Renewable Energy Credits: Policy Design and Price Volatility

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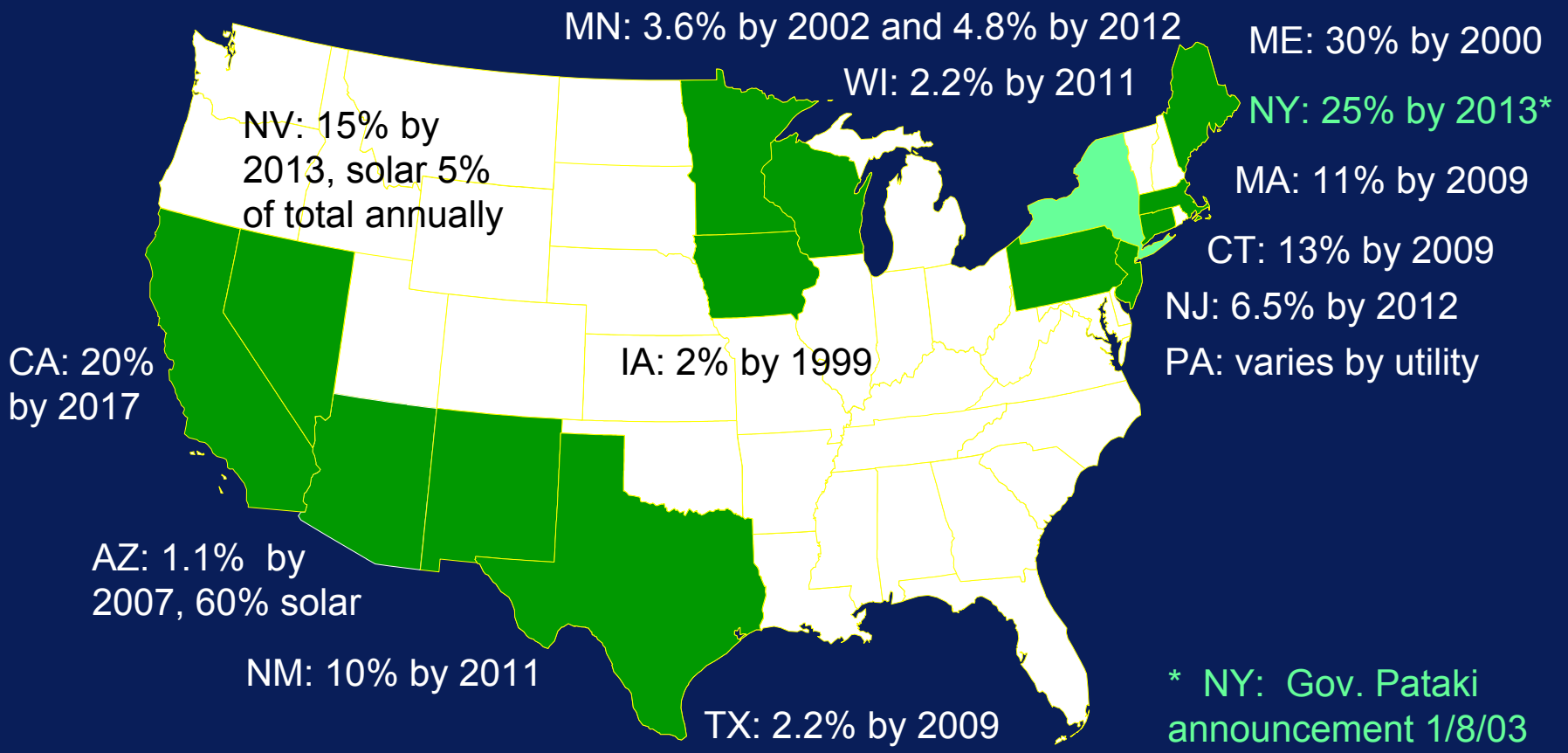
Themes

- 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

- 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



Source: Union of Concerned Scientists

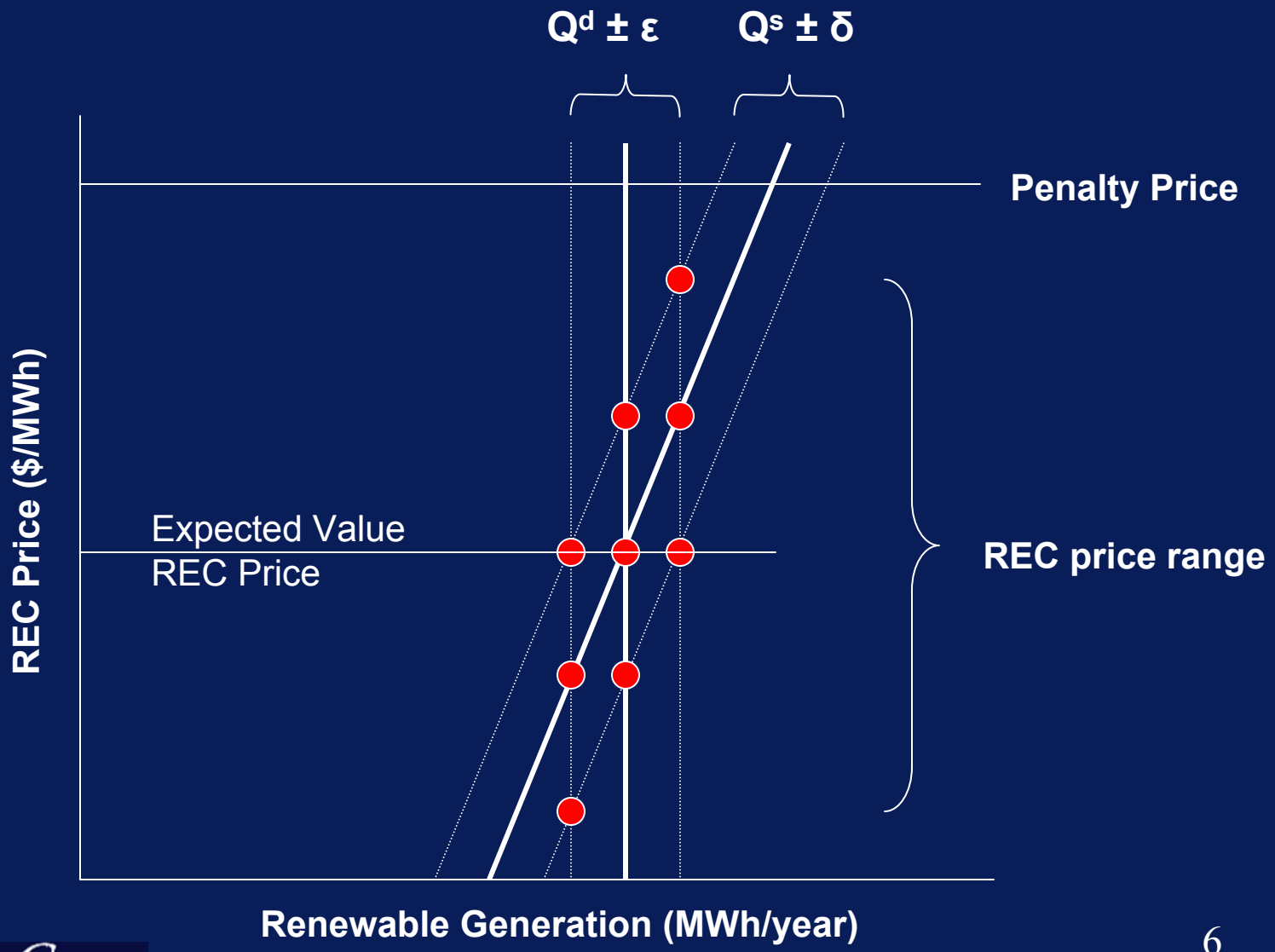
What is a REC?

- **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**

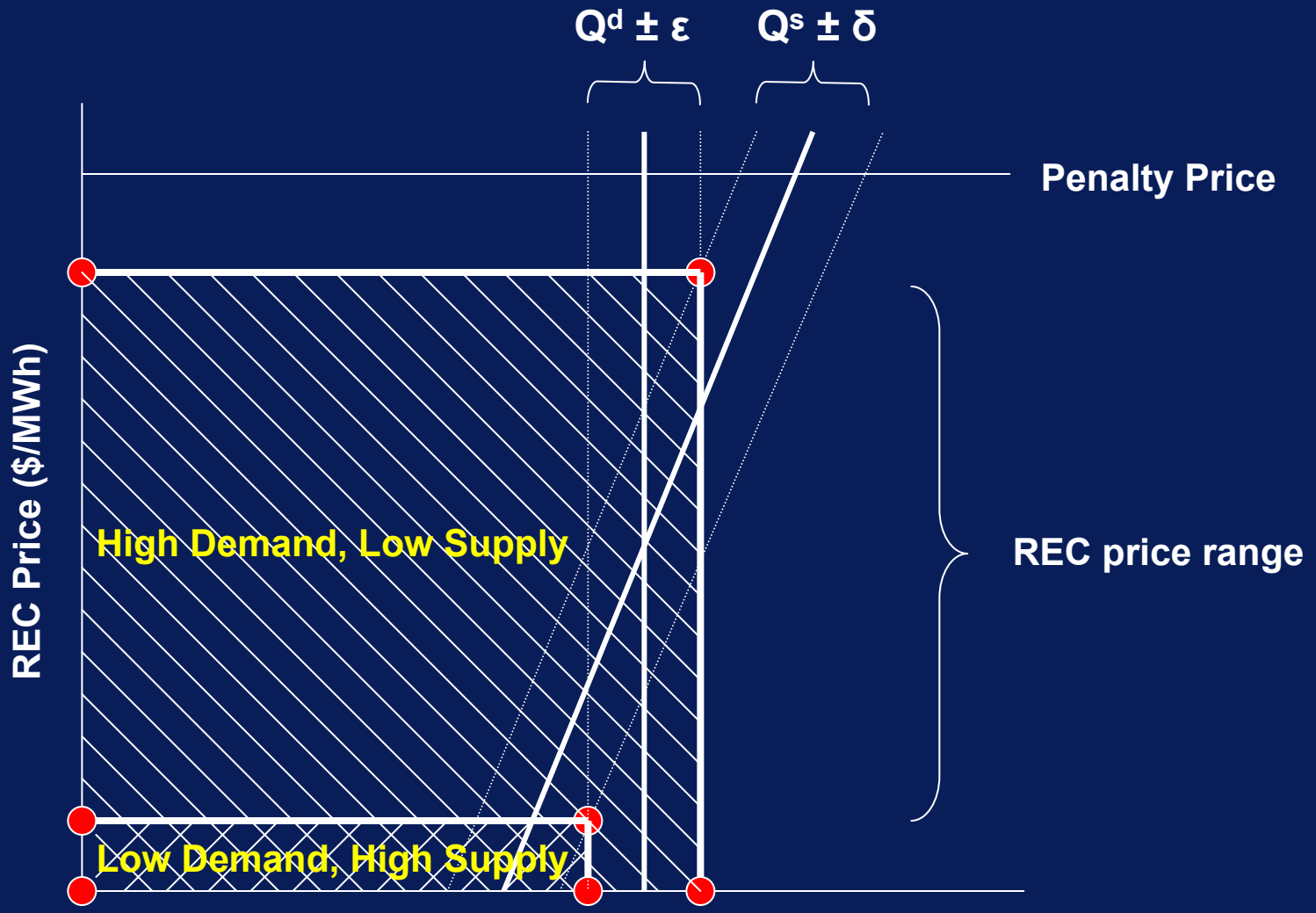
Realities of REC Markets

- 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

- 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

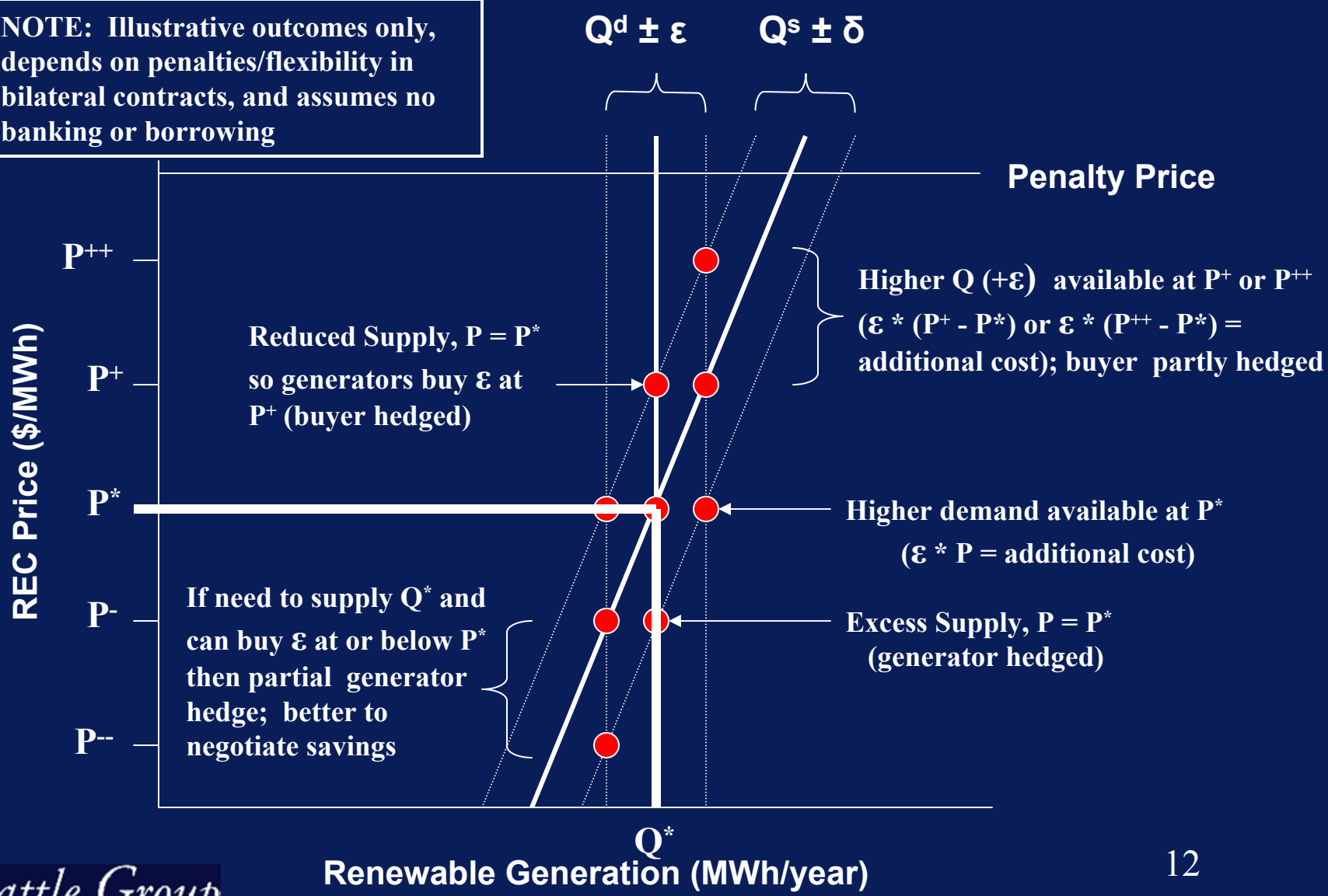
- **Renewable generator's perspective:**
  - **Long term bilateral contract for RECs (bundled or unbundled with MWh) reduces revenue variability and enables higher proportion of lower-cost debt finance**
- **Retail provider's perspective:**
  - **Long term bilateral for RECs hedges REC price risk and 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

- 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^*

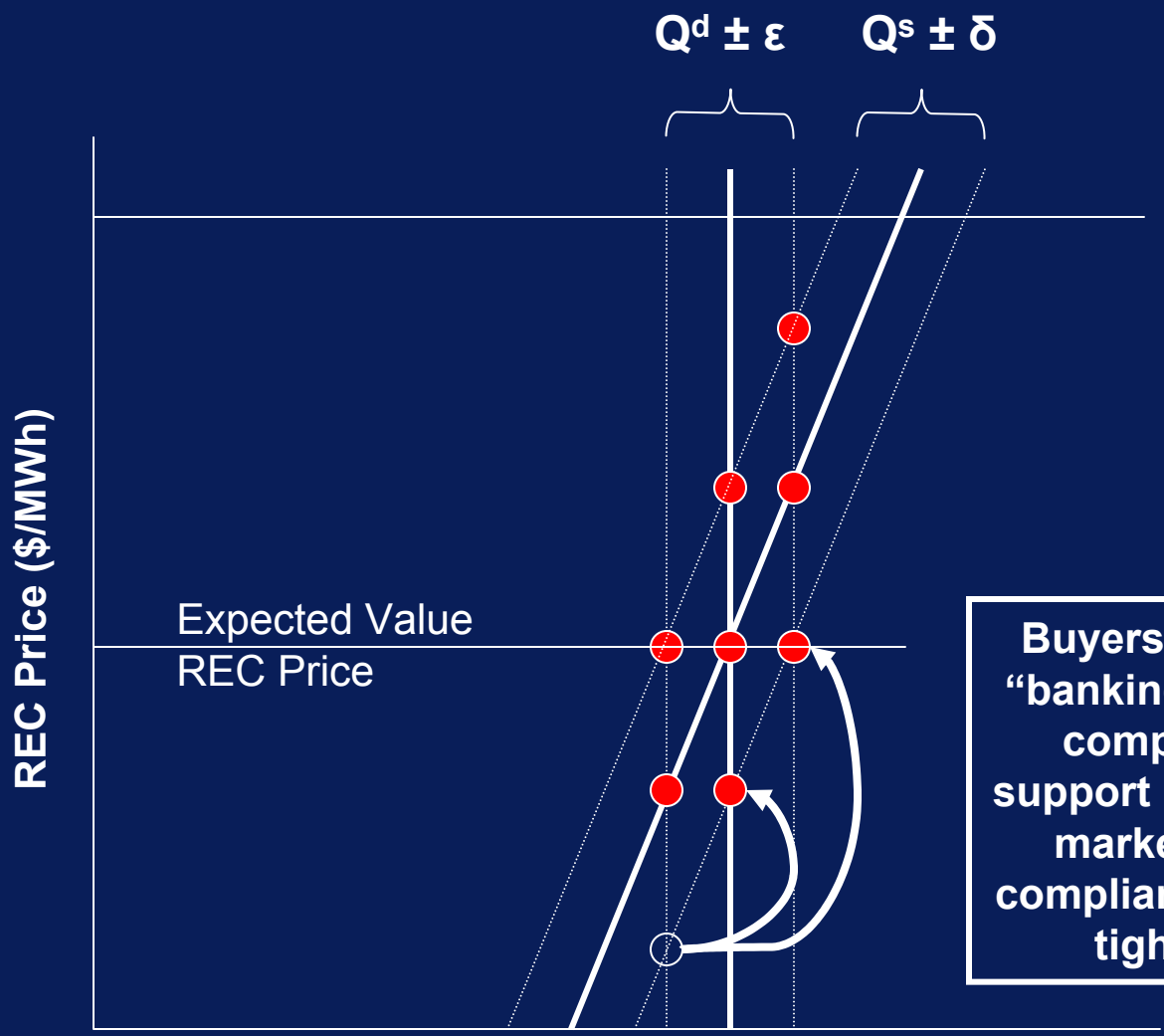
NOTE: Illustrative outcomes only, depends on penalties/flexibility in bilateral contracts, and assumes no banking or borrowing



Bilaterals, Spot Markets, & Compliance

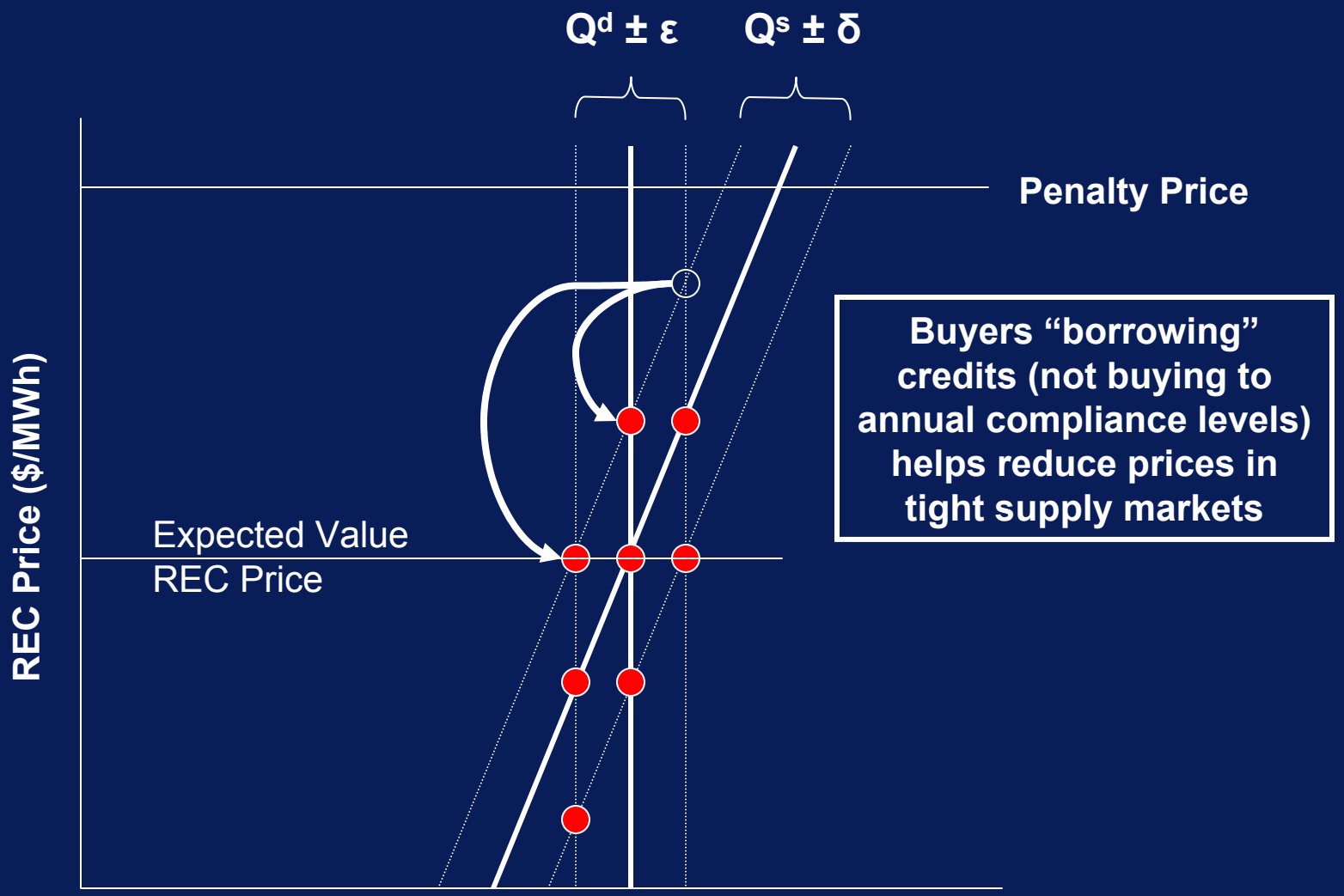
- If spot market used primarily for annual imbalance, then REC price volatility still likely
- Prevalence of long-term bilaterals will shield most revenues & costs from volatility, but large imbalances may still cause significant variation in cash flows
- If resulting REC prices are volatile at significant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

Banking



Buyers or even sellers "banking" credits (over-compliance) helps support prices in surplus markets and builds compliance inventory for tighter markets

Borrowing


$Q^d \pm \varepsilon$
$Q^s \pm \delta$
Penalty Price
REC Price ($/MWh)
Expected Value
REC Price
Buyers "borrowing" credits (not buying to annual compliance levels) helps reduce prices in tight supply markets
Renewable Generation (MWh/year)

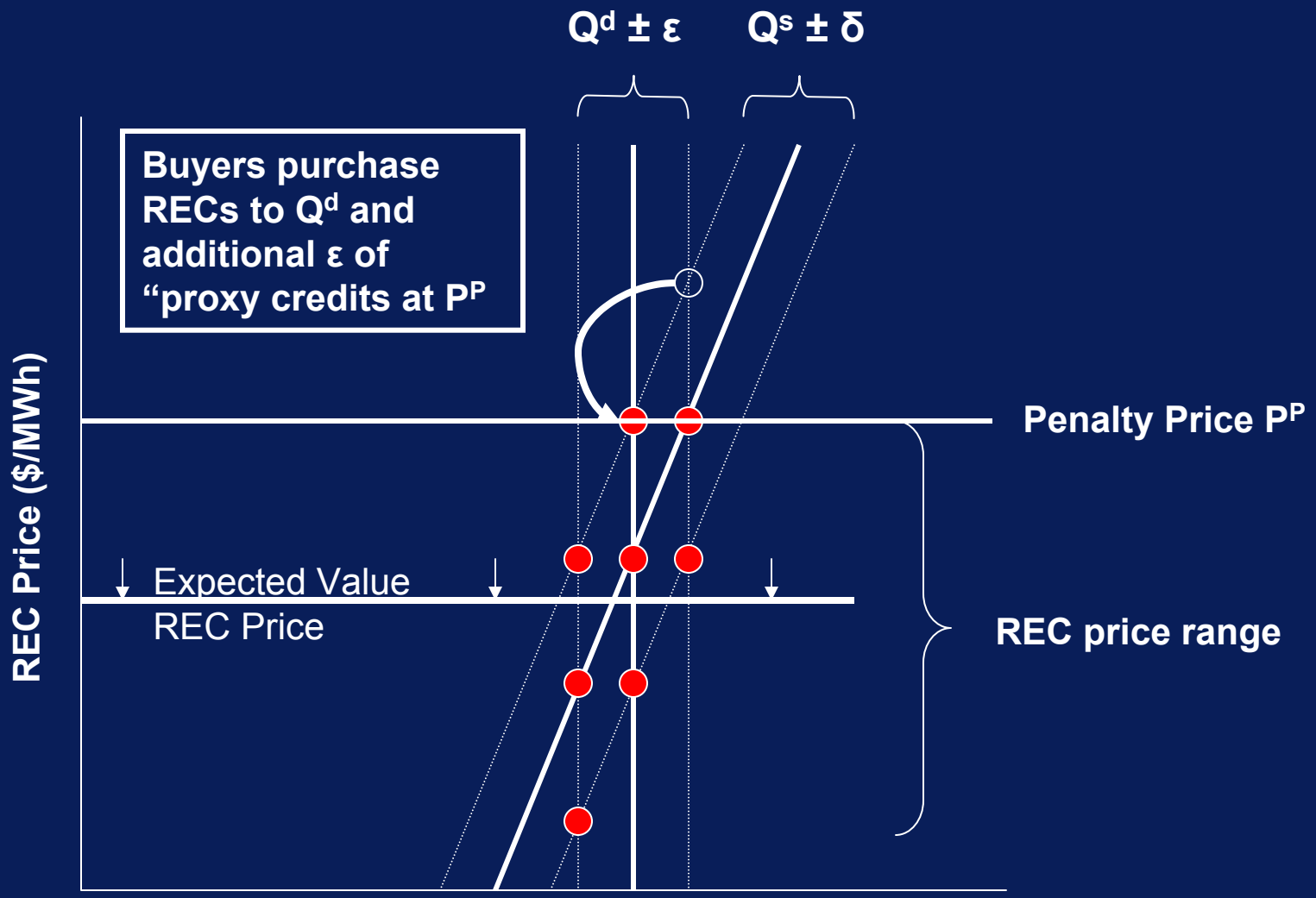
Benefits of Banking and Borrowing

- 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)

- 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

- National Bills in 107th and 108th 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

- 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