

American Council of Engineering Companies
Energy and Environment Committee

**Diversification of Energy Sources, Renewable Energy
Markets and Distributed Generation**

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***Emerging Trends and Opportunities
in Electric Power Generation and
Energy Efficiency***

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Presentation Outline

- **NM's World-class Energy Resources**
 - An unabashed “pitch” for the Clean Energy State!
- **Electric Power Generation**
 - Utility-scale
 - Distributed Generation
- **Energy Usage and Efficiency in the Building Sector**
- **Vehicle and Transportation Sector**
- **What's at Stake: Competing for the 21st Century Energy Economy**

NM is blessed with substantial energy resources under our feet and above our heads!!

- Fossil Energy Resources

- Coal: 12th in the nation in production, 3rd in reserves
- Coal bed methane: 1st in production and reserves (San Juan Basin)
- Oil: 4th in crude oil production and reserves
- Natural Gas: 4th in production and 3rd in reserves

- Renewable Energy Resources

- Solar: 2nd in potential (AZ is 1st) → best “Concentrating Solar Power” incentives in the country
- Wind: 6th in wind production capacity (500 mw), 12th in potential
- Geothermal: 7th in potential (amt. of electric grade geothermal is not known)
- Biomass (forest material and dairy/feedlot wastes): promising at specific locations

Electric Power Generation Trends

- Increasing Fossil Fuel Costs: Sustained high natural gas prices make large “base load” NG plants cost prohibitive. Tripling of NG prices in the last 5 years is an early resource depletion price signal. Coal prices on the rise.
- State RPSes: Nearly half of U.S. states have adopted aggressive Renewable Portfolio Standards (RPSes) mandating RE use (10-25%) by utilities
- Climate Change Concerns: Utilities, utility commissions, utility shareholders & power developers have accepted the realities of a carbon constrained future in the U.S. and are adjusting their resource acquisition needs accordingly
- Wind Power Explosion: Development has exploded in the U.S. (12,000 MW) and NM (500 MW) in the last 5 years, primarily in response to state RPSes.

States Adopting and Increasing their RPSes: Turning the Trend into an Opportunity

- In response to state RPSes, 10s of 1000s of MW of new RE generation capacity will be needed in the next 15 years
- NM's world-class wind & solar and its central location provide enormous opportunities to develop >10,000 MW of RE to serve out-of-state markets (existing traditional power gen. is 6,000 MW)
- NM Efforts to Capitalize on this Opportunity
 - RE production tax credit (1 of only 2 states)
 - RE Transmission Authority → >30% must be from renewable sources
 - Sales tax exemption for wind turbine components and large-scale solar

Electric Power Generation & Climate Change

Changing the Entire Outlook for Power Generation in the Future

- Creates need for “carbon friendly” (eliminating or reducing CO₂ emissions to the atmosphere) baseload, dispatchable power sources
 - Advanced Coal Technologies: offer ability to capture CO₂ and store long-term (“sequester”) in subsurface formations
 - Nuclear Power
 - Renewable Power with Energy Storage:
- **Cost comparisons → should consider 40+ yr. lives of facilities**



Carbon Friendly Baseload Power Generation

Advanced Coal “IGCC” Plant →
Tampa, Florida



- **Advanced coal technologies** → promising but potentially costly. Feasibility of carbon capture and sequestration (CCS) on an enormous scale is considered technically feasible but needs to be proven.
 - **NM has economic development opportunity by combining CO₂ sequestration with Enhanced Oil Recovery**
 - **CCS is a HUGE technical challenge that will require all sorts of engineering expertise!**
- **Nuclear** → Likely to be “in the mix” despite radioactive waste disposal issues remain unsolved
 - **Public acceptance, financing issues, and permitting realities suggest very long lead times to bringing new plants on line.**

Carbon Friendly Power Generation

Concentrating Solar Power (CSP)

Using the Sun to Boil Water and Make Steam!



**350 MW of "Parabolic Trough"
Operating 15 Years
Mojave Desert, Calif.**



**Advanced "Power Tower" Design
New Demo Projects in Spain**

Renewables Will be Able to Meet Intermediate and Baseload Power Generation Needs? Yes!

- Concentrating Solar Power (1000s of MWs)
 - Solar plants with 12+ hours of thermal storage can deliver 60+% “capacity factors” (per National Renewable Energy Lab).
 - DOE cost projections: 4-6 cents/kwh (w/o storage) once 3-4000 MW have been deployed
 - Spain, Nevada and California’s utilities are now turning to CSP as their “next wave” in renewable energy development. Some utilities are suggesting that they’ve “max-ed out” on wind, due to its intermittency.
- Wind Power (1000s of MWs)
 - Currently constrained by its intermittency to 20-30% of a utility’s operational mix
 - Electricity and energy storage R&D may offer dispatchable wind in the future → fuel cells, compressed air storage, pumped hydro

Renewable Energy, continued

- Biomass and Geothermal (100s of MWs)
 - Opportunities for medium scale contribution
 - Geothermal resource needs detailed assessment
- Distributed Generation Solar:
 - While not technically “base load”, PV and solar thermal (e.g. space cooling) match up well with electric load (reducing annual baseload needs) and deliver their power directly to the consumer (saving transmission infrastructure costs).



Combined Solar Heat & Power System

Capitalizing on the Need for Carbon Friendly Power Generation in New Mexico

- Advanced Energy Tax Credits Act – advanced coal and CSP
- RE Production Tax Credit → best CSP incentive in the country (\$5.4 million/yr, 10 yrs)
- **Clean Energy Economic Development Working Group** → Gov's Office, Economic Dev. Dept., EMNRD, NMED, Economic Partnership, NMFA
- Alternative Energy Product Manufacturers Tax Credit – incentivizing clean energy tech. mfg. , as well as projects
- “Integrated Resource Planning” provision in Efficient Use of Energy Act → requires likelihood of future CO₂ costs to be considered in utility resource decisions, over long-term
 - CO₂ Costs: \$8/ton, \$20/ton, \$40/ton (PRC)
- Participation in 7 State/2 Canadian Provinces Regional Climate Change Initiative

Energy Usage and Efficiency in Buildings

- Cost-effective Savings of EE can off-set the impacts of increasing energy costs
- 57% of needed greenhouse gas reductions to come from EE (43% from renewables and fossil CCS)
- EE renovations can be “packaged” with solar improvements for cost-effectiveness
- Energy Service Companies (ESCOs) will see huge increase in business volume as EE goals and requirements multiply → building audits, retrofits, performance modeling, etc.
- EE can make NM businesses more cost competitive nationally and internationally → 2x the amt. of energy required to produce \$1 GDP in U.S. vs. Japan



Trends in Energy Usage in Buildings

(The forgotten or at least way underutilized resource)

- High natural gas prices have significantly increased winter heating bills → disproportionate impact on low income populations
- Major trend in NM (like the rest of arid SW) away from energy-conserving evaporative cooling to energy intensive (3-4x the energy usage) refrigerated A/C.
 - **Projected increases in summer electric load growth significantly due to this trend.**
- Doubling of size of newly built American home (1960-1995) and increase in energy using appliances/computers has increased per household energy usage
- Federal and state adoption of EE stds. for appliances has helped off-set electric and NG demand growth.
- Energy efficient Green Building certification standards for residential and commercial → established, accepted
 - **States and other governments are adopting aggressive sustainable building standards for public buildings**
 - **States are adopting green building incentives for the public**
- Some states are requiring EE measures in code that go beyond the standard building code.

NM Actions to Capitalize on EE's Opportunities

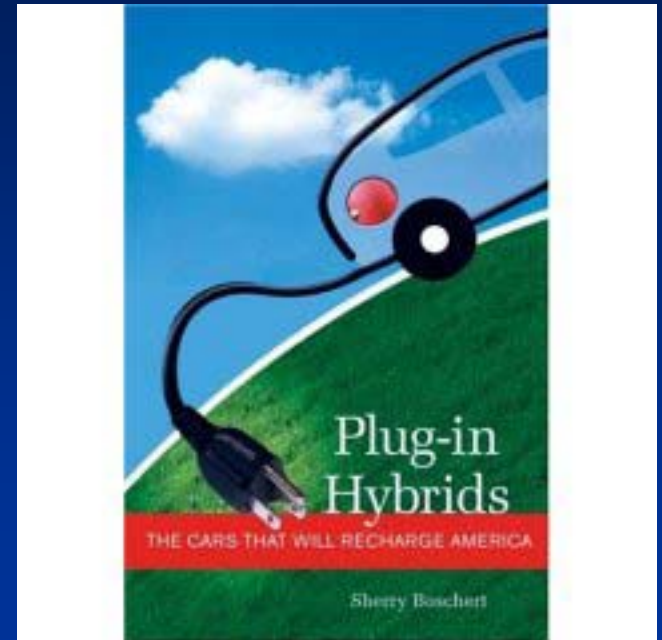
- **Governor's Exec. Order 2006-01** → requiring state buildings to be LEED Silver and 50% more energy efficient
- **Efficient Use of Energy Act (2005)** → PRC reviewed utility EE electric and NG programs
- **\$2 million for EE in public school construction (2007)**
- **Residential and Commercial Sustainable Building Tax Credit**
 - 1st residential EE tax credit in country
 - NM leadership could make state national focal point for sustainable building industry

NM Actions to Capitalize on EE's Opportunities

- Adopting “Beyond Code” EE measures in building code
 - Climate Change Exec Order requires measures to be brought before Construction Industries Commission by 1/1/08.
 - Requiring certain cost-effective EE measures in buildings can be pro-home builder, pro-home buyer, pro-commercial building developer. e.g. Slight increase to monthly home mortgage payment (due to added costs of incorporating the req'd EE measures) can be more than off-set by reduction in monthly energy utility bills.
- Considering adopting more stringent appliance EE stds. for selected appliances and HVAC systems

Trends in Vehicle Energy Usage and Transportation Sector

- **Strong interest in and R&D work on biofuels to help off-set reliance on fossil fuels.**
 - Corn-based and cellulosic ethanol
 - Biodiesel from canola, soy beans, algae
 - Renewable fuels refinery technologies
- **Efficient vehicle trend may be from present-day gas/electric hybrids to plug-in electric hybrid vehicles (PHEVs)**
 - PHEVs could run 30-40 miles on just their charged-batteries and electric motor. Gas engine would “kick-in” for longer hauls.
 - Suggests that the transportation “fuel” of the future could be electricity as much as liquid fuels. If this occurs, it will create a HUGE increase in electric power generation needs.
 - PHEV’s could “feed the grid”



News: Ford Motor Company and Southern California Edison Join Forces to Advance a New Transportation and Energy Vision
7/18/07

Vehicles and Transportation: Actions NM has Taken

- Hybrid vehicle motor vehicle excise tax exemption
- B5 (5% biodiesel) requirement in all diesel by 2012. “Advanced” signal makes strong statement to biofuels industry on NM’s commitment to renewable fuels.
- Biofuels tax incentives for infrastructure

What's at Stake.....

Competing for the 21st Century Energy Economy

- U.S. states and U.S. corporations are competing with other countries and foreign corporations for this emerging economic “pie”. All are “jockeying for position” right NOW!!
- Year 2100: the nation's energy-based economy won't look much like today's energy economy
 - Renewables, state-of-the-art efficiency, fuel cells, plug-in hybrid vehicles, nanotechnology, etc.
- As this transition unfolds → winners and losers
 - States, countries, multi-national companies, small start-ups
 - Not unlike → transition in transportation-related economy in first decade of 1900s (horse & buggy → automobile)
- 20th Century: United States was a national leader in energy development
- Will we maintain our leadership position in the 21st century? Time to accelerate the transition is *NOW!*