What Will It Take to Tap the 'Saudi Arabia of Wind'?

25th USAEE/IAEE North American Conference

Frank Stern & Ron Norman

20 September 2005

Overview

Introduction

Current production economics of wind in the region

Transmission issues

Renewable portfolio standards

Carbon dioxide emission costs

Conclusion

Everyone wants to be “The Saudi Arabia of Wind”

Great Plains

North Dakota

South Dakota

North and South Dakota

United States

Texas

Canada

Quebec

New Zealand

Massachusetts

Massachusetts Bay

Iowa

American West

Midwest

Nebraska

Central United States

Montana

Ohio

Colorado

Alberta and Saskatchewan

Upper Midwest

Denmark

Minnesota

Land between the Mississippi and the Rockies

Kansas

New England coast

Inner Mongolia

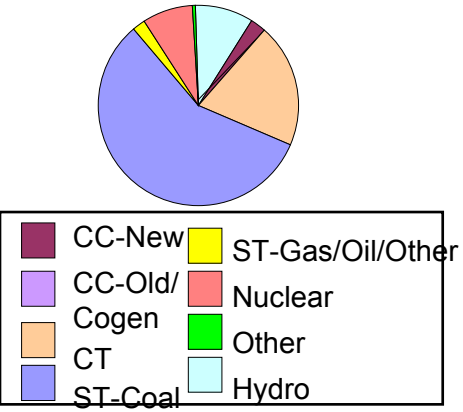
Inner Mongolia and parts of Northern China

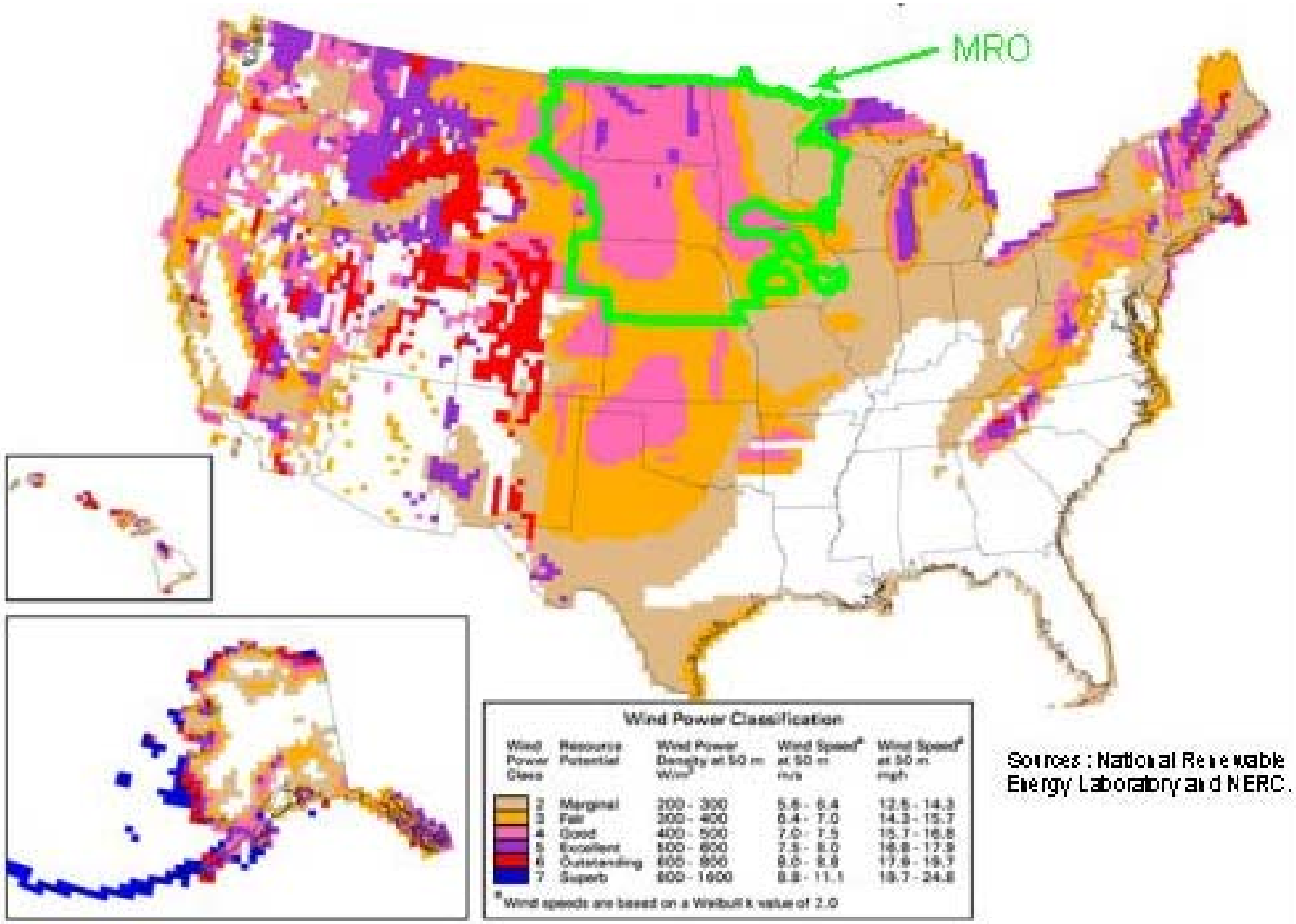
Area between Kansas and California

The Midwest Reliability Organization Region

The region has substantial land with Category 4 above wind speeds, and low land costs.

Coal-fired capacity is dominant.



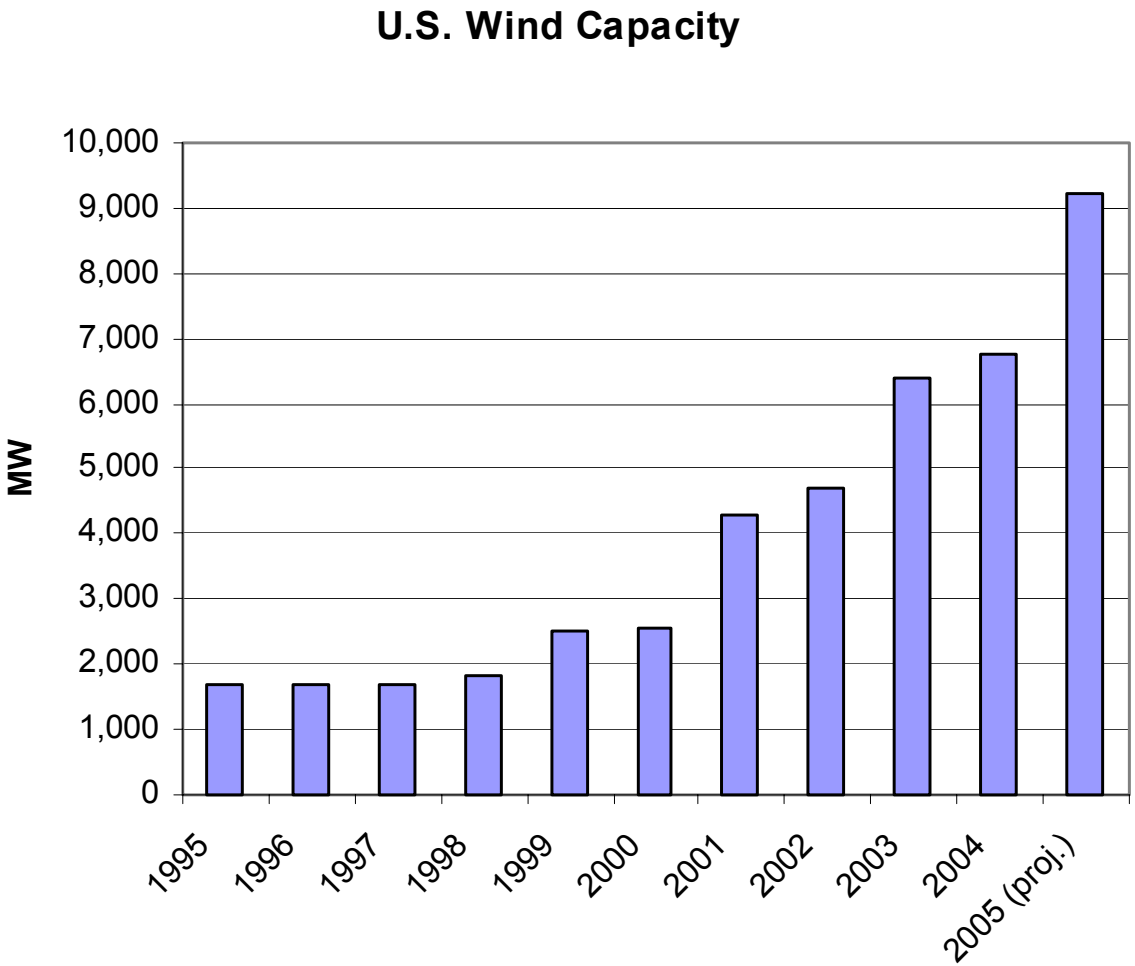


Wind power in the U.S. has seen explosive growth in 2005

A total of 2,500 MW are likely to be installed in 2005, a record.

The federal energy production tax credit was reinstated after lapsing in 2004 and was extended through 2007 by the Energy Policy Act.

Renewable portfolio standards have been proliferating.

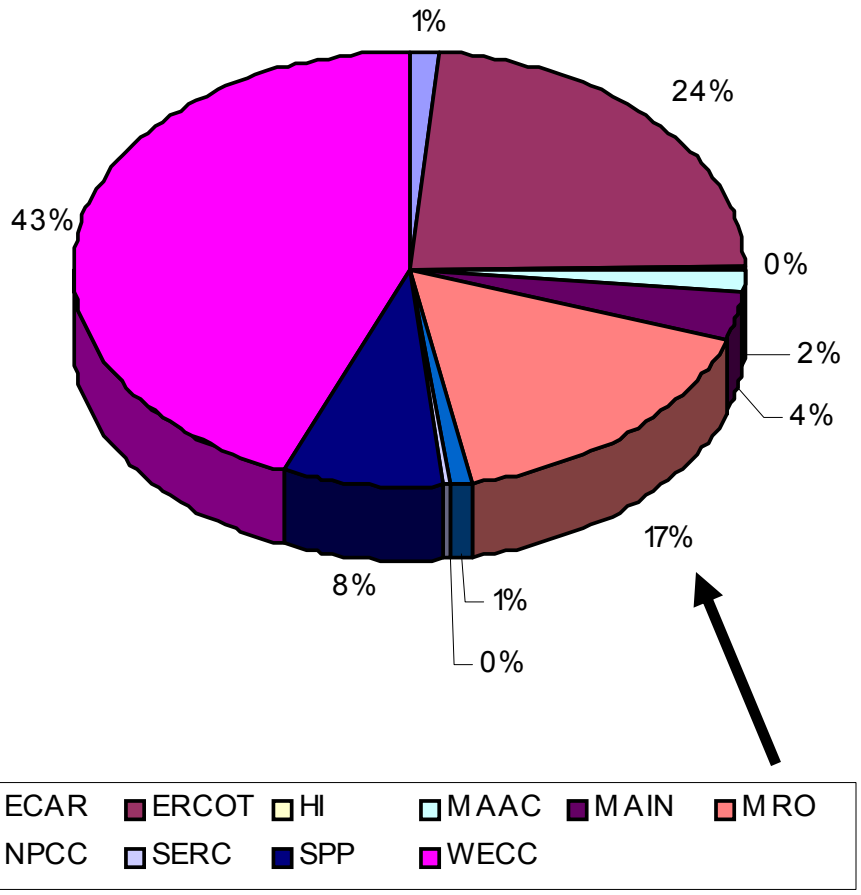


Source: U.S. Dept. of Energy and American Wind Energy Association

However, wind development in the MRO region has lagged other regions

The wind is a stranded asset similar to methane hydrates or natural gas in Nigeria.

Electricity production from the upper Midwest must bear additional costs to reach available markets.



Source: Platts PowerDat

Obstacles to wind development in the region

Regional transmission constraints -- may preclude significant volumes of wind energy from reaching load centers

'Pancaked' transmission fees – wind generation often crosses multiple system boundaries before it can get to the load and may be subject to layers of transmission fees.

Parochial renewable portfolio standards – RPS's often require that renewable power must be generated in the state or at least delivered to that state. While the green attributes or renewable energy credits can be sold separately from power, most state standards don't allow RECs to be imported.

What policy changes would allow the potential of this region to be tapped?

Overview

Introduction

Current production economics of wind in the region

Transmission issues

Renewable portfolio standards

Carbon dioxide emission costs

Conclusion

Current production economics of wind in the region

We examined the comparative production economics of wind energy versus more conventional alternatives in the region.

We compared the internal rate of return that would be earned by a wind plant owner facing different assumptions about PTCs and RECs, as well as IRRs earned by owners of gas, coal, and integrated combined cycle plants.

We assumed the plants would earn revenues in the power markets at the projected market price.

We assumed the plant would come on line in 2009, which is the point at which PA anticipates the MRO region, currently in surplus, would need new capacity.

Using internal return allows an apples to apples comparison of the economics, unlike comparing levelized energy costs, which don't consider the relative value of capacity or renewable energy credits.

Key assumptions

Capital costs:

Wind: $1,000/kW
Gas: $585/kW
Coal: $1,200/kW
IGCC: $1,750/kW

Capacity factor:

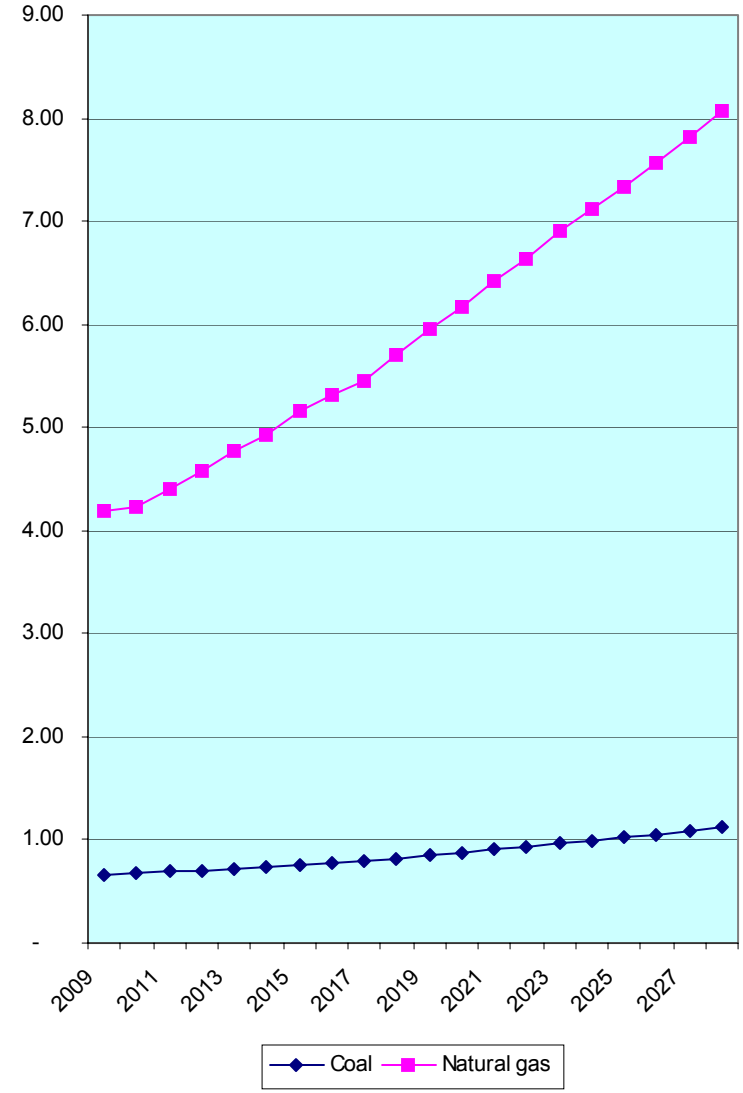
Wind: 31%
Gas: 75%
Coal: 85%
IGCC: 85%

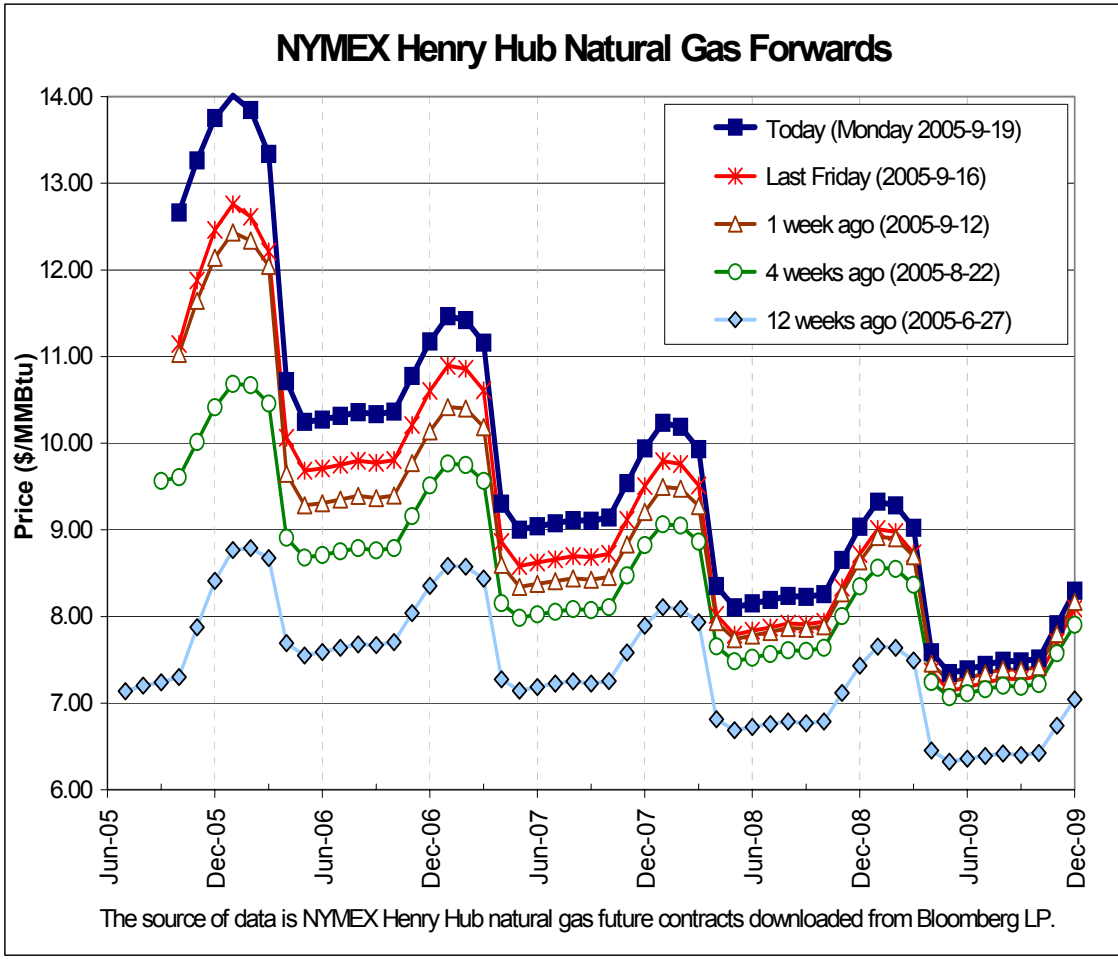
Value of renewable energy credits: $4/MWh

Wind system integration costs: $4.50/MWh

Gas prices have been changing dramatically

Forecast of Fuel Prices in MRO

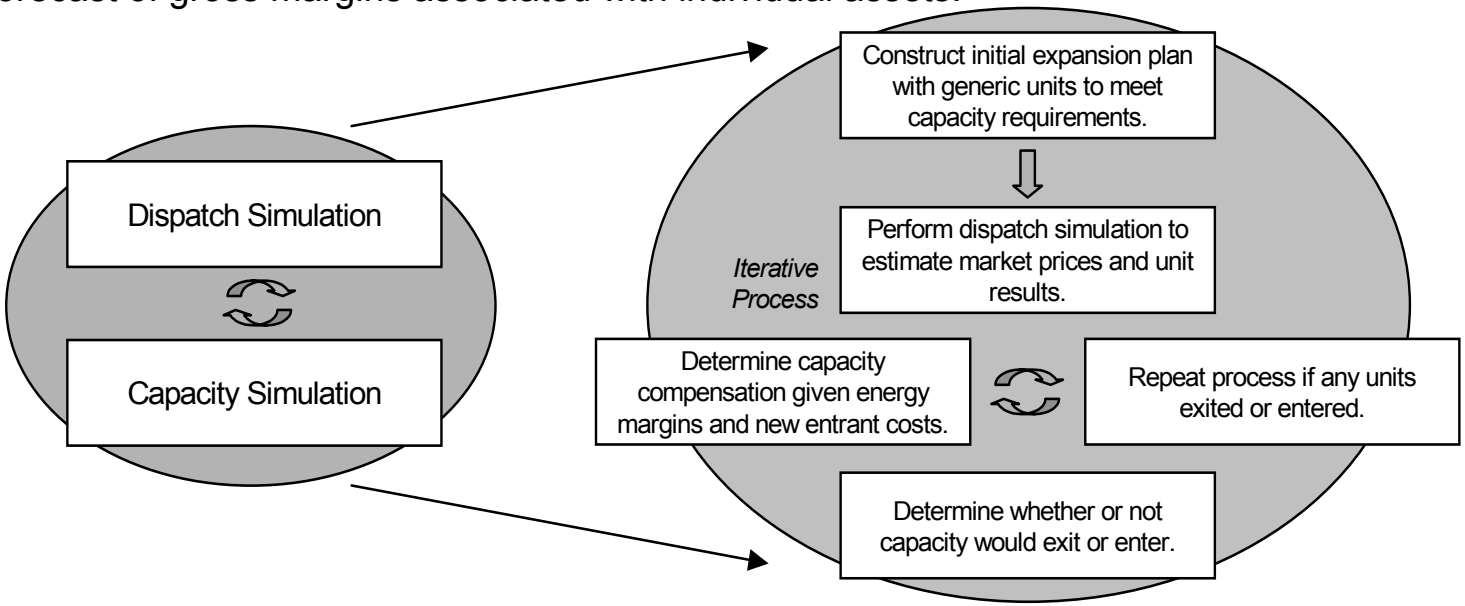




Market Price forecasting

PA uses the following approach:

- fundamental market price forecast with production cost model
  - chronological hourly price forecast based upon SRMC and transmission constraints
  - reflects current transmission system and planned upgrades
  - utilizes PA's proprietary database of generation characteristics
- capacity simulation
  - evaluate need for new resources and incorporate physical and economic retirements
  - develop capacity compensation forecast – going forward costs vs. full cost recovery
- forecast of gross margins associated with individual assets.



Results

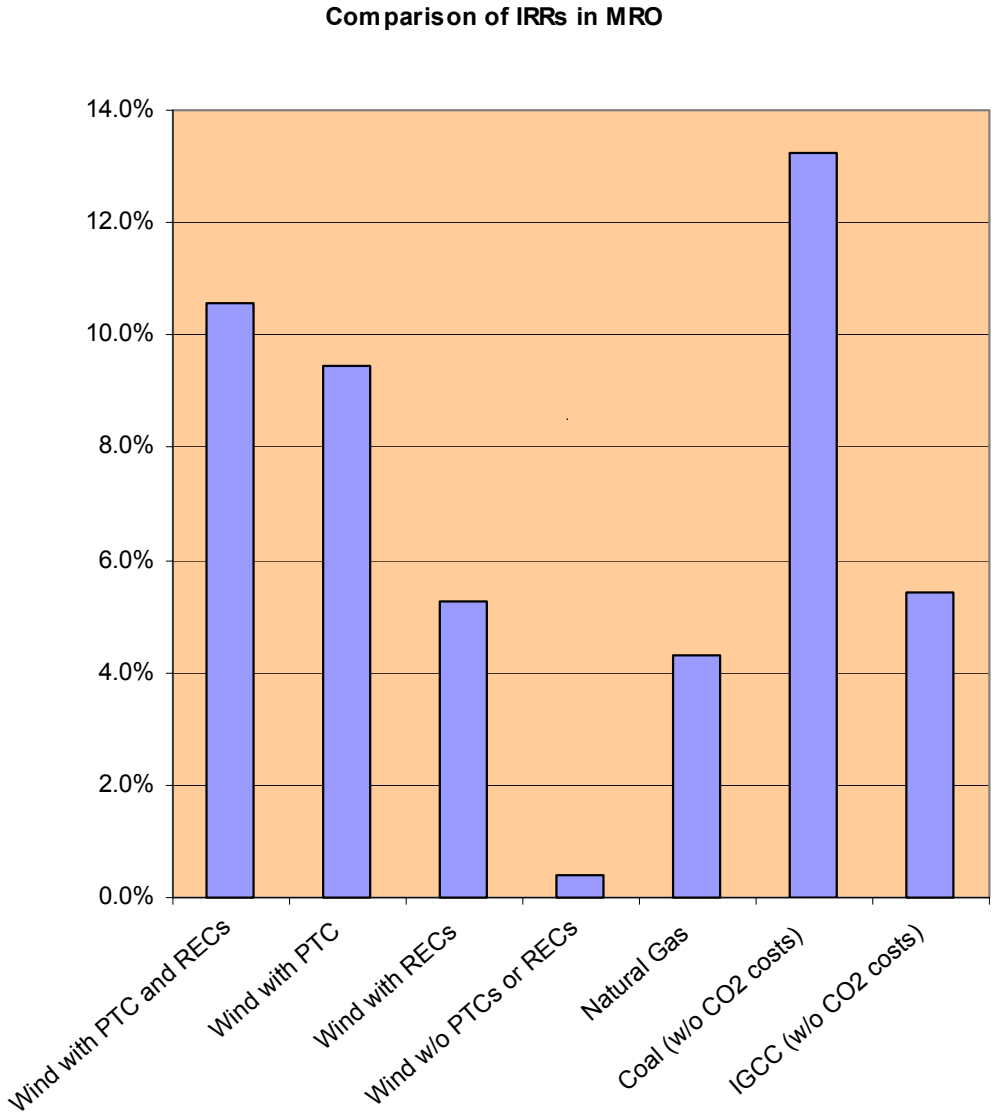
Wind with PTC and/or RECs is more competitive than natural gas CCs.

Without PTCs or RECs, wind is not competitive.

An additional $13/MWh would be required to make wind without PTCs or RECs more competitive.

Coal appears more competitive, but we have not considered CO2 costs.

Risk adjusting returns might add more value to wind.



Overview

Introduction

Current production economics of wind in the region

Transmission issues

Renewable portfolio standards

Carbon dioxide emission costs

Conclusion

Transmission issues and solutions

Insufficient transmission

- Physical access
- Transmission congestion

Pancaked rates

Unfavorable tariff structures

Insufficient transmission

Physical access

- Sparely populated western regions of MRO have relatively few transmission lines.
- Developers must build interconnection, sometimes at costs of $1 million per mile – impact on cost can be $2.45/MWh

Congestion

- Constraints can sometimes force curtailment of otherwise economic resources.
- In the Midwest Independent System Operator market, constraints are likely to result in lower locational marginal prices

Transmission investment issues

- Solution requires investment, but it is unclear who pays.
- State governors in Midwest have agreed to work together to develop a plan for investment.

Pancaked rates

Resources in certain areas would be subject to pancaking due to crossing multiple transmission service providers and market ‘seams.’

Pancaking tends to discourage long distance transactions – as such, it particularly effects wind in the remote regions of MRO.

Costs to transmit power from South Dakota to Minnesota could add $16/MWh to energy sold.

Solutions to pancaking include:

- Improved transmission service and ‘seams’ agreements
- Expanded coverage by regional transmission organizations and independent system operators, such as MISO.

Tariff structure

Effects of low capacity factors

- Impact of transmission tariffs cost be more daunting to intermittent resource such as wind.
- Wind producer may need to purchase firm transmission capacity to handle maximum output, while capacity factors are typically around 30%.
- MISO charge of $1,900/MW-month equates to $8.25/MWh or around 17% of power price.

Imbalance penalties

- Can be severe for wind generator.
- FERC has recognized need for structural changes that allow a wider “imbalance bandwidth.”

Overview

Introduction

Current production economics of wind in the region

Transmission issues

Renewable portfolio standards

Carbon dioxide emission costs

Conclusion

Renewable portfolio standards

Renewable portfolio standards are in place in 22 states and DC.

Standards create markets for renewable energy.

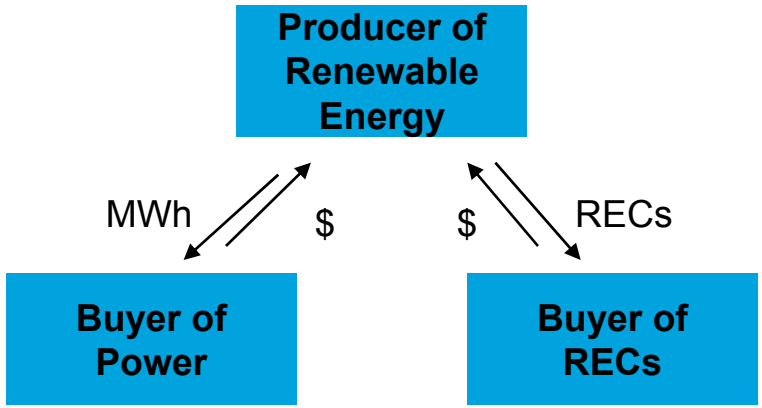
Markets can be explicit and liquid if renewable energy credits can be separated from power.

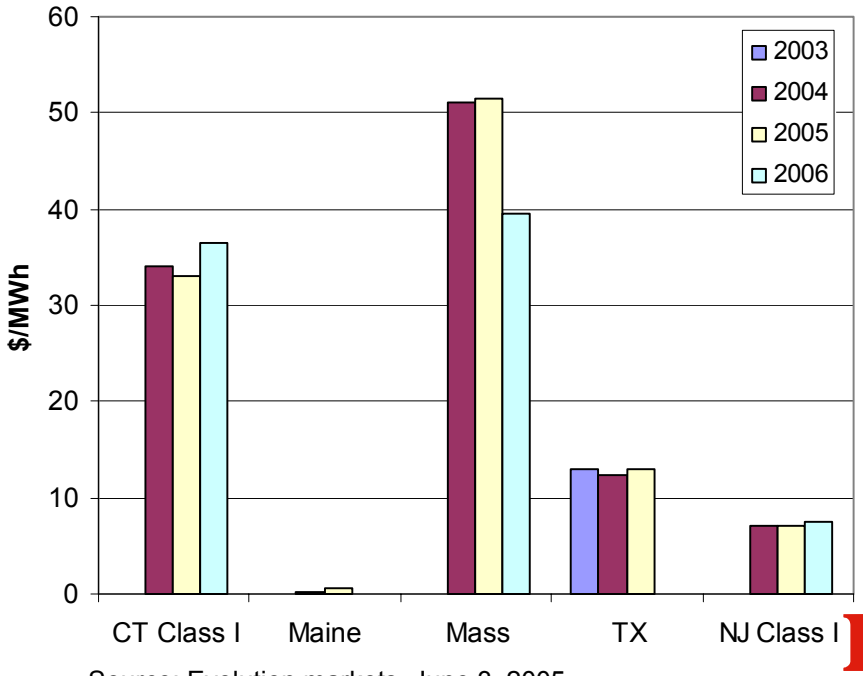
Most standards require that energy be produced in state or region.

As a result, these standards provide little or no incentive in MRO.

A national RPS would be more economically efficient than individual state programs.

Voluntary REC markets currently provide only modest value ($3/MWh), but demand could increase prices.





Source: Evolution markets, June 3, 2005.

Overview

Introduction

Current production economics of wind in the region

Transmission issues

Renewable portfolio standards

Carbon dioxide emission costs

Conclusion

Carbon dioxide emission costs

Regulation of emission of CO_2 would advantage wind by increasing prices of electricity.

In June 2005, U.S. Senate passed a "Sense of the Senate" bill stating that ". . . Congress should enact a comprehensive and effective national program of mandatory, market-based limits on emission of greenhouse gases . . ."

Many utilities are now including CO_2 costs in their resource planning:

- California IOUs assume $12.50/ton by 2008 and $17.50/ton by 2013. Pacificorp assumes value of at least $8/ton
- Idaho Power assumes a value of $12.30/ton.
- Xcel is using $9/ton

Restricting emissions to 1990 levels would likely translate to a $20 to $25/MWh price increase.

These levels would be more than the $13/MWh value needed to make wind economic.

Overview

Introduction

Current production economics of wind in the region

Transmission issues

Renewable portfolio standards

Carbon dioxide emission costs

Conclusion

Obstacles can be overcome through several types of policies

Many obstacles can be summarized as lack of access to the best markets – both energy and RECs.

Obstacles can be overcome through

- increased transmission investment
- Reform of transmission markets and tariffs
- Implementation of national renewable energy credit markets
- Implementation of CO_2 constraints.

Whether or not the benefits (greenhouse gas emission reduction and energy supply diversification) offset additional costs is a topic for another day.

PA Consulting Group

This slide is optional, and may be used only at the end of a presentation