

# Renewable Energy in New Mexico

*Quivira Coalition,*  
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[www.NMCCAEE.org](http://www.NMCCAEE.org)



# New Mexico Coalition for Clean Affordable Energy (CCAEE)

- New Mexico Solar Energy Association
- New Mexico Public Interest Research Group
- Rio Grande Chapter of the Sierra Club
- Southwest Research and Information Center
- Western Resource Advocates
- Southwest Energy Efficiency Project
- Citizens for Clean Air & Water
- Natural Resources Defense Council
- League of Women Voters
- Community Action New Mexico
- New Mexico Physicians for Social Responsibility

*20,000 members in New Mexico*



# CCAIE Contact Info

- Website: [www.NMCCAIE.org](http://www.NMCCAIE.org)
  - Extensive NM Clean Energy Policy Info
  - Info on Incentives
  - Info on Sizing and Buying Systems
  - Technologies Info
- Clean Energy Network (sign up via website)
- Volunteers welcome
- Solar Professionals Directory, etc:  
[www.NMSEA.org](http://www.NMSEA.org)

# Outline

- Why Renewables?
- NM Renewable Energy Resources
- Overview of Solar and Wind Technologies
- (Quick) Overview of All Policies/Incentives
- More Details on Incentives for *Distributed* Renewables

# Why Renewables?

- Eliminate Greenhouse Gas Emissions
  - *Urgent*
  - Feasible!
  - Efficiency alone won't suffice
  - Efficiency *enables* renewables
  - Other “solutions” may fail, be undesirable
- Energy Independence
- Insulation against energy costs
- Economic Development:

Clean energy = Jobs

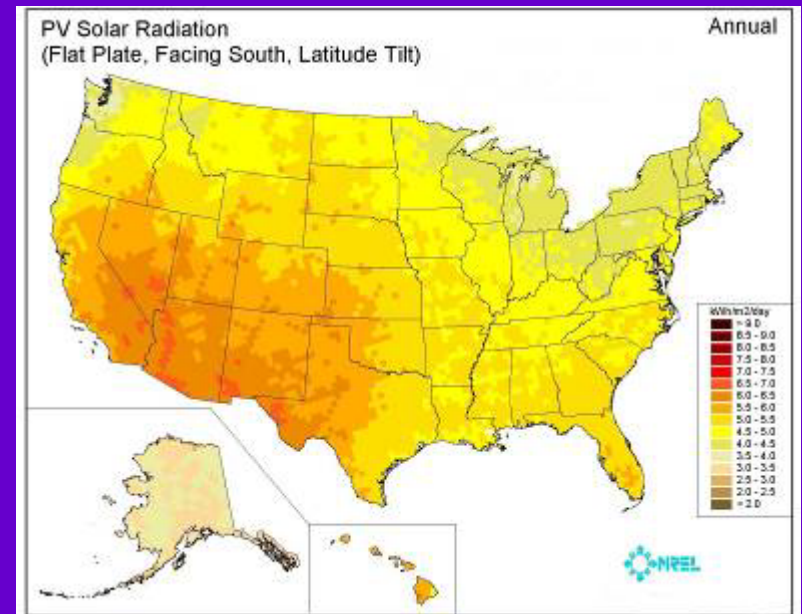
# Take Action!

- *Learn* about it
- *Buy* it: Green Power, Green Tags, or:
- *Generate* your own:
  - Incentives are here! Now is the time!
- *Invest* in it
- *Advocate* for it
- *Vote* for it
- *Join* local organizations that support it

# NM Solar Resource

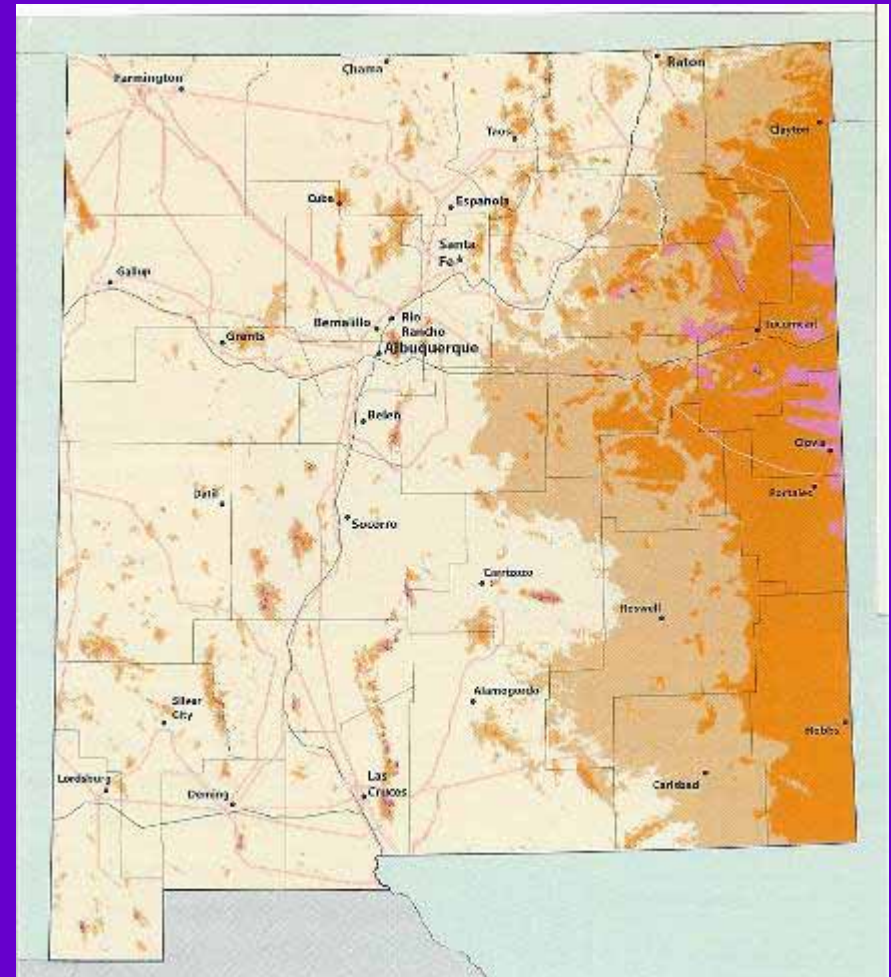
- US energy demand ~ 100 “quads”  
= 100 million billion BTUs/yr
- Annual solar energy falling on NM each year is *34 times larger!*

*New Mexico is a potential  
“Solar Saudi Arabia”!*



# NM Wind Resource

- Mostly on Eastern Plains
- 5 GW, possibly 20+ GW
- ~ 5-20 large coal plants
- Larger than CA's



# Renewable Energy Technologies

- Wind Power
- Solar:
  - Photovoltaics
  - Concentrating Solar Power
  - Solar Hot Water
  - Passive Solar
- Geothermal:
  - Space Heating/Cooling
  - Electricity Generation
- Biomass/Biofuels
- Energy Storage: Batteries, Hydrogen, Compressed Air, Thermal Storage

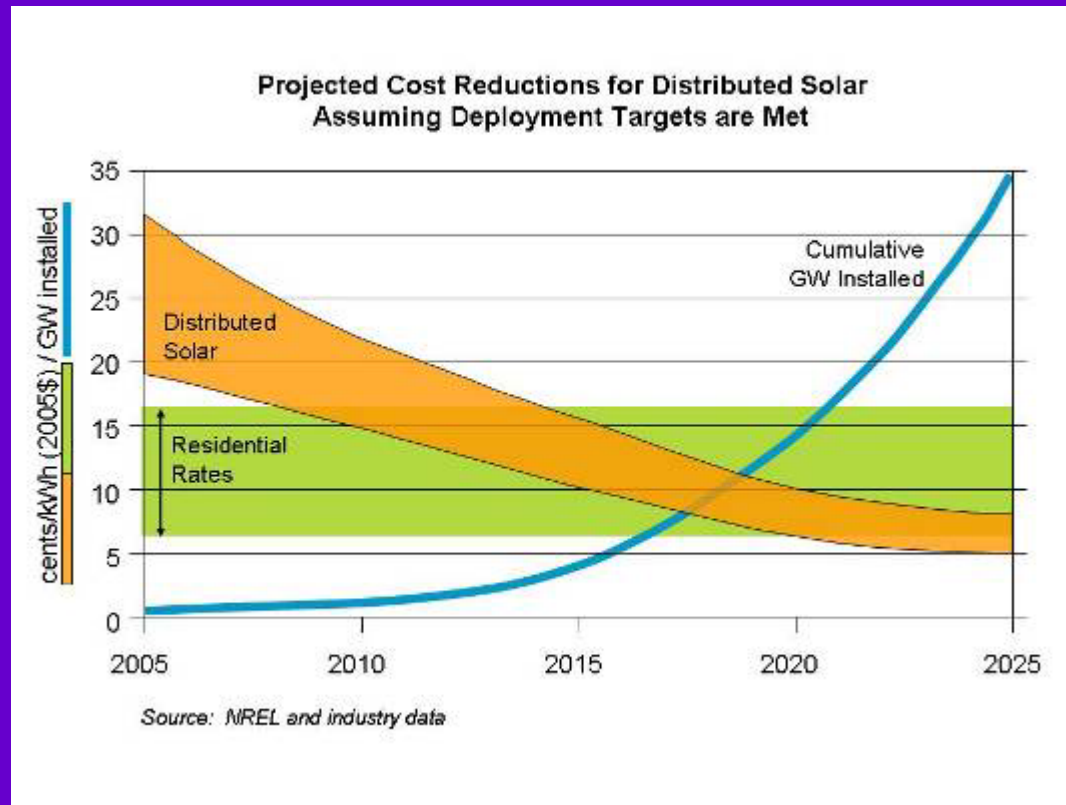
# Photovoltaics (“PV”)



- **Direct Solar Electricity**
- **No fuel cost**
- **Distributed or Centralized**
- **Easy to Maintain**
- **Grid-tied or Off Grid**

- **\$10/watt, \$.26/kWh**
- **Technology Evolving Rapidly**
- **Huge Potential**
- **CA just announced \$2.9 B program**

# PV Cost Trajectory



- 30-40% Growth Rate
- Cost decreases 20% for each doubling
- PV will be a major source by 2030, possibly before

# Concentrating Solar Power (“CSP”)

“Power Towers”



“Solar Troughs”



“Solar Dishes”

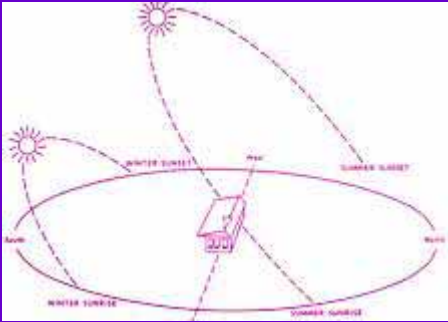


# New CSP Technology: Compact Linear Fresnel Reflector



- **CSP has similar cost curve to PV**
- **Can incorporate energy storage**

# Passive Solar Design



# Solar Hot Water



- Simple, cost effective, mature
- Closed loop (glycol-water) systems are typical
- Federal Incentive (30% up to \$2000) already available in 2006 and 2007 only!
- Not enough installers (NM has some)

# Wind Power



- **Competitive!**
- **Cheaper than natural gas fired generation**
- **Cost: \$.03-\$.05/kWh**
- **1 turbine offsets  
~ 2000 tons of CO<sub>2</sub>/yr**



# Overview of Existing NM Policies

- Solar Rights Law (early 1980's)
- Net-metering for 10 kw and smaller systems (1998)
- Production Tax Credits for large RE facilities (2002)
- Renewable Energy Standard; 10% by 2011 (2004)
- Green Power Requirements (2004)
- Clean Energy Fund (2004)
- PNM Customer Solar RECs Buyback (2006)  
(RECs = Renewable Energy Credits)
- Gas and Electric Efficiency Rebates (available soon)

# Overview of Anticipated NM Policies

- Solar Tax Credits
- Net-metering for larger systems
- Incentives for biomass use
- Production Tax Credits for on-site RE generation
- Ability of businesses to co-investment and enjoy PTC
- Green Tags Programs for community based projects
- Renewable Energy Transmission and Storage Authority

# Overview of New Federal Renewable Energy Incentives

- Solar Tax Credits (2006 and 2007 only)
- Rebates for renewable energy systems
- Extension of Production Tax Credit
- Tax Credits for “clean fuel” refueling property
- Tax Credits for biofuel producers

# Overview of New Federal Energy Efficiency Incentives

- Tax Credits for Homeowners:
  - Heating and cooling systems
  - Building envelope
- Tax Credits for Builders:
  - Both built and manufactured homes
  - Homes that meet Energy Star or other criteria
- Tax Deduction for owners/designers of Commercial buildings that meet certain criteria

# Distributed Solar Incentives

- Solar Rights
  - Must notify adjacent property owners and register rights before a adjacent owners apply for permits.
  - Protects solar resources at 12' barrier at boundary and higher.
  - Pre-empted by local solar rights codes, if any apply.

# Distributed Solar Incentives

- Net-Metering:
  - RE systems 10 kw or under can interconnect
  - 10 kw limit expected to increase
  - Full retail credit for fed-back power
  - Investor owned utilities and co-ops
  - ~ 60 systems to date
  - Munis: Los Alamos. More?

# Distributed Solar Incentives

- PNM Customer Solar RECs Buyback
  - “RECs” = Renewable Energy Credits
  - PNM will buy RECs at \$.13/kWh until 2018
  - PNM will RECs to meet NM Renewable Energy Standard
  - *In addition to net-metering*: \$.21/kWh combined value
  - Cost Balance:
    - 2 kilowatt system cost: about \$20,000
    - 2 kilowatt system RECs earnings: about \$5000
    - Solar Tax Credits: \$6000
    - Net-metering offset (27 years): about \$9000
    - Payback time: ~27 years

# Distributed Solar Incentives

- Proposed Solar Tax Credit:
  - Endorsed by Governor
  - Residential PV and solar thermal
  - 30% of system cost, minus federal credits, up to \$9K:
    - State Credit =  $.3 \times (\text{System Cost}) - \$2000$
  - \$5 million/yr budget proposed
  - Session starts *next week*:
  - Urge your legislators to support this!

# Proposed Distributed Wind Incentive

- Modify Production Tax Credit to Support *Small* Wind:
  - Endorsed by Governor
  - Lower eligibility threshold to 1 MW
  - Example: Single (utility scale) turbine at farm or factory.
  - Allow businesses to co-invest and enjoy PTC

# Federal Solar Tax Credits

- Two years only ('06 and '07)
- PV and solar hot water systems only
- *NOT* pool heaters, hot tub heaters, hot air systems
- 30% of installed Cost
- Capped at \$2000 for homeowners:
  - Good for small solar hot water systems
  - Not great for PV, larger solar hot water systems
- No cap for businesses! (Intel)
- Reverts to 10% for businesses, 0% for home owners, after 2007.

# Federal Solar Tax Credits

- For systems “placed in service” after January 1, 2006.
- Credits can be carried forward 1 year.
- Any other rebates or credits must be subtracted from installed cost prior to calculating federal credit.

# Federal Renewable Energy Rebates

- Homeowners and businesses
- Up to \$3,000 based on 25% of the cost
- Solar, wind, geothermal, biomass systems
- Total funding is limited: *Don't bank on it*
- These rebates must be subtracted before other federal solar credits are calculated

# Federal Energy Efficiency Credits for Home Owners

- Lifetime cap of \$500 for all measures
- Individual caps for qualifying measures:
  - \$300 for qualifying air conditioners, water heaters, heat pumps.
  - \$150 for qualifying furnaces
  - \$50 for qualifying furnace fans
  - 10% of qualifying building envelope improvements (windows limited to \$200)

# Federal Energy Efficiency Credits for Homeowners

“Qualifying” for air conditioners means:

- Seasonal Energy Efficiency Rating (SEER) at least 15,
- Energy Efficiency Rating (EER) at least 12.5
- Heating Seasonal Performance Factor (HSPF) at least 8.5.

# Federal Energy Efficiency Credits for Homeowners

- “Qualifying” for furnaces means 95% efficiency rating.
- “Qualifying” for building envelope means consistent with the 2000 International Energy Code.

# Federal Energy Efficiency Credits for Builders

- Up to \$2000 for each home
- Must save at least 50% energy compared to the 2003 International Energy Conservation Code
- HVAC equipment must meet the minimum federal standards
- Building envelope must account for 1/5th of the 50%.

# Federal Energy Efficiency Credits for Manufacturers

- Up to \$1000 for each manufactured home
- Energy Star *or* 30% more efficient than 2003 International Energy Conservation Code
- HVAC equipment must meet the minimum federal standards
- Building envelope must account for 1/3<sup>rd</sup> of the 30%.

# Federal Energy Efficiency Credits for Commercial Buildings

- Up to \$1.80/square foot.
- Must use 50% less energy than required by the ASHRAE 90.1-2001 model commercial code.
- If only portions of HVAC or lighting meet the 50% reduction, then maximum is \$.60/square foot.
- If federal or state owned, credit goes to designer.

# Cost of PV today

- Installed systems cost about \$10/watt
- 1 kw system in NM produces ~ 4.5 kWh/day (annual average)
- System lifetime: > 25 years

$$\text{Cost/kWh} = \$10 \times 1000 / (4.5 \times 365 \times 25)$$

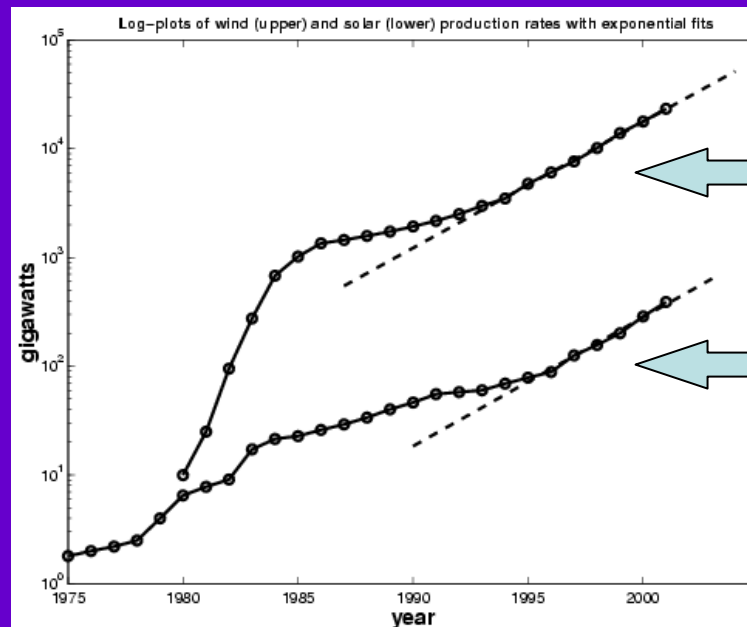
$$\sim 24 \text{ cents/kWh}$$

$$\sim 3 \text{ x retail cost of grid power}$$

# Future Cost of PV

- **Moore's Law for PV:** Each doubling of the industry decreases cost by about 20%
- Growth rate of industry  $\sim 31\%/year$

Log-linear  
Plot of worldwide  
installed wind and  
manufactured PV,  
1976-2001



Wind

PV

# Future Cost of PV

- **Project future cost via Moore's Law:**

We have:  $(1.31)^{10 \text{ years}} > 16 = 2^4$

Therefore, sustained 31% annual growth implies more than four doublings in the next ten years

Applying Moore's Law over 10 years then yields:

$$24.3 \text{ cents/kWh} \times (.8)^4 = 10 \text{ cents/kWh}$$

*PV may be directly competitive by 2015*

# Innovation in PV

- Inverters have improved dramatically over the past five years (e.g. SMA's "SunnyBoy" series)
- Grid-tied inverters are now general high voltage (e.g. 250 volts dc input) , leading to lower system and installation costs, easy expandability.
- New manufacturing techniques = lower costs
  - Thinner cells
  - Multi-junction cells (higher efficiency)
  - New contact technology (e.g. laser drilled holes)
  - Stable thin film cells

*Innovation will help keep PV growth on track  
as subsidies are phased out.*

# New for New Mexico: Large, tracking, grid-tied systems



# Firming Wind

- Large untapped potential
  - New direct loads: Charging hybrids, etc.
  - DSM technology + data links with wind
  - Better integration with natural gas, hydro, and gasified coal
  - Many businesses and home owners would embrace DSM linked to wind output

# Cost of Wind Power

- Existing, unsubsidized: 4-5 cents/kWh
- If new transmission added: ~6 cents/kWh
- Future costs: DOE technology characterizations predict 1.5 cents/kWh (not including transmission)

*Wind power is just getting started.*

*Significant cost reductions can be expected with further innovation and economies of scale*

# Hydrogen

- Hydrogen production at filling stations using wind:
  - Cost outlook actually promising:  
1 gallon gasoline ~ 34 kWh.  
Assume: Wind power at \$.07/kWh,  
electrolysis efficiency ~ 70%,  
compression efficiency ~ 90% (10,000 psi tank),  
and; hydrogen hybrid efficiency ~ 2 x today's typical ICE  
(NEED NOT WAIT FOR FUEL CELLS!)

Gasoline equivalent cost

$$= 34 \times \$0.07 / (.7 \times .9 \times 2)$$

$$= \$1.88/\text{gallon equivalent}$$

# Hydrogen

- Hydrogen is essential in our view, and implementation must begin soon:
  - We *must* de-carbonize fuels to address climate change: Need hydrogen even if we rely on nuclear.
  - Biofuel potential is limited by low photosynthetic rates of plants: Large land, fertilizer, water, and harvesting energy requirements.

*In our view, in the medium to long term, wind and eventually solar may well be the cheapest carbon-free sources for producing hydrogen, especially when external costs such as nuclear waste disposal, nonproliferation, mining impacts, carbon sequestration, and other costs are factored in.*

# Scale of Renewable Resources

- *Developable* wind resource in US ~ 2-10 times US electricity demand: *Yes, siting issues impose strong limitations, but there is still plenty of developable wind to do the job.*
- Solar energy falling on 0.2 percent of US land area = total US energy demand.

Solar intensity/km<sup>2</sup> = 1 GW

*Solar is not weak and diffuse: Solar energy density (energy per square meter), over 100 years, is about 5 times the energy density of coal (assuming 1 meter thick coal beds, with 30 MJ/kg)*