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Can Wind Power with Storage Survive in the Day-Ahead Market?

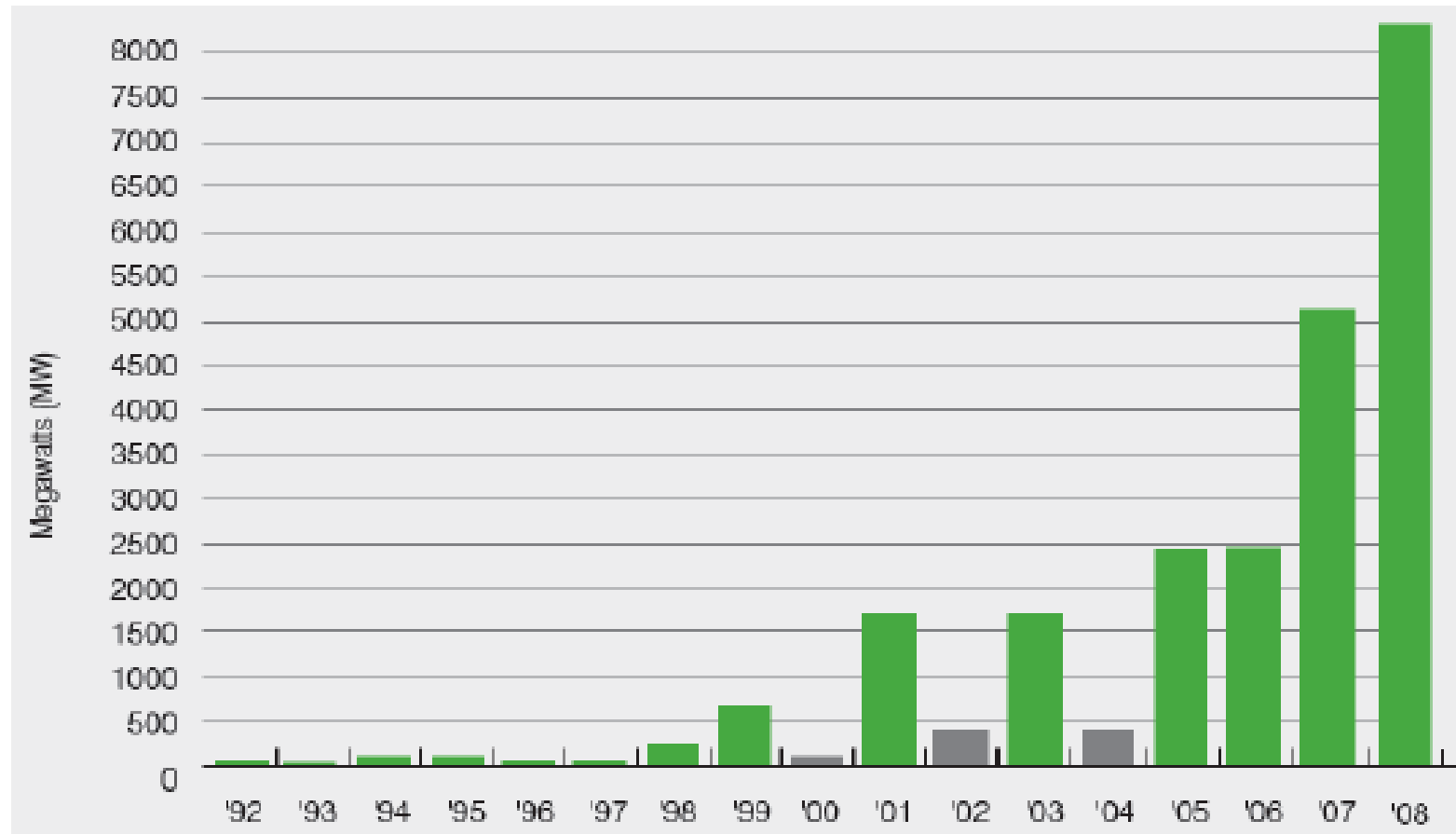
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TMP Consortium
June 29, 2010

Wind Energy Policy

- Federal Production Tax Credit
- Renewable Portfolio Standards
- Feed-in tariffs

Annual Installed Wind Capacity in the US



Source: American Wind Energy Association

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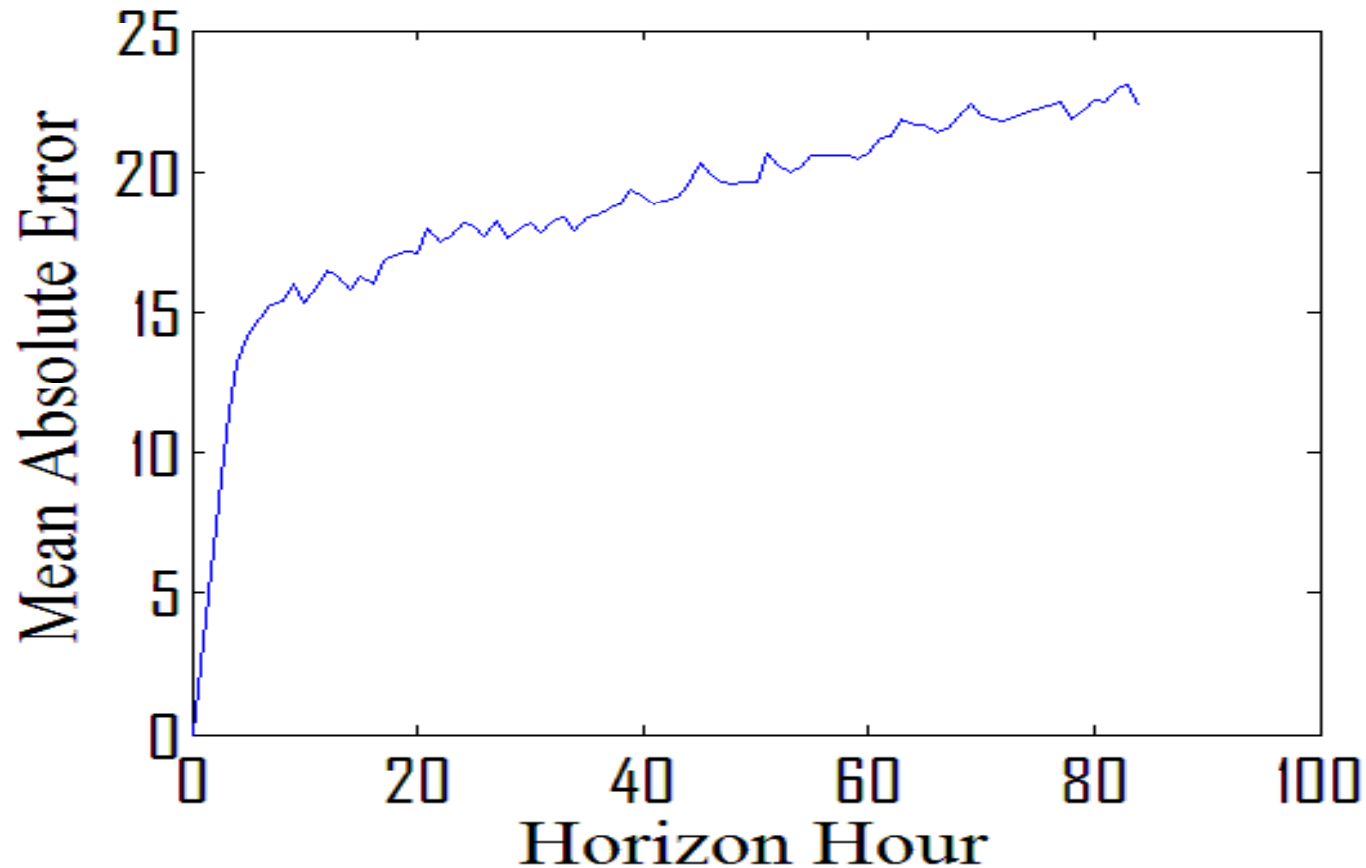
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Day-Ahead Market

- Generators submit hourly bids of price and quantity one day in advance of dispatch.
- Prices become known after bids are matched with forecasted load.
- Majority of electricity is sold in the day-ahead market.

Uncertainty with Wind Forecasts

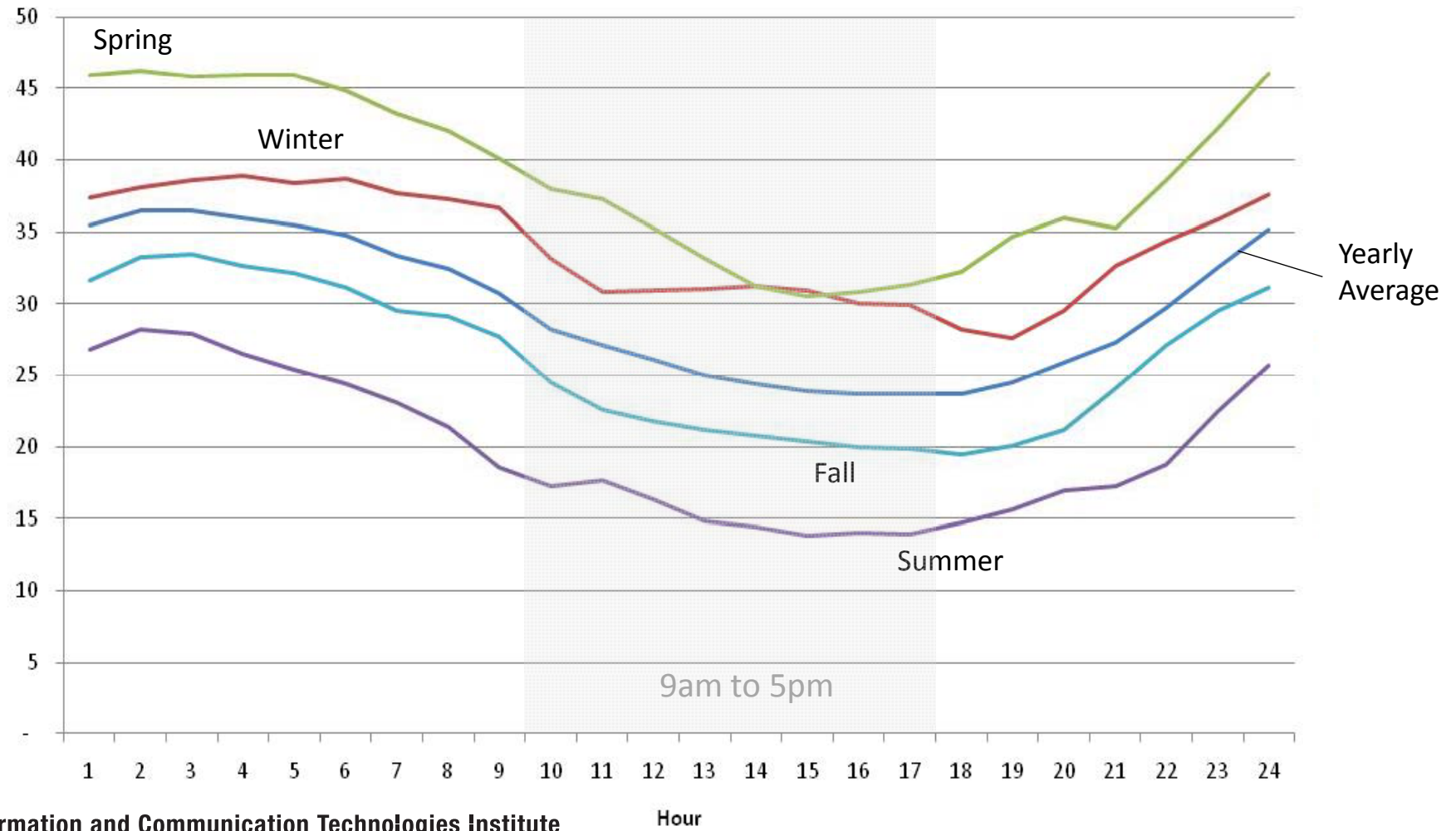


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Average Hourly Wind Generation for 2008 in Texas



Is wind energy economically viable in the day-ahead market if the wind farm is coupled with compressed air energy storage?

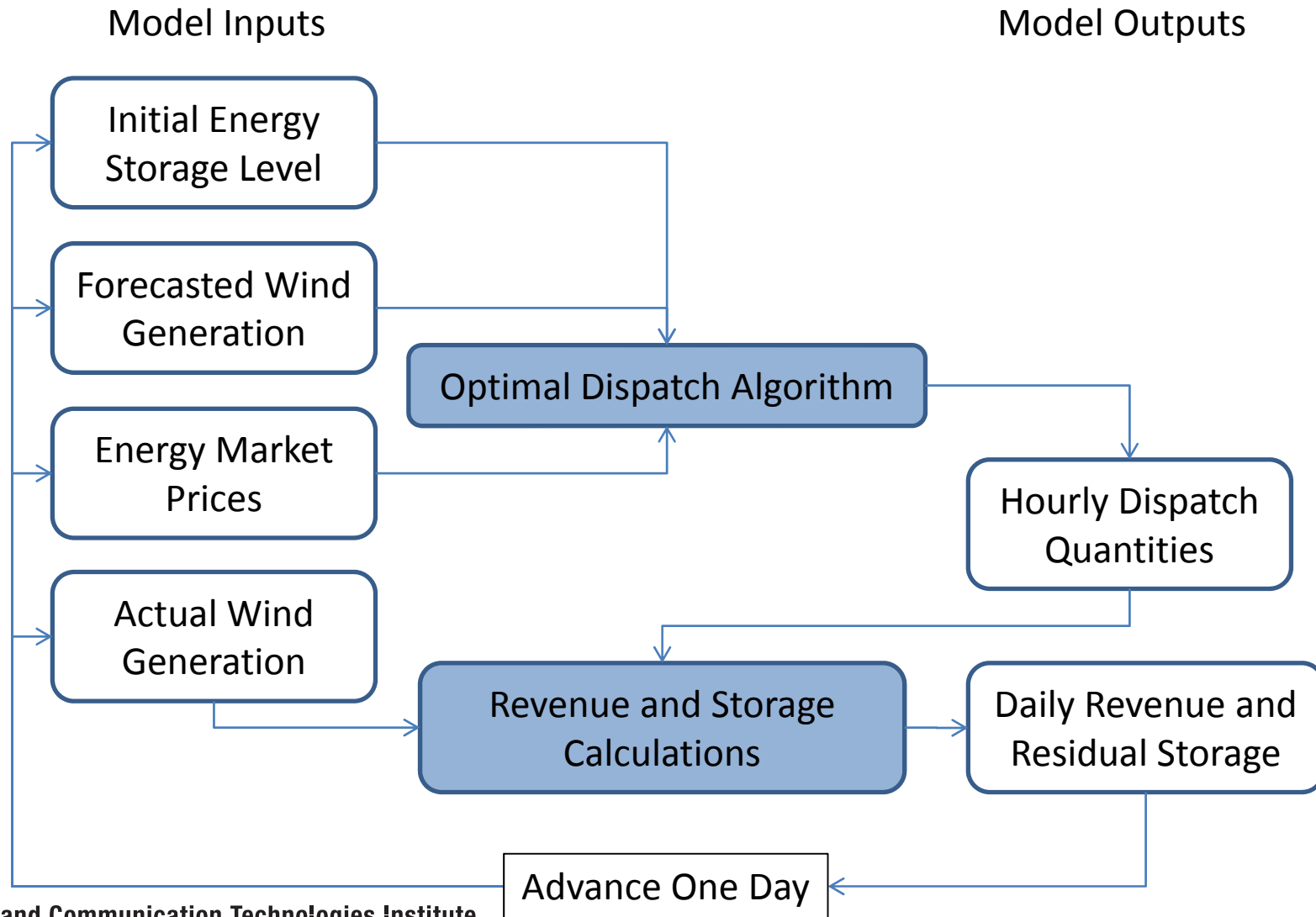
Energy storage provides

- Limited control of output
- Reduced risk of energy imbalance

Compressed Air Energy Storage (CAES)



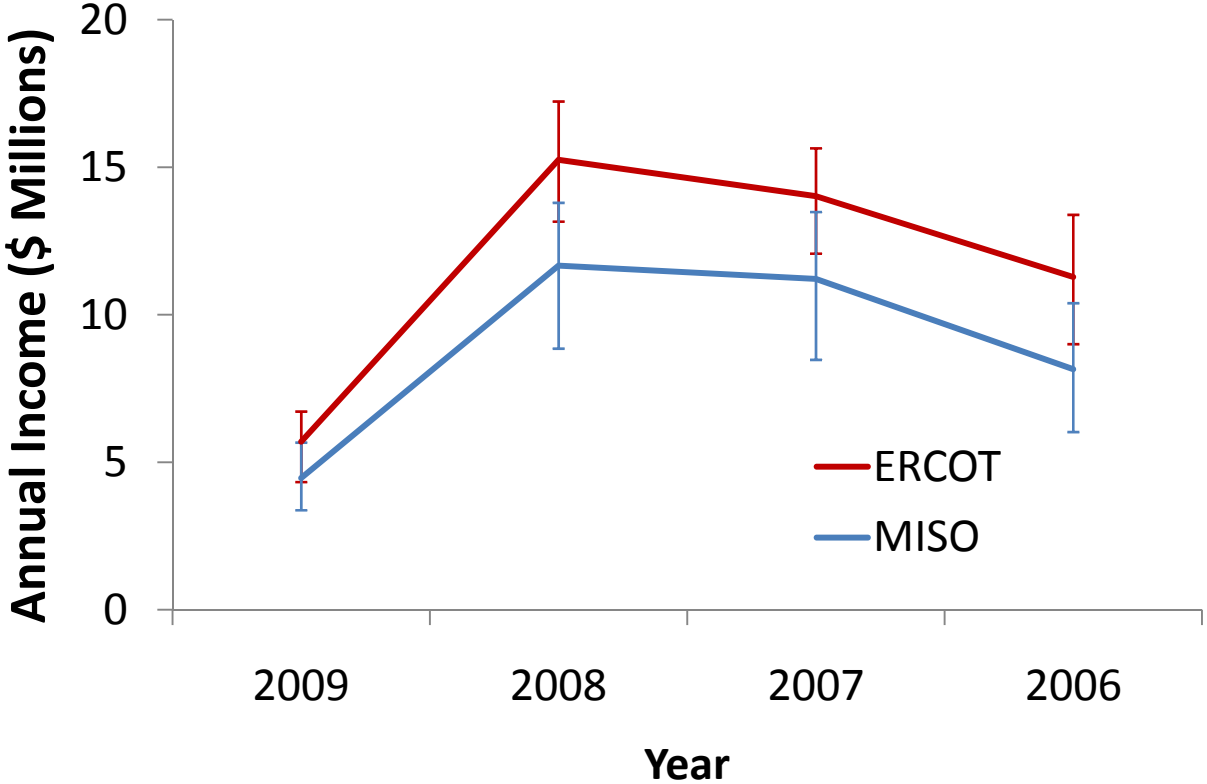
Wind with CAES Model



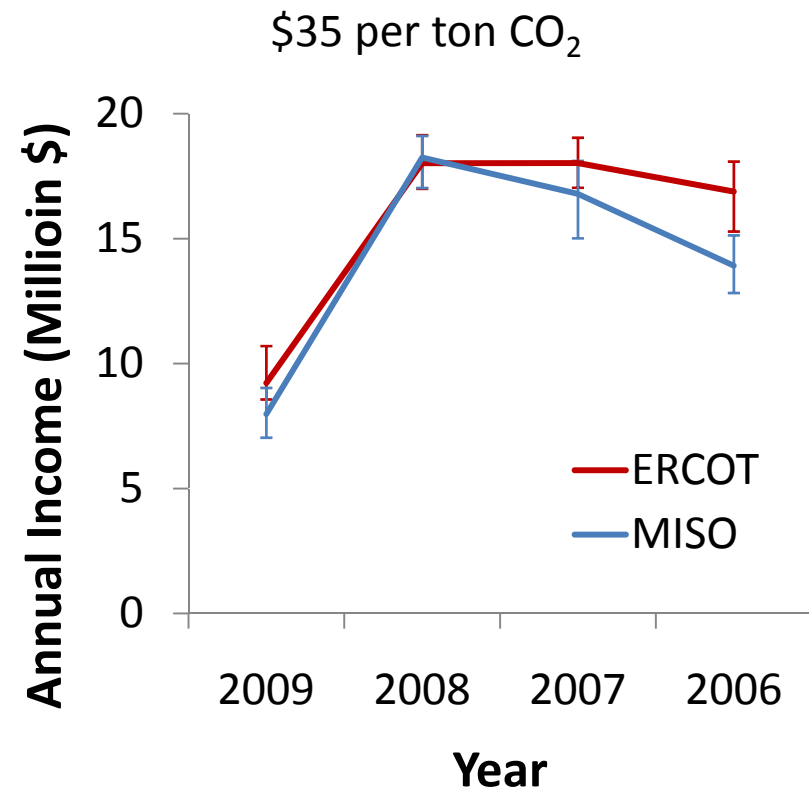
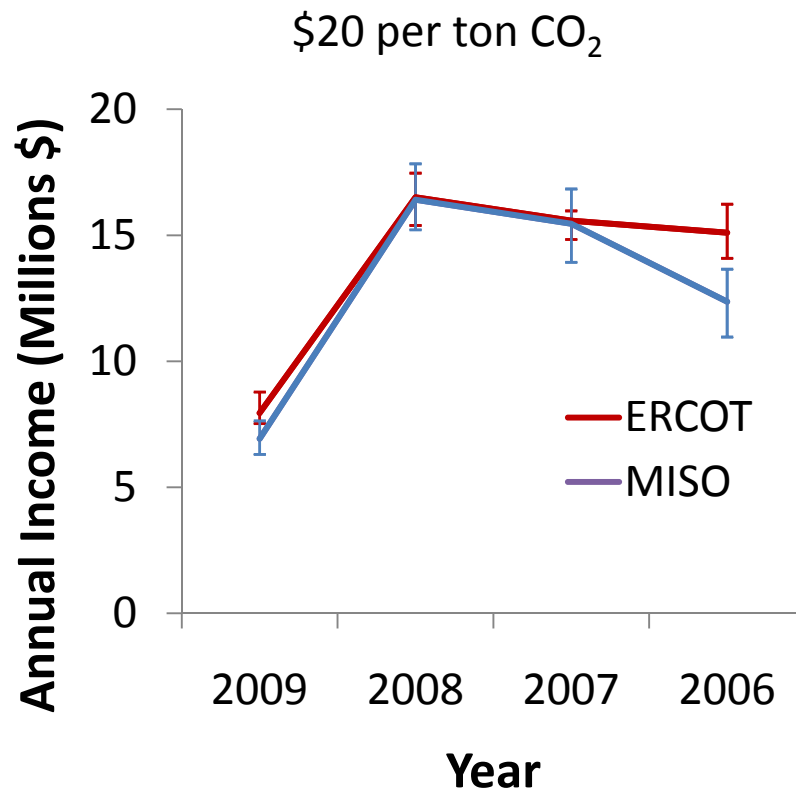
Cost Estimates

- Capitol costs
 - Wind Farm \$220 million
 - CAES \$80 million
- Annualized costs range from \$24 to \$29 million
- If the investment tax credit applied, annualized cost are reduced to \$17 to \$21 million.

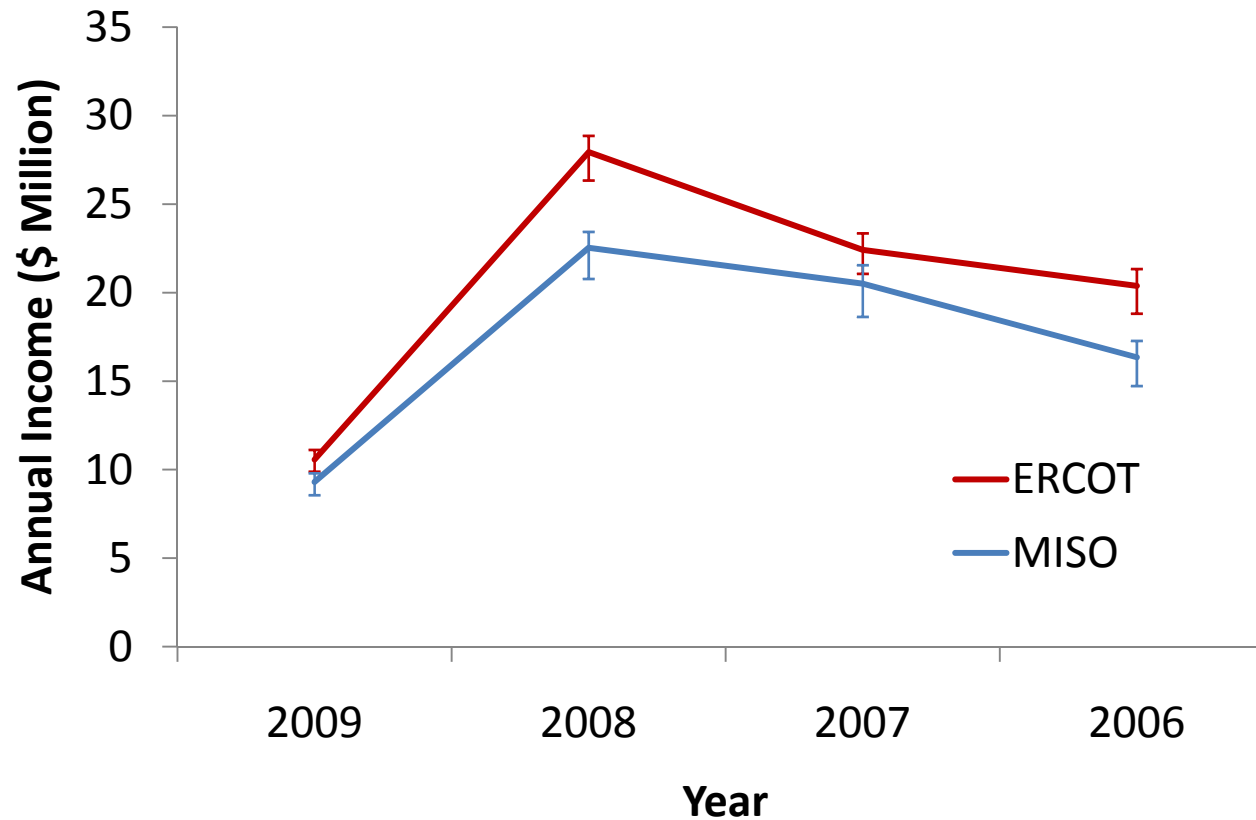
Estimated Annual Income



Estimated Income with a Carbon Price



Annual Income with Perfect Wind Knowledge



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Conclusion

Income from the day-ahead market alone is not sufficient for wind with CAES without financial assistance.

However, storage will provide additional income

- Regulation Markets
- Capacity Markets

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