



Advanced Research: Developing Options for a Carbon Constrained Future

Moderator:
Commissioner Paul A Centolella
Public Utilities Commission of Ohio



Panel Members

- **Sasha Mackler**, Research Director of the National Commission on Energy Policy & Contributor to American Energy Innovation Council June 2010 Report: *A Business Plan for America's Energy Future*
- **Dr. Mark Johnson**, Program Director, U.S. Department of Energy, Advanced Research Project Agency- Energy (ARPA-E), Associate Professor of Materials Science and Engineering and Director of Engineering for the Technology, Entrepreneurship and Commercialization (TEC) Program at North Carolina State University
- **Dr. Rosa Yang**, Vice President, Technology Innovation, Electric Power Research Institute
- **Michael Dworkin**, Professor, Vermont Law School, member EPRI Board of Directors, and former Chair of both the Vermont Public Service Commission and the NARUC Energy Resources and the Environment Committee

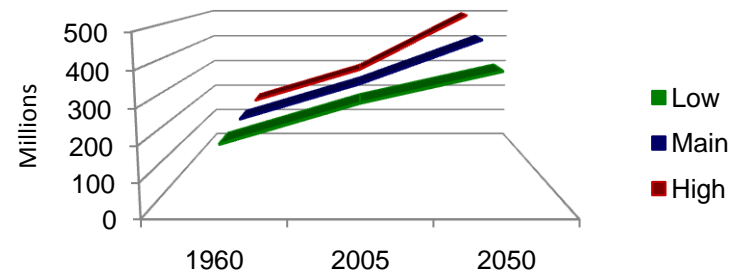




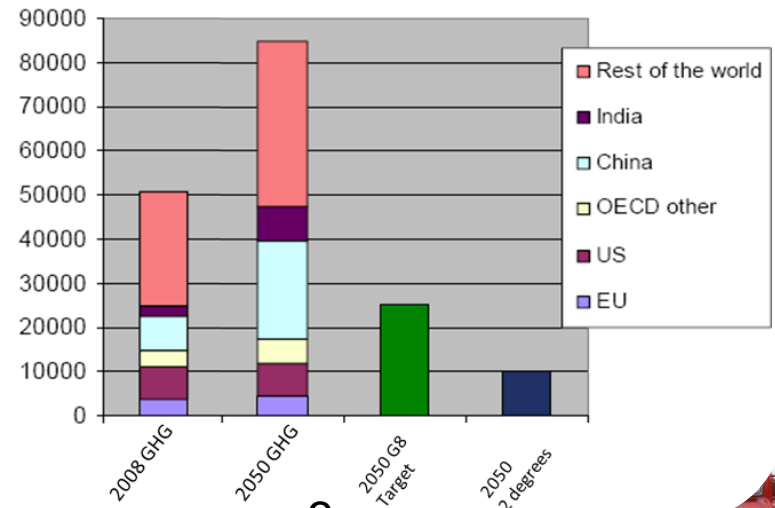
Carbon Constraint

- If Climate science is correct, what may be the implications for power sector?
- Global Issue: Accommodate Global Population Growth & Development
- U.S. Population & BAU CO₂ Growing
 - 438 Million People by 2050
- Growing Per Capita Electric Energy Services
 - Electric Vehicles
 - Electronic Devices
 - Electrification of Heating & Cooling Loads
- Some Agricultural & Industrial GHG Emissions Difficult to Cut
- Targeted Reductions by 2050 = Largely Decarbonizing Electricity in 40 years

Projected U.S. Population Growth



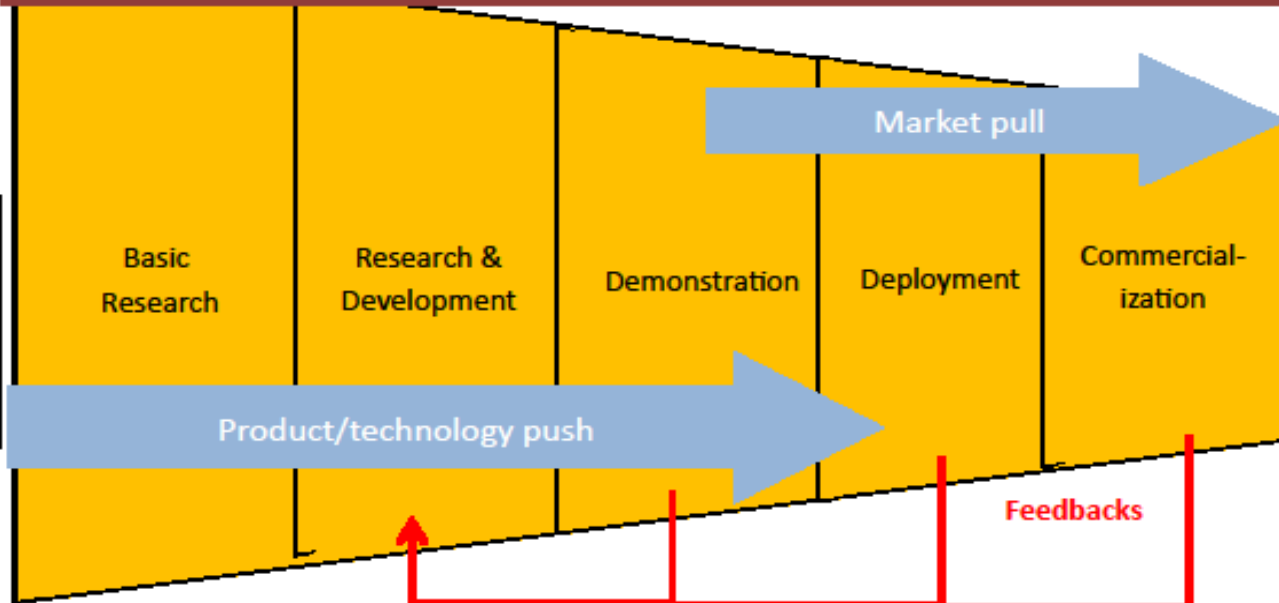
Projected Global GHG Emissions & Targets



The Innovation Ecosystem

Policy environment— Tax incentives, subsidies, regulations

Innovation Chain



Supply

- Academia
- Research Centres
- Business

Demand

- Consumers
- Energy Sectors
- Government
- Exports

Investments

Government, firms, venture capital and equity markets

Framework Conditions: macroeconomic stability, education and skills development, innovative business climate, IP protection etc.



Basis for Innovation Policy

- Environmental & National Security Externalities
- Spillover Benefits of Innovation
- Regulated Utility Market Disincentives
- Capital Requirements for Commercial Demonstration – Valley of Death





VALLEY OF DEATH

