

# ***Building A New Generation of Power***

***Engineering Society of Detroit  
September 10, 2009***

***Jack Hanson  
Vice President  
Generation Engineering Services***



## Growing demand

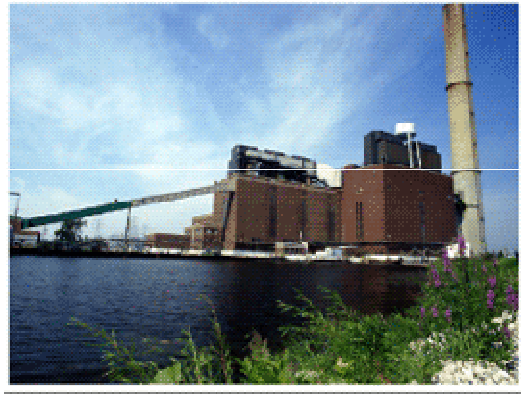
- Average customer using 8 percent more in the last ten years



Photo courtesy of General Motors

## Aging fleet

- Average age is 50 years old



## Cost of imported power

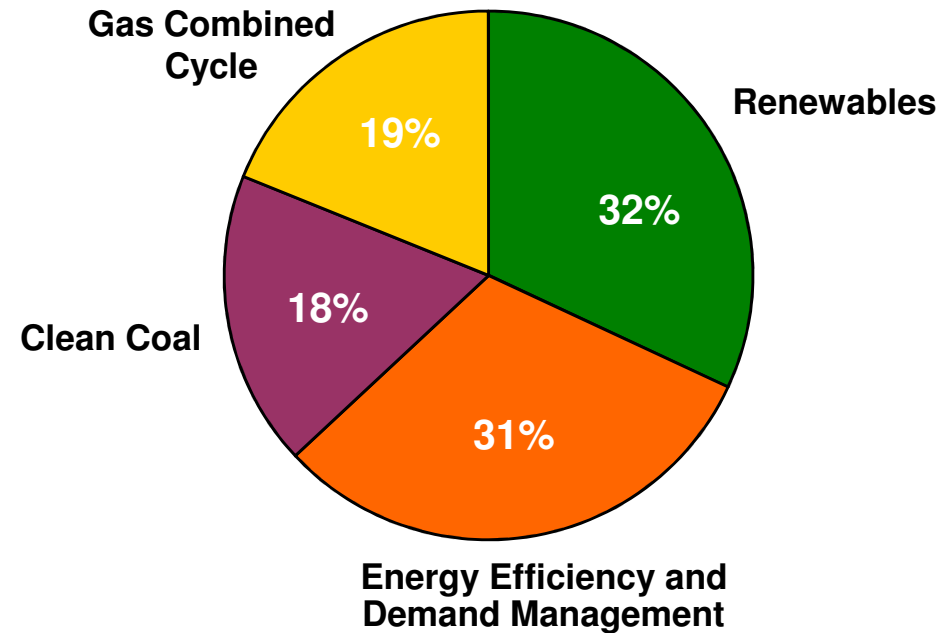
- Imported power means exported jobs



- **No one single correct answer (no silver bullet)**
  
- **Key is to have a balanced portfolio to minimize risk**
  - **Most efficient way to meet customer's needs is by developing the lowest cost options of a number of different technologies.**
    - ◆ **Law of diminishing returns**
    - ◆ **Gain some experience with new technologies without betting the farm**
    - ◆ **Give technologies time to develop both technically and commercially**
  
- **Consumers Energy's answer is the Balanced Energy Initiative**

- Extensive analysis of alternatives and risks
- Diverse and balanced plan
- Meets 10 percent renewable portfolio standard by 2015
- Over 900 MW of renewable capacity additions by 2018
- Meets energy efficiency target of 5.5 percent by 2015
- Includes demand management programs
- Purchase of natural gas plant in 2007
- Build new clean coal facility

## New Capacity 2008 - 2018



- **Renewables**

- **Significant cost premium**
- **Solar extremely costly in Michigan due to high latitude and persistent cloud cover**
- **Wind**
  - ◆ **More costly than traditional sources**
  - ◆ **Transmission cost and siting issues are significant**
  - ◆ **Impacts on birds and other animals not totally defined**
  - ◆ **Noise and light flicker potential impact on humans**
- **Reasonable to do on limited basis**
  - ◆ **Gain experience with technology and environmental and system impacts**
  - ◆ **If over done has potential to impact competitiveness of State economy**
- **Land fill gas, anerobic digestion, small hydro**
  - ◆ **More competitive cost wise**
  - ◆ **Limited potential capacity**

- **Cost competitive to a certain level**
  - Law of diminishing returns
  - Cannot save your way to zero
  - Requires behavior changes and personal investment even with subsidies
  - Uncertainty around what levels can be achieved cost effectively
  
- **Energy Efficiency and Demand Management needs to be an important element of any energy strategy.**
  - New energy legislation set reasonable targets and timeframes for energy efficiency

- **Nuclear generation is a well developed and technically sound technology**
- **Advantages**
  - **Reliable base load generation**
  - **Low fuel cost**
  - **No CO<sub>2</sub> emissions**
  - **Waste can be reprocessed to produce more fuel**
- **Disadvantages**
  - **High capital cost (A new 1500MW nuclear plant could run around \$12B)**
  - **Undemonstrated and highly uncertain licensing process**
  - **Well established anti-nuclear community**
  - **No long term solution to nuclear waste disposition in place today**
- **Construction of a new nuclear plant in today's regulatory, legal and political environment has significant risks**

# ***Clean Coal Technology Investment***

- **Baseload generation needed to meet customers needs for low cost, reliable energy.**
- **Michigan Public Service Commission's 21st Century Energy Plan calls for new baseload coal generating plants**
- **Why Coal?**



- **Coal will continue to be a significant factor in U.S. power generation**
  - **Energy security, reliability, and affordability**
- **Important component of a balanced resource portfolio**
  - **Fuel diversity and risk management**
- **Replaces old less efficient plants**
- **Reduces coal generation costs and emissions**
  - **State-of-the art technology**
- **Potential for carbon capture and sequestration (CCS)**
- **Avoids natural gas volatility**

# ***Proposed New Clean Coal Facility***

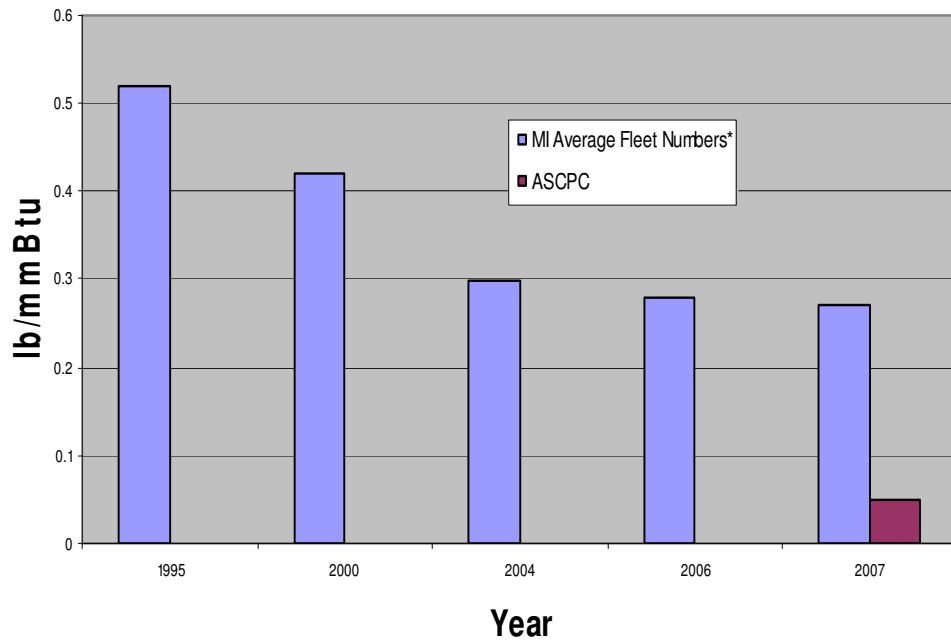
- **Consumers Energy chose Advanced SuperCritical Pulverised Coal (ASCPC) technology as its best baseload alternative.**
- **ASCPC pushes the technology to the limits of well demonstrated metallurgical performance.**
  - **Achieves highest efficiency without the risks of relying on undemonstrated exotic alloys as required for Ultra-Supercritical units.**

# ***Why Advanced Supercritical Technology?***

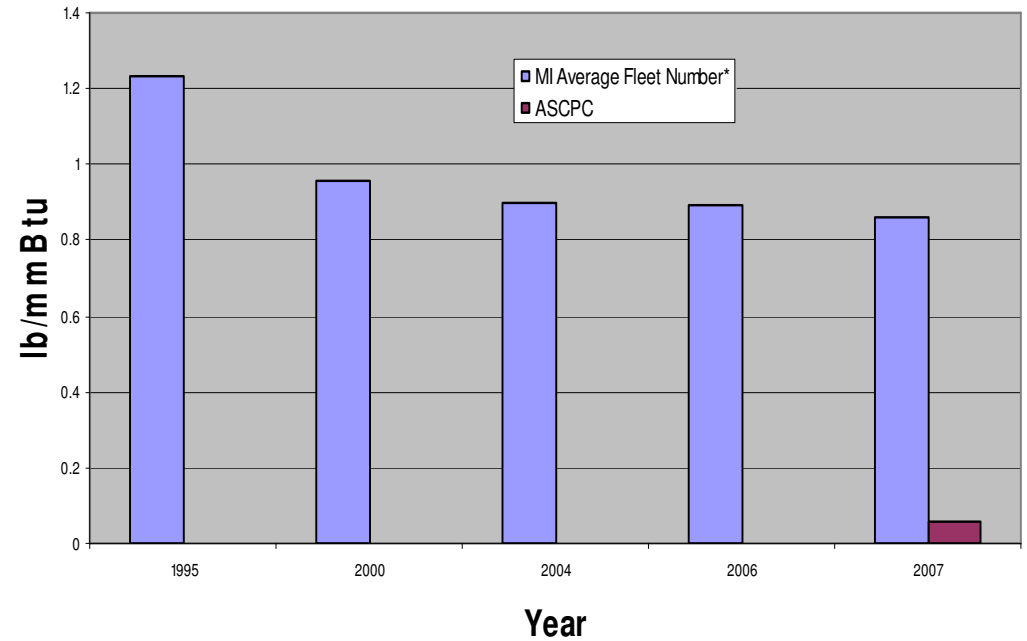
- **Advanced supercritical pulverized coal (ASCPC) technology is proven**
  - **More than 400 SCPC plants operating worldwide, including more than 25 with the advanced SCPC technology**
- **ASCPC systems operate at higher temperatures and steam pressures**
  - **1100/1100 F and 3800 psig**
  - **Higher efficiency means:**
    - ◆ **Lower emissions per MWh generated, including CO<sub>2</sub>**
    - ◆ **Lower fuel costs per MWh generated**
- **CE's decision to use ASCPC consistent with statewide modeling used in 21st Century Energy Plan**

# New Unit vs. Average Michigan Fleet Emissions

New Unit vs Avg. MI NOx Emissions



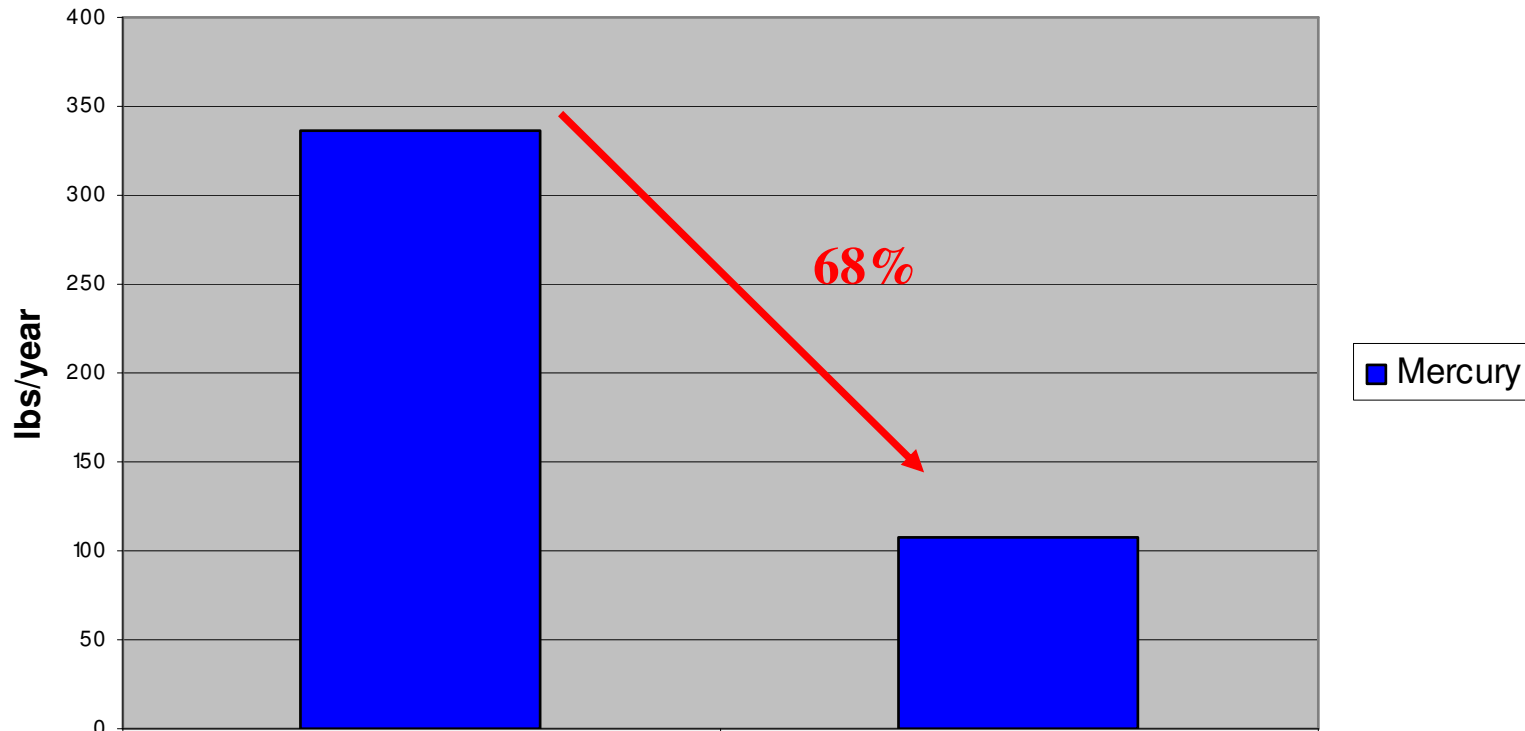
New Unit vs. Avg. MI SO<sub>2</sub> Emissions



\*MI fleet emissions taken from EPA Clean Air Markets database for acid rain reporting. This includes all sources subject to the acid rain program including natural gas and oil. Comparisons are based on gross MW output

# Mercury: Karn/Weadock Site-Wide Comparison

**Karn/Weadock Site Mercury Emissions - approx. 68% Reduction with New Unit in Operation**



- 1999 is the baseline reference year for the draft new Michigan Mercury Rule
- 1999 data source: EPA 1991 ICR Data
- Assumes approximately 90% control on all units accomplished by 2015

# *Clean Coal Technology Plant Economic Impact*

- **Jobs created**
  - **Construction:** Nearly 1,800 at peak direct and over 2,000 in-direct
  - **Operating:** About 130 direct, several hundred in-direct
- **Economic impact (w/multiplier)**
  - **Statewide construction** – \$1.2 billion\*
  - **Statewide operating (typical year)** – \$68 million
  - **Bay Region construction** – \$500 million
  - **Bay Region operating (typical year)** – \$46 million
- **Annual Tax revenue**
  - **State sales (construction):** \$10 million
  - **State education (operating)** \$6 million per year
  - **Local property:** \$10.5 million per year



\*Reported in 2007 dollars

\*\*Consumers Energy received a local property tax abatement from Hampton Township through 2028

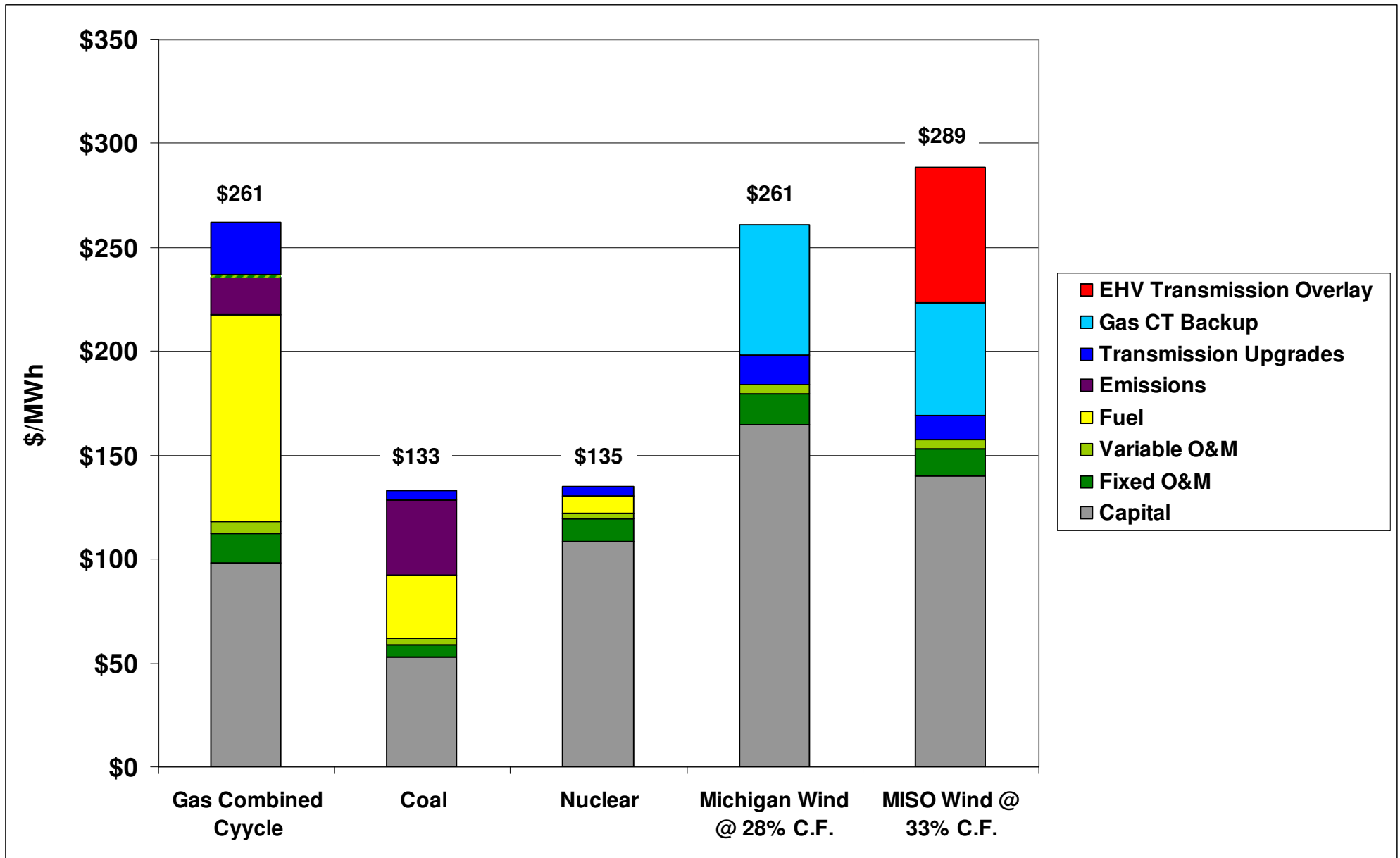
# Technology Cost Comparison



Fuel	Straight Cost	Other Cost Factors
Coal	\$97/MWh	\$133/MWh CO <sub>2</sub> included
Natural Gas	\$243/MWh	\$267/MWh CO <sub>2</sub> included
Wind	\$198/ MWh	\$258/MWh CT backup
Solar	\$650/MWh-R* \$450/MWh-C*	NA
Nuclear	\$105/MWh	\$135/MWh (High End Costs)

\*R=Residential; C=Commercial

# Generation Bus-Bar Costs



- State needs new power supplies including renewable and base-load along with energy-efficiency and demand management programs
- Clean coal plant investment will result in significant economic impact including direct and in-direct jobs



# Building a New Generation of Power for Michigan

**Consumers Energy**



800 Megawatt  
Advanced Supercritical  
Clean Coal Power  
Generation Facility

