Capacity Need Forum
June 23, 2005
Agenda

- PJM Capacity Markets
  - Jeff Bladen
  - Richard Mathias
- Work Group Updates
  - Central Station
  - Other Generation
  - Demand
  - Integration

Other Generation Resources Work Group

ChairmanDon Johns-- Michigan Independent Power Producers Assoc.
Mark Nida--MPSC Staff

Primary Objective:

Develop a series of supply curves or other representations that can be used to model the non traditional technologies deemed capable of providing significant generation resources over the next decade or less.

Expected Deliverables:

A set of equations and/or projections of supply that can realistically be expected to be made available I an economically feasible fashion at a given price or prices along with output and emissions characteristics

Other Generation Resources Work Group

Status Report:

- Major Work Completed
- Editing Final Work Group Report
- Validating Cost Estimates
- Working with NewEnergy to Put Data in A Compatible Format

Other Generation Resources Work Group

Technologies Chosen to be Modeled:

- Landfill Gas
- Anaerobic Digestion
- Onshore Wind
- Industrial/large commercial cogeneration at existing sites
- Other emerging technologies to be addressed in a narrative and perhaps included as an annual (small) increment to be added.

Other Generation Resources Work Group

- Preliminary Results:
- Landfill Gas: 79 MW existing with 70 MW current potential growing at 5% per year@ 7 cents per kWh. 90% capacity factor must run generation.
- . 90% capacity factor must run generation Farm Digestion: 52 MW potential @ 7 cents per kWh.
- Wind: 410 MW potential @ 7 cents per kWh or $1200 per kW. 25% average capacity factor.Assumes 50% of all class 4 or greater. 50 MW Shifted to SE Michigan.
- Cogeneration: Sites greater 100 MLbs per Hour. 1085 MW Potentially Available.

37 companies that have large (100,000+ lbs/steam/hr) boilers have the best potential to provide an estimated 1085 MW of potential CHP capacity. Capacity by sector is as follows:

Sector	%	Potential
Automotive/Transportation	43%	466 MW
Mining/Metal Forming	18%	193 MW
Pulp/Paper	15%	159 MW
Chemical/Pharmaceutical	10%	108 MW
Food Processing	9%	99 MW
Other	6%	59 MW

Assumed 50% is Developable for Modeling Purposes

Capacity factor calculations are difficult for wind generation because wind speed varies due to climatic conditions. The following capacity factors used by the workgroup are based on average wind speed at the Muskegon Airport:

Month	Weighted Average Wind speed	On-peak Wind speed	Off-peak Wind speed	On-peak Cap. Factor	Off-peak Cap. Factor	Weighted Capacity Factor
January	8.52	8.68	8.19	45.66	37.44	41.55
February	8.21	8.47	7.70	42.42	31.11	36.77
March	7.61	8.06	6.72	36.56	20.68	28.62
April	7.60	8.00	6.81	35.75	21.52	28.63
May	7.34	7.99	6.05	35.61	15.09	25.35
June	6.42	7.18	4.92	25.84	8.12	13.98
July	5.94	6.73	4.37	21.28	5.69	13.48
August	5.59	6.35	4.05	17.88	4.53	11.20
Sept.	6.63	7.17	5.55	25.73	11.65	18.69
October	6.57	6.84	6.03	22.34	14.94	18.64
Nov.	7.67	8.01	6.98	35.88	23.18	29.53
Dec.	7.69	7.86	7.36	33.90	27.17	30.54

Production Plant Estimated Costs

Technology	Size (Mw's)	Construction Cost $/Kw	Fixed O&M $/Kw	Variable O&M $/Mwh	Heat Rate BTU/kwh
Pulverized Coal Sub-critical	500	1,370	42.97	1.80	9,496
Pulverized Coal Supercritical	500	1,437	43.60	1.70	8,864
Fluidized Bed	300	1,505	44.77	4.24	9,996
IGCC	550	1,647	59.52	0.95	9,000
IGCC - PRB	550	1,845	59.52	0.95	10,080
Nuclear	1,000	2,180	67.90	0.53	10,400
Combined Cycle	500	467	5.41	2.12	7,200
Combustion Turbine	160	375	2.12	3.71	10,450

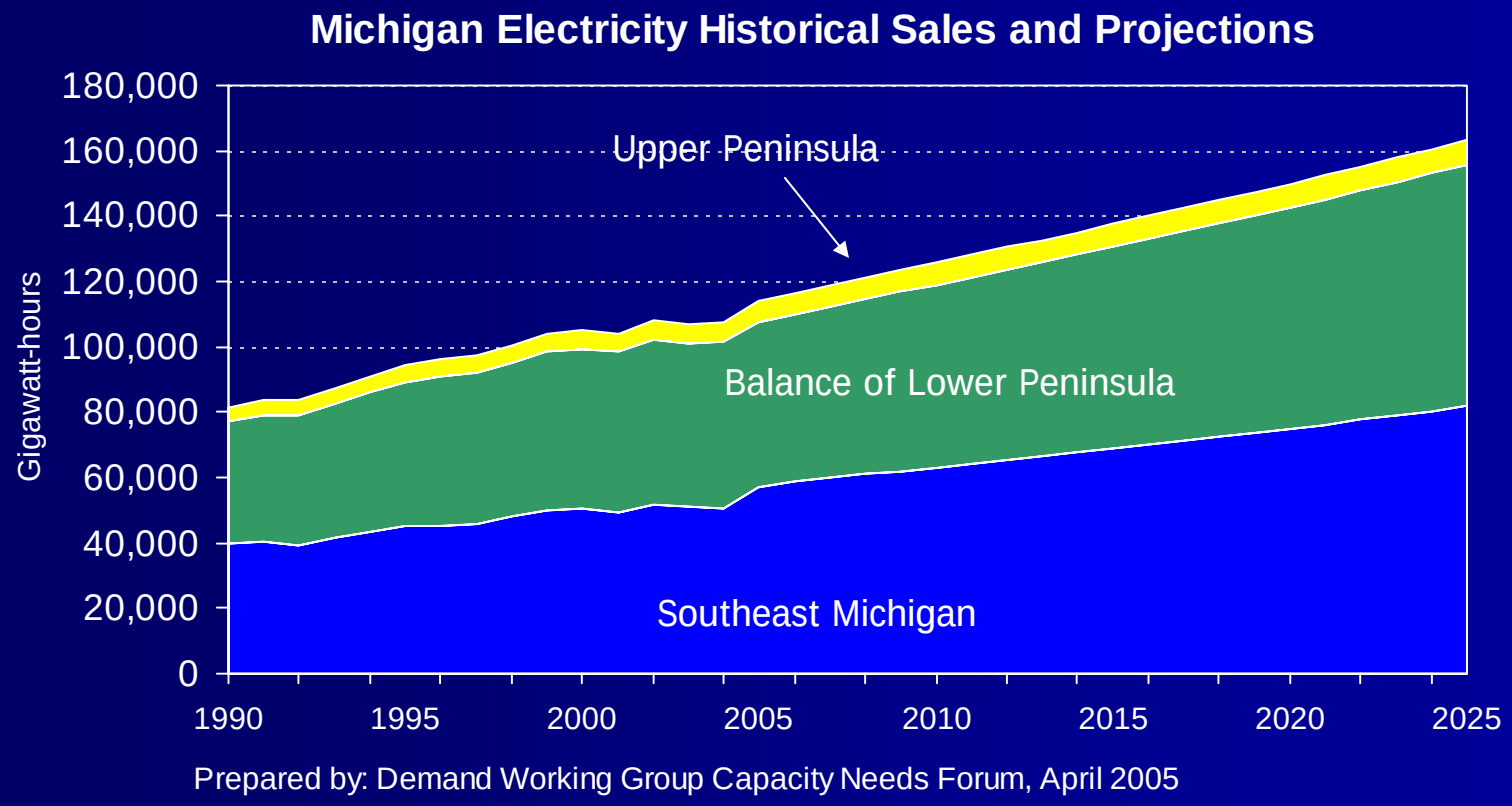
Estimated Busbar Cost

Technology	Fuel Cost $/MMBTU	Capacity Factor	Dispatch Cost $/Mwh	Fixed Costs (Cap+O&M)	Busbar Cost ($/Mwh)
Pulverized Coal Sub-critical	1.25	85%	13.67	27.85	41.53
Pulverized Coal Supercirtical	1.25	85%	12.78	29.01	41.79
Fluidized Bed	1.25	85%	16.74	30.27	47.01
IGCC IGCC-PRB	2.75 1.25	80% 80%	25.70 13.55	36.70 40.08	62.40 53.63
Nuclear	.50	90%	6.23	41.79	48.02
Combined Cycle	6.00	45%	45.32	15.58	60.90
Combustion Turbine	6.00	5%	66.41	107.58	174.00

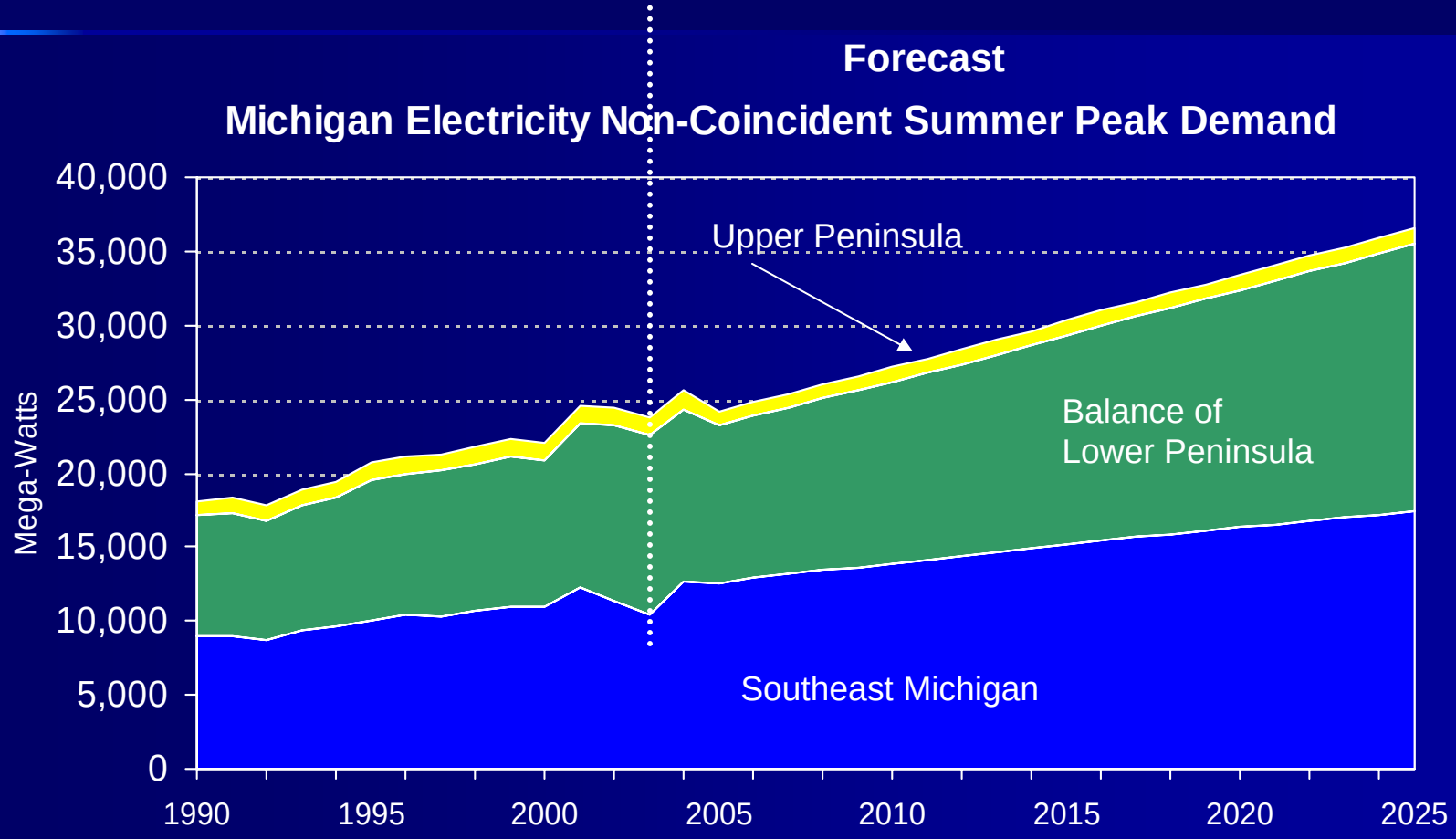
Estimated Emissions by Technology (# / MMBTU)

Technology	SO2	NOx	Particulates	Hg	CO2
Pulverized Coal Sub-critical	.10	.03	.015		200
Pulverized Coal Supercritical	.10	.03	.015		200
Fluidized Bed	.02	.10	.015		
IGCC	.05	.05	.01		
Nuclear	0	0	0	0	0
Combined Cycle	.001	.03	0	0	120
Combustion Turbine	.001	.03	0	0	0

Michigan Sales Forecast by Region



Michigan Demand Forecast by Region



Prepared by: Demand Working Group Capacity Needs Forum, April 2005

Estimated Michigan Energy Efficiency Savings

Year	Percent of Total Sales
2006	.86
2007	1.15
2008	1.44
2009	1.73
2010	2.03
2011	2.27
2012	2.52
2013	2.77
2014	3.02
2015	3.26
2016	3.51
2017	3.87
2018	4.23
2019	4.59
2020	4.95

MARELI Model Results

- Updated Forecast
- Transmission Results

Preliminary stand-alone LOLP

- METC – 0.38 days/year **(previously 0.73)**
- ITC – 32.3 days/year **(previously 36.61)**
- MECS – 5.17 days/year **(previously 6.3)**
- ATC zone2 – 289 days/year
- Note:
  - **Revised values are after forced outage rate (FOR) changes were made to Consumers and DTE data**
  - **One of the PJM muni/co-op was**
  - **included in Lower Peninsula forecasts. Values presented reflect *updated forecasts*.**

Stand Alone system - Summary

STAND ALONE SYSTEM						
			Sensitivity Cases			
	BaseCase		High Growth		Low Growth	
	LOLP	Support (MW)	LOLP	Support (MW)	LOLP	Support (MW)
METC	0.4	450	1.6	1000	0.1	(-) 100
ITC	32.3	> 1000	49.8	> 1000	20.5	> 1000
MECS	5.2	> 1000	11.6	> 1000	1.8	> 1000
ATC zone2	289.1	315	338.6	355	204.3	275

Note: A negative sign for “support” indicates the capacity a given area can export before reaching the criteria limit.

Notes for “with support” values

- The import values correspond to May 10 results on the T&D web page (previous presentations pointed to March results)
- Only “prevailing limits” were considered
- Both Phase Shifter positions (0 MW and 1500 MW) were considered

"With Support" system – Summary
(IESO Phase Shifter Flow = 0 MW)

IESO Phase Shifter Flow = 0 MW								
			BaseCase		High Growth		Low Growth	
	Imports	Import		Additional Imports		Additional Imports		Additional Imports
Sink	From	Value	LOLP	Needed	LOLP	Needed	LOLP	Needed
ITC	MAIN	3000	0.69	880	2.2	1540	0.16	None
	TVA	2800	1.03	1050	3.03	1700	0.26	400
	VACAR	2700	1.24	1100	3.55	1800	0.33	450
	MAAC	2500	1.76	1350	4.75	1980	0.51	630
	ALL	2800	1.03	1050	3.03	1700	0.26	400
METC	MAIN	3800	0	(-) 3360	0	(-) 2800	N/A	
	TVA	3500	0	(-) 2645	0	(-) 2375	N/A	
	VACAR	3250	0	(-) 3720	0	(-) 2160	N/A	
	MAAC	3000	0	(-) 2530	0	(-) 1980	N/A	
	ALL	3500	0	(-) 2645	0	(-) 2375	N/A	
MECS	MAIN	3250	0.13	120	0.8	1440	0	(-) 1200
	TVA	3000	0.2	440	1.03	1540	0	(-) 880
	VACAR	3000	0.2	440	1.03	1540	0	(-) 880
	MAAC	2800	0.28	630	1.24	1890	0	(-) 630
	ALL	3000	0.2	440	1.03	1540	0	(-) 880

Note: A negative sign for "Additional Imports Needed" indicates the capacity a given area can export before reaching the criteria limit.

"With Support" system – Summary
(IESO Phase Shifter Flow = 1500 MW)

IESO Phase Shifter Flow = 1500 MW								
			BaseCase		High Growth		Low Growth	
	Imports	Import		Additional Imports		Additional Imports		Additional Imports
Sink	From	Value	LOLP	Needed	LOLP	Needed	LOLP	Needed
ITC	MAIN	1750	5.62	2080	11.33	2700	2.14	1430
	TVA	1750	same as above					
	VACAR	1500	7.63	2145	14.33	> 2200	3.22	1650
	MAAC	1500	same as above					
	ALL	1500						
METC	MAIN	1000	0.02	(-) 560	0.13	70	0	(-) 1120
	TVA	1000	same as above					
	VACAR	1000						
	MAAC	1000						
	ALL	1000						
MECS	MAIN	1500	1.33	1870	3.9	> 2200	0.3	660
	TVA	1500	same as above					
	VACAR	1500						
	MAAC	1250	1.68	1800	4.87	> 1800	0.43	900
	ALL	1250	same as above					

Note: A negative sign for "Additional Imports Needed" indicates the capacity a given area can export before reaching the criteria limit.

Integration Work Group

Scenarios

Capacity Need Forum Proposed Integration Scenarios

Traditional Power	Emissions	Energy Conservation	Non-Traditional
Assume Clean Air Interstate Rule and Clean Air Mercury Rule for environmental regulations.	Mercury cap is raised to 85% from 1999 baseline emissions in 2018. Carbon tax at $30 per ton carbon in 2010.	Energy conservation portfolio wired in. Maybe replace some CT's with a demand control option (not specified at this time who would develop program).	Mandated Renewable Portfolio Standard of 3% by 2008, 5% by 2010 and 7% by 2015. Additional capacity need will be filled from CT's and IGCC.

Resource Units				
PC Unit		X	X	
CT Unit	X	X	X	X
GCC Unit	X			
IGCC Unit	X		X	X
IGCC C Seq.		X		
Nuclear Unit	X	X	X	X
Waste Energy			X	X
Wind Generation		X	X	X
Cogeneration		X		X
Energy Conservation			X	
Sensitivities				
High Load		X	X	X
Low Load		X		X
High Gas Cost		X	X	X
Max Import 1(4,500)		X		X
Restricted Import (2,000)		X	X	X
Non-Traditional with PC				X
Assumptions				
Normal price driven energy Conservation	X	X	X	
Carbon tax ($10.00=2010-$30.00=2018)			X	
95% Mercury Emissions Removal			X	
IGCC has CO2 sequestering			X	
Max energy conservation options			X	
Demand Control replaces CT			X	
Maximum waste to energy				X
Maximum Cogeneration				X
Wind Energy 2 times assumed				X
Assumed Transfer **Capability (Normal)**	**3,000-3,500**	**3,000-3,5000**	**3,000-3,500**	**3,000-3,500**

1) Capacity pricing would be based on 1/2 CT
2) and 1/2 combined cycle. Energy Pricing would be based on New Energy estimates.