

# **Renewable Energy Credits: Policy Design and Price Volatility**

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# Themes

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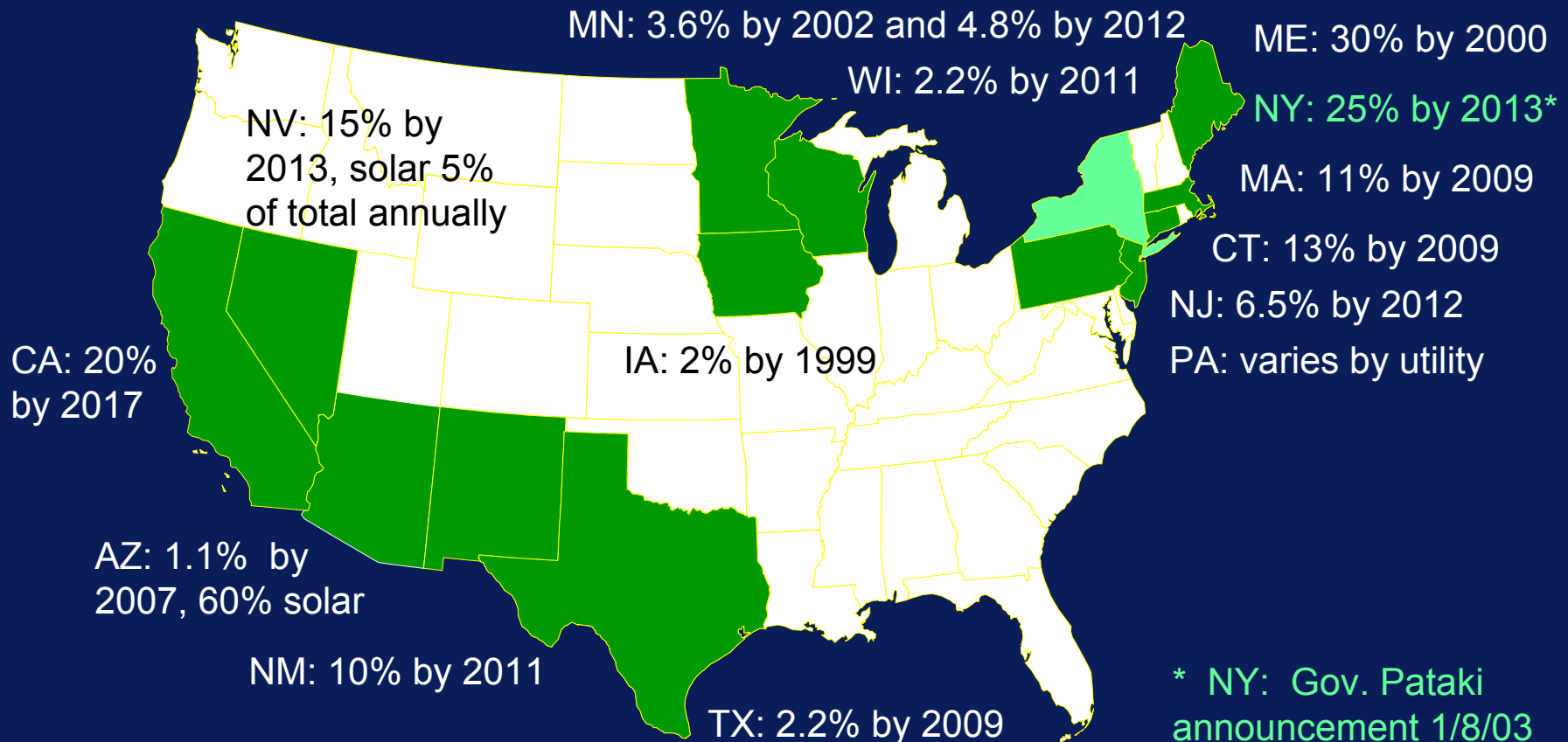
- Renewable portfolio standards (RPS) work best when supported by *flexible* renewable energy credit (REC) trading markets
- Policy designs that inhibit REC trading across compliance periods cause REC price volatility
- Impact of volatility can be partly managed through long-term fixed price bilateral contracts
- Flexible rules such as borrowing and banking can enhance REC trading and improve markets

# Renewable Portfolio Standards

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- Requirement for electricity retailers to purchase a specific % of sales from renewable generators
  - ▶ 13 states have some type of requirement, 7 allow tradable renewable energy credits (RECs)
  - ▶ Congress has looked at 10% - 20% requirements on a national level over 10-20 year period
- Main issues are qualifying technologies (e.g. existing renewables, hydro, waste-to-energy), target levels, costs and compliance penalties
- Little attention given to REC market design

# Renewable Energy Standards



# What is a REC?

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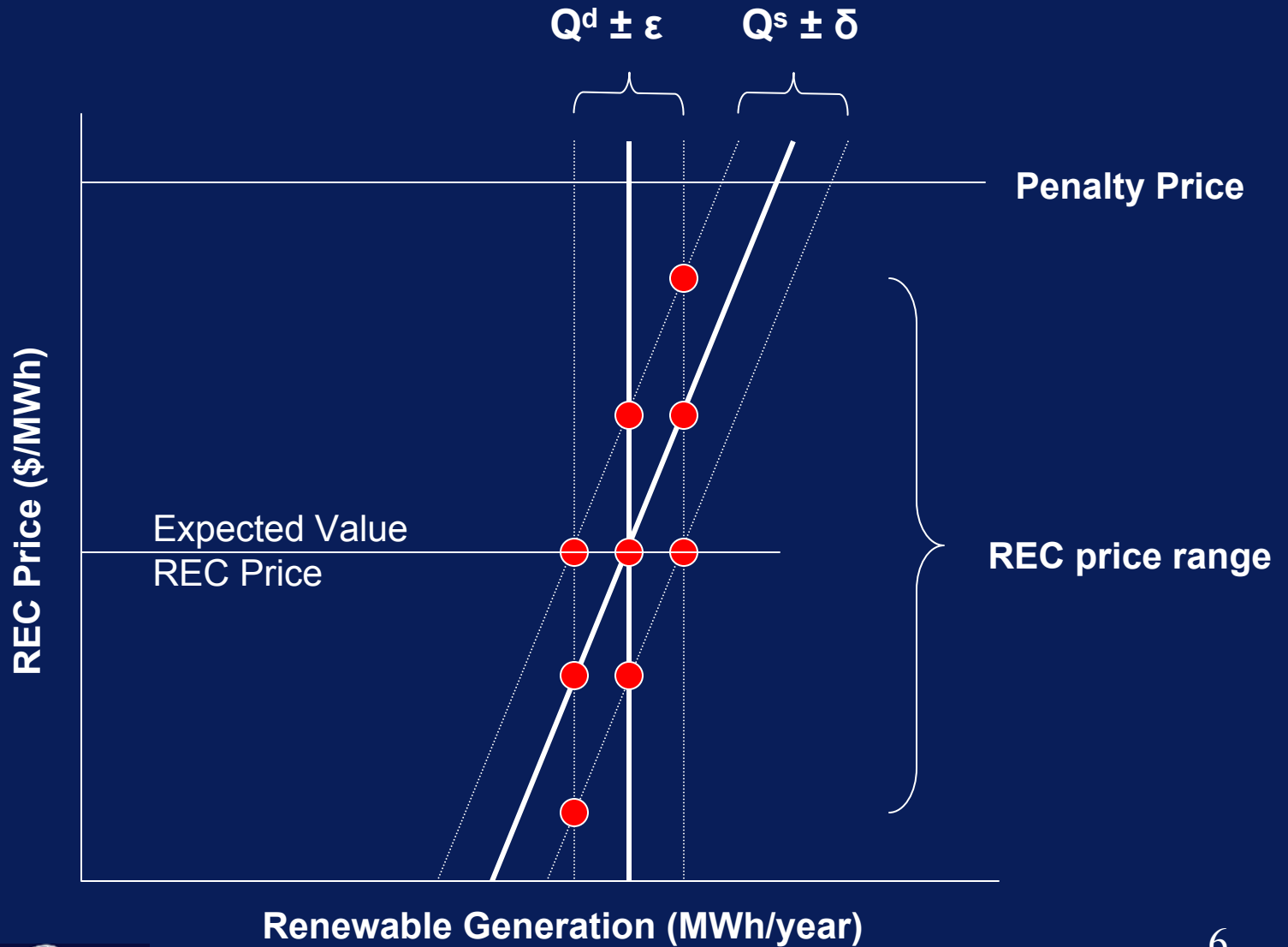
- **Renewable Energy Credit (REC) is the renewable “attribute” of 1 MWh of electricity that can be unbundled from the electricity sale**
  - ▶ **Retailers can demonstrate RPS compliance with RECs in lieu of direct renewable purchases**
  - ▶ **Generators can sell RECs bundled or unbundled with MWh, creating additional revenue stream**
  - ▶ **Separate REC trading market promotes investment in most cost-effective renewables and lowers RPS compliance cost**

# Realities of REC Markets

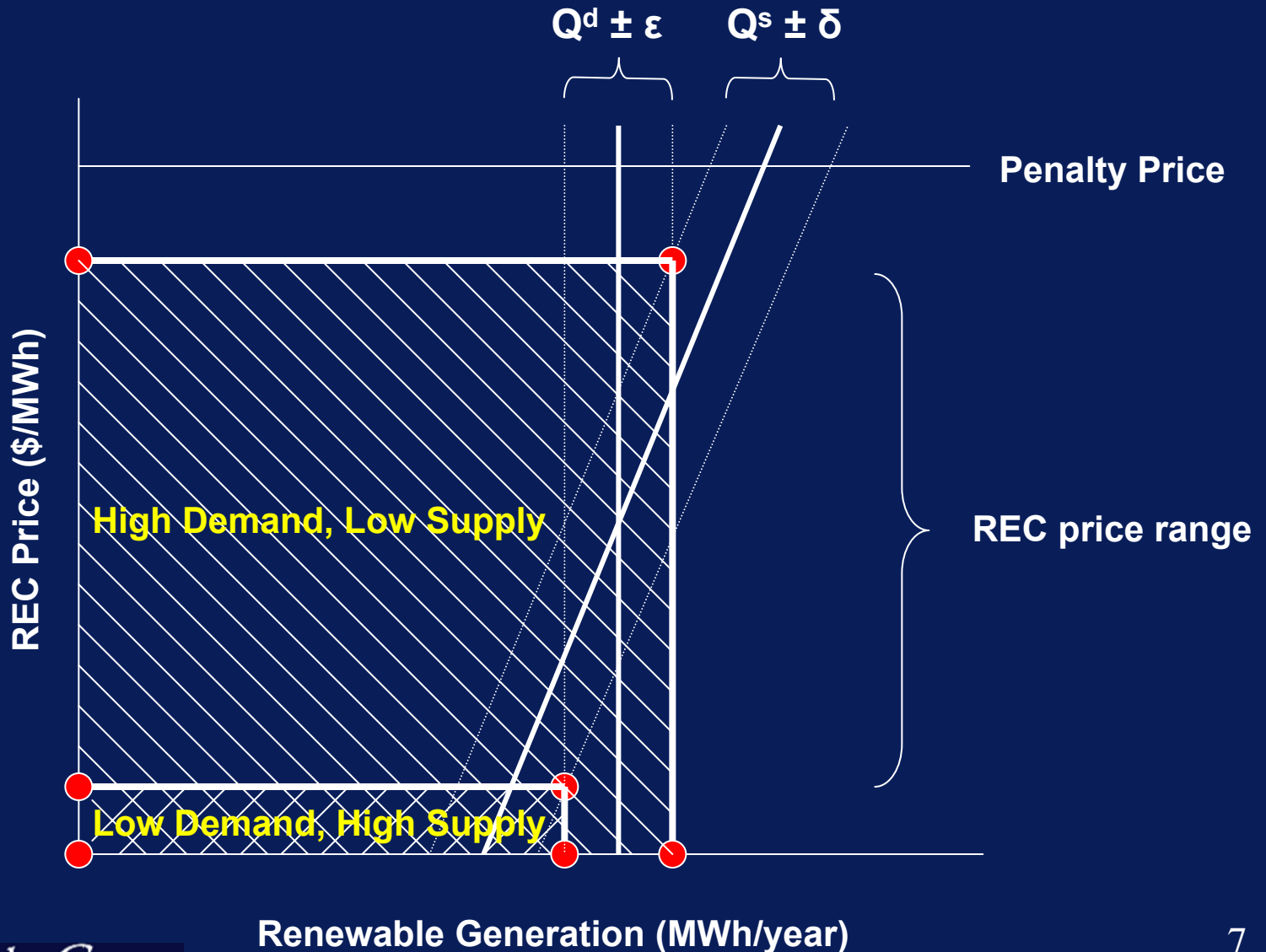
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- Nobody knows what the size of the market is in advance: supply and demand are variables
- In the short run (annual) REC market there is:
  - ▶ NO opportunity to control demand; as % of retail sales it is a function of weather, economic conditions
  - ▶ LIMITED opportunity to control supply because renewable generation usually is *inframarginal*
- REC quantities are relatively inelastic in prices
- Inelasticity is a recipe for *price volatility*

# Structure of Annual REC Market



# Range of Annual REC Revenues, Costs



# Annual Generation Variability

## Annual Variability in Renewable Generation 1991 - 2001

Renewable Type	Average GWh per Installed MW (1991-2001)	Standard Deviation (1991-2001)	Standard Deviation as Percent of Average	Installed Capacity 2001 (MW)	Percent of Total Installed Renewable Capacity	Percent of Total Non-Hydro Renewable Capacity
Conventional Hydroelectric	3.77	0.53	14%	79,379	82%	N/A
Biomass	5.67	0.19	3%	10,120	10%	58%
Geothermal	5.34	0.41	8%	2,793	3%	16%
Solar	1.97	0.59	30%	387	0%	2%
Wind	1.84	0.26	14%	4,062	4%	23%
Total Renewables (w/ hydro)	3.98	0.44	11%	96,741	100%	N/A
Total Renewables (w/o hydro)	5.02	0.18	4%	17,362	18%	100%

Sources: Capacity and Generation Data from EIA Renewable Energy Annual 1996 - 2001

# Mitigating REC Price Volatility

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- Price volatility risk can partly be managed by long-term bilateral contracts between renewable generators and electricity retailers
  - ▶ But volumetric risk remains; there will be some spot market sales and purchases at potentially volatile prices that will create some variability in cash flows
- Price volatility can be significantly reduced by allowing banking and borrowing across compliance periods (years)
- Penalty prices only partly contain volatility

# Long Term Contracts

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- **Renewable generator's perspective:**
  - ▶ Long term bilateral contract for RECs (bundled or unbundled with MWh) reduces revenue variability and enables higher proportion of lower-cost debt finance
- **Retail provider's perspective:**
  - ▶ Long term bilateral for RECs hedges REC price risk and provides a shield against prudence review
  - ▶ But regulators can scrutinize REC costs if long-term contracts are above current REC prices

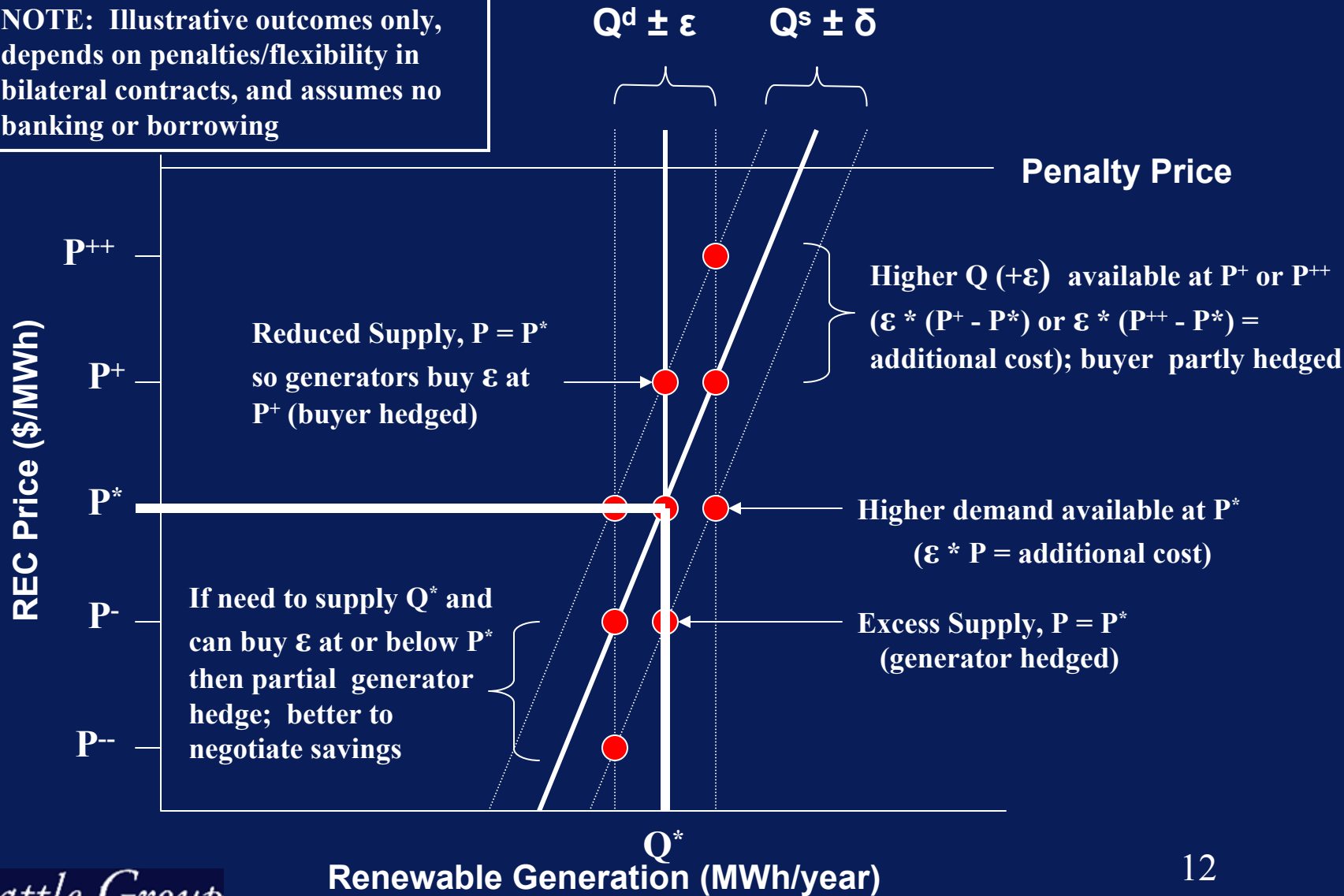
# Role of Spot Market

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- If most market participants opt for long-term bilateral contracts, then smaller volumes of spot market transactions would occur
- Spot market will be more like an annual *imbalance* market
  - ▶ Thinly traded with unreliable price discovery?
  - ▶ Limited information on long-term price trends or excess supply or demand conditions?
  - ▶ Actual outcomes will depend on how contracts deal with delivery volume risk

# Bilateral Contracts at Expected $P^*, Q^*$

NOTE: Illustrative outcomes only, depends on penalties/flexibility in bilateral contracts, and assumes no banking or borrowing

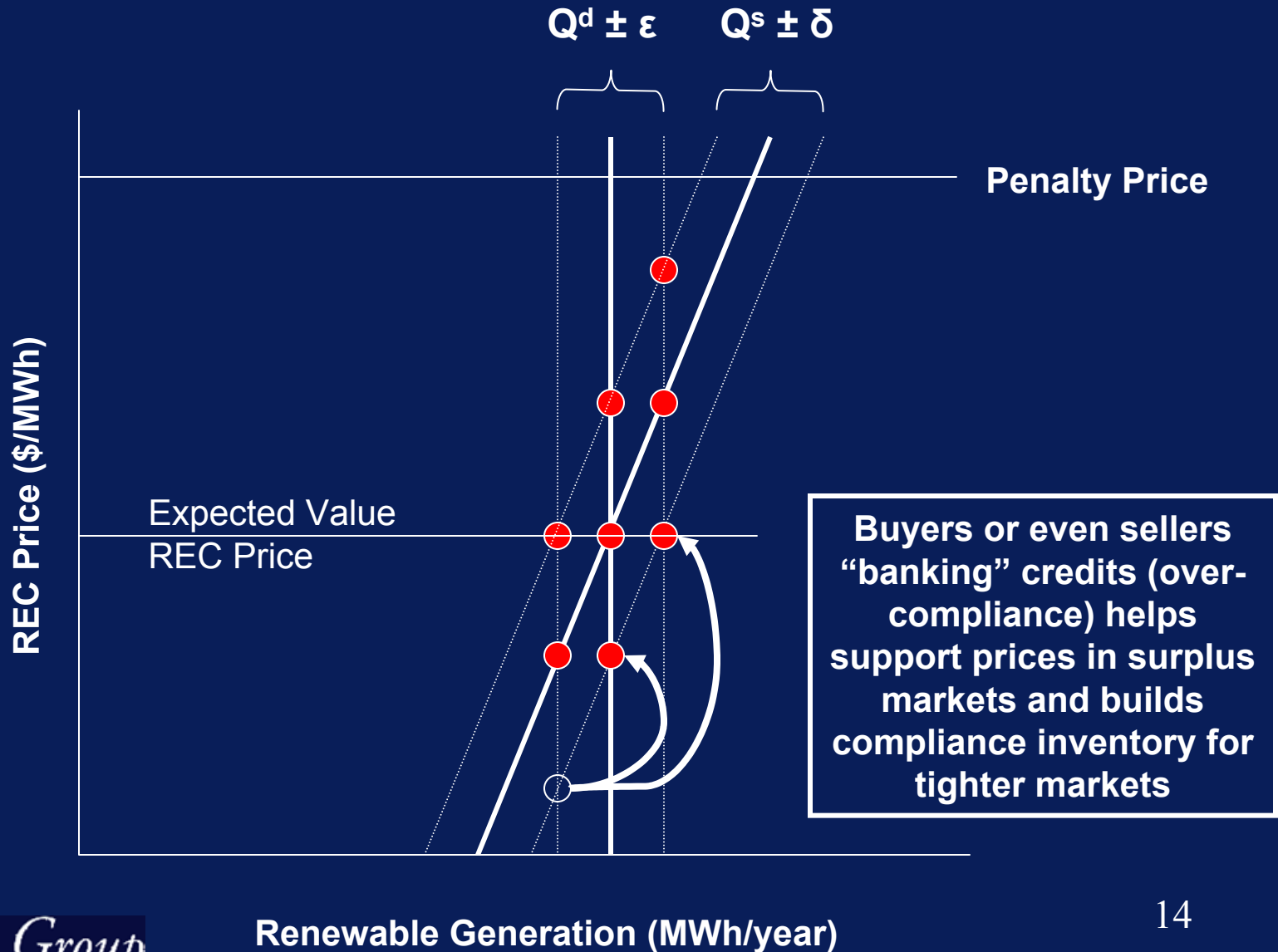


# **Bilaterals, Spot Markets, & Compliance**

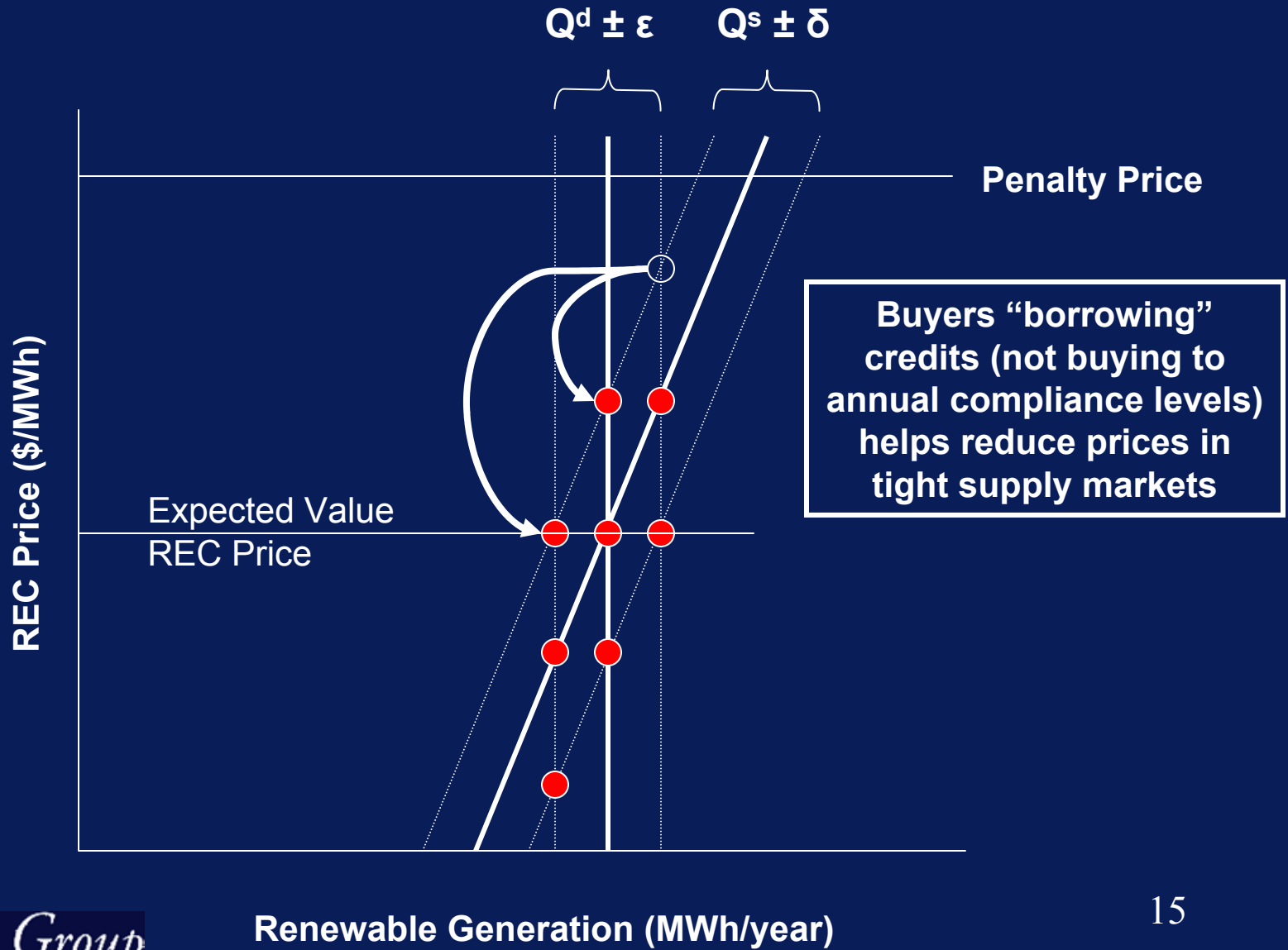
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- **If spot market used primarily for annual imbalance, then REC price volatility still likely**
- **Prevalence of long-term bilaterals will shield most revenues & costs from volatility, but large imbalances may still cause significant variation in cash flows**
- **If resulting REC prices are volatile at significant traded volumes, this undermines the role that renewables can play in reducing fuel price risks**
- **Banking and borrowing can help smooth prices**

# Banking



# Borrowing



# Benefits of Banking and Borrowing

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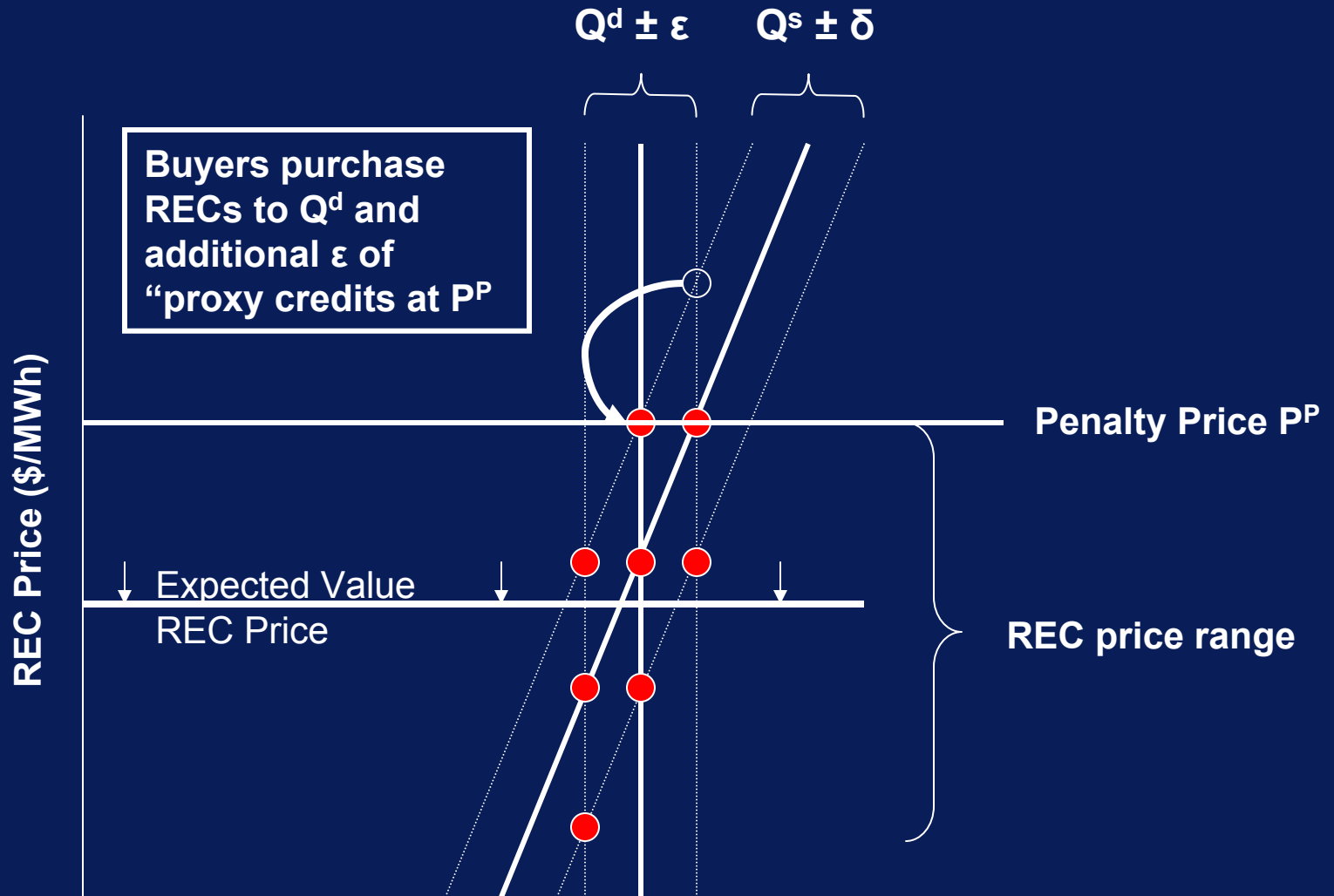
- **Allows economically rational variation in renewable generating percentage target**
- **Market participants able to avoid price extremes from variations of supply and demand**
- **Reduces REC price volatility; steadier cash flow**
- **Allows accumulated REC balances and accrued liabilities to be resolved in subsequent markets**
- **Facilitates spot market transactions and may encourage forward market development**

# Penalty Price (Cost Cap)

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- **Penalty price represents a (free) call option on RECs at a strike price equal to the penalty level**
- **Can help limit highest REC price spikes**
- **May interact with borrowing and banking incentives by lowering expected REC price**
- **A political necessity, but perhaps not as effective as flexible banking and borrowing provisions**
- **What to do with revenues?**

# Lower Penalty Price



# RPS/REC Provisions

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- **National Bills in 107<sup>th</sup> and 108<sup>th</sup> Congress**
  - ▶ **3% - 10% RPS by 2010, 10% - 20% by 2020**
  - ▶ **Most have REC trading, no banking/borrowing**
  - ▶ **1.5¢ - 3.0¢/kWh cost cap penalty**
- **State systems**
  - ▶ **Large variation in RPS levels, technologies, market segments, minimum contracts**
  - ▶ **Texas has limited banking and borrowing**

# Conclusions

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- RPS/REC markets evolving but earliest designs not conducive to spot market trades
- REC market designs need to reconcile the preference for long-term contracts with the need to maintain a rational spot market
- Banking and borrowing are critical to a stable spot market
- Penalty prices or cost caps less effective at reducing REC price volatility