An Overview of the Wind Power Project Development Process and Financial Performance of Wind Energy Projects

February 26, 2008

Wayne Walker
Principal
Wayne Walker Conservation
Consulting LLC

Credits

- Horizon Wind Energy
- BP Alternative
- Iberdrola USA
- FPL Energy
- enXco
- AES
- Ridgeline Energy
- Laurie Jodziewicz & Liz Salerno, AWEA

Agenda

I. Credentials ⟵
II. Wind Industry Drivers
III. Wind Energy Development Process
IV. Development Dollars Expended Over Time
V. Economics of Wind Energy
VI. Construction Sequence
VII. Investors' Perspectives
VIII. Existing wind industry regional research initiatives
IX. Q & A

Credentials

- Horizon Wind Energy LLC 2000-2007, Director of Project Development, Southwest Region
  - Successfully developed (projects that were built) >$600M (425 MW) of projects in Oklahoma and Kansas
  - Left Horizon with 3000 MW of development assets in pipeline across four states in September 2007
  - #5 employee of company
  - Company witness on PUCT 33672 “Texas CREZ”
- AWEA Siting Committee, Vice Chair since 2004
- NWCC GS3C sub group founding member
- Launch Director, American Wind Wildlife Institute

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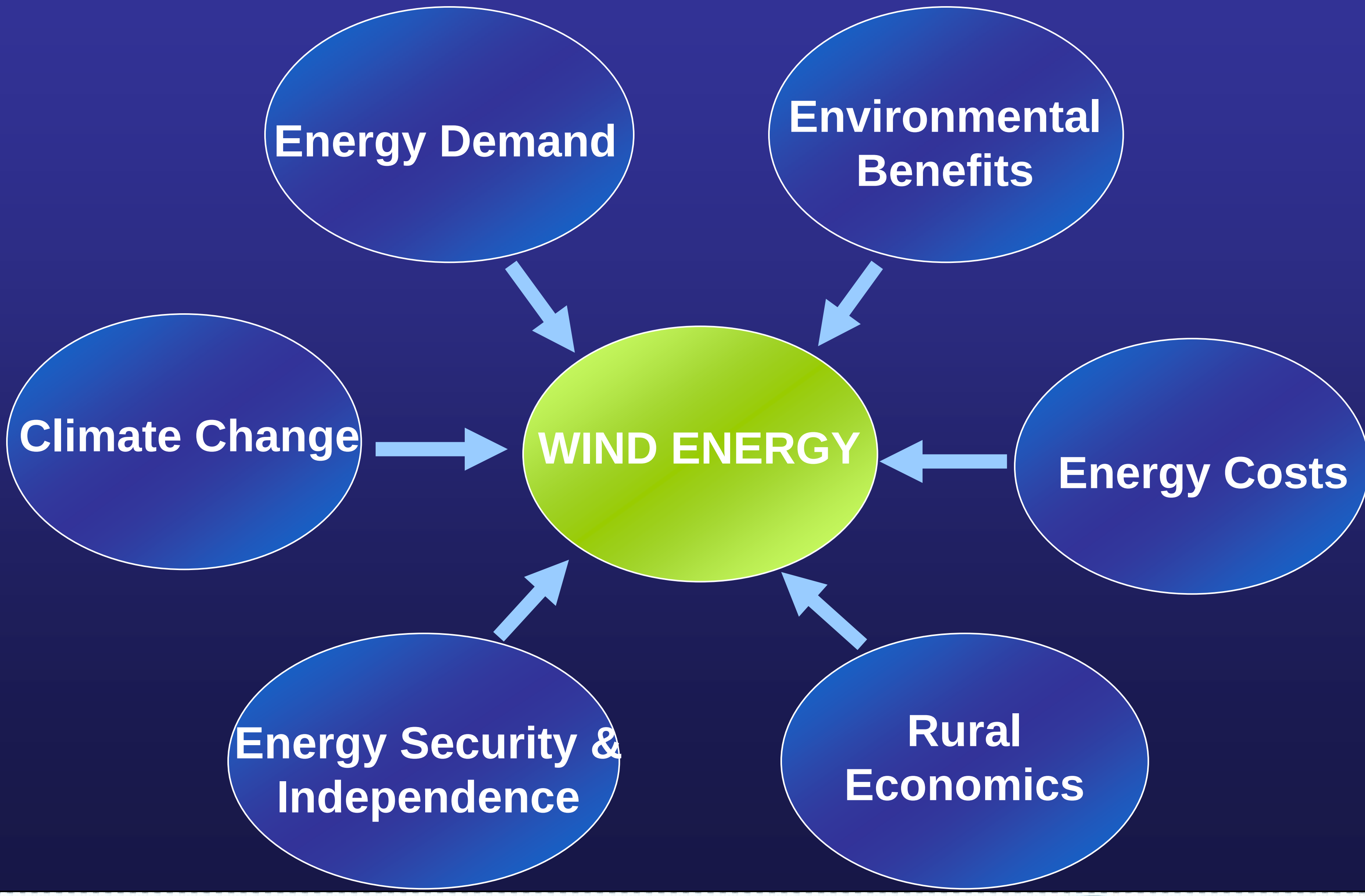
Drivers for Wind

Several factors explain why wind is the world's fastest growing energy resource



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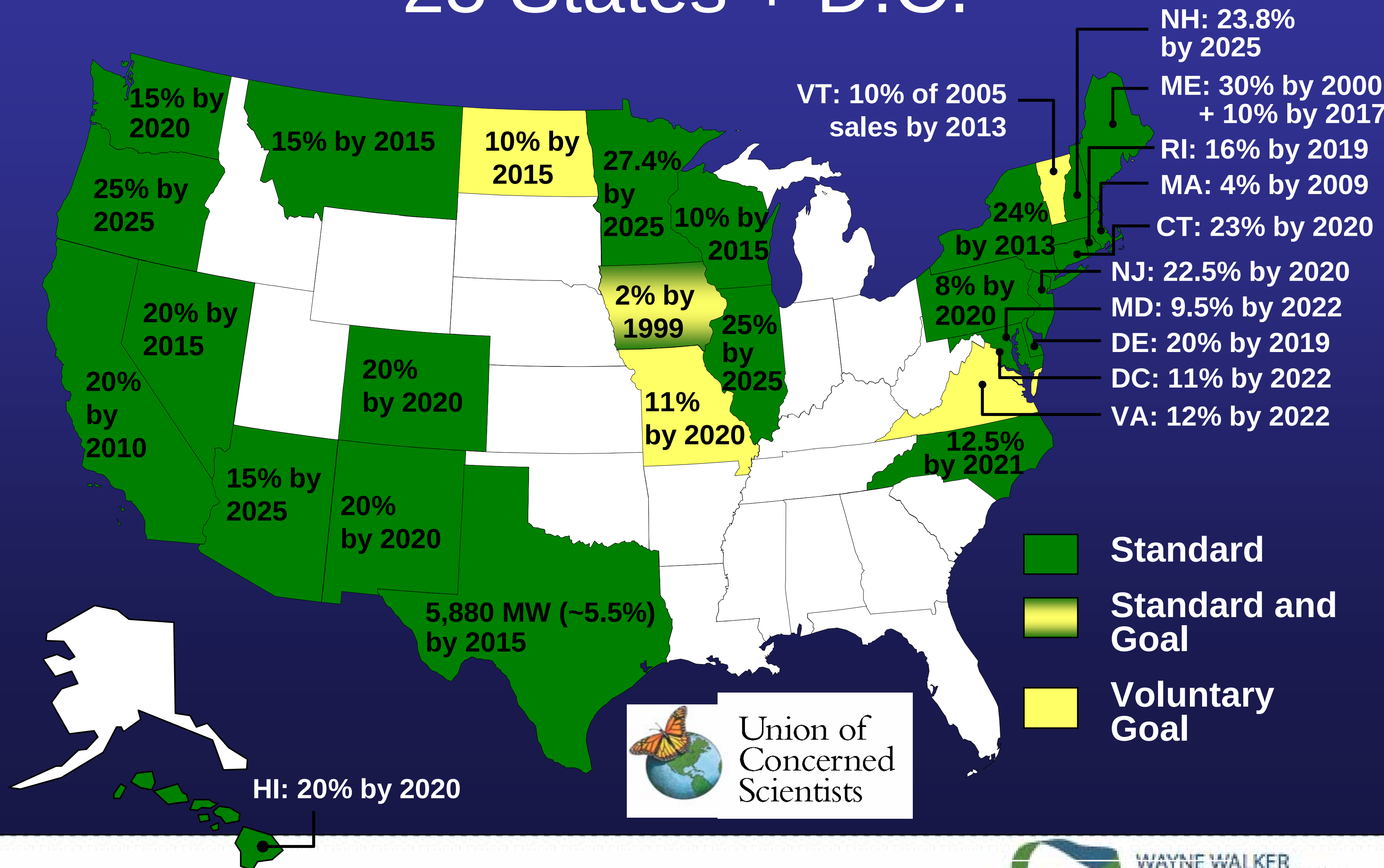
Wind Industry State of Affairs

- Experiencing record growth
  - 5244 MW's installed in US in 2007
  - Expected to install 4-5000 MW in 2008
- 20% Vision Plan to be released in Spring (DOE/AWEA)
  - Goal: Wind to supply 20% of United State's energy by 2030
  - >1% of nations energy supply today
  - Fastest growing renewable resource
  - 2nd fastest growing energy resource
- Significant amount of mergers and acquisitions over the last two years have made wind a mainstream contributor to the energy equation

Renewable Electricity Standards

25 States + D.C.



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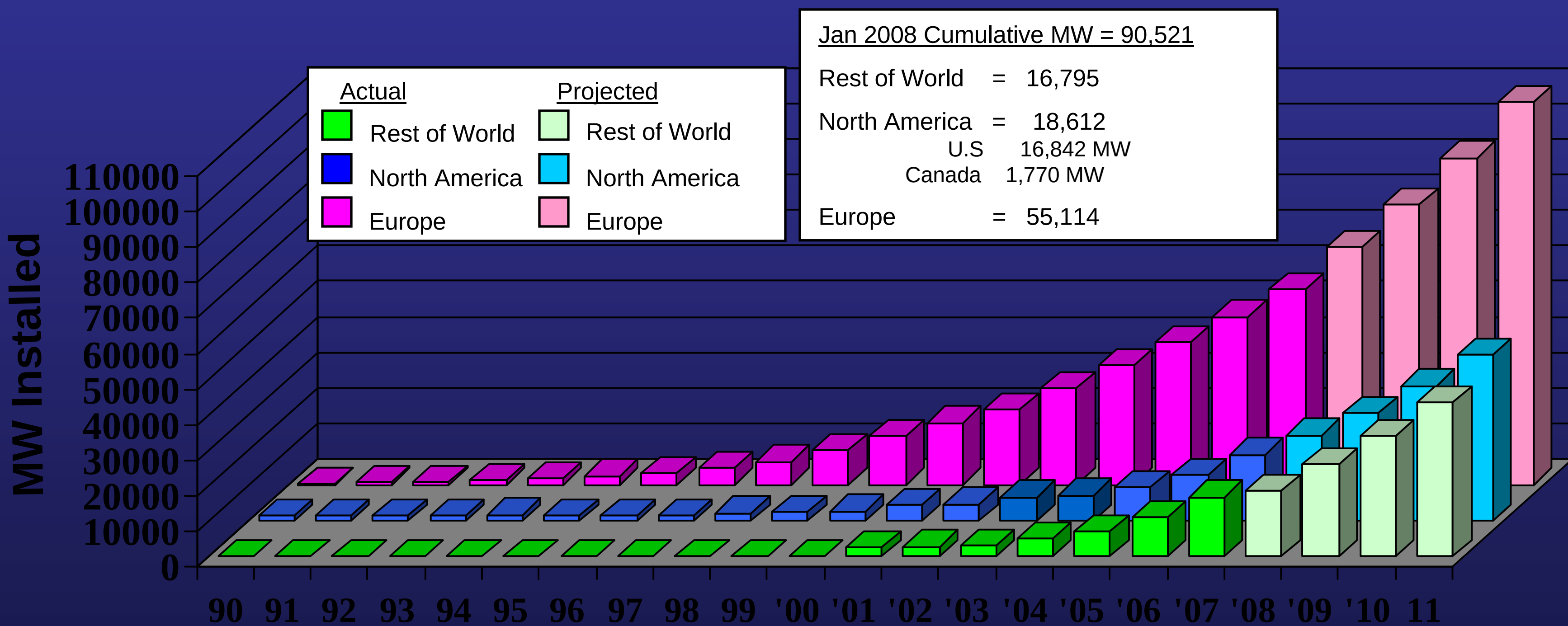
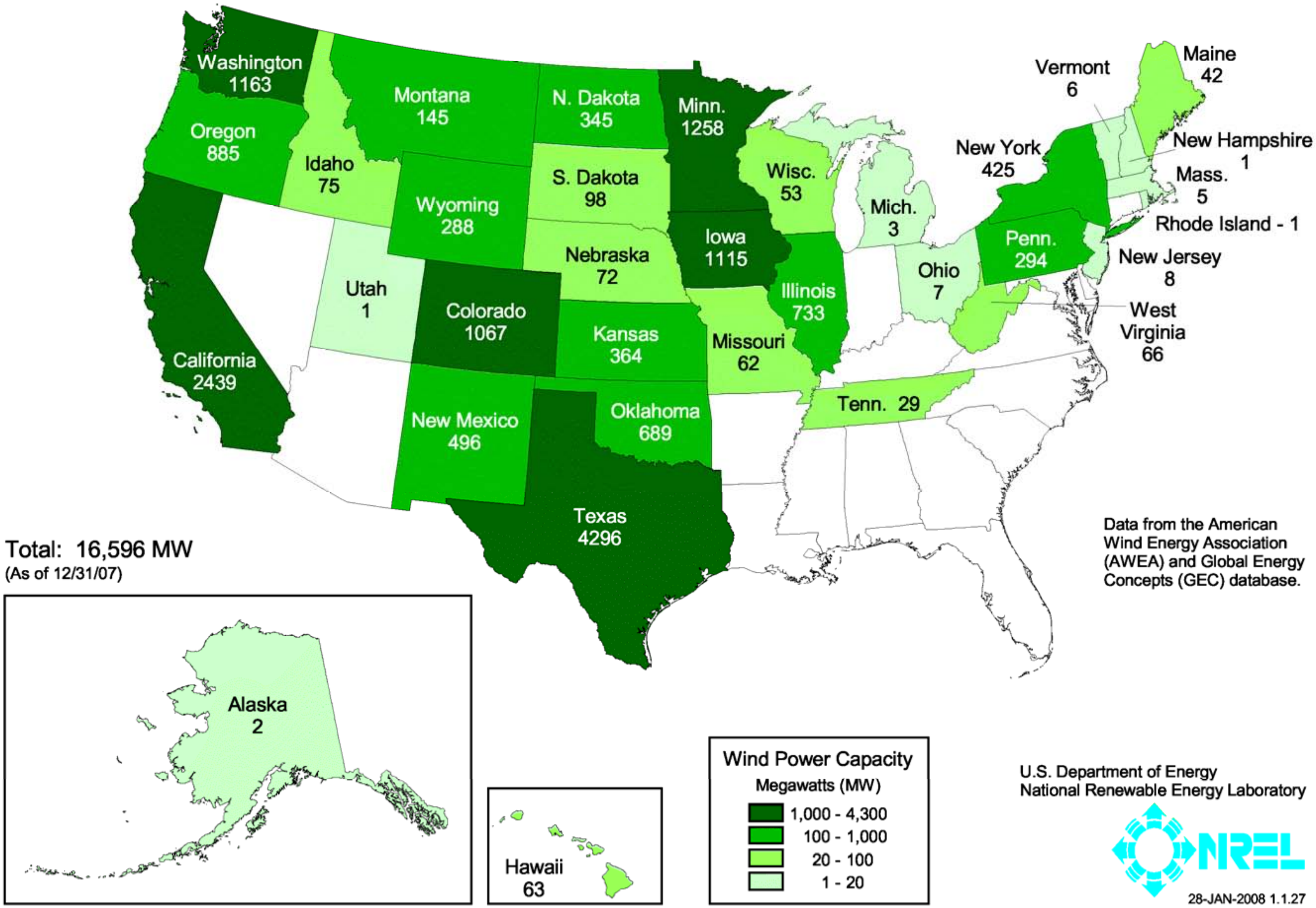
Growth of Wind Energy Capacity Worldwide



Sources: BTM Consult Aps, March 2007
Windpower Monthly, January 2008
*NREL Estimate for 2008

United States - 2007 Year End Wind Power Capacity (MW)



Total: 16,596 MW
(As of 12/31/07)

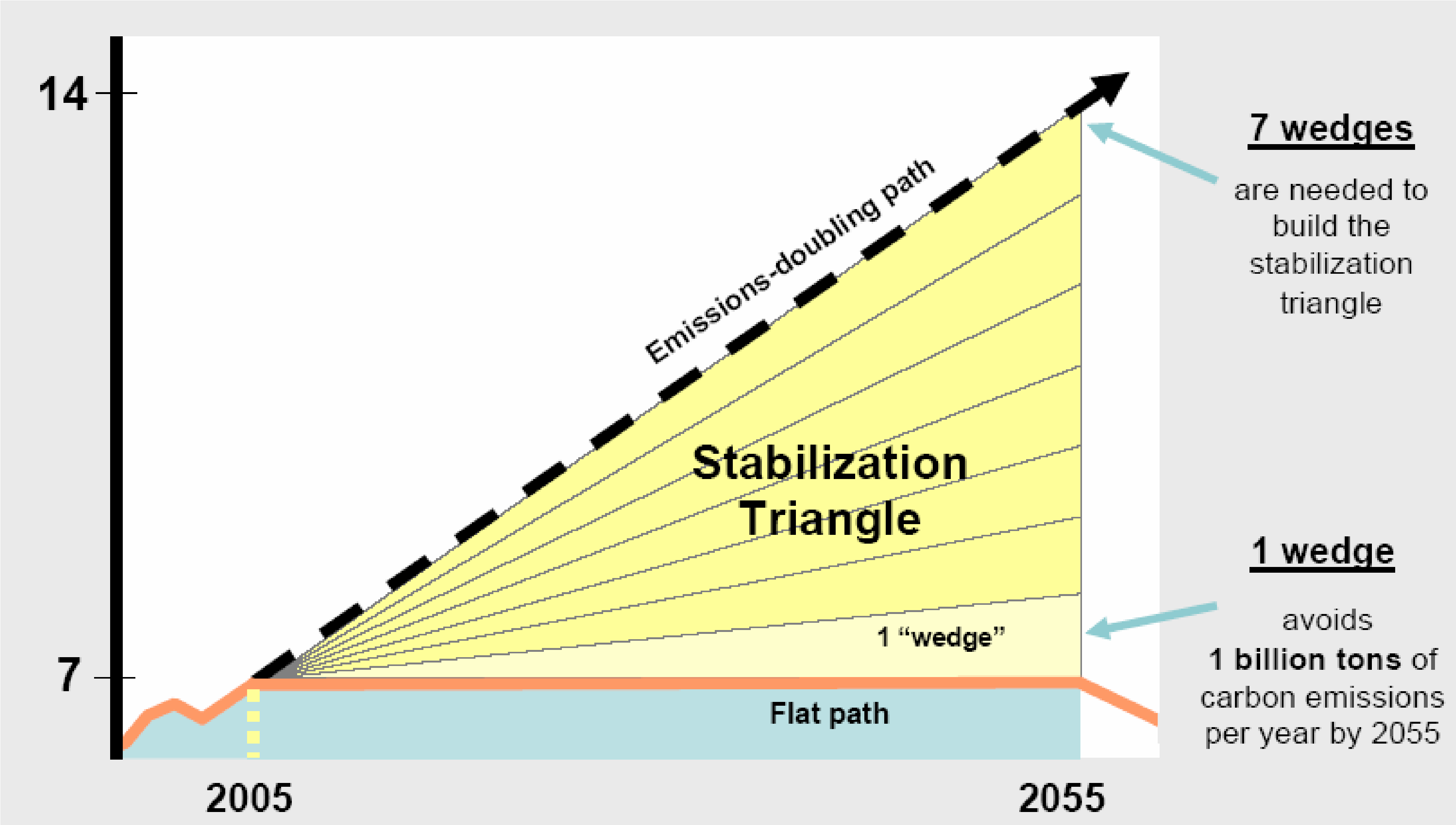
Data from the American Wind Energy Association (AWEA) and Global Energy Concepts (GEC) database.

U.S. Department of Energy
National Renewable Energy Laboratory

28-JAN-2008 1.1.27

Can wind make a difference?

- Locally
  - Does not use Water
  - No emissions
  - Compatible with most existing land uses
  - Limited site impacts during operation
- What about Globally?



Princeton University, Carbon Mitigation Initiative, S. Pacala and R. Socolow

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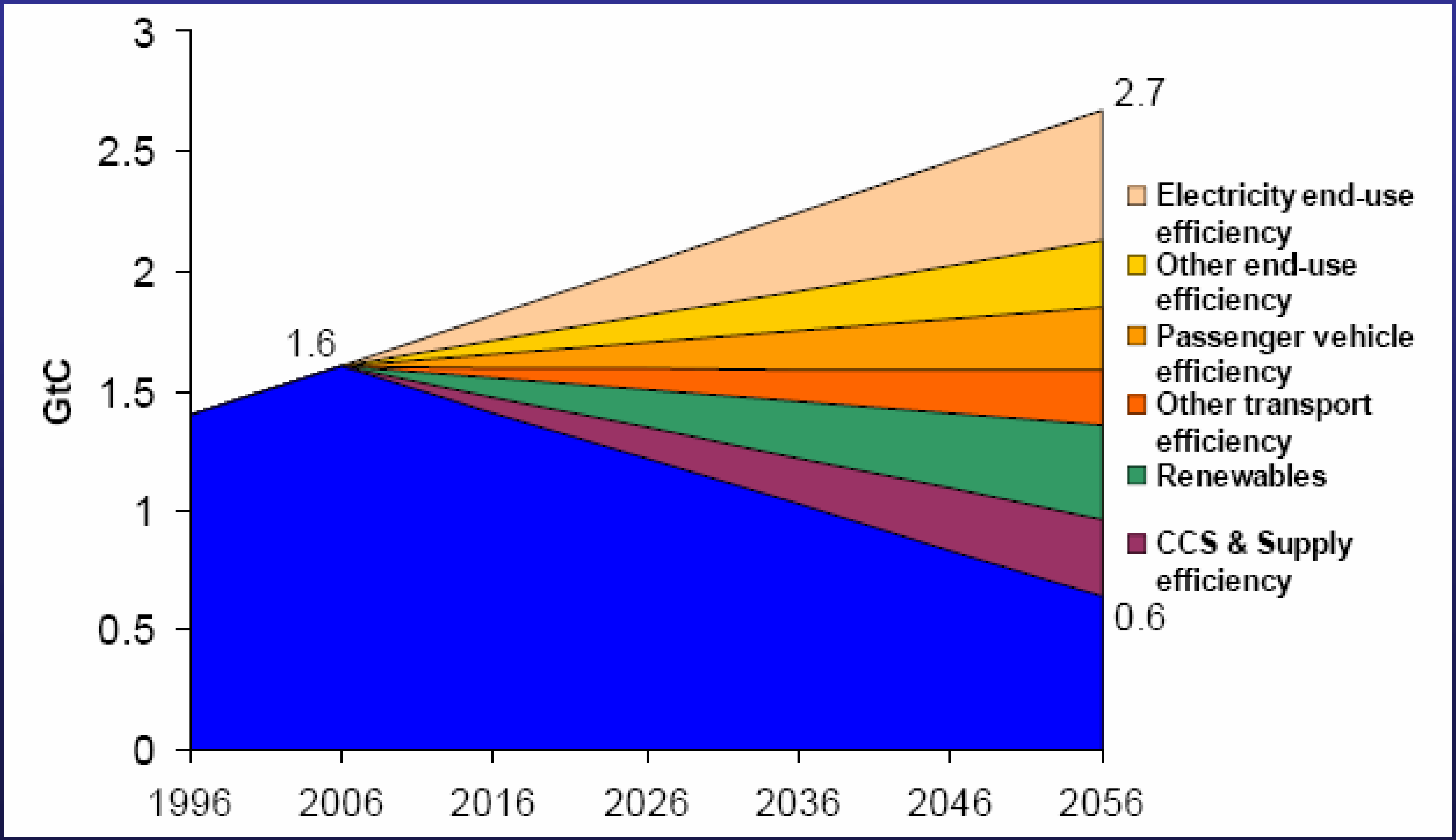
• 1 U.S. Wedge = Annual Reduction by 2056 of
.25 gigatons of carbon (GtC) = 917,000,000 CO2

• US Renewables = 1.6 Wedges
• 20% Wind by 2030=825,000,000 CO2-Wind can provide an entire wedge!



NRDC: An Action Plan to Reduce U.S. Global Warming

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Who's Who – Wind Development Value Chain

DEVELOPERS

- FPLE
- Iberdrola
- Acciona
- AES
- BP Alternative
- Babcock & Brown
- Invenergy
- Horizon/EDP
- Shell

POWER PURCHASERS

- AEP
- PacifiCorp
- Exelon
- Xcel
- LADWP
- PSE
- Reliant

EQUIPMENT MANUFACTURERS

- GE
- Vestas
- Gamesa
- Siemens
- Clipper
- Suzlon
- Mitsubishi

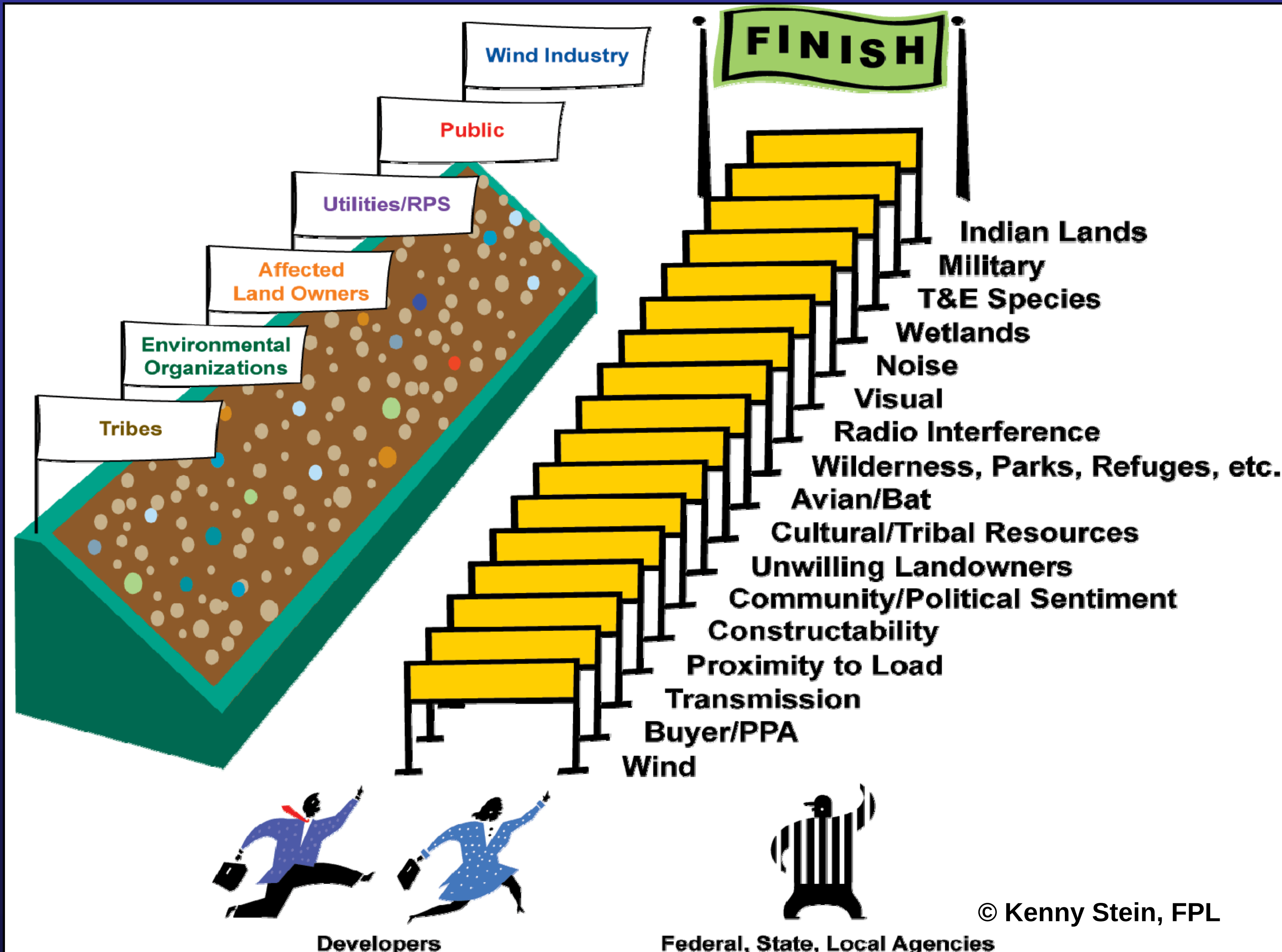
PROJECT FINANCIERS

- Fortis
- Bayerische Landesbank
- Dexia
- Manulife
- Prudential
- JP Morgan
- GE Financial Services

EQUITY INVESTORS

- JP Morgan
- Babcock & Brown
- FPL Energy
- Edison Mission
- Meridian

Wind Project Siting Challenges/Hurdles



Wind Development Tools

- People
  - Project developers-usually in house
  - Business development-Must obtain PPA or go Merchant to sell the power
  - Land-in house/contract
  - Meteorologists-in house/contract
  - Transmission-in house/contract
  - Wildlife/Environmental-in house/contract
  - Permitting-in house/contract
- Maps
  - Land: GIS, USGS Topographic, GPS
  - Wind: NREL, State, 3rd party public and/or proprietary
  - Wildlife: Agency, NGOs, Academic, local resources
  - Transmission: ISO's and proposed new lines (policy dependent)
- Finance
  - It all has to make sense in the financial model
  - Arranges debt and equity participants for single or portfolio of projects
- New-AWEA Siting Handbook http://www.awea.org/sitinghandbook/

The 6 Key Elements of a Successful Wind Project

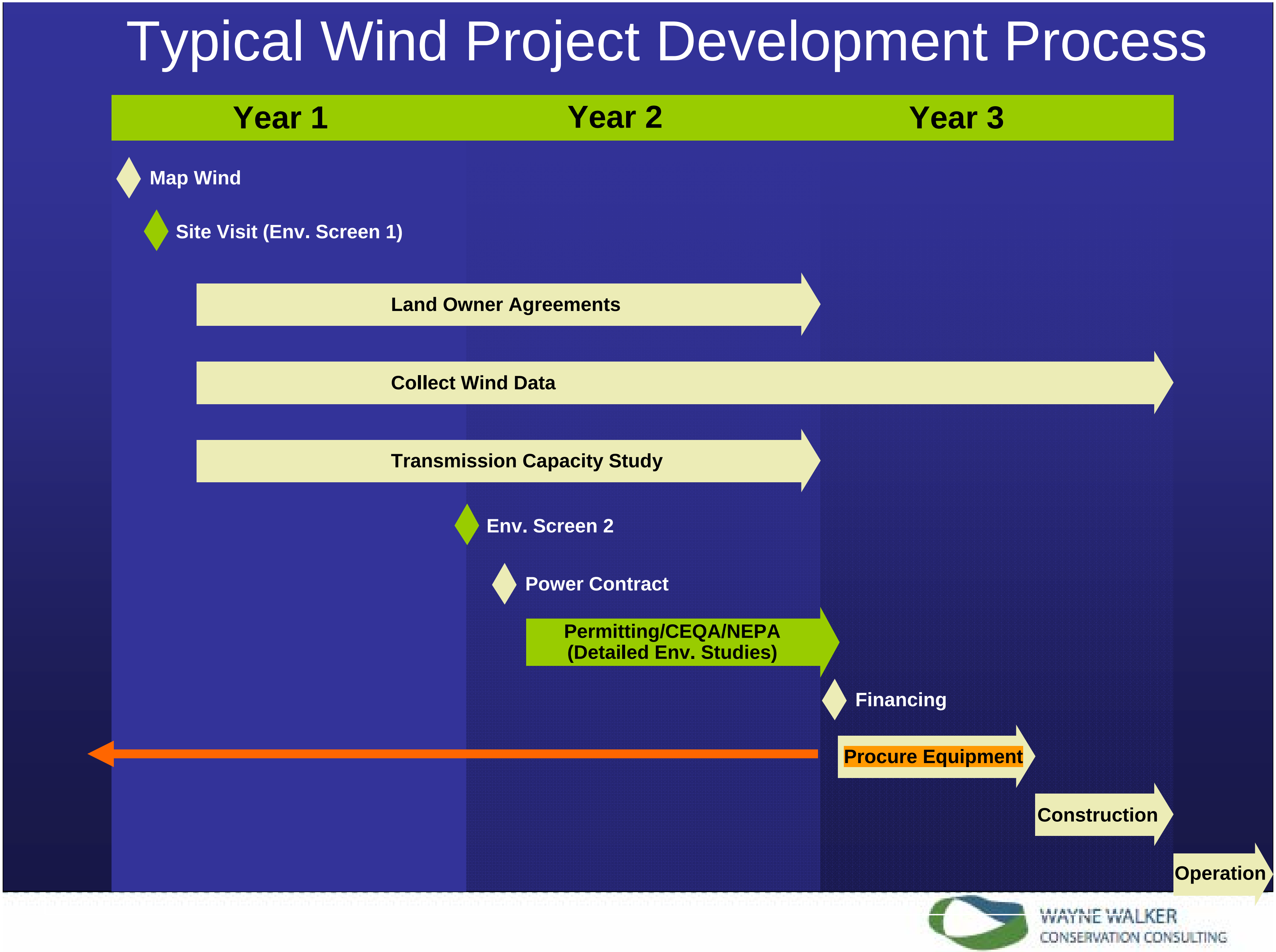
- Wind – 1 mph difference is make or break
- Land – need willing landowners
- Permits – wildlife and NIMBY issues
- Transmission (capacity and proximity)
- Buyer (Power Purchase Agreement)
- Financing – need all 5 above to get it

6 Key Elements

- Need ALL 6 elements to build a project
- The lack of any one kills a project
- Timing is critical: PTC, Turbine Supply, Market Timing
- Unlike natural gas, coal or nuclear power plants, we can not transport our “fuel” (wind) to a desirable location – we have to go to where the resource is
- Rate of return is set by capital markets- it is not a question of “how much can we make?” but rather, “can this project get built?”

Typical Sequence of Development Process

- The sequence of evaluating each element varies by site, but often the order is:
  - Wind – evaluate the resource
  - Land – are landowners interested?
  - Environmental Review (wildlife fatal flaw & EA/EIS)
  - Permits – initial review of permitting issues
  - Transmission – capacity; cost
  - Buyer – general market; merchant or PPA?
  - Financing- based on all of the above


Typical Wind Project Development Process
Year 1
Year 2
Year 3
Map Wind
Site Visit (Env. Screen 1)
Land Owner Agreements
Collect Wind Data
Transmission Capacity Study
Env. Screen 2
Power Contract
Permitting/CEQA/NEPA
(Detailed Env. Studies)
Financing
Procure Equipment
Construction
Operation
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Developer Sensitivity re. Confidentiality

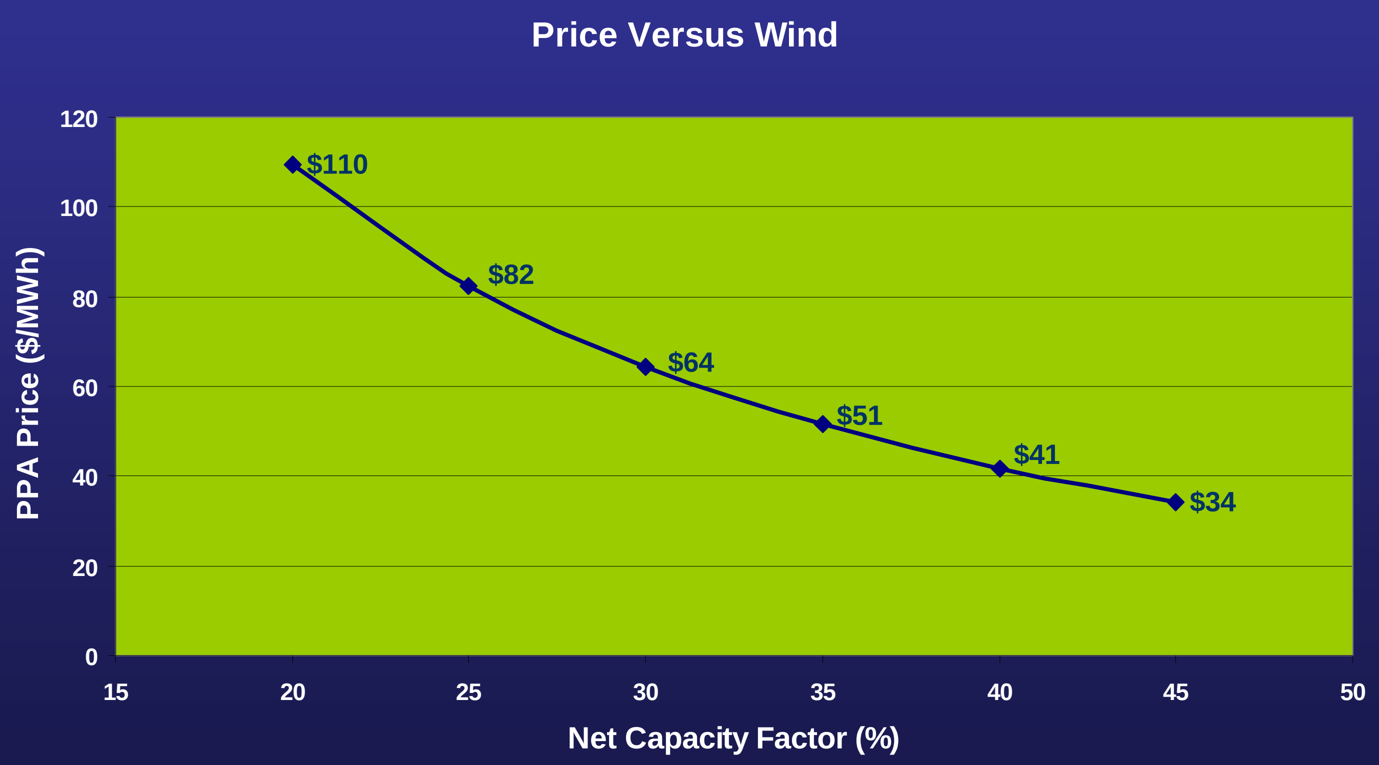
- At early stages of a project, confidentiality is a very real business issue for the wind industry
  - Agencies subject to FOIA/state sunshine laws
  - Fierce competition for best sites, land and interconnection
  - Until you know viability of critical items (wind, land, transmission, etc.) you don't want to spend scarce time and resources on site specific studies
- Cause of great deal of miscommunication and mistrust between developers and wildlife agencies/advocates.
- After land is acquired and permit applications are imminent, developer should be willing to discuss details

Key Siting Considerations

Meteorological Tower

- Wind - is the most absolute requirement –
  - Energy is function of cube of wind speed
  - Avg. wind speeds of 16-19 mph in most areas
  - At higher altitudes, air density drops - requires a higher wind speed for same output
  - Depends on region's market price for power
  - No mitigation for low wind speed!

Project Viability Very Sensitive to Wind Speed



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Key Siting Considerations

- Land - Owners must be willing
  - Can't build without land
  - Need large, contiguous parcels
  - Compatible land uses - e.g. ranching, dry farming, open space, oil/mineral extraction
  - Developers do not have power of eminent domain
  - Good land people can and have made or broken many projects across the landscape

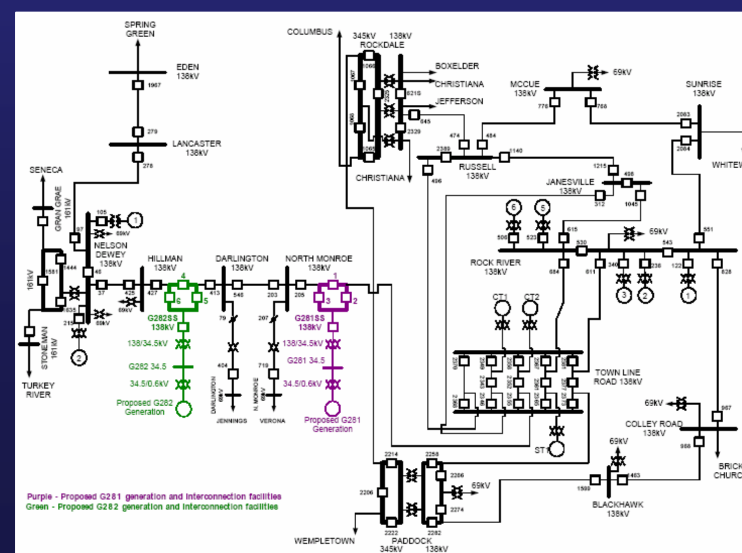
Key Siting Considerations

- Transmission-
  - Typically connect to 115/230/345 kV lines
  - Must have capacity available
    - Interconnection
    - Delivery: Curtailment risk allocation
  - Feeder lines typically 5 – 20 miles, getting longer
  - Ability to finance feeder lines, upgrades depends on project size and economics. Bigger projects with better winds can afford longer feeder lines and more upgrades
  - Long feeder lines may be difficult and expensive to acquire and permit

Transmission Interconnection Process

- Conduct internal load flow studies
- Submit interconnection application “get in the queue”
- Perform system impact & facility studies
- Sign interconnection agreement

ID	3-Phase Fault	Breaker # & Primary Clearing	Other Details	Transient Performance[1]		
				Dispatch -1[2]	Dispatch -2[2]	Dispatch -3[2]
				Simulated clearing: +1.0 cy primary +1.0 cy backup	Simulated clearing: +1.0 cy primary +1.0 cy backup	Simulated clearing: +1.0 cy primary +1.0 cy backup
Primary Faults (at from ends)						
F.1	N. Monroe – Town Line Rd 138kV	NOM 205 – 5 cy TLR 2352,2355 – 5.5 cy		Good	Good	Good
F.2	Town Line Rd – N. Monroe 138kV	TLR 2352,2355 – 5 cy NOM 205 – 5.5 cy		Good	Good	Good
F.3	Nelson Dewey – Hillman 138kV	NED 37 – 5 cy HLM 425 – 5.5 cy		Good	Good	Good
F.4	Eden – Lancaster 138kV	EDN 1967 – 5 cy LAN 279 – 5.5 cy		Good	Good	Good
F.5	Town Line Rd – Rock River 138kV	TLR 2367,2361 – 5 cy ROR 684 – 5.5 cy		Good	Good	Good
F.6	Town Line Rd – Janesville 138kV	TLR 2343,2346 – 5 cy JAN 312 – 5.5 cy		Good	Good	Good
F.7	Town Line Rd – Russell 138kV	TLR 2368,2370 – 5 cy RUS 496 – 5.5 cy		Good	Good	Good
F.8	Town Line Rd – Paddock 138kV	TLR 2373,2377 – 5 cy PAD 2258,2266 – 5.5 cy		Good	Good	Good



Permits and Outreach

- Conduct fatal flaw analysis
- Determine permit requirements
- Conduct avian, wildlife and environmental studies
- Build local support
- Develop local media strategy, if necessary
- Maintain maximum flexibility for future project optimization

Visual Simulation of Twin Groves Wind Farm

Courtesy Horizon Wind Energy

Key Siting Considerations

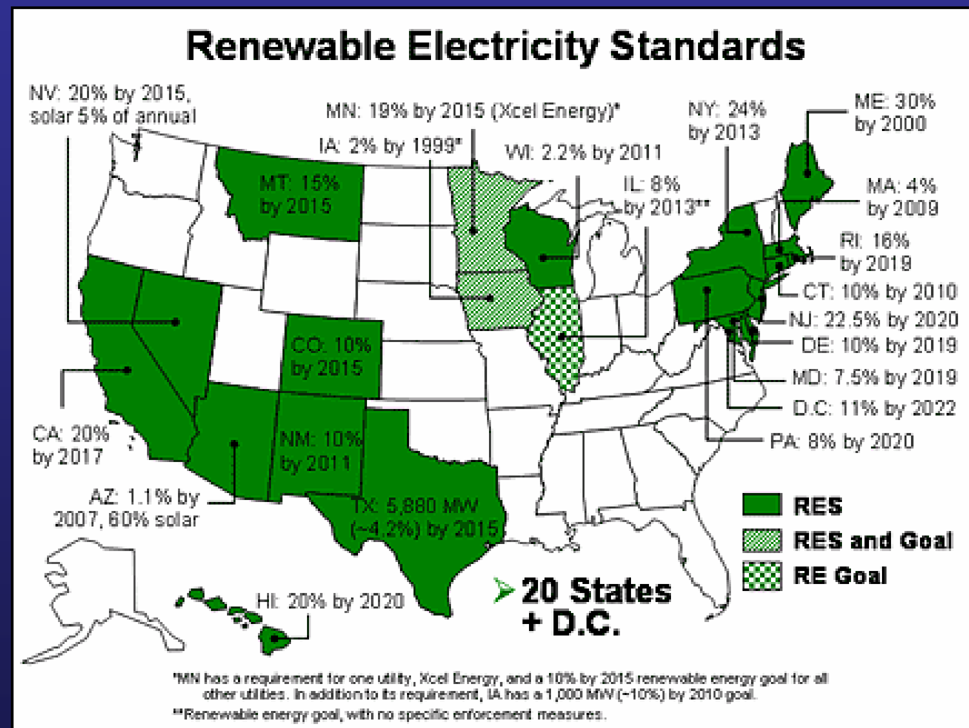
- Permits and Environmental
  - Wildlife impacts risk is typically the top issue
  - But - many issues and stakeholders to address- potentially conflicting interests to reconcile (e.g. wildlife, visual, NIMBY, archeological)
  - Different agencies and advocates have different agendas and concerns
  - Airspace/military/radar
  - Developer has to strike a balance among all

Key Siting Considerations

- Current Headline Wildlife Issues for Wind Industry
  - Bats (BWEC)
    - Lots of research, still unanswered questions
    - Wind Industry is committed to finding answers
  - Prairie Chickens/Grouse (NWCC GS3C)
    - Kansas Prairie Chicken Study in progress
    - Sage Grouse-Increasing scrutiny driven by traditional energy development threats today and future projected development in West (all types). No wind sponsored research at this time
  - Raptors/Altamont
    - Agreement in place, new mitigation strategies being evaluated
    - Wind Industry does not want another Altamont
  - Habitat Fragmentation
    - Emerging concern, especially in remaining grassland and shrub steppe ecosystems

Power Sales - 

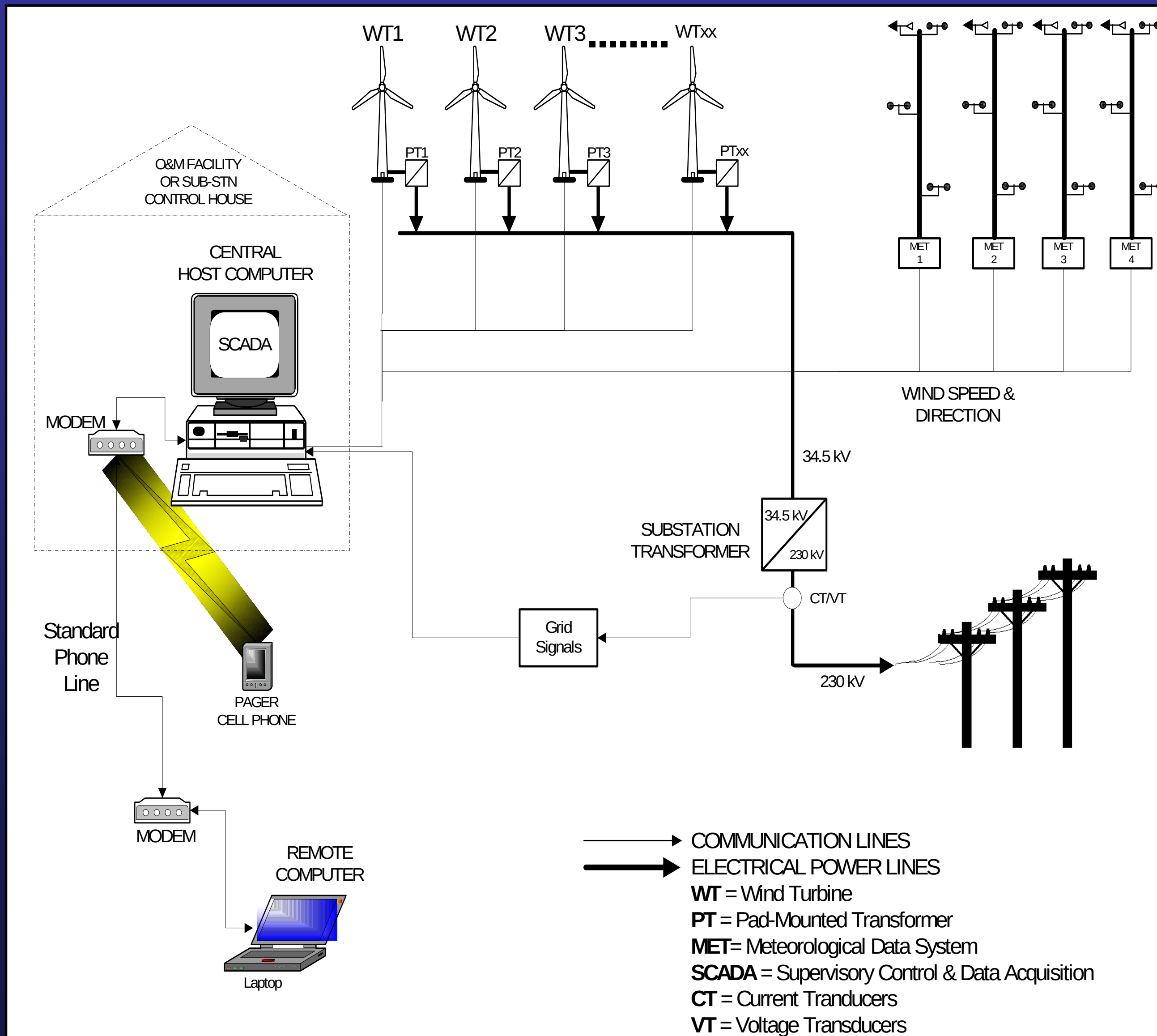
- Bilateral vs pool markets
- REC markets
- Power pool rules
- RECs bundled with power or sold separately?



Key Siting Considerations

- Market - Must have a buyer for power
  - Most, but not all, areas of the country have growing need for power
  - RPS and other policies drive wind demand
  - This typically dictates the region more than the individual site (i.e. ND vs. NY)
  - Closely related to transmission – who owns the lines, where do they go, are new ones coming, etc.
  - Regulated versus de-regulated market
    - SPP versus ERCOT example

Wind Plant Design



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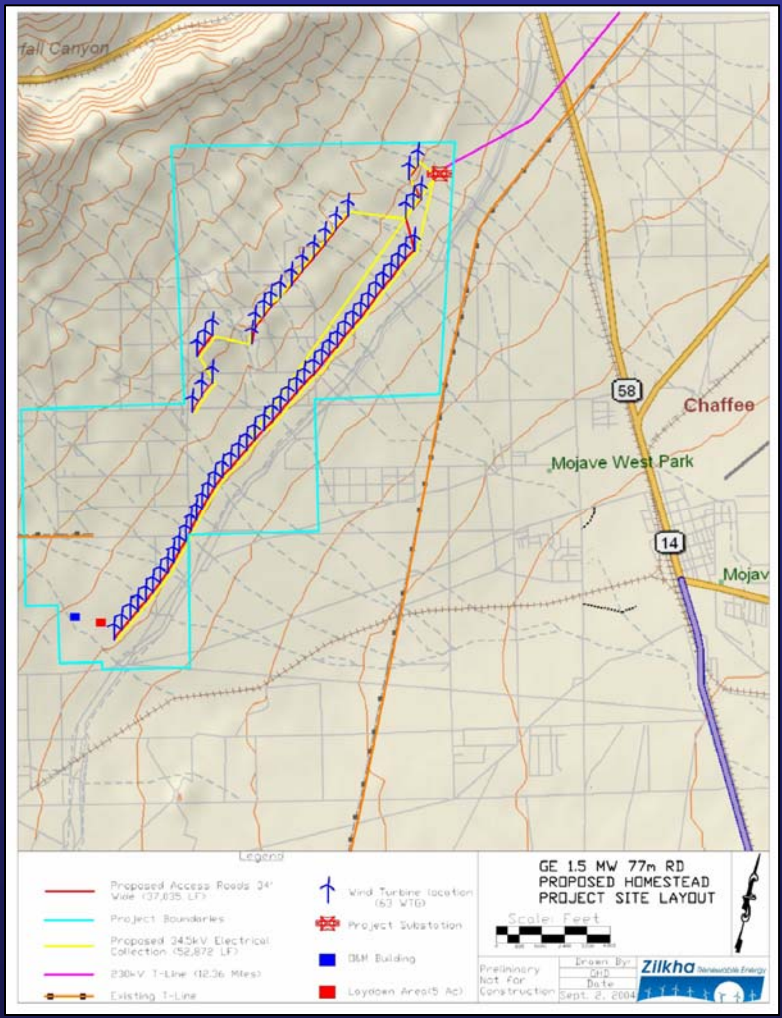
Wind Plant Design

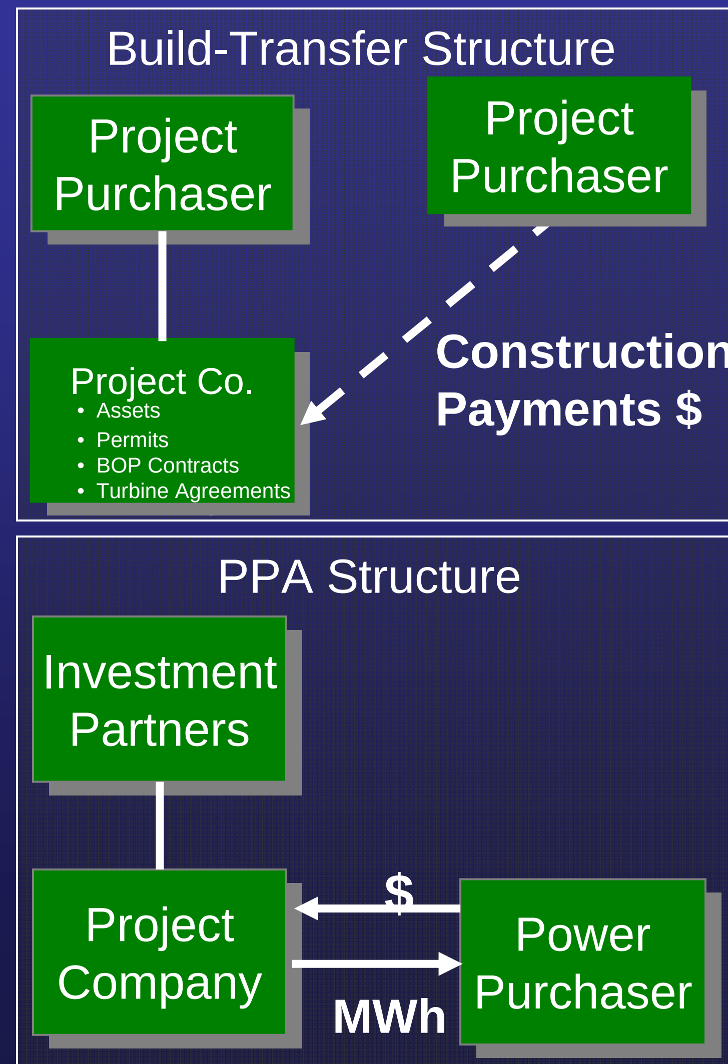
- Constructability
- Turbine selection
- Permitting
- Landowner preferences
- Maximum efficiency (max NPV or max MWh)



Sample Wind Project Layout

Finance

- Sell or maintain ownership?
- Many wind developers with limited tax capacity sell projects to utilities or other investors
- Trend in non-deregulated markets is toward utility ownership
- European market entrants want to retain ownership in most cases but must have US Tax Equity for PTCs



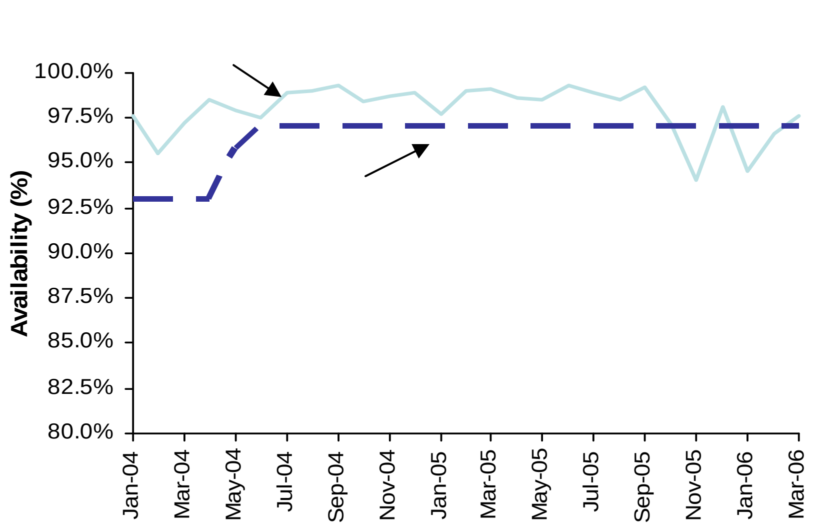
Build

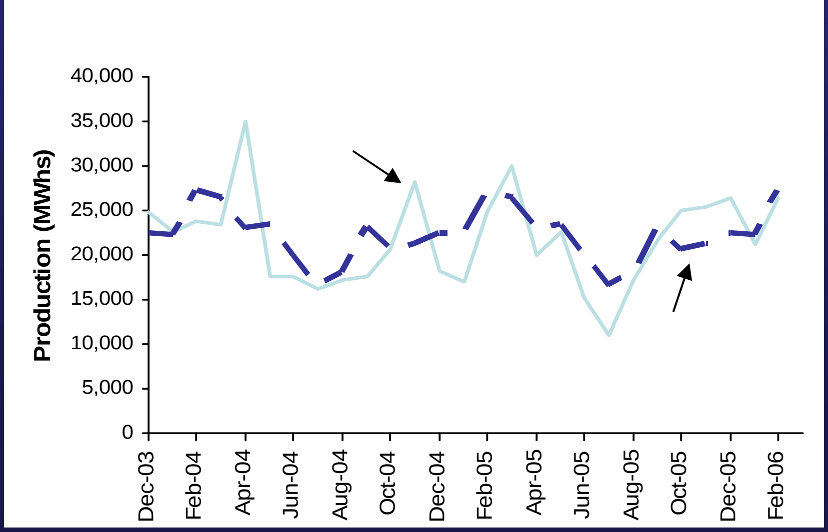
- Different developers play different roles in the construction process
- Normally one turbine supply contract and one "balance of plant" contract
- Constant pressure to meet PTC-production tax-deadlines

Blue Canyon Night Construction

Operate

- Plant owner operator's role in operations varies
- Turbine suppliers provide operations and maintenance
- Creates valuable feedback for development side





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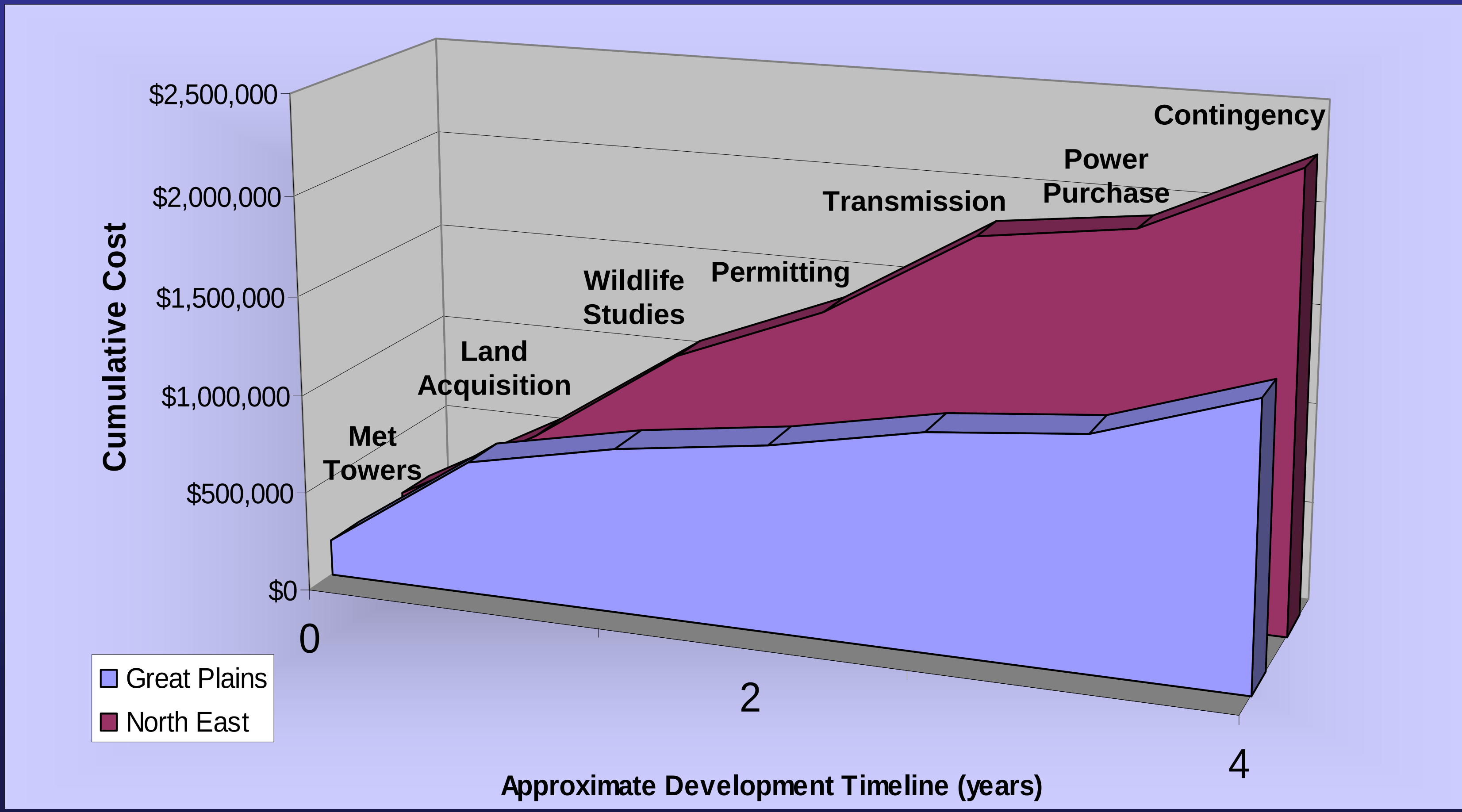
Development Dollars Expended Over Time



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<u>Things You Never Hear About</u> brought to you by *RNN-Responsible News Network*

- "Company X abandons >50% of evaluated wind sites"
- "$2M written off for wind project that did not pass internal Company X environmental review"
- "Company X cheers Company Y for taking over a project site that Company X voluntarily abandoned because it deemed possible wildlife risk too high to be a responsible wind project"

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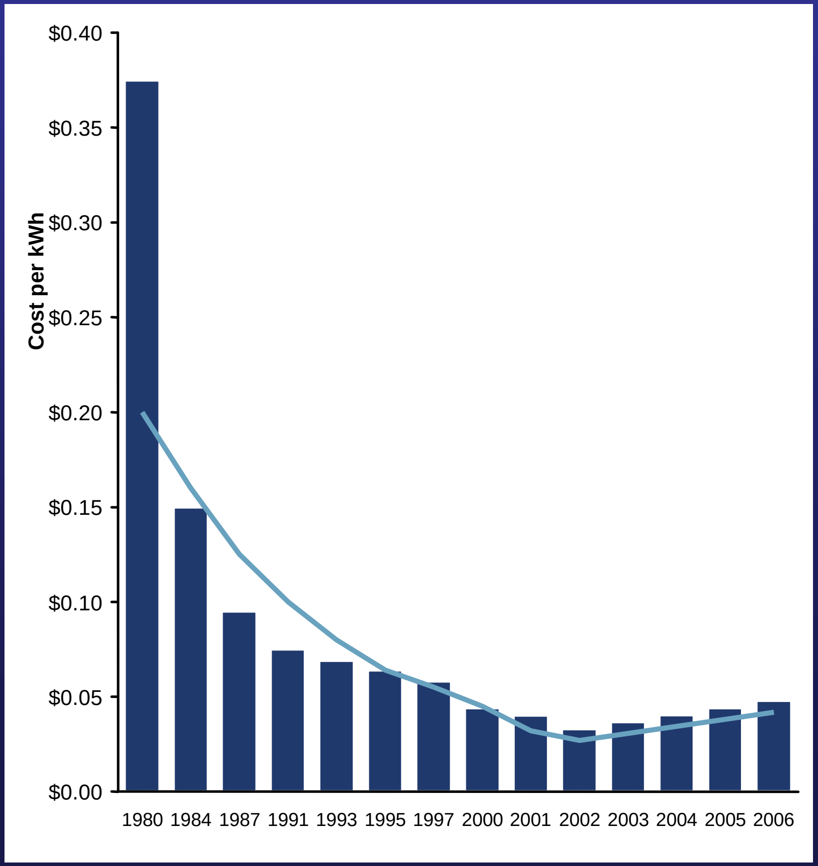
Wind Energy Cost Trends

- Commercial and technological development has been closely related to turbine size. Technical advances from 1980 to 2000 significantly increased efficiency and reduced cost
- Since 2003, although turbine efficiencies have continued to increase, all-in wind energy costs have increased because of:
  - Increasing steel and commodity prices
  - Increasing construction costs
  - Very tight turbine supply market
  - Unfavorable exchange rate



Graph indicative of Great Plains Wind Project bus bar price

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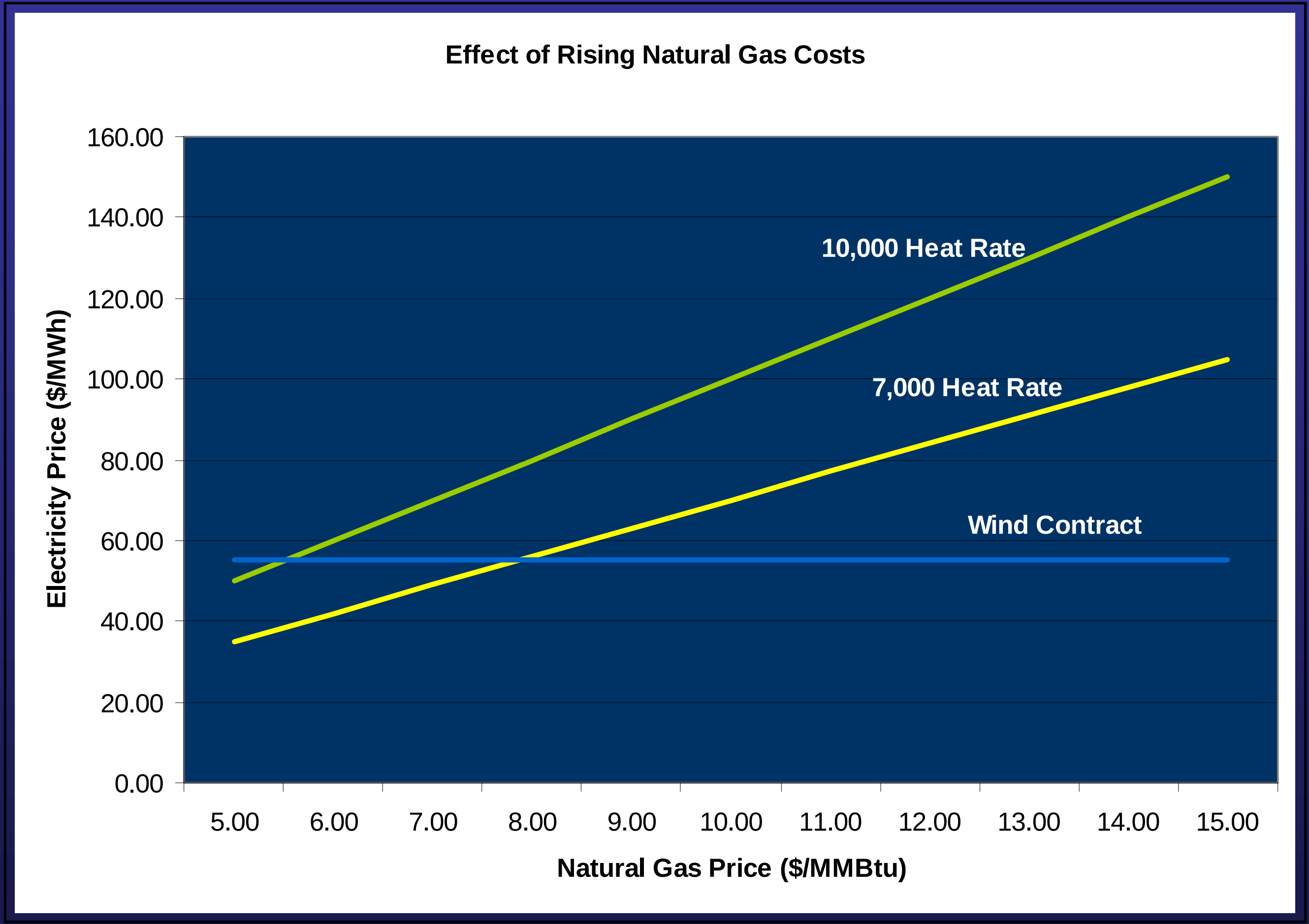
Offsets Natural Gas on the Margin



“$5/MWh can be considered the approximate hedge value that investments in renewable energy provide relative to variable-price, gas-based electricity contracts.”

~ Wiser, R. et al. LBNL 50484. June 2002.

Note: Slide is dated (2002), but trends remain the same

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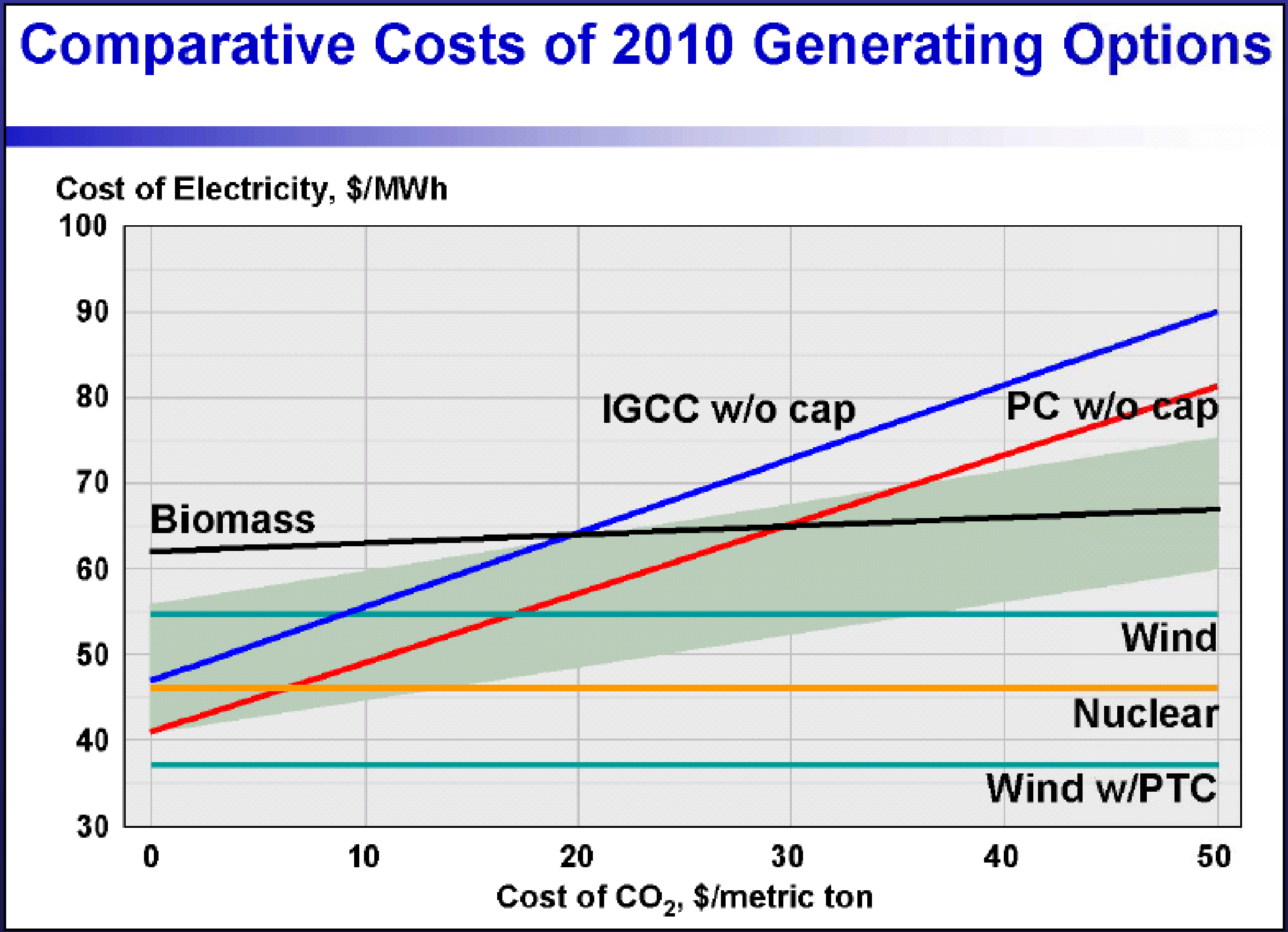
Lowest Cost New Generation



Source: Electric Power Research Institute 2005. Revised numbers will be available May 2008. All generation costs have increased.

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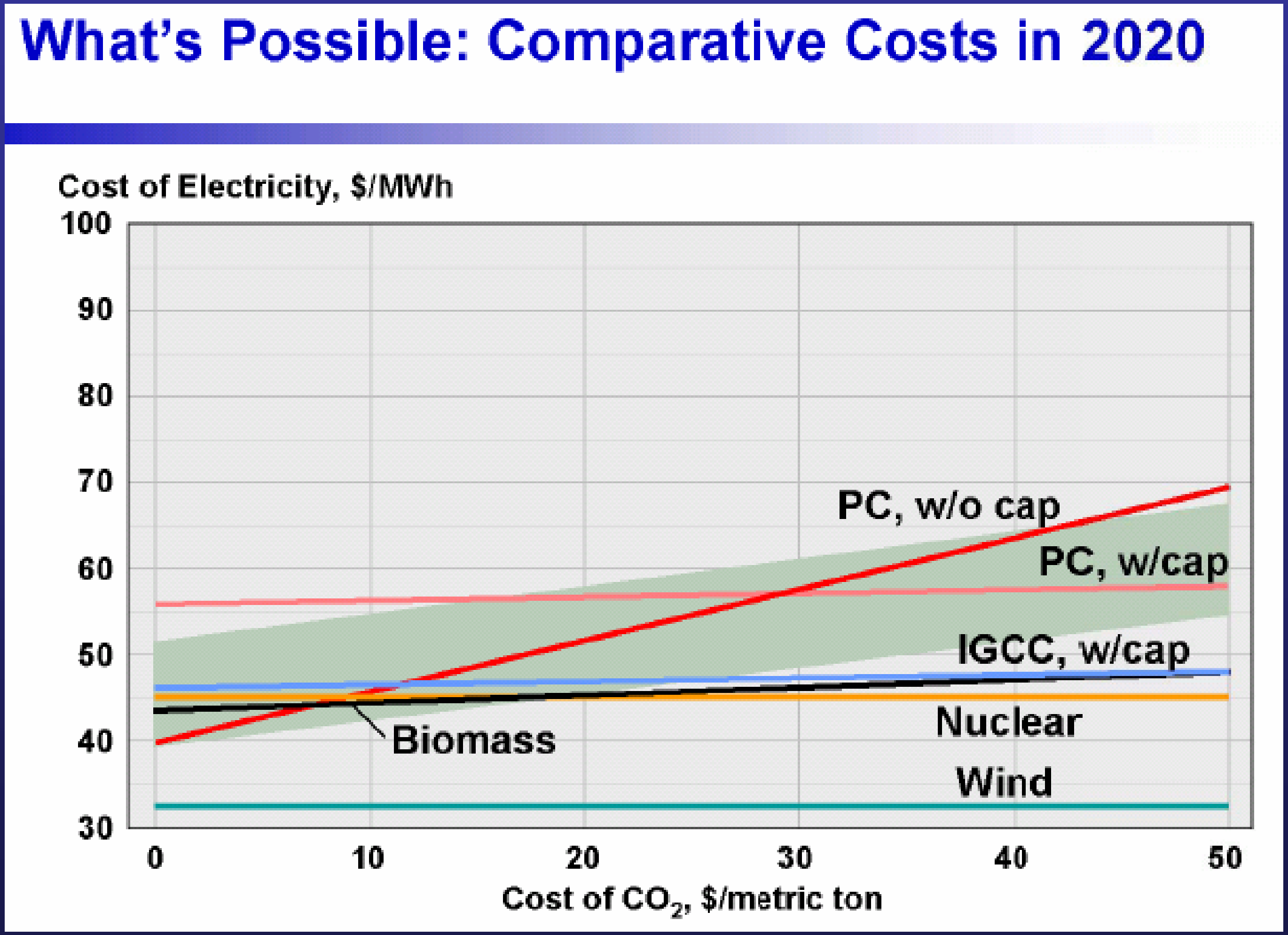
Hedge Against Carbon Caps



Source: Electric Power Research Institute 2005. Revised numbers will be available May 2008. All generation costs have increased.

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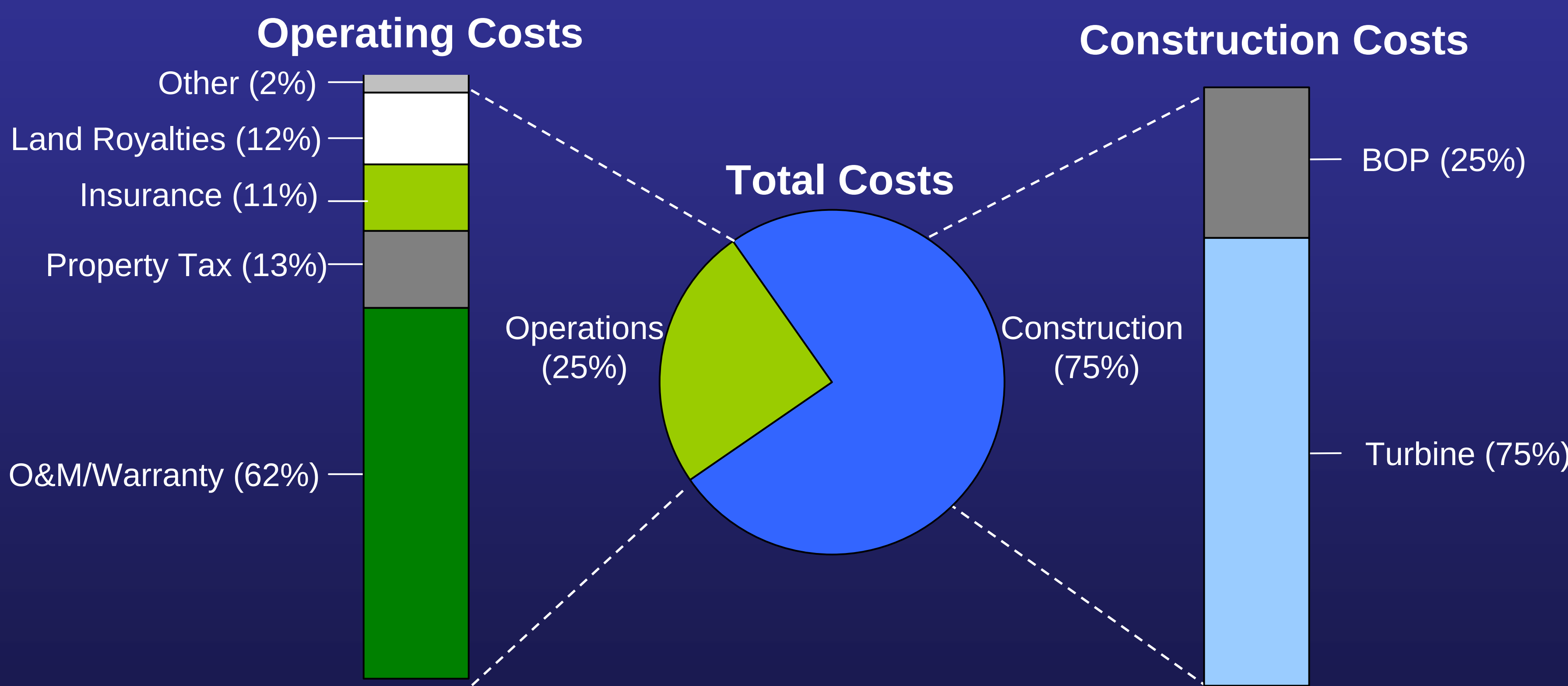
Cost Components



Major Assumptions:
a) 37% Net Capacity Factor
b) PPA = 5.5 cents/kWh
c) 200 MW project with $1.77 million/MW total cost

Graphic Source: GE

Critical Influencers of Wind Energy Economics-Regional

Assumptions	Great Plains	North East	Community Wind
Size (MW)	200	100	4.5
Project Life (Finance)	20 Years	20 Years	20 Years
Wind (MPH)	19	16	19
Wind (Net Capacity Factor)	35%	28%	35%
Permitting	$15,000	$1,000,000	$10,000
Wildlife Studies	$150,000	$350,000	$15,000
BOP Cost Including Turbines ($/kW)	$1,950	$2,050	$2,200
Land Acquisition (acreage)	20,000	10,000	320
Land Acquisition (cost/acre) for 7 year option	$25	$40	$5
Annual Land Royalty Range (escalating)	3-4.5%	4.00%	$4,000-6000/Yr/Turbine
Transmission Interconnection Study Cost	$150,000	$150,000	$25-50k
Transmission/Interconnection Cost**	$5,000,000	$3,000,000	150-250k
Total Capital Cost of Project (2009 COD)	$390,000,000	$205,000,000	$9,900,000
REC value/MWH at interconnect point	$0	$10.00	$5-20
Brown Power cost/MWH at interconnect poin	$55.75*	$75.00	$55-70
Internal Rate of Return	**9.05%**	**9.21%**	**9.50%**

*Note: Energy cost escalated @ 1% annually for Great Plains Project and North East Project

**Note 2: GP-$300k/mile (138 kv) +$2M sub, NE-$250k/mile (115kV) + $1.75M sub

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Critical Influencers of Wind Energy Economics-Financial Sensitivity Example

Assumptions	Great Plains Base	Great Plains Modified	Great Plains Modified 2	Great Plains Modified 3
Size (MW)	200	200	200	200
Project Life (Finance)	20 Years	20 Years	20 Years	20 Years
Wind (MPH)	19	17.5	20	19
Wind (Net Capacity Factor)	35%	33%	37%	35%
Permitting	$15,000	$15,000	$15,000	$15,000
Wildlife Studies	$150,000	$150,000	$150,000	$150,000
BOP Cost Including Turbines (KW/hr)	$1,950	$1,950	$1,950	$1,500
Land Acquisition (acreage)	20000	20000	20000	20000
Land Acquisition (cost/acre) for 7 year option	$25	$25	$25	$25
Annual Land Royalty Range (escalating)	3-4.5%	3-4.5%	3-4.5%	3-4.5%
Transmission Interconnectin Study Cost	$150,000	150,000	150,000	150,000
Transmission/Interconnection Cost	$5,000,000	$5,000,000	$5,000,000	$5,000,000
Total Capital Cost of Project (2009 COD)	$390,000,000	$390,000,000	$390,000,000	$390,000,000
REC cost at interconnect point	$0	$0	$0	$0
Brown Power cost at interconnect point	$55.75	$55.75	$55.75	$55.75
Internal Rate of Return	9.05%	8.33%	9.79%	12.46%

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Critical Influencers of Wind Energy Economics-Other Impacts on IRR

- Curtailment (affects capacity factor)
- Currency exchange (affects BOP)
  - 2008: 1 Euro=~1.5 US Dollars
  - 2000: 1 Euro=~.83 US Dollars
- Turbine price increase (affects BOP)
- Unexpected land costs
- Un-anticipated mitigation costs (regulatory or voluntary)
- Unexpected interconnection costs (affects BOP)- Capacitor banks, etc.

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What Else is Required?

- Site must be accessible – must be able to deliver and erect turbines over 400’ tall
- Need adequate level ground around each turbine site – crane pads, laydown areas
- Need adequate spacing between rows of turbines – 1/3 to ½ mile

Project Facilities

- Access Roads – Gravel roads linking wind turbine strings to existing roads.
- Electrical Collection System – Cables that electrically connect wind turbines to the project substation.
- Project Substation – Steps up project generation to interconnection voltage.
- Operations & Maintenance Building – Houses central office, computer systems for facility operations, equipment storage and maintenance areas.

Construction Sequence

- Roads
- Foundations
- Electrical Collector System
- Wind Turbine Generator
  - Tower
  - Setting the generator
  - Rotor assembly
- Interconnection
- Commercial Operation

Road Construction

Grading

- Prepare road for construction

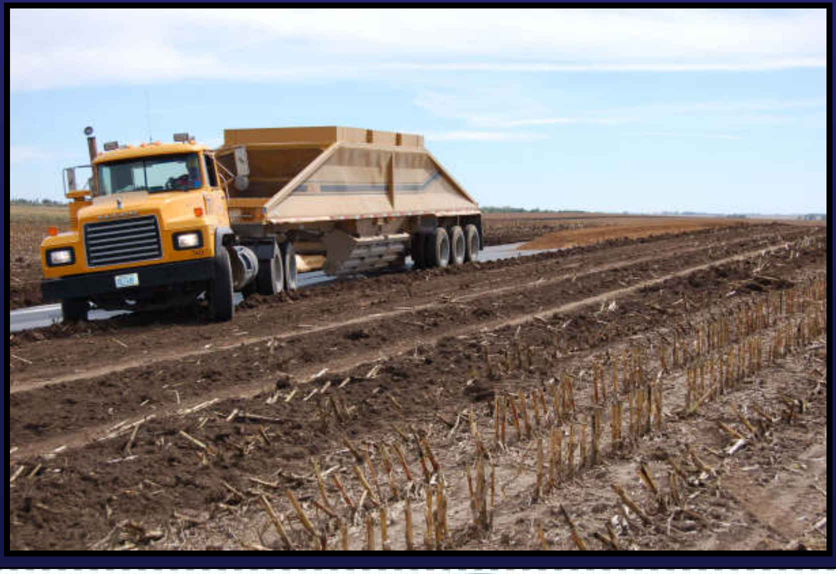
Drainage

- Install culverts, fords at drainage areas

Road Construction (cont.)

Install Base Material:

- Place geo-fabric or Geo-Grid on top of compacted 16 to 20 foot wide road sub-grade.
- Place 6 to 8 inches of gravel over road surface.
- Finish road profile slightly above natural grade with a 2% crown in the center to promote drainage.
- Construct shoulders with a maximum of 2% side slope for crane travel (reclaimed after construction).



Turbine Foundations

Tower Pier Foundation with Spreadfooter Example

- Footing: 50-80 ft diameter, 4ft depth with taper.
- Pier: 16-20 ft diameter, 3ft height.
- Apron: Compacted area over footing diameter with 6 in rock surface.

Construction:

- Excavation depth to ~8ft and +40ft base elevation.
- Mud Mat – 2 to 4 inches lean concrete.
- Rebar cage and anchor bolts cage.
- Concrete (5000 psi) formed and poured in two lifts.
- Backfill with native soil

Tower Erection

- The 80-meter turbine tower is composed of four cylindrical steel sections.
- The four tower sections are typically unloaded adjacent to each wind turbine foundation to minimize handling of these heavy steel components.
- Each tower section weighs between 35 and 50 tons.

Tower Erection

- The lower tower section is set first. A flange on the bottom of this 15’ diameter section allows it to be bolted to the top of the foundation pedestal.

- After the tower sections are set, the nacelle is raised and bolted to the top of the tower.

- A 2 megawatt class turbine nacelle weighs over 100 tons.

Tower Erection

- The rotor assembly is erected last.
- The rotor consists of three blades and a hub that mounts on the front of the nacelle.
- Typically, the blades and hub are assembled on the ground and then raised as a single unit, called the rotor, and attached to the nacelle.

Collector Cable Construction

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Collector Substation

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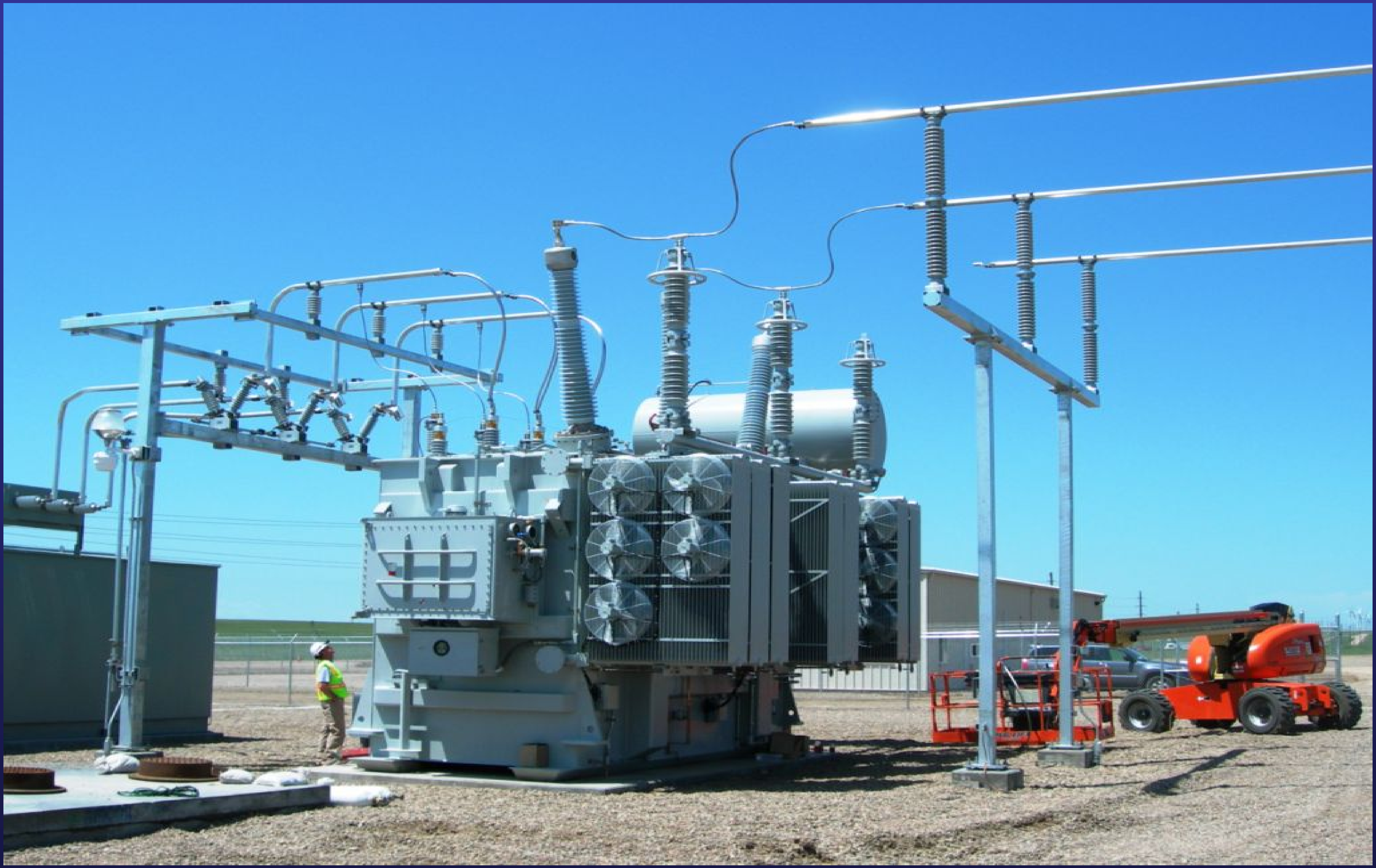

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O&M Building

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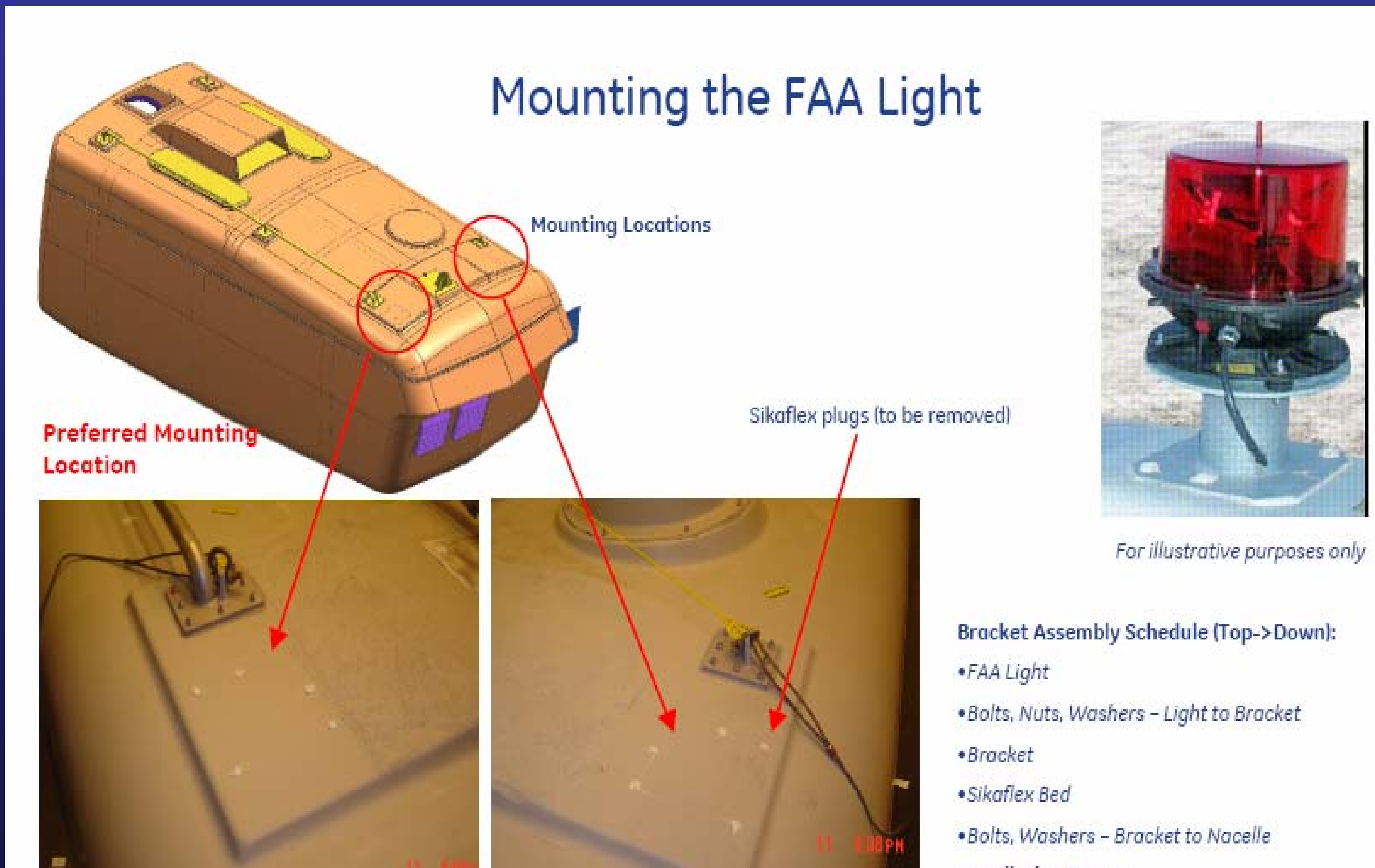
FAA Lights


Mounting the FAA Light
Mounting Locations
Preferred Mounting Location
Sikaflex plugs (to be removed)
For illustrative purposes only
Bracket Assembly Schedule (Top->Down):
•FAA Light
•Bolts, Nuts, Washers – Light to Bracket
•Bracket
•Sikaflex Bed
•Bolts, Washers – Bracket to Nacelle

Agenda

I. Credentials
II. Wind Industry Drivers
III. Wind Energy Development Process
IV. Development Dollars Expended Over Time
V. Economics of Wind Energy
VI. Construction Sequence
VII. Investors' Perspectives ⟵
VIII. Existing wind industry regional research initiatives
IX. Q & A

Investment Attractions

- Stable revenue from long-term contracts
- Proven technology with strong warranties
- Low operating costs/risks
- Predictable wind resource
- Tax incentives
- Attractive and predictable risk/return

Investment Challenges

- Heavy tax component
- PTC ownership requirements
- PTC uncertainty
- Tax market very specialized
- Transmission constraints
- Curtailment or operating shutdowns

Value Components

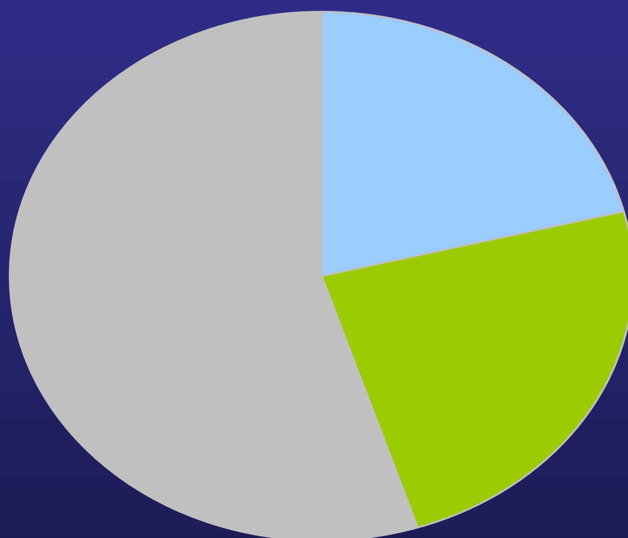
% NPV Value of Equity Cash Flows

Production Tax Credit (21%)

- **Requires tax appetite**
- **10-year term**

Energy Revenue (55%)

- **20-year term**



Depreciation (24%)

- **Requires tax appetite**
- **Predominantly 5-year term**

Major Assumptions: a) 37% Net Capacity Factor
b) PPA = 5.5 cents/kWh
c) 200 MW project with $1.77 million/MW total cost

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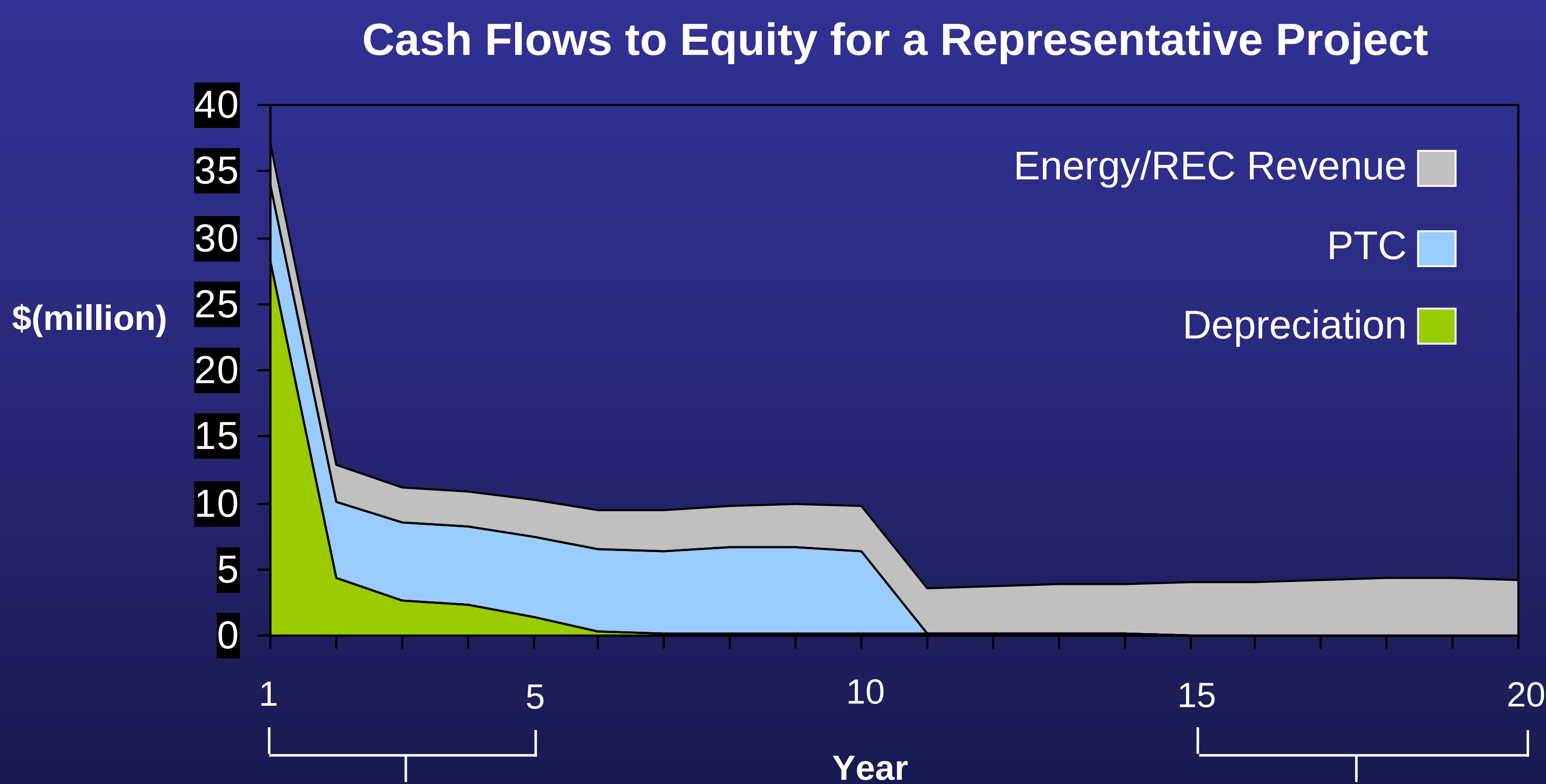
Cash Flows to Equity



- **Returns front-loaded**
- **Warranty coincides with peak cash flow period**

- **Option value:**
  - **Repower**
  - **Fossil fuel price uncertainty**
  - **RECs/Carbon offsets**

Source: GE

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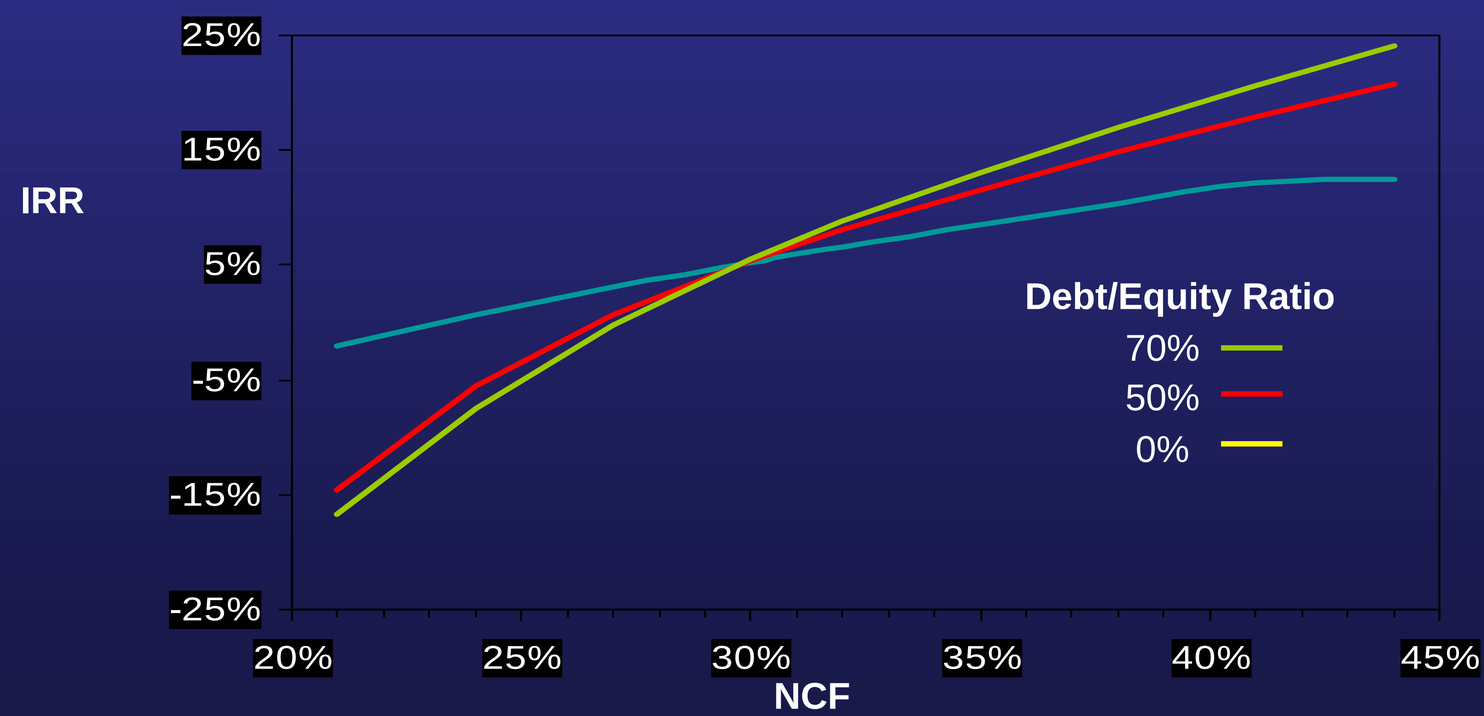
Risk/Reward of Leverage

Impact of Leverage on Returns for a Representative Project



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Wind industry/wildlife stakeholder regional wildlife initiatives

- Bat Wind Energy Collaborative
- NWCC Grassland Shrub Steppe Species
- Others emerging (USGS in Dakotas, etc)

Summary

- Wind is a viable technology, today, that is readily scaleable to positively affect the Climate Change Battle….Wind can be a Wedge in the US!
- Development process is very challenging
- Significant amount of resources are already being expended on wildlife issues
- Forward looking policies and actions are needed now to ensure the bulk of future wind projects are sited responsibly

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Questions?

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