



Advanced Energy in Northeast Ohio

CSU Fall Forum
October 18, 2006

Summary



- Challenges facing the conventional energy sector mandate building an advanced energy industry
- Along with many others, The Cleveland Foundation is pursuing the opportunity for our area to become a leader in the future advanced energy industry
- You can contribute to making advanced energy in Northeast Ohio a reality

Twin Global Energy Challenges

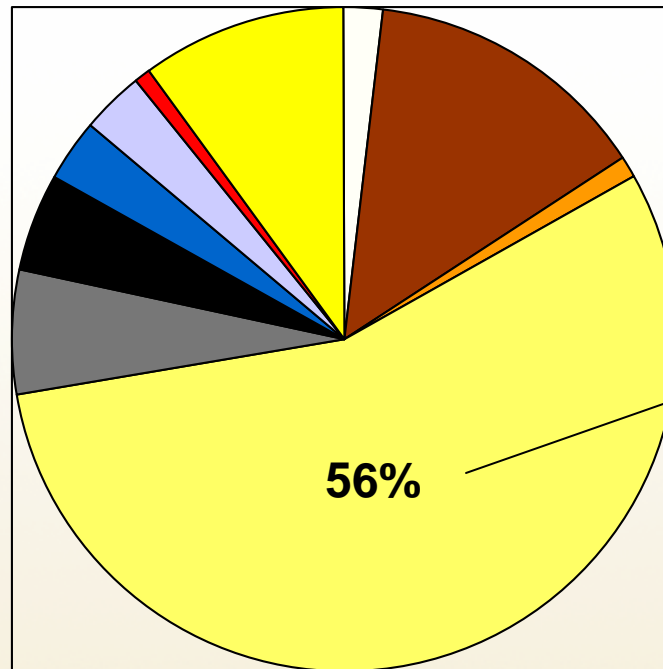


- Oil – high prices, with strong upward pressures due to supply concerns
 - Remaining reserves increasingly located in Middle East
 - Potential for further growth in production rates ever more in doubt
- Climate change – increasingly recognized to be real and significant, caused by fossil fuels:
 - Planetary impacts already being seen, likely to get much greater (perhaps quickly)
 - Energy demand expected to at least double in next 50 years, due largely to China/India

Most Remaining Oil in Middle East



100% = 1292.6 billion barrels

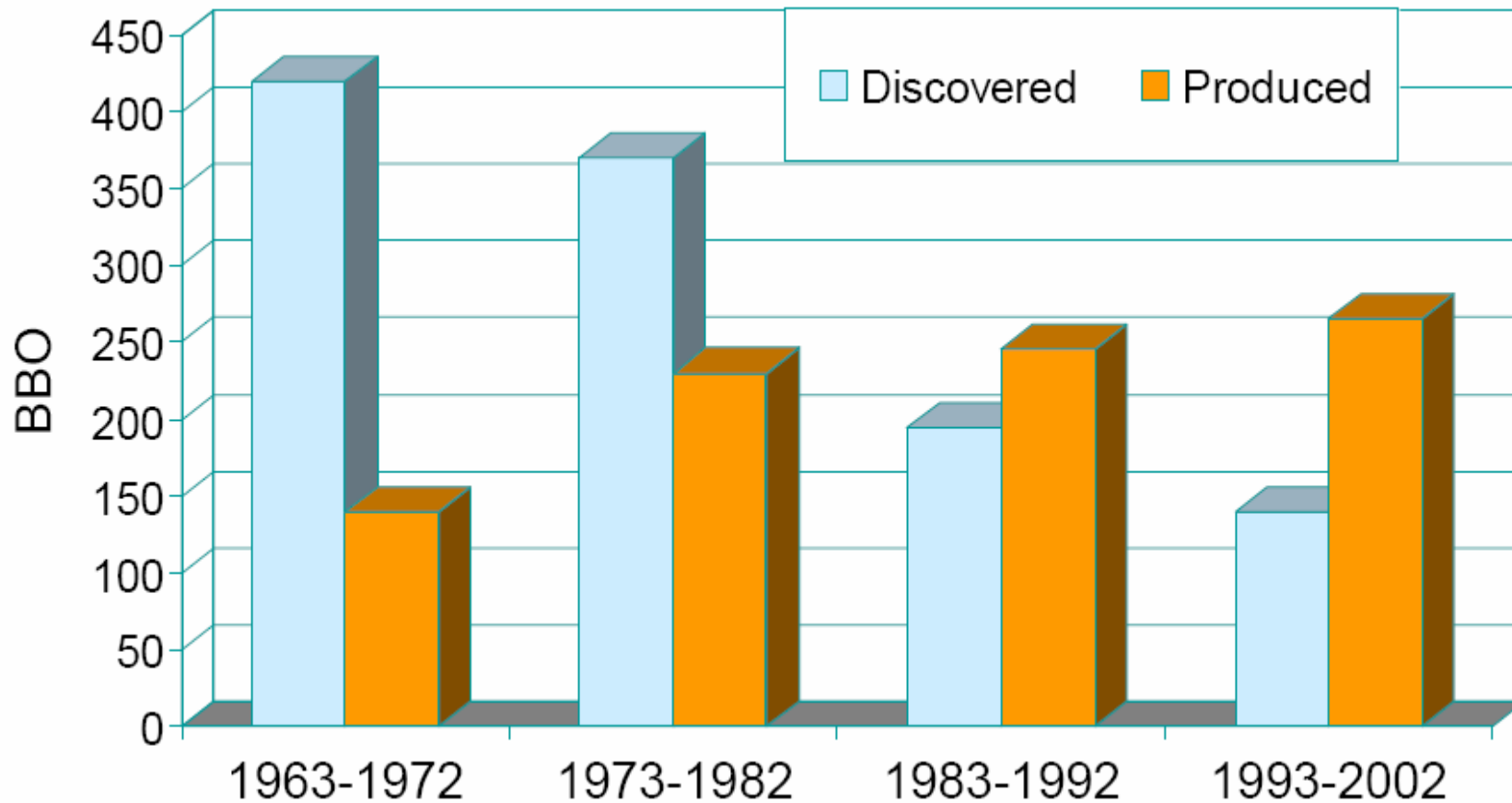


- Saudi Arabia
- Iran
- Iraq
- Kuwait
- UAE
- Qatar



Source: Oil & Gas Journal, Vol. 102, No. 47 (Dec. 10, 2004), from U.S. EIA

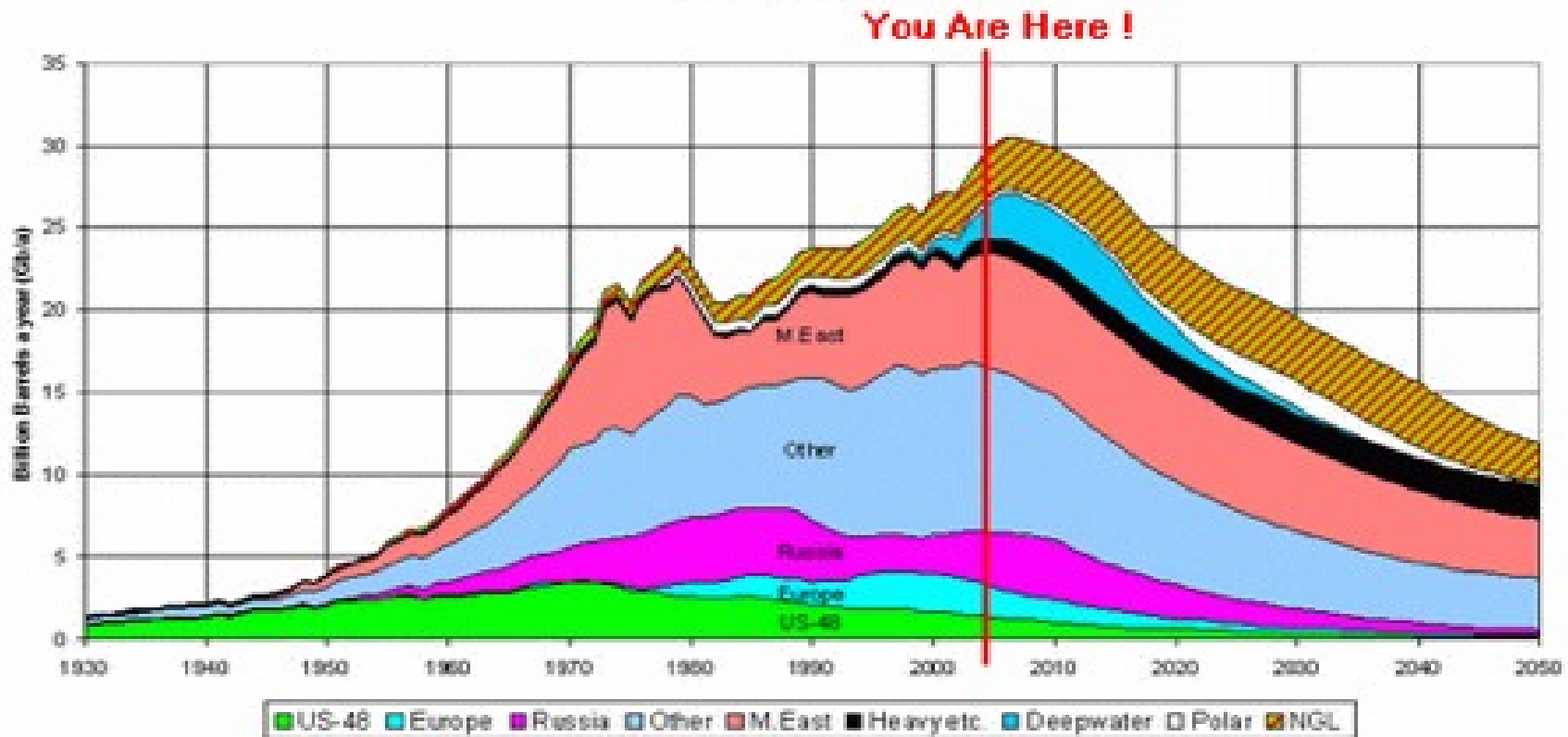
Global Oil Discovery & Production



Oil Production Peaking?

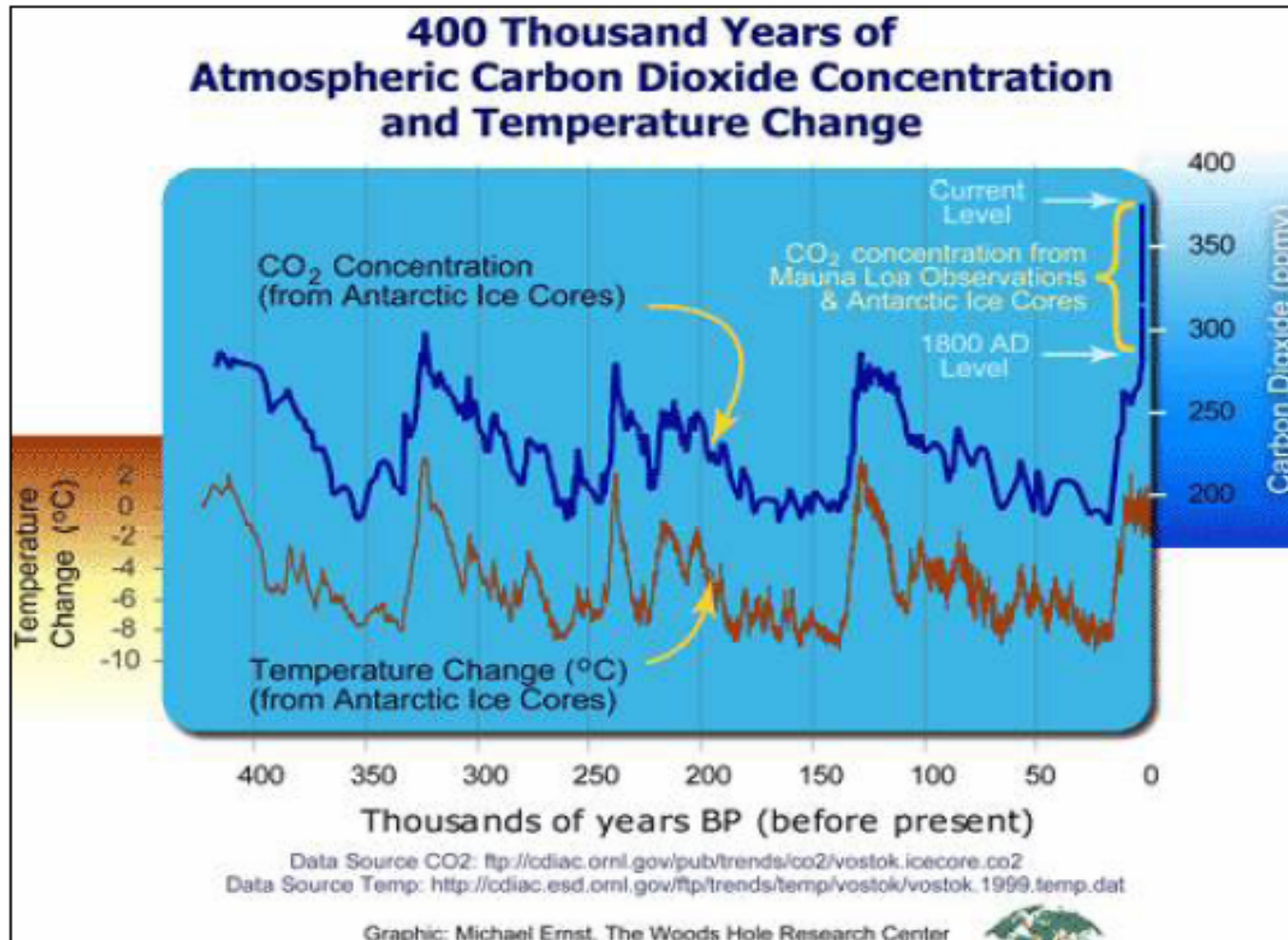


OIL AND GAS LIQUIDS



Source: www.romaenergia.org

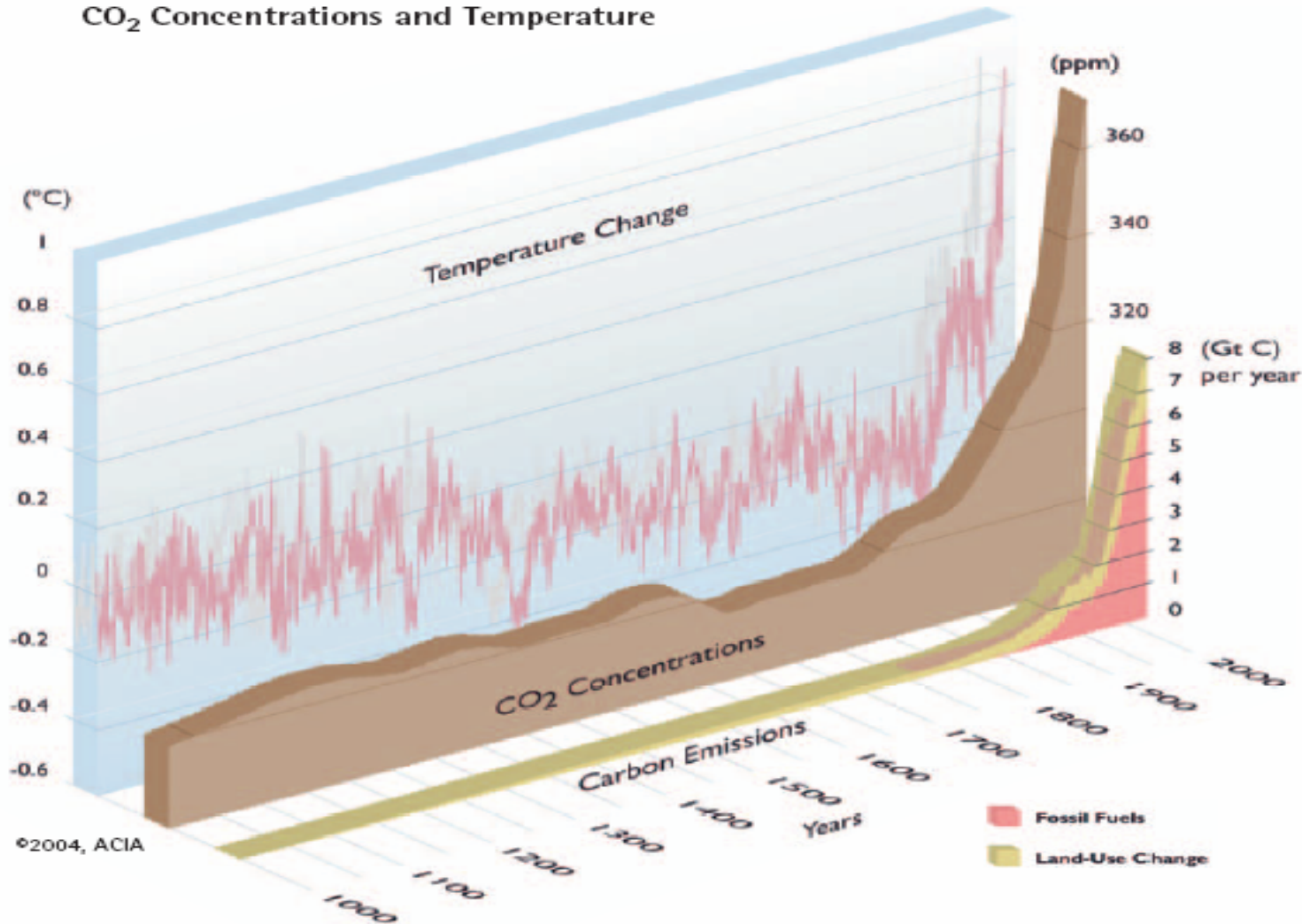
Unprecedented CO₂ Concentrations



Rising Global Temperatures



1000 Years of Changes in Carbon Emissions, CO₂ Concentrations and Temperature



Source: "Impacts of a warming Arctic: Arctic Climate Impact Assessment", Cambridge University Press. 2004.

Melting Polar Ice Caps



Arctic Ice Cover Changes, 1979-2005

1979



2005

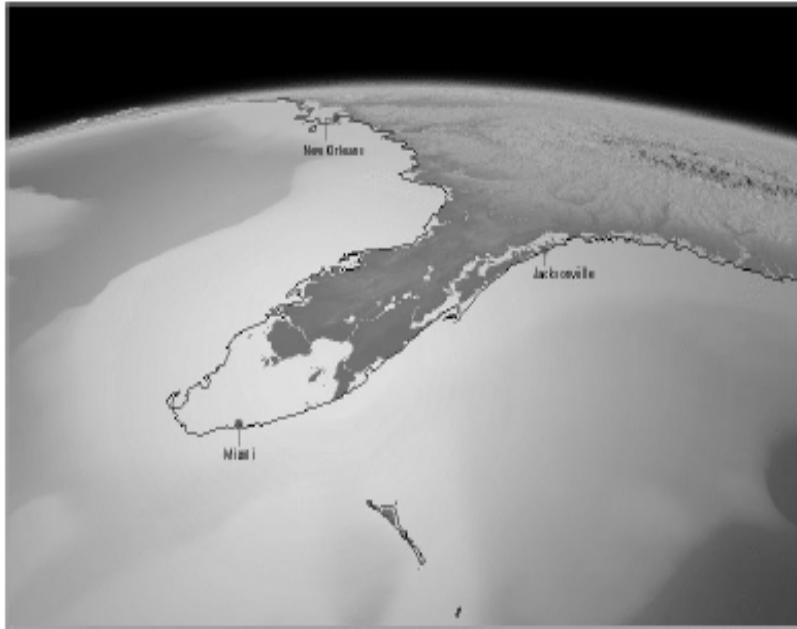


Source: "Impacts of a warming Arctic: Arctic Climate Impact Assessment", Cambridge University Press. 2004.

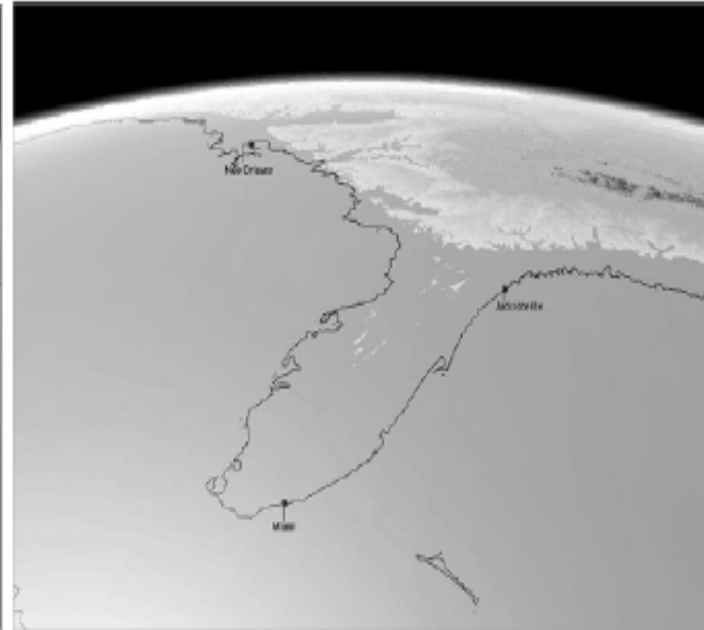
Impact on Coastal Areas



Florida w/17 feet rise



Florida w/170 feet rise

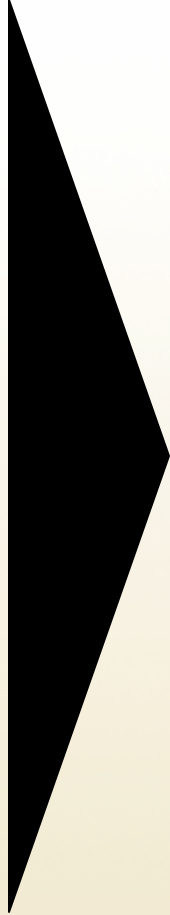


Consistent with West Sheet collapse Consistent with East Sheet collapse

Source: http://www.bio.psu.edu/greendestiny/publications/gdc-kyoto_primer.pdf

Opportunity: Advanced Energy



- Future energy supply security and price stability increasingly in doubt
 - Significant and intensifying environmental challenges from energy consumption
- 
- Multi-trillion dollar “conventional” energy paradigm increasingly unlikely to meet these challenges
 - Enormous “advanced” energy industry will need to be built in coming decades
 - Opportunity for Ohio to seize leadership in some segments of advanced energy → thousands of jobs

Advanced Energy



Stationary	<ul style="list-style-type: none"> • Central powerplants (coal, gas, nuclear) • Power grid • Natural gas heating/distribution • Inefficient end-uses 	<ul style="list-style-type: none"> • Efficient appliances, motors, lighting • Geothermal heat pumps • Solar thermal • Superconductivity 	<ul style="list-style-type: none"> • Wind • Solar PV • Coal gasification • Biopower • Fuel cells
Transport	<ul style="list-style-type: none"> • Oil E&P and refining • Gasoline automobiles • Diesel trucks 	<ul style="list-style-type: none"> • Plug-in hybrids • Advanced diesels • Composites • Hydrogen • Fuel cells 	<ul style="list-style-type: none"> • Biofuels • Gas/coal to liquids • Unconventional hydrocarbons
	Conventional energy	Demand-reducing Supply-increasing <hr/> Advanced energy	

Advanced Energy Priorities



1. Maximize efficiency: “the cheapest/cleanest source of energy is usually the energy we don’t need”



2. Maximize viable use of renewable energy and “hybrids” (e.g., combined heat and power), to minimize use/depletion of non-renewable fossil fuels



3. “Top up” from existing infrastructure – teaming with (not fighting against) electric/gas grids, etc.

Advanced Energy in Ohio



- **Fuel cells:** recognized as a leader in fuel cell technology development (Ohio Fuel Cell Coalition, Wright Fuel Cell Group)
- **Wind:** decent wind resource, several developers evaluating sites/projects, excellent industrial/supply chain base to attract manufacturers
- **Bioenergy:** large agricultural base, considerable ethanol and biodiesel fuel opportunities
- **Solar:** leader in thin-film technologies (University of Toledo, First Solar)
- **Clean coal:** AEP's IGCC plant under development, FirstEnergy CO₂ control pilot at Burger plant, coal gasification project exploration (Energy Industries of Ohio)
- **Coal-to-liquids:** proposal for demonstration project at Wright-Patterson
- **Energy efficiency:** increasing "green building" efforts, cogeneration and steam loop potential in cities, leadership in efficient lighting technologies

Why Ohio for Advanced Energy?



- **Materials science leadership**
 - Polymers, membranes, films, coatings
 - Academia: Case, U Akron
 - Leading companies: Sherwin-Williams, RPM, PolyOne, etc.
- **Manufacturing resources**
 - Significant available facilities
 - Trained and experienced labor force
 - Extensive supply chain
- **Distribution advantages**
 - Location: <500 miles to ~50% of U.S. population
 - Transportation network: road, rail, barge, air, pipelines, power grid
 - Logistics excellence

Regional Energy Constituencies



Corporate	Public	Not-for-profit	Academia
<ul style="list-style-type: none"> • First Energy • Dominion • Eaton • Parker-Hannifin • Timken • Lubrizol • RPM • Sherwin-Williams • Key Bank • National City Bank • GELcore • GrafTech 	<ul style="list-style-type: none"> • City of Cleveland • Cuyahoga County • Port Authority • NOACA • PUCO • Ohio DOD • Ohio Air Quality Development Agency • Ohio EPA • Ohio DNR 	<ul style="list-style-type: none"> • Green Energy Ohio • Clean Fuels Ohio • Cleveland Green Building Coalition • Entrepreneurs for Sustainability • Ohio Environment Coalition • Greater Ohio • Ohio Consumers' Counsel • NorTech • Team NEO • JumpStart 	<ul style="list-style-type: none"> • CSU • OSU • Case • KSU • Ohio U. • U. Akron • U. Toledo • Baldwin Wallace • Oberlin • John Carroll • Hiram

TCF's Advanced Energy Initiatives



- Grants to local wind development since 2004:
 - Study of wind resource on Lake Erie
 - Anemometer on Crib
 - Great Lakes Science Center turbine
- Creation of BP Fellow role, March 2006:
 - Three year fellowship, supported by funds from BP
 - Objective: to take actions that lead our area to become world-leader in at least one segment of advanced energy
 - Success:
 - Job creation and increased economic activity
 - Reduced vulnerability to energy supply and price shocks
 - Reduced emissions (local air quality, climate change)
 - Improved image of Cleveland to area citizens and non-residents

Role of BP Fellow



Direct: engagement with market players

- Attracting AE businesses to region
- Nurturing new AE technologies/ventures
- Facilitating AE demonstration projects in area
- Elevating AE on business development agendas of local corporations
- Securing commitments to AE from large regional institutions

Goal: increased regional advanced energy activity

- **Jobs**
- **Energy price/supply security**
- **Environmental improvement**
- **Image**

Indirect: positive influence on market environment

- Seeking policy changes to accelerate AE activity in state/county/city
- Increasing public awareness of AE need/opportunity to affect candidates/voting
- Establishing programs to educate regional students and workforce about AE

Regional Advanced Energy Strategy



REGIONAL ADVANCED ENERGY STRATEGY

1. Develop and implement advanced energy supply and consumption plan for region

Coherence,
consistency
and linkages

2. Cultivate and achieve local excellence in supplying advanced energy to world markets

Results

- Reduced customer expenditures on energy, without harming customer “experience” associated with energy consumption
- Improved local air quality, and reduced contributions to global climate change

- Increased economic activity: jobs, tax base, wealth creation
- Technological leadership and culture of innovation
- Improved public pride and civic reputation

Advanced Energy Policy Elements



City/county

- Mandatory green building energy efficiency standards
- High efficiency auto and transit fleets
- Carbon emissions baselining and reduction targets
- Mandatory purchases of green energy
- Solar installations on public buildings

Ohio

- Renewable portfolio standard (including efficiency)
- Delinking of utility profitability and revenue
- Public benefits charge for additional R&D
- Streamlining and standardization of net metering and interconnection
- Real-time retail electricity pricing

Federal

- Higher gasoline taxes
- CO₂ limitations
- Extension of renewables production tax credit
- Stronger building/vehicle efficiency standards
- True standardization of RTO's/ISO's
- Appropriations of DOE, EPA R&D
- Low-interest loans for advanced energy deployment

What You Can Do: Attitudes



- Become committed to understand energy issues in non-dogmatic fashion, and encourage others to do the same
- Discard the “cheap energy” entitlement mentality, and view energy as a scarce resource to be cherished and used sparingly
- Be willing to model prudent energy behavior to children, neighbors, friends, co-workers

What You Can Do: Decisions



- Minimize energy consumption in your current daily life:
 - Reduce unnecessary use and wastage
 - Buy and install efficient light bulbs
 - Use public transport, walk, or ride bicycle when reasonable
 - Stop buying excess consumer goods
- Buy biofuels and green power where possible, and ask more local suppliers (e.g., service stations, utilities) to provide it
- Think about energy and environment when making asset purchases:
 - Select house to minimize driving
 - Buy more efficient car (e.g., hybrid)
 - Consider installing solar or high-efficiency HVAC systems

What You Can Do: Voting



- Demand better energy policy at local, state, federal levels from agencies (e.g., PUCO) and elected officials – and vote accordingly to put better people in office:
 - Expand public transportation, sidewalks, bike lanes
 - Eliminate subsidies and increase taxes on conventional energy
 - Mandate public sector purchasing of energy efficiency and “green” energy
 - Provide additional financial incentives, institute market supports and increase R&D expenditures for advanced energy technologies (e.g., renewable portfolio standard)
- Commit time and/or money to advocacy groups supporting advanced energy interests, and prepare to send messages to elected officials per their positions, such as:
 - Green Energy Ohio
 - Clean Fuels Ohio
 - Cleveland Green Building Coalition
 - Greater Ohio
 - Ohio Environmental Council
 - Entrepreneurs for Sustainability

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