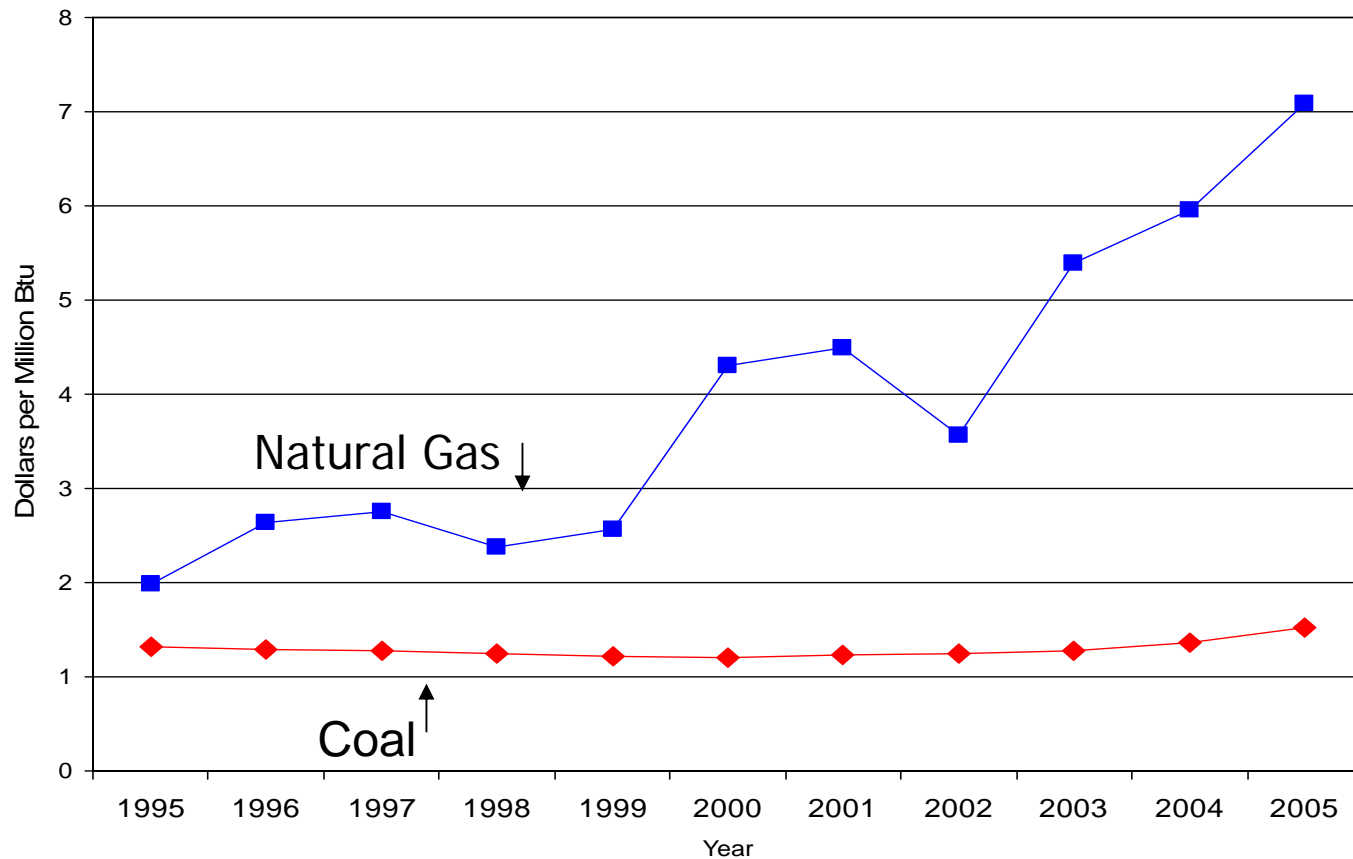


Gas and Nuclear up 5%, Coal down 10%

Source DOE EIA



Cost of Fossil-Fuels Receipts at Electric Generating Plants 1995-2005 yearly averages



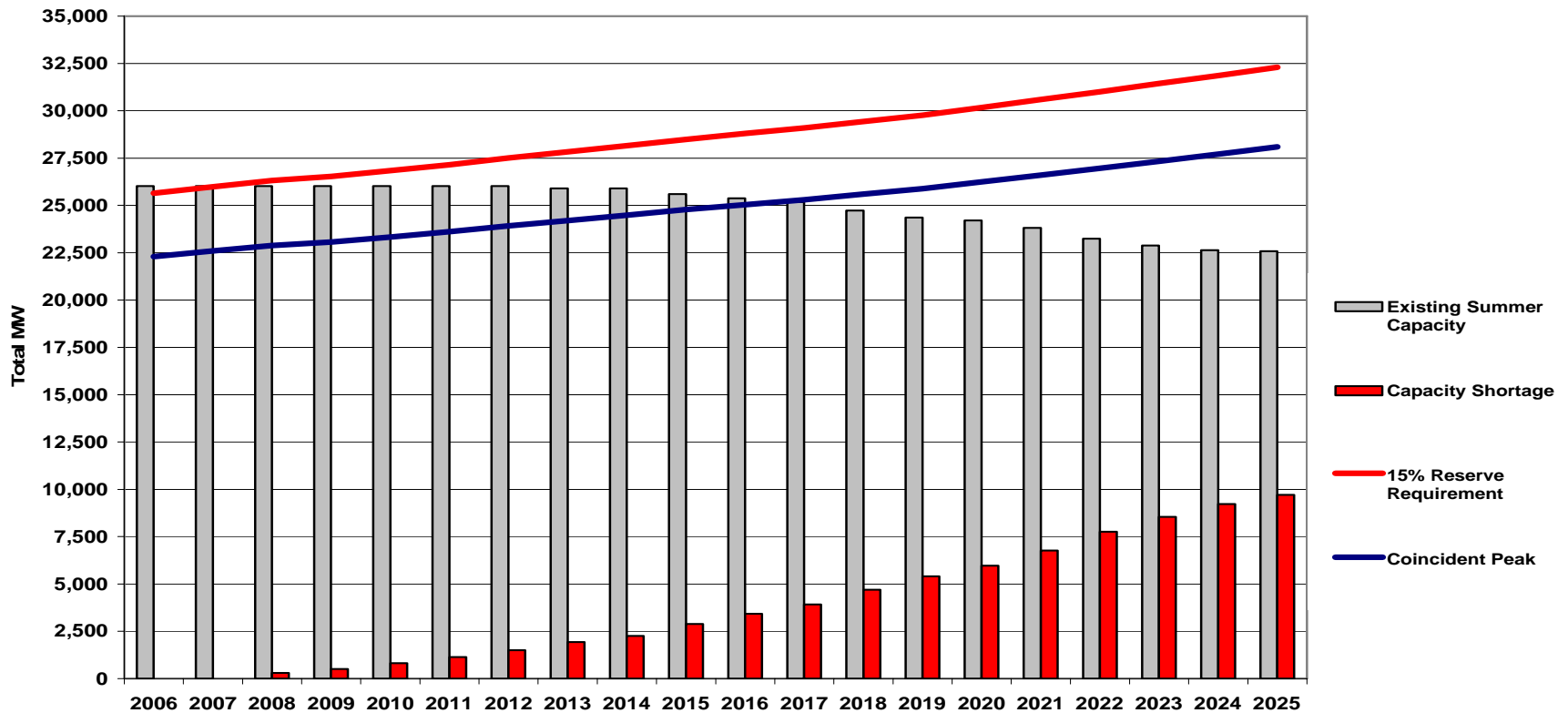
Transmission Capability Into Michigan

- Lower Peninsula total capability 3,000 MW for 2009
 - 0 MW flow to Ontario
 - 1,500 MW flow to Ontario
- Upper Peninsula
 - 2005 224 MW
 - 2006 300 MW
 - 2007 300 MW
 - 2008 325 MW
 - 2009 525 MW



Overview of Michigan Generating Resource Needs

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

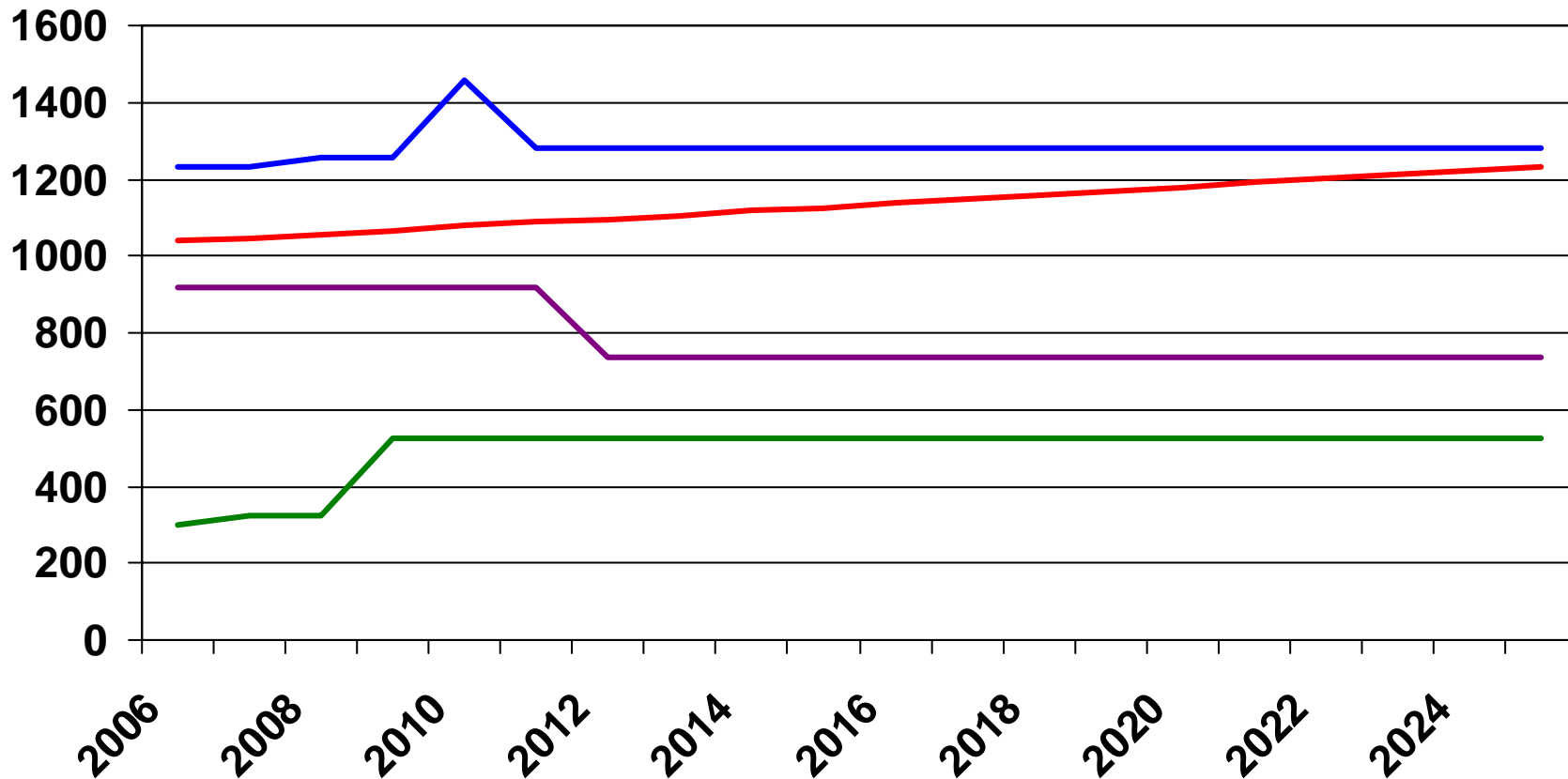


* Excludes Upper Peninsula



Upper Peninsula Capacity Summary

Presque Units 1-4 Retired in 2012



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
• U.P./CFB	150	1,766	80.69	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
Cellulosic Biomass	385	0.069
Total	1,123	



Energy Efficiency Program

- Aggressive energy efficiency savings
 - 2016
 - 8,474 Gwh's
 - 1,218 Mw's
 - 2026
 - 15,040 Gwh's
 - 2,128 Mw's
- Moderate Program
 - 2016
 - 4,952 Gwh's
 - 660 Mw's
 - 2026
 - 8,650 Gwh's
 - 1,211 Mw's
- Active load Management 569 Mw's
- Commercial Building Code 544 Mw's

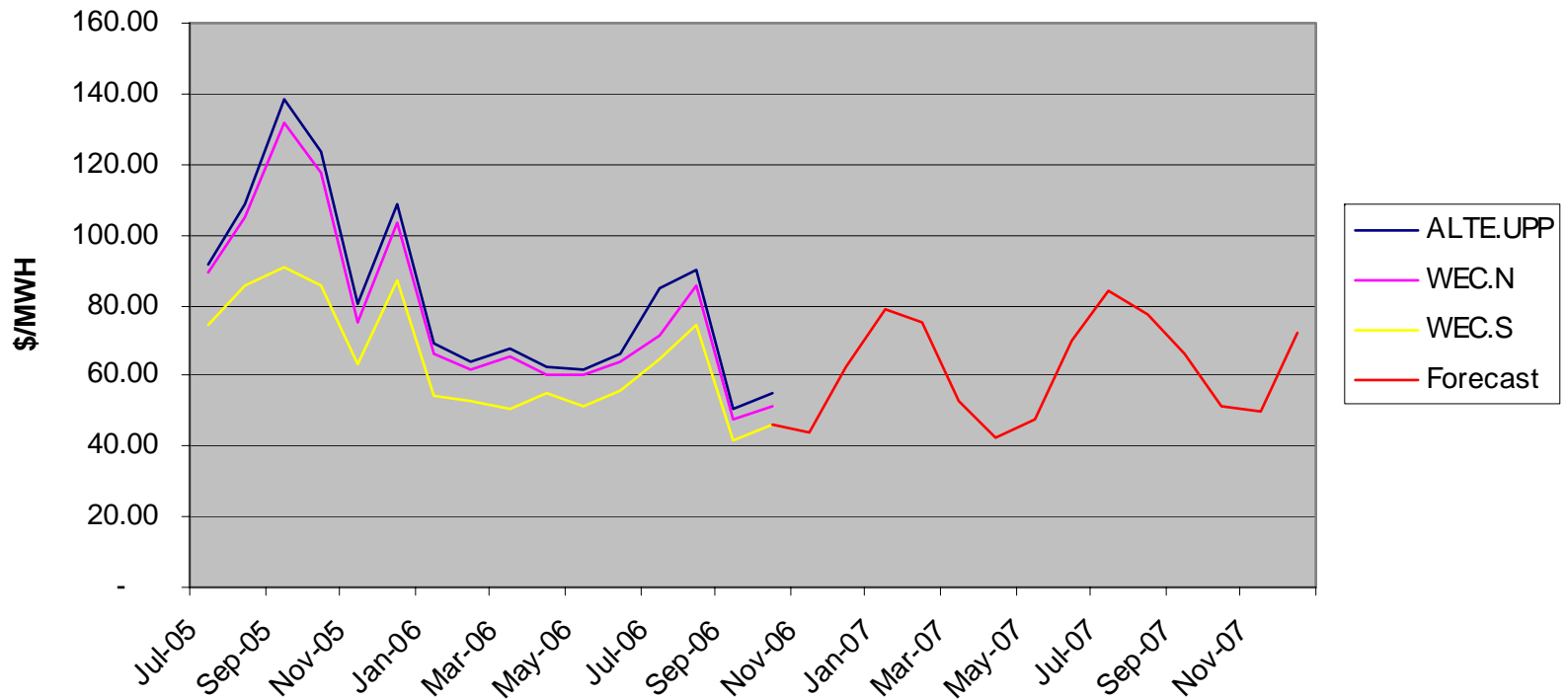


New Transmission Options

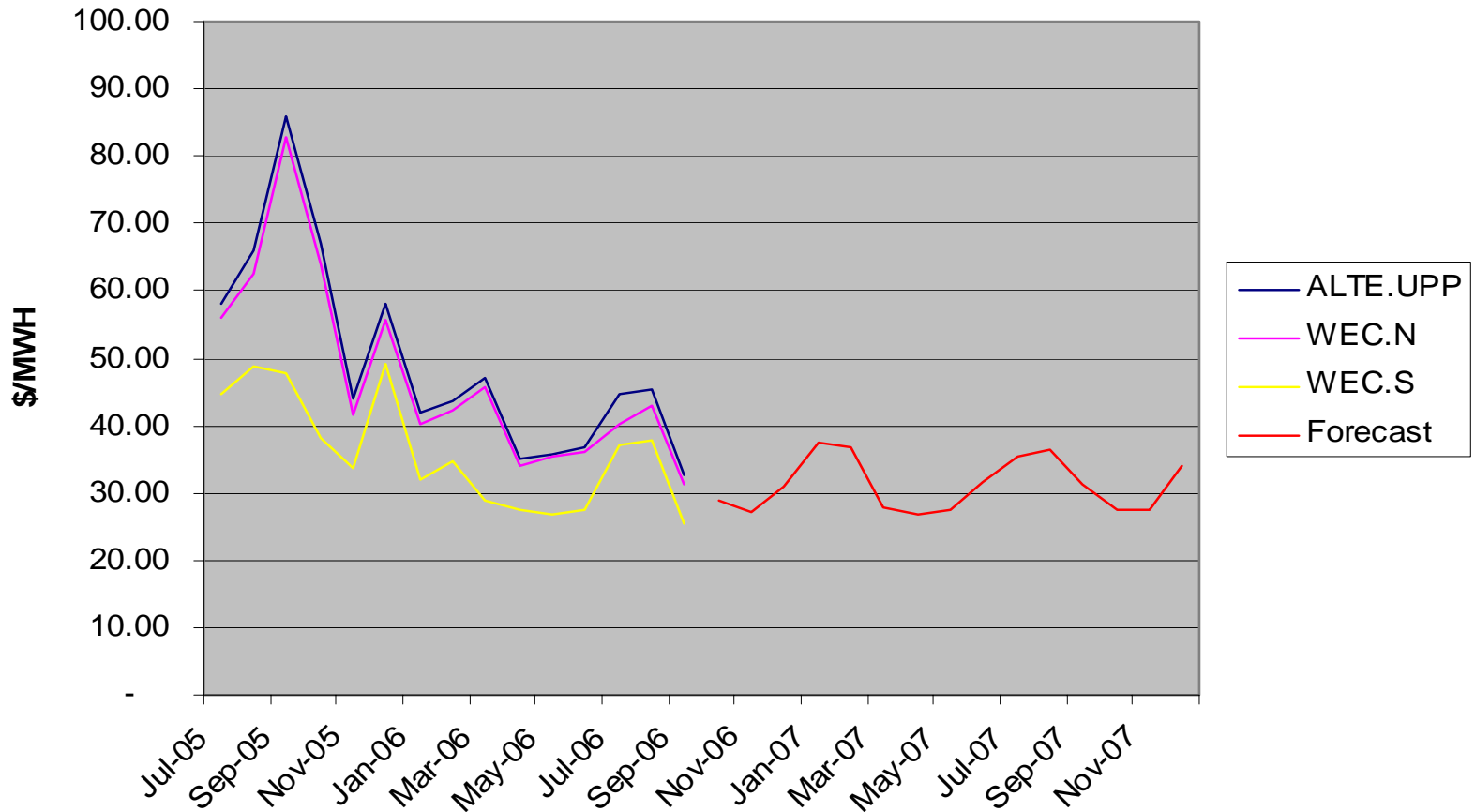
- TIER I Transmission upgrades into Lower Peninsula
 - 1,000 MW
 - \$100 Million
- TIER II Transmission upgrades into Lower Peninsula
 - 2,000 to 2,500 MW
 - \$800 Million (DC)



Upper Peninsula Market Price Forecast On-Peak Monthly Average

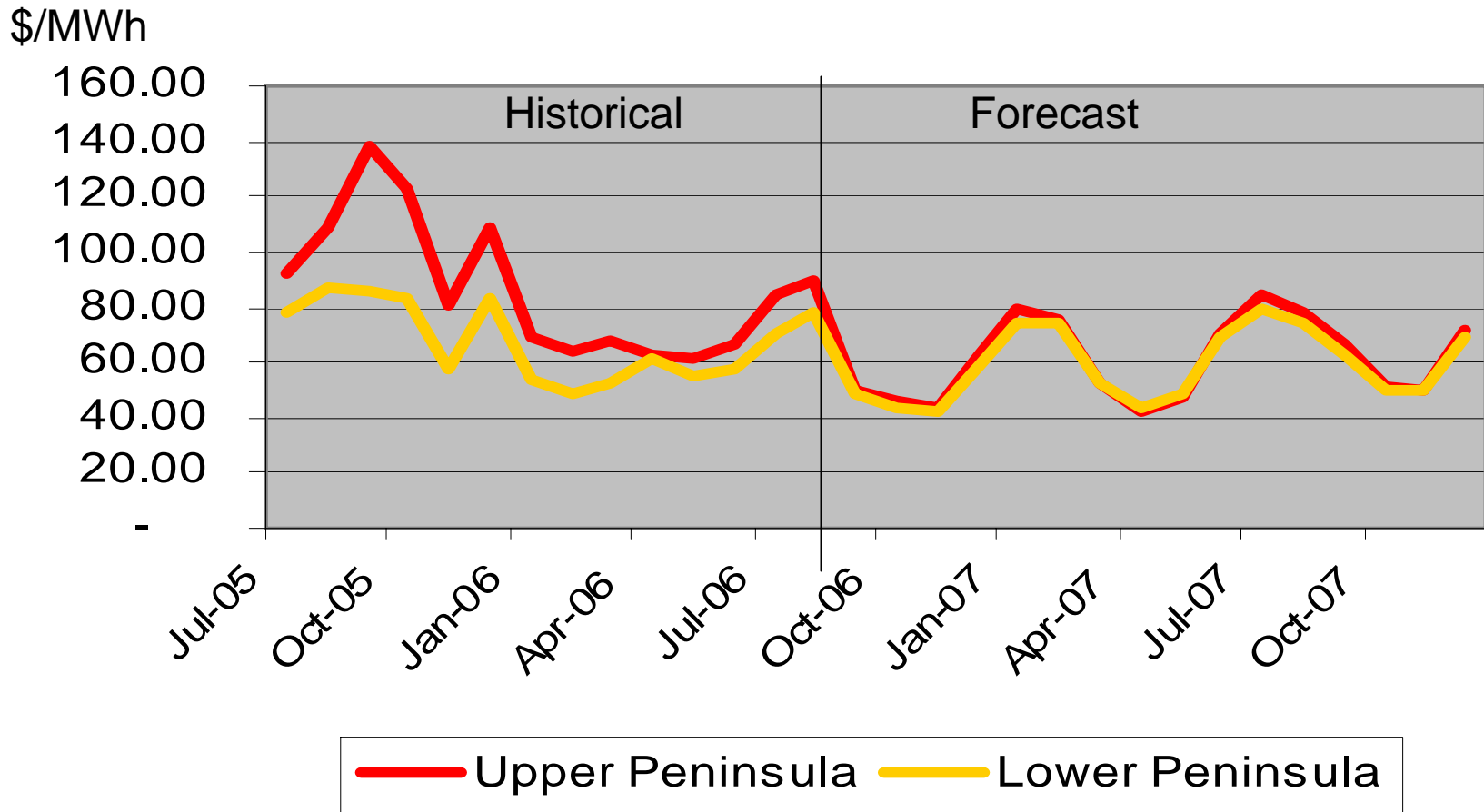


Upper Peninsula Market Price Forecast Off-Peak Monthly Average



On-Peak Market Price Forecasts

Monthly Average Prices



Planning Contingencies

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



Planning Scenarios

- Traditional Generation
- Greenhouse gas controls
- 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



Central Station Base Case Results

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



Emission Scenario Base Growth

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



Planning Results

- Reliability concerns continue to exist for Southeast Michigan in the 2009-2010 period
- Energy efficiency and renewable energy options can lower future power costs, eliminate the need for gas fired generation, and offset cost that may arise from greenhouse gas controls
- Upper Peninsula electric reliability dependent on completion of Northern Umbrella Project
- Numerous scenarios and sensitivities choose additional base load generation when the schedule permits construction
- Further study is needed on a major transmission expansion



Policy Initiatives

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



Traditional Generation Policy Issues

- Michigan's hybrid electricity market is unique
 - Allows customers choice of electric suppliers
 - Undermines revenue certainty needed for financing major base load generation
 - Opportunity to question need for new generating plant after it is built makes financing more difficult
- Participants have agreed on need for some changes in policy



Customer Choice Issues

- What obligation does a utility have to customers who leaves regulated service for a choice supplier and then wants to return to utility service?
- Can the utility build additional generation?
- Does a public utility need to competitively bid its need for additional capacity?
- Should rates be based on cost to serve each customer class?
- Should all electric suppliers be required to maintain the same level of electric reliability?



Renewable and Alternative Energy Strawman Proposals

- Renewable Energy Portfolio
 - Universal applicability
 - Mandatory standards
 - Periodic adjustment
 - Renewable options included conform to PA 141
 - Existing renewables count
 - Renewable Energy Credits
 - Rate impact limit
 - Statewide purchasing entity
- Tax credits, zoning issues, and distributed generation credits, standby rates, financial incentives



Energy Efficiency Issues

- 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



21st Century Energy Plan Website

<http://www.dleg.state.mi.us/mpsc/electric/capacity/energyplan/index.htm>



Michigan's 21st Century Energy Plan