Developing a Plan to Accelerate Plug-in Electric Vehicle Deployment in Michigan

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Readying Michigan to Make Good Energy Decisions
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Crystal Mountain Background Information

- 1500 acre four-season resort near Traverse City
- >350,000 drive-to customer visits each year
- 500 employees in Summer, >600 employees in winter
- $1.3 Million in annual direct energy consumption
- >>$5 Million in annual operating supply expenses
- $2.2 Million in annual capital purchases (CAPEX)
- Fuels used - electricity, LP gas, Diesel fuel, gasoline
- Level II PEV charging stations on site

Energy Related Business Risks

- Direct
  - Electricity and liquid fuel cost increases reduce profits and capital available for re-investment
  - Supply reliability and security
- Indirect
  - Increasing petroleum prices flow-through from suppliers and increase the cost of capital purchases and operating supplies.
  - Customer energy cost increases (primarily motor gasoline) reduce disposable income for discretionary purchases such as a resort vacation.
  - Suppler and customer energy reliability and security
  - Climate Change

Energy and the Economy

- Thermodynamics is a natural law that governs the relationship between heat, work and energy
- It says that in order to manufacture something, or transport people and freight we must consume energy
- Energy consumed doing “work” causes economic growth, not the converse
- Energy is a limiting factor for economic growth.

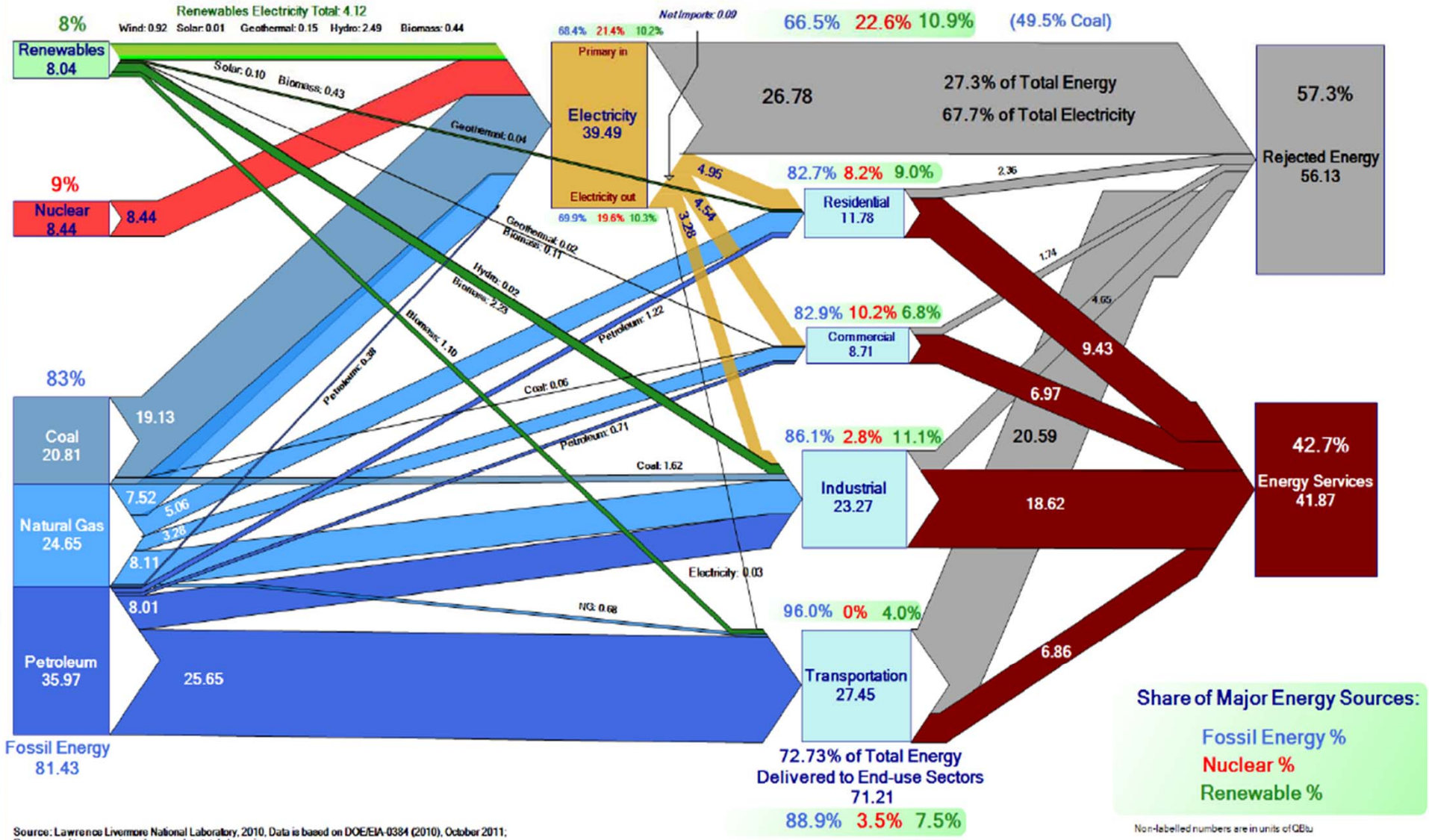
(1)

Our High Dependency on Liquid Fuels

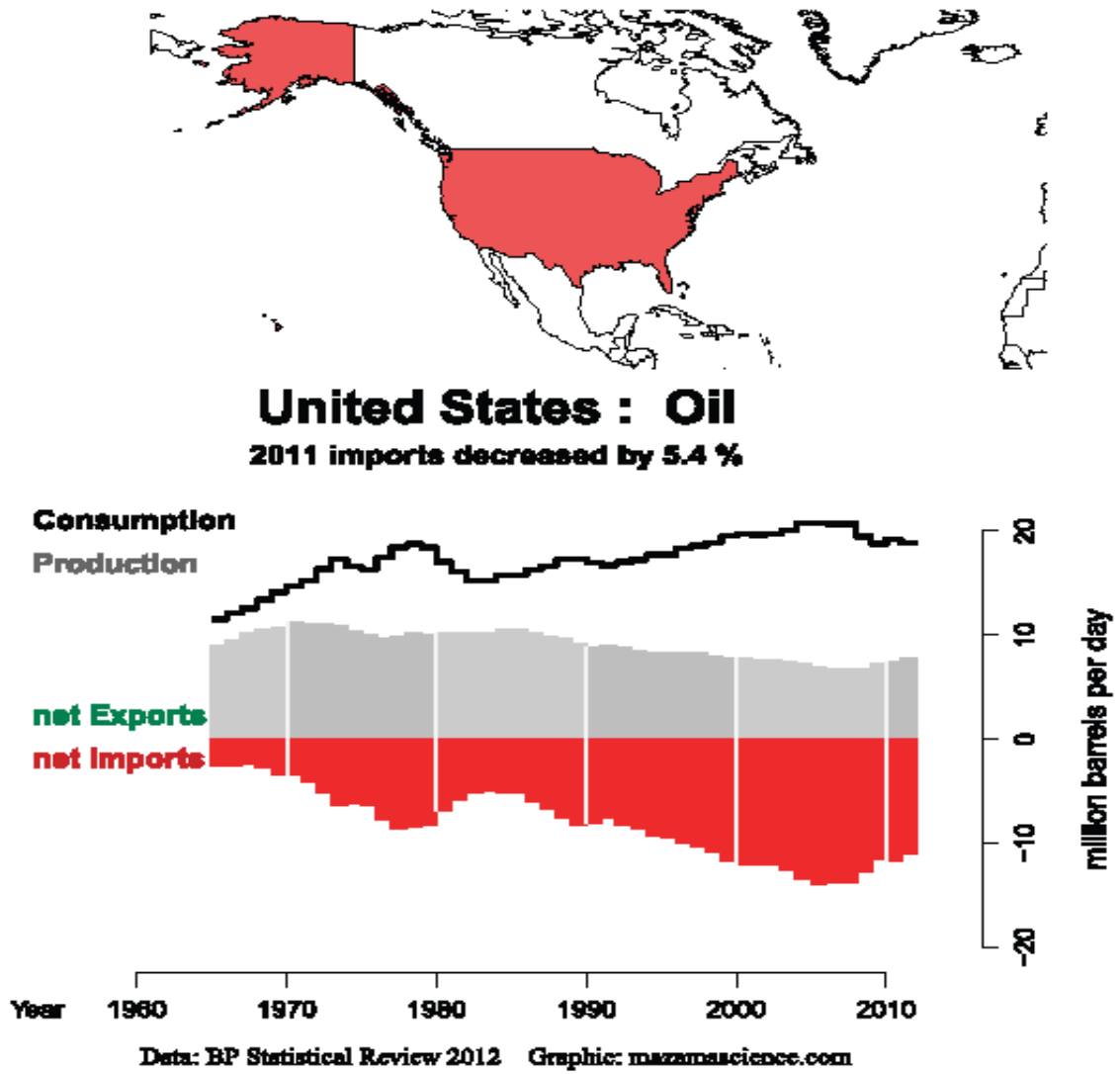
- 93% of all US transportation fuel is petroleum based
- The transportation sector consumes 71% of all US petroleum consumption
- 34% of the energy used in US Manufacturing is petroleum based (2)
- 72% of the price of transportation fuel is based on world oil prices (3)
- “At best, shale gas, tight oil, tar sands, and other unconventional resources provide a temporary reprieve from having to deal with the real problems: fossil fuels are finite, and production of new fossil fuel resources tends to be increasingly expensive and environmentally damaging” – Geologist, David Hughes (4)

Estimated U.S. Energy Use in 2010: 98.0 Quads

Contributions of Major Energy Sources



Source: Lawrence Livermore National Laboratory, 2010, Data is based on DOE/EIA-0384 (2010), October 2011; Rearranged to segregate and accumulate totals by major energy source

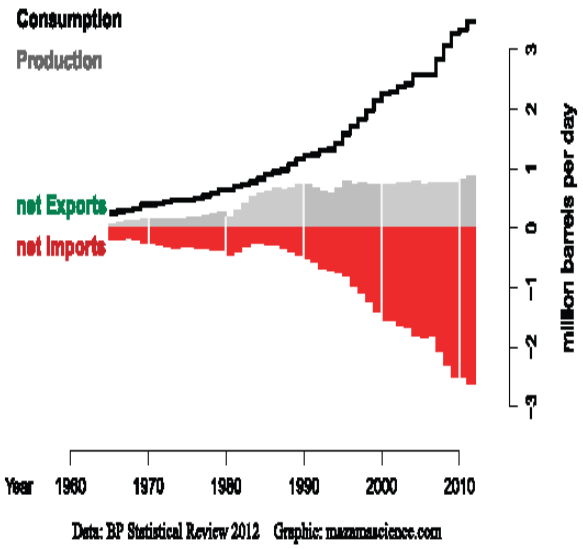

United States : Oil
2011 imports decreased by 5.4 %
Consumption
Production
net Exports
net Imports
20
10
0
-10
-20
million barrels per day
Year
1960
1970
1980
1990
2000
2010
Data: BP Statistical Review 2012
Graphic: mazamascience.com

World Oil Statistics

- World Oil production has been on an “undulating plateau” for 7 years (6)
- World Oil prices are based on the cost to develop a marginal barrel
- It is becoming increasingly expensive to develop a marginal barrel (1)
- Rapid growth of transportation needs in emerging (Non-OECD) economies exerts an upward pressure on world oil demand and price (7)
- Emerging (Non-OECD) market growth accelerated as Non-OECD oil demand gained 4.5% on the year earlier.
- Developed (OECD) economies including the US continue to see a declining oil demand trend, with a drop in consumption of 1.4% on the year. (8)
- US oil demand is the lowest in 16 years – EIA (9)

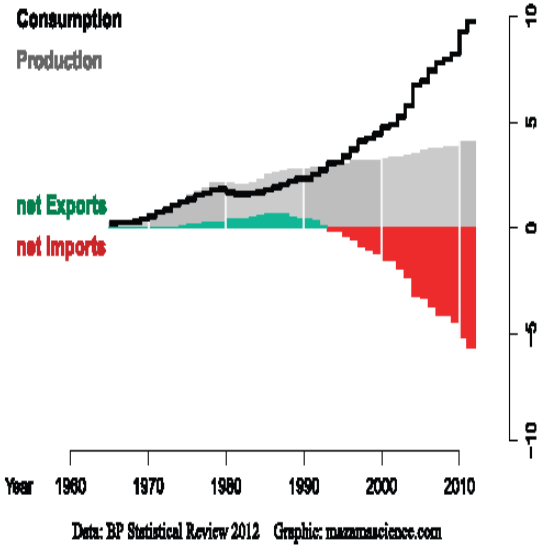
India : Oil

2011 imports increased by 4.3 %



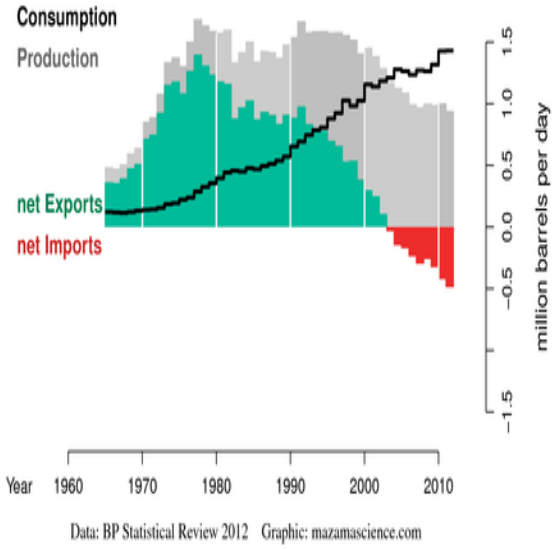
China : Oil

2011 imports increased by 9.5 %



Indonesia : Oil

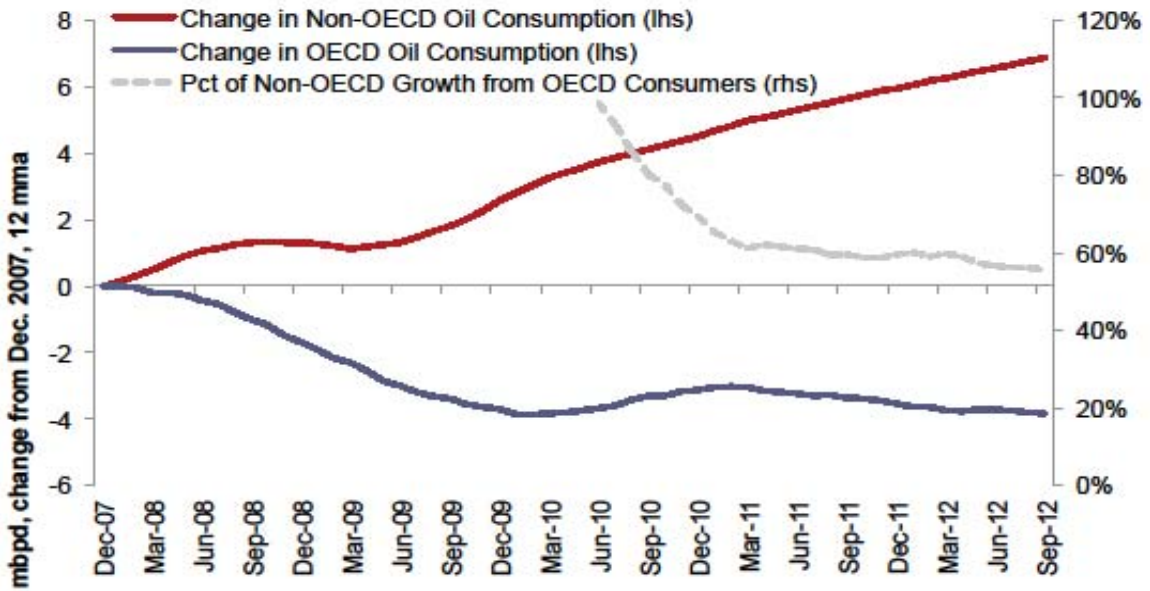
2011 imports increased by 15. %



India, China and Indonesia are fast growing (non-OECD) countries and represent 40% of the world's population. They also consume 85% of the amount of oil consumed in the US

Douglas – Westwood

OECD and Non-OECD Oil Consumption



Non-OECD countries in systemic crisis: ?

OECD countries in systemic crisis: USA, UK, Ireland, Iceland, Greece, Spain, Portugal, Hungary, Italy, France, Cyprus, Estonia, Latvia, Lithuania, Netherlands, Japan

- OECD *consumers* providing 56% of new non-OECD oil consumption
- Price above OECD carrying capacity, below non-OECD carrying capacity
- US squeezed out of oil import markets = "energy independence"

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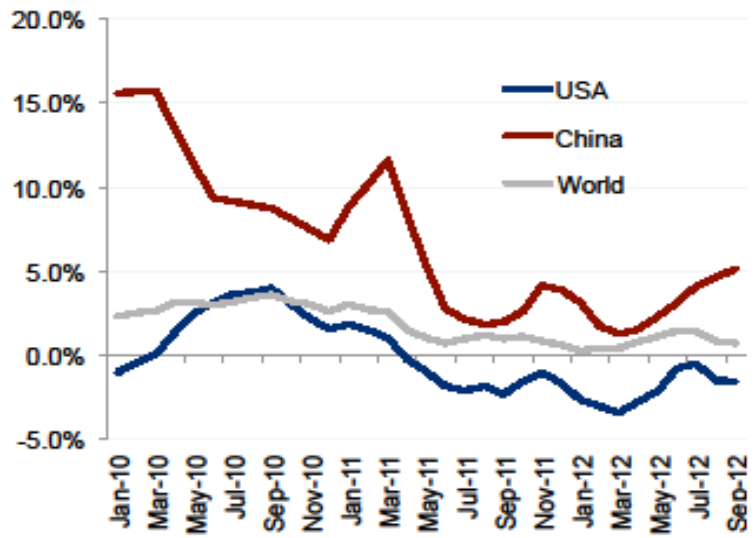
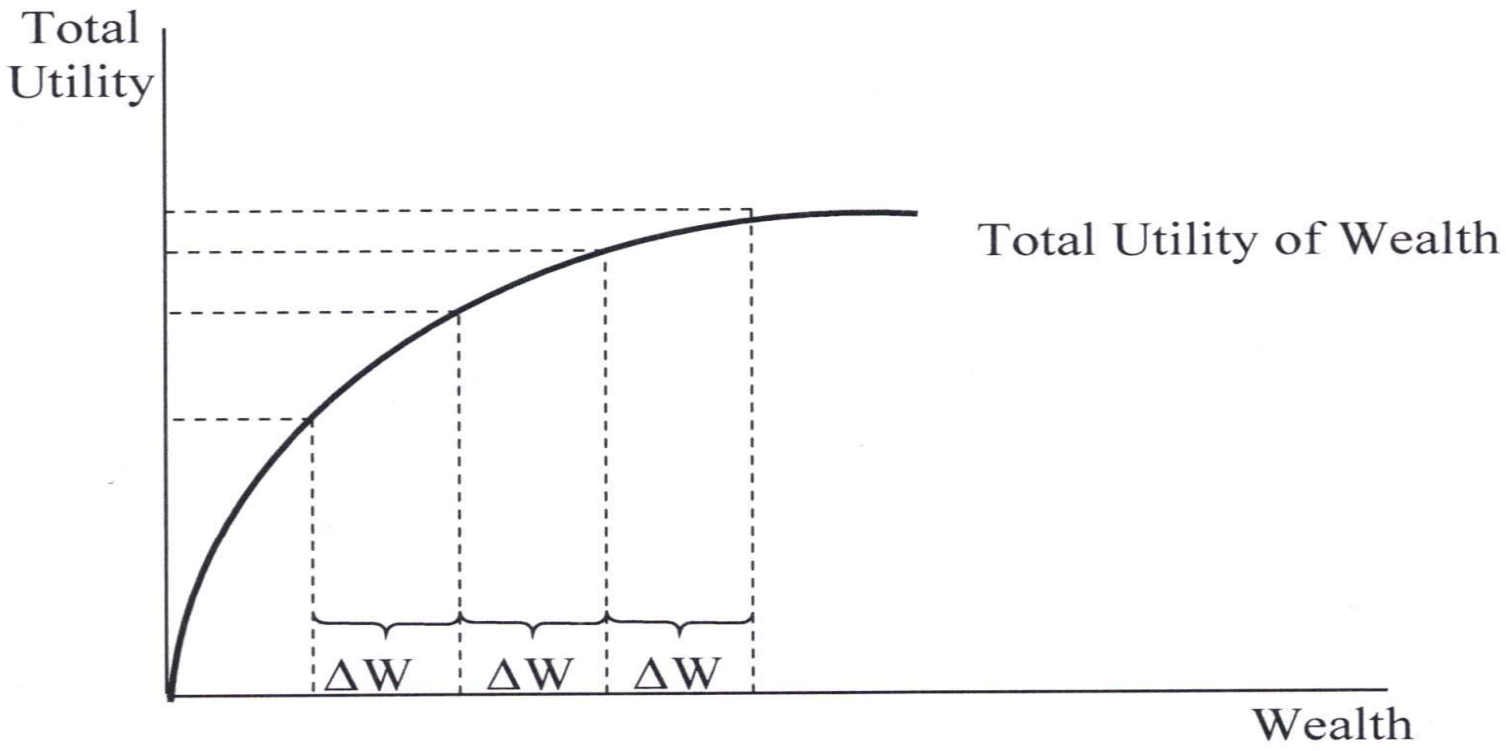
Oil Demand Outlook 2012

- US oil consumption for this cycle peaked in August 2010—at $85 Brent.
- US consumption falling at 1.5% per annum
- China's consumption growth peaked in June 2010—and has been winding down since
- China's apparent demand growth only recovering
- US max carrying capacity: $95 Brent
- China max carrying capacity: $115-120 Brent.



Oil Consumption Growth, percent annually

Source: EIA STEO May 2011



Emerging, non-OECD, economies can afford to pay more for an incremental barrel of oil (wealth) because it offers more incremental benefit (utility)

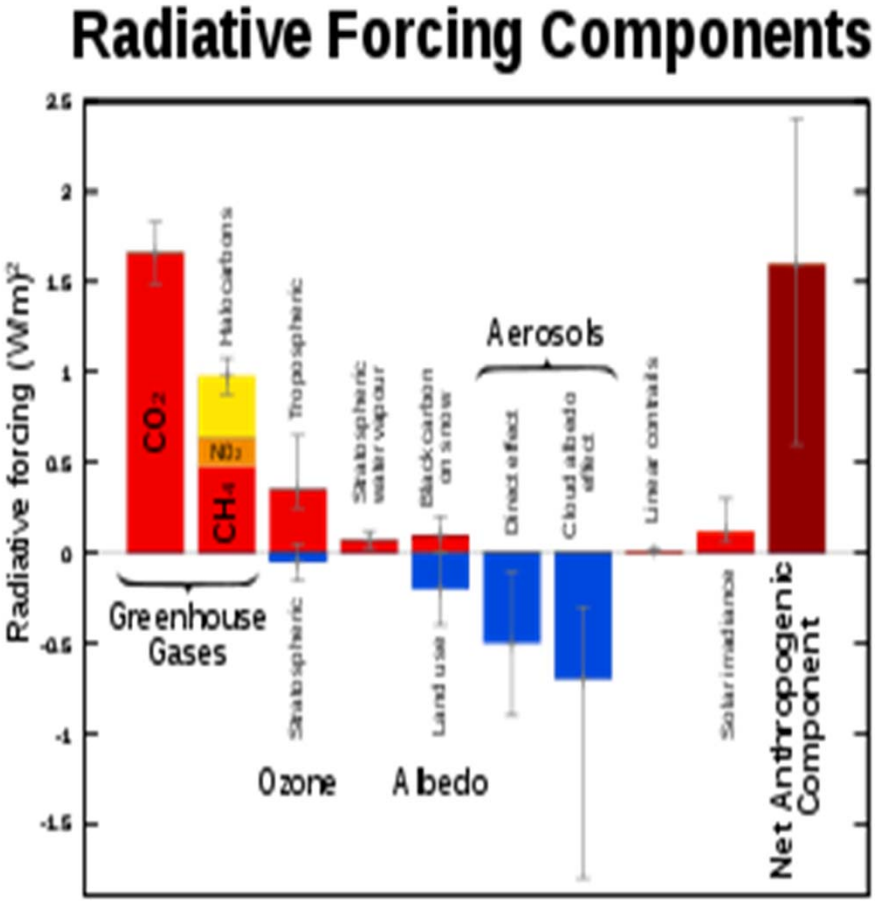
Michigan Liquid Fuel Consumption Statistics

- Motor Gasoline represented 33% of Michigan's total energy expenditures in 2009 while Retail Electricity represented 29% (LARA)
- 107.5 Million Barrels of Motor Gasoline consumed in 2011 at a cost of $15.1 Billion
- 10.9 Million Barrels of Fuel Ethanol at a cost of $1.05 Billion
- Michigan citizens consumed an average of 463 Gallons of Motor Gasoline per person in 2010 (11)
- Michigan imports 97% of its petroleum needs (LARA)

Climate Change Impacts from Burning Oil and Other Fossil Fuels

- Draft National Climate Assessment
  - Increase of 10 deg F by 2100
  - Increase of 4-6 deg F in Midwest by mid-century
- MIT says < 1 percent chance of keeping increase < 3 deg C
- Intergovernmental Panel on Climate Change (IPCC) - anthropogenic sources increase radiative forcing

  “unequivocal”



(12, 13)

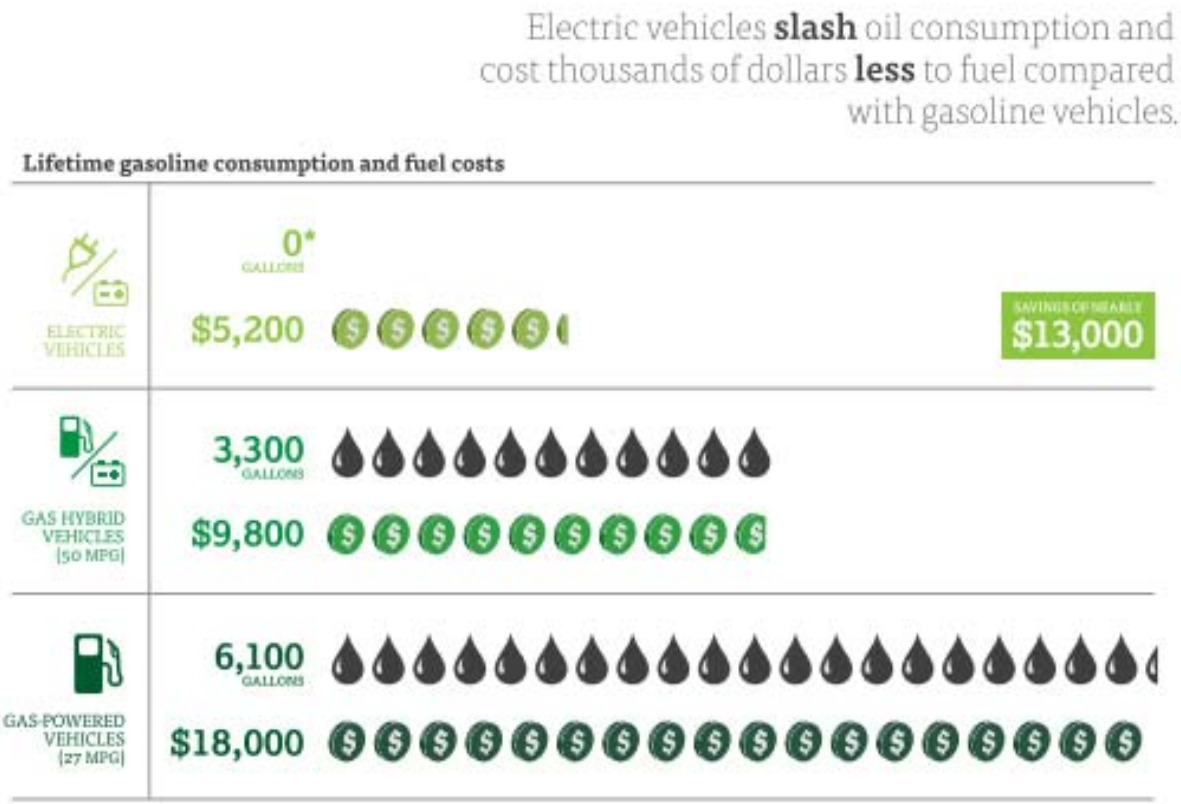
Reduce our Dependence on Oil while Transforming Transportation

- Reduce oil use in the transportation sector through electrification
- Vehicle Electrification would help to inoculate Michigan businesses and residents from world oil price increases and energy insecurity
- The US electrical infrastructure is in place to permit on the order of 75% reduction in the dependence on liquid fuels through greater penetration of plug-in vehicles (14)
- In addition to substituting for oil, electrification increases overall transportation system efficiency

Reduce our Dependence on Oil while Transforming Transportation (continued)

- Electrification can reduce greenhouse gas emissions and is one of the few transportation options capable of directly using renewable generation.
- Advancing Vehicle to Grid (V2G) energy storage capability is a critical pathway to achieving a higher penetration of renewable energy within our power grid (15)
- Electrified transportation allows essential economic activity to continue even if a major oil supply disruption occurs.
- Michigan based auto companies are already rolling out Plug-in electric vehicles including: GM's Chevy Volt and Cadillac ELR; Ford's Focus Electric, Fusion Hybrid and C-Max Energi
- An example: a Chevy Volt can go 30 miles using 60 cents worth of electricity based on Consumers Energy Off-Peak electricity rate.

Figure 2.1. COMPARISON OF LIFETIME VEHICLE FUEL/CHARGING COSTS AND GASOLINE CONSUMPTION



*Electric vehicles consume no gasoline and contribute very little to oil consumption, since less than 1 percent of U.S. electricity is generated with petroleum. Note: Assumptions include gasoline cost of $3.50 per gallon, a national average electricity price of 11 cents/kWh, a discount rate of 3 percent applied to future savings, cumulative lifetime mileage of 166,000 miles, and annual travel that starts at 15,000 miles per year and declines 4.5 percent per year over 15 years. Electric-drive efficiency is that of the Nissan LEAF (0.34 kWh/mile) and is representative of today's small to midsize EVs. Greater annual mileage or higher electric efficiency would result in increased cost-savings estimates.

Develop a plan to accelerate Plug-in Electric Vehicle (PEV) deployment in Michigan

- Support PEV infrastructure planning and investment by public and private entities
- Plan for and integrate peak vehicle demand for electricity into the state's power grid
- Streamline the location and installation of public PEV infrastructure.
- Develop and maintain attractive non-monetary incentives for use of PEV's
- Promote consumer awareness of PEV's through public education, outreach and direct driving experiences
- Provide PEV users with options to connect PEV charging with renewable energy supplies
- Incorporate PEV's into the state vehicle fleet

Develop a plan to accelerate Plug-in Electric Vehicle (PEV) deployment in Michigan (continued)

- Expand use of PEV's for private light- and medium-duty commercial fleets
- Leverage and augment the technical and financial assistance of the U. S. Department of Energy's "Clean Cities Program" activities, focusing on the deployment of PEVs. (17)
- Support demonstration and commercialization of PEV-related technologies by Michigan companies
- Leverage tools to support business attraction, retention and expansion of PEV companies
- Make lower Time-of-Use electricity rates available to PEV utility customers
- Encourage utilities to provide a cleaner and less fossil fuel dependent electric power supply by significantly increasing the mix of renewable energy, including low-cost clean energy imported via the 11 state MISO power grid (15) (18)
- Research the PEV deployment policies of other states and cities such as California; Maryland; New York City; Portland, OR; Austin, TX. (19, 20, 21)

“Time is the natural resource in shortest supply.”

- Elinor Ostrom

Nobel Laureate in Economics, June 2012

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