New Jersey Solar Market Development Volatility

Sustainable Energy Advantage, LLC

MEISTER CONSULTANTS GROUP

THE ASSIGNMENT

"The board shall complete a proceeding to investigate approaches to mitigate solar development volatility and prepare and submit, pursuant to section 2 of P.L.1991, c.164 (C.52:14-19.1), a report to the Legislature, detailing its findings and recommendations. As part of the proceeding, the board shall evaluate other techniques used nationally and internationally.

PRESENTATION OVERVIEW

- Introduction to the Project Team
- Market Development Volatility Defined
- Analysis of Past Market Experience
- Market Development Volatility Drivers
- Example Policies
- Potential New Jersey Policy Options

Sustainable Energy Advantage, LLC

Mission: ***Sustainable Energy***

Approach: ***Sustainable Advantage***

Helping governments, research institutions, developers, asset owners, investors, and utilities build renewable energy businesses, markets, policies & projects…
through analysis, strategy & implementation

Consulting Services

- ***Renewable Energy Market, Policy, Financial and Strategic Analysis*** (regional & national)

Subscription Services

- ***New England Renewable Energy Market Outlook[sm]*** (REMO) market fundamentals briefings
- ***New England Eyes & Ears[sm]*** Regulatory, Policy & Legislative Tracking and Analysis Service
  - (full and solar versions)

Practice Areas

- ***Public Policy Analysis, Development and Implementation***
- ***Quantitative Analysis and Modeling.***
- ***Strategy Development and Market Analysis.***
- ***Financial Analysis & Economic Feasibility.***
- ***Renewable Energy Supply & Procurement.***
- ***Transaction Facilitation, Contract Development and Negotiation Support.***
- ***Business infrastructure development.***
- ***Financial Modeling and Advisory Services***

About Meister Consultants Group

Company Description

- International, Boston-headquartered consulting firm specializing in energy policy and strategy development
- Clients include state energy offices, local governments, international institutions, national labs, and the U.S. DOE.

Expertise

- Renewable Energy
- Energy Efficiency
- Climate Adaptation
- International Green Growth
- Corporate Sustainability

Services

- Market Research
- Policy Analysis
- Program Implementation
- Network Management
- Stakeholder Engagement
- Participation and Dialogue

The New Jersey Solar Market Structure
Solar Act of 2012

- Accelerated near-term SREC requirements on LSEs
- Provided BPU with discretion to approve solar projects on farmland
- Developed program to support PV on brownfields
- Requirement that between EY 2014-2016 the BPU approve 80 MW of grid-supply capacity per year
- Extended SREC banking to five years

Solar Market Development Volatility
What is it & how do we know what it looks like?

- Extensive BPU stakeholder process
- No consensus definition
- Based on roles in market, stakeholders differ on:
  - Definition of "Solar Market Development Volatility"
  - Future potential for volatility
- Limited discussion of what appropriate market volatility would look like. Should New Jersey market be compared to:
  - Other state solar markets?
  - Energy commodity prices?
  - Other similar industries?

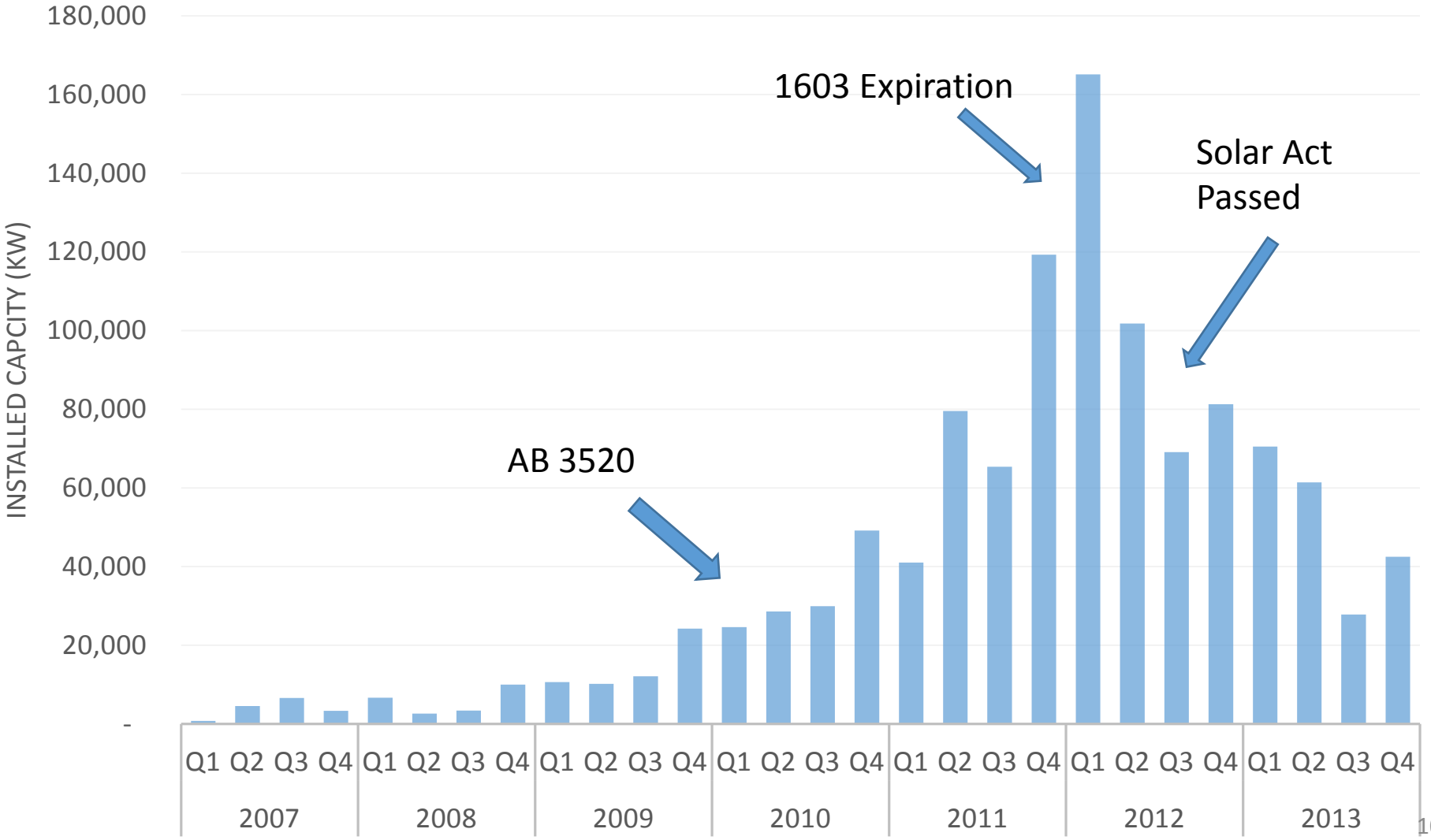
Solar Market Development Volatility

- Team "*Working" Definition: significant and rapid changes in rate of market capacity additions over time.*
  - Analysis performed on a *quarterly* basis, but other timeframes could be valid from market actor perspective.
- Why Quarterly Analysis?
  - Provides some data smoothing but still allows for granularity
  - Aligns with standard economic and business reporting data
    - E.g., Quarterly business reporting, GDP, housing starts, etc.

Analysis of Past Market Experience

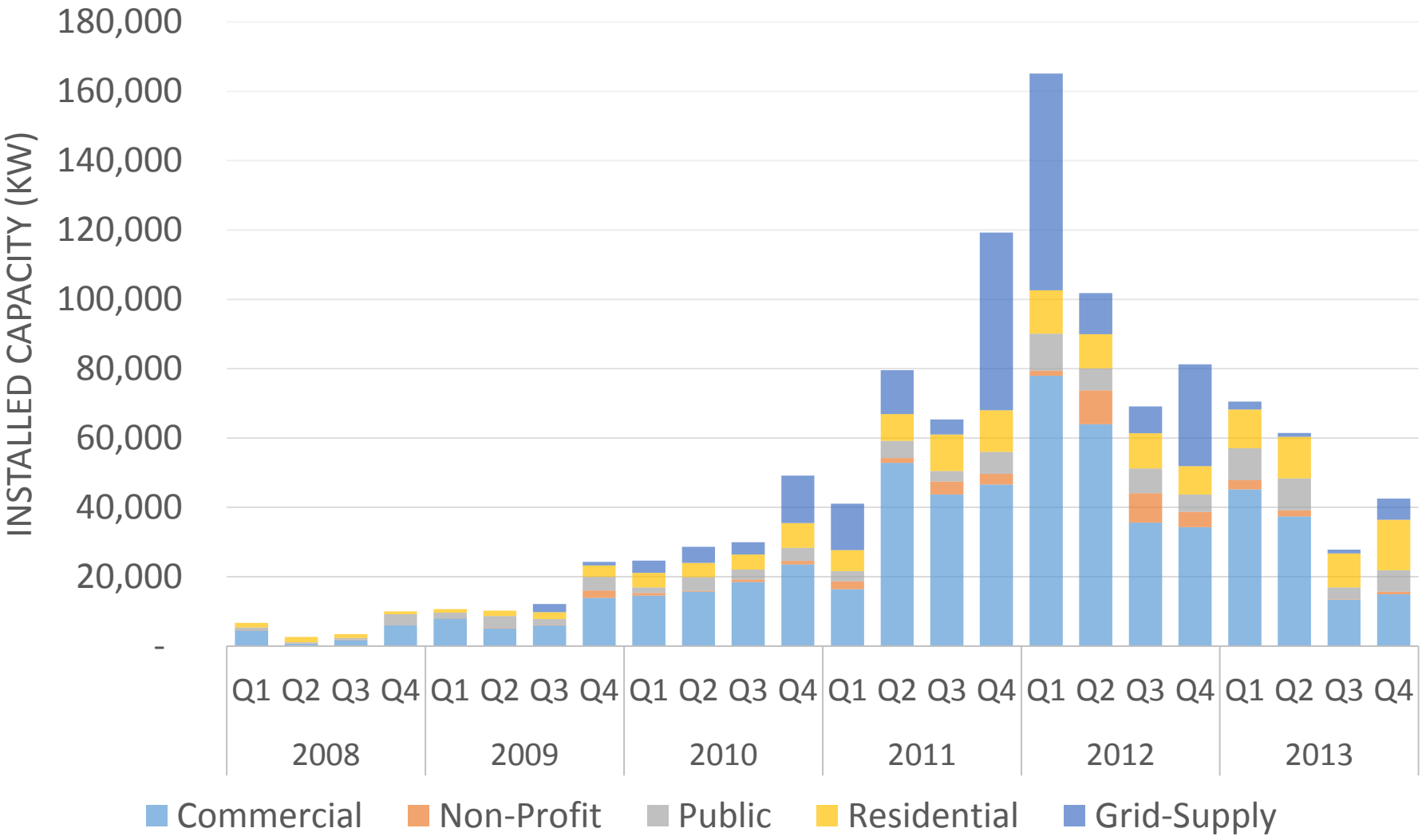
NJ Solar Market History

Multiple Factors Driving Market Boom



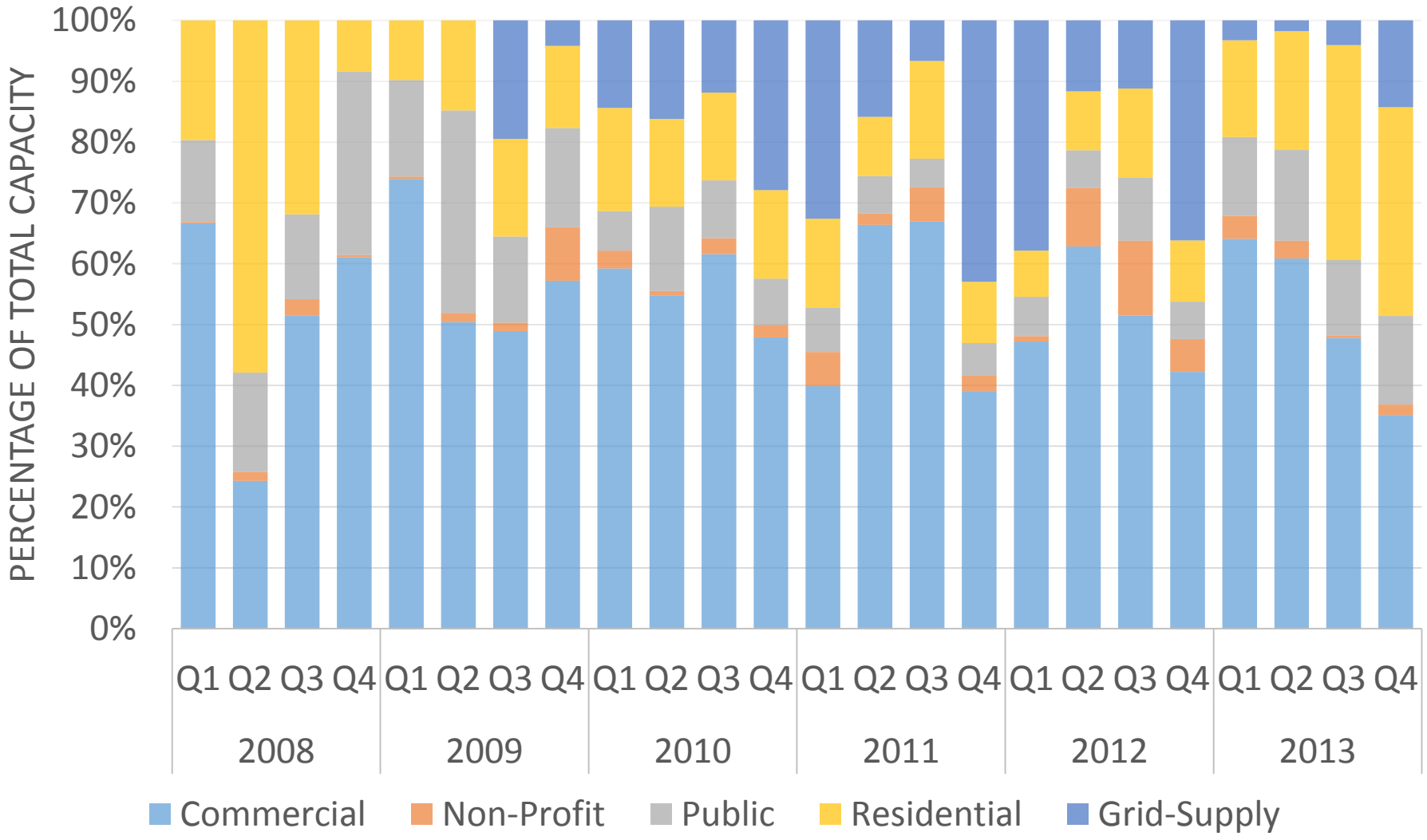
Market Performance by Sector

Grid-Supply and Commercial Peaks During the Boom



Market Performance by Sector

Quarterly Market Composition Varies Over Time



Market Performance by Sector

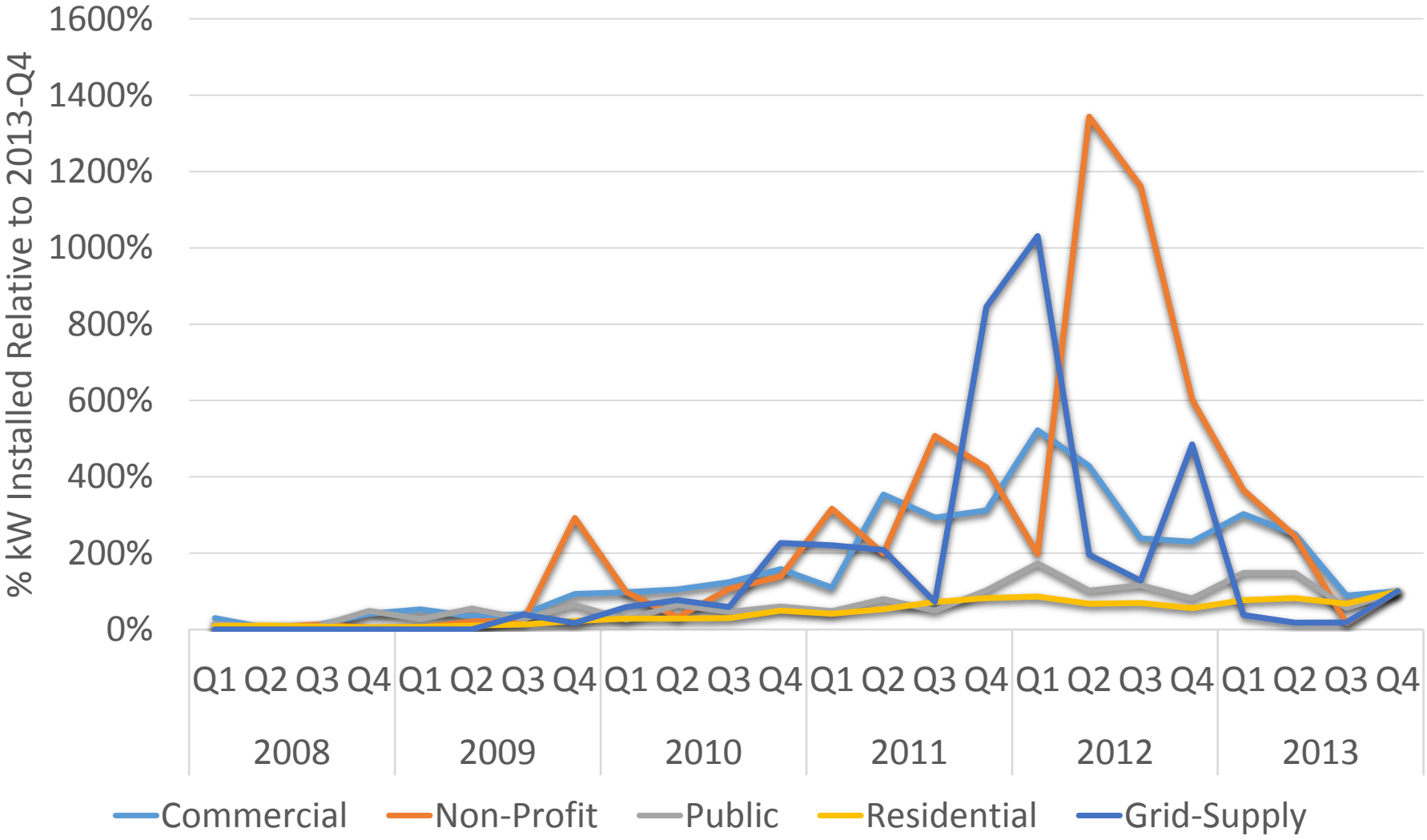
Statistical Analysis 2009-2013

	Commercial	Non-Profit	Public	Residential	Grid-Supply
Average Quarterly Installations (MW)	25.0	1,9	4.3	6.5	12.9
Standard Deviation	21.2	2.6	2.8	4.5	17.5
Coefficient of Variation	**0.85**	**1.36**	**0.66**	**0.68**	**1.36**

While measures of volatility are relative, sector volatility over entire period is significant. But…

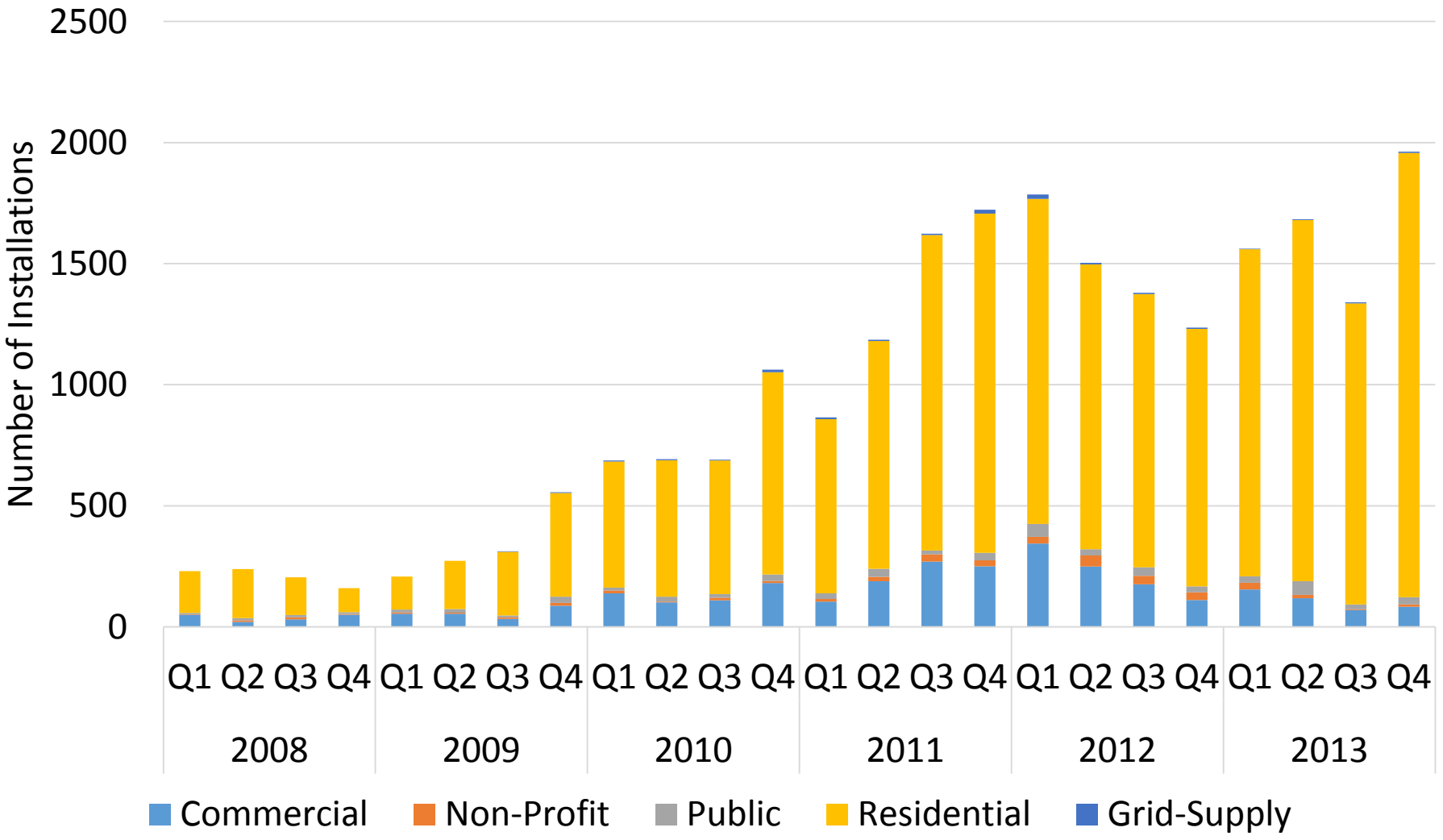
Market Performance by Sector

Volatility Differs by Sector Over Time



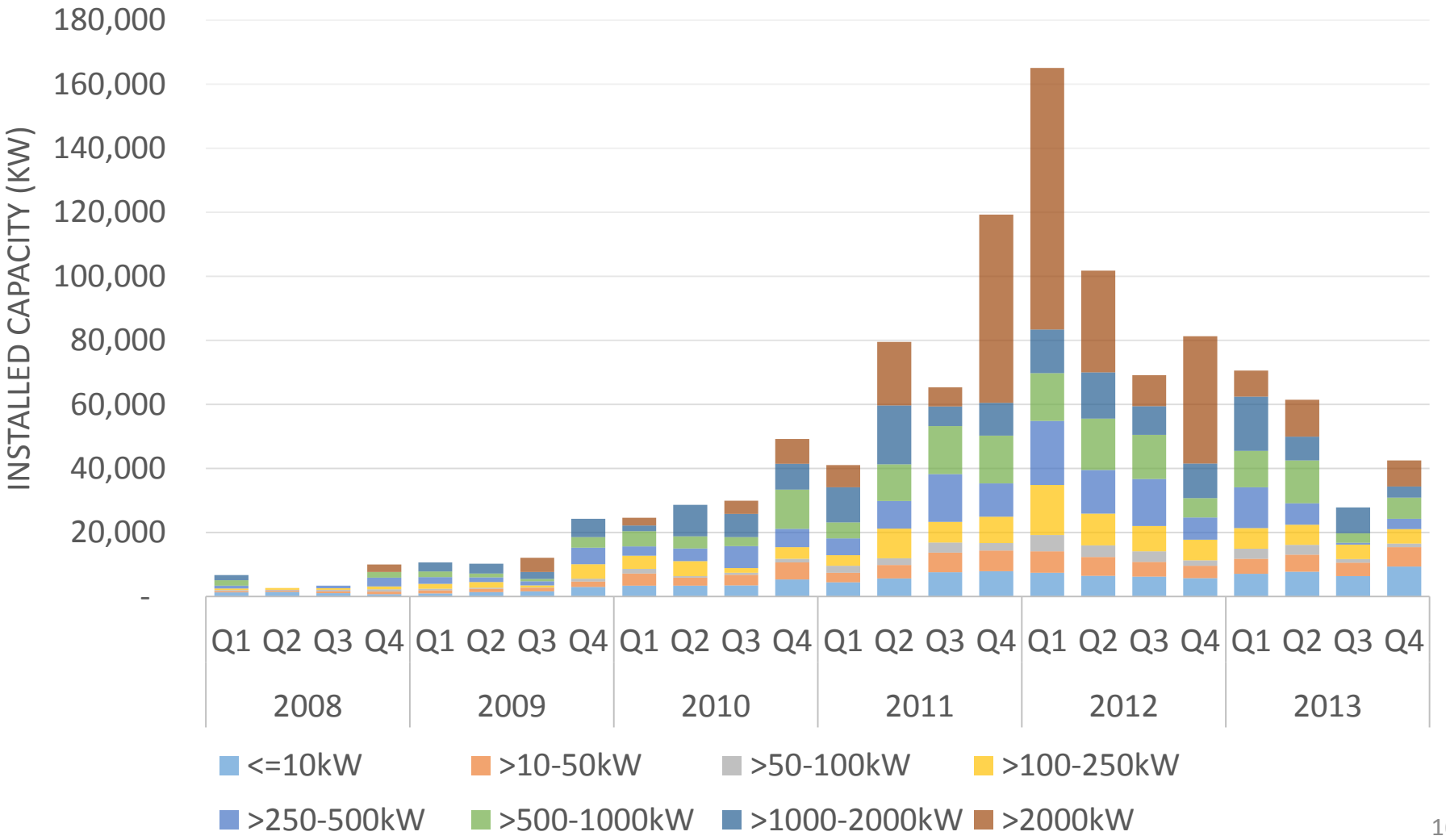
Market Performance by Sector

Residential Dominates Number of Systems



Market Performance by System Size

Large Systems Dominate Volatility Spike



Market Development Volatility Drivers

Market Development Volatility Drivers

Stakeholder Perspectives

- SREC Price Volatility
  - Consensus views: market prices appear to have stabilized since Solar Act
  - Concern that future instability could lead to boom-bust development cycles
- Lack of Long-term SREC Contracting
  - Generally not provided by LSEs (typically have 1-3 year contractual load obligations)
  - Lack of substantial long-term forward SREC contract market increases SREC revenue volatility

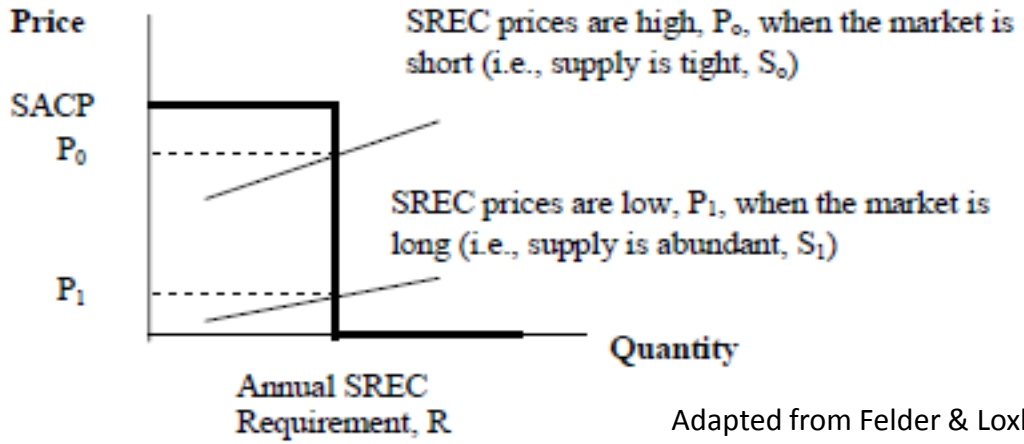
Market Development Volatility Drivers

Stakeholder Perspectives

- Limited Market Transparency
  - Market transparency key to functioning of competitive markets
  - Stakeholders note market information has improved
  - Some note improved price information would be useful
- Potential for Regulatory Change
  - Some stakeholders indicated expectations that demand schedule likely to be revised in future
  - Creates incentives to make decisions that look beyond current supply and demand dynamics

Potential Market Volatility Drivers
Research derived

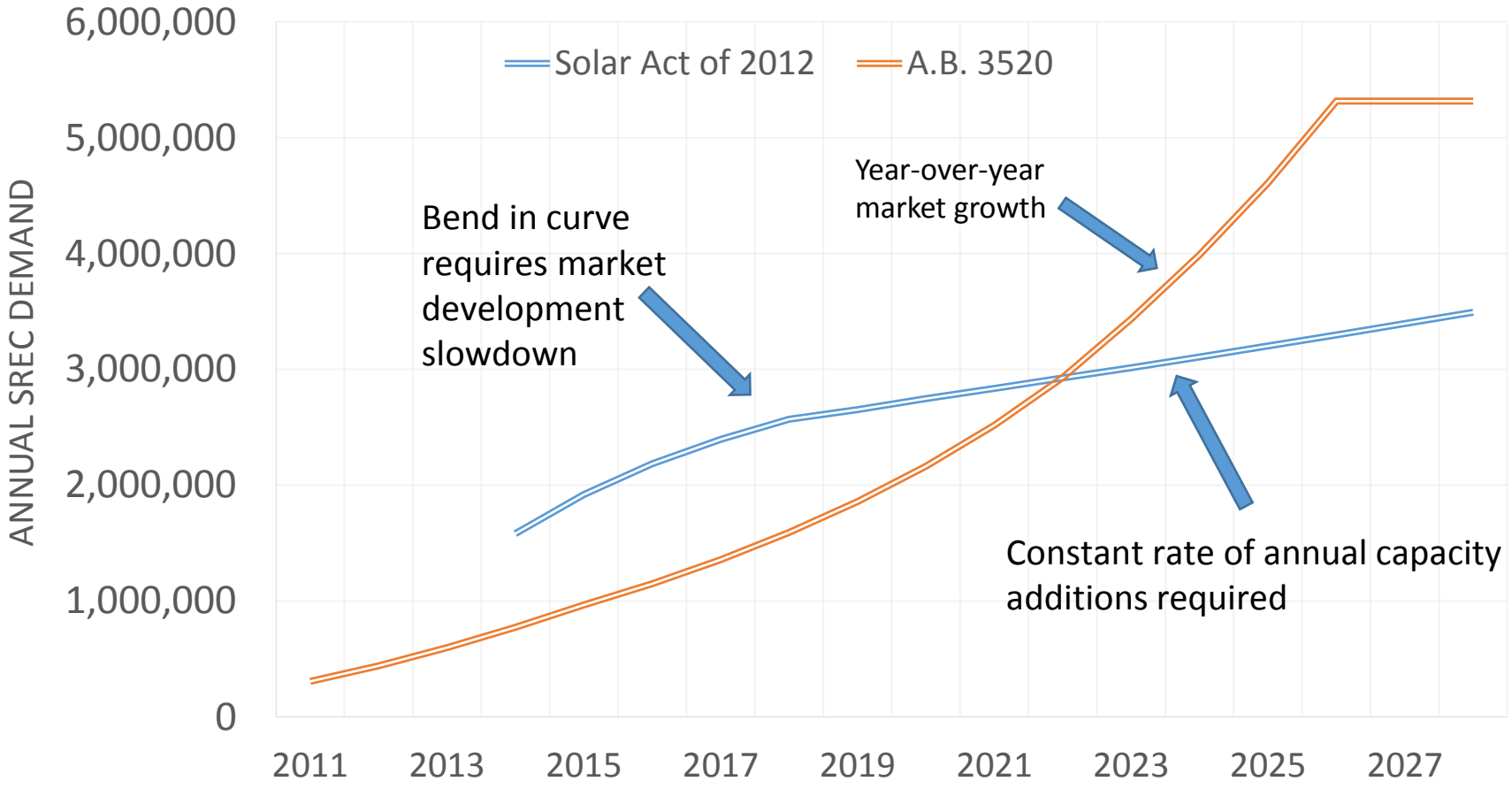
- Vertical Demand Curve
  - SREC demand fixed based on legislatively established schedule… not responsive to price
  - Current SREC market supply based on investment decisions made months and years earlier
  - SREC prices near ACP in shortage, near zero in surplus
  - SREC banking can partially mitigate SREC price volatility



Adapted from Felder & Loxley

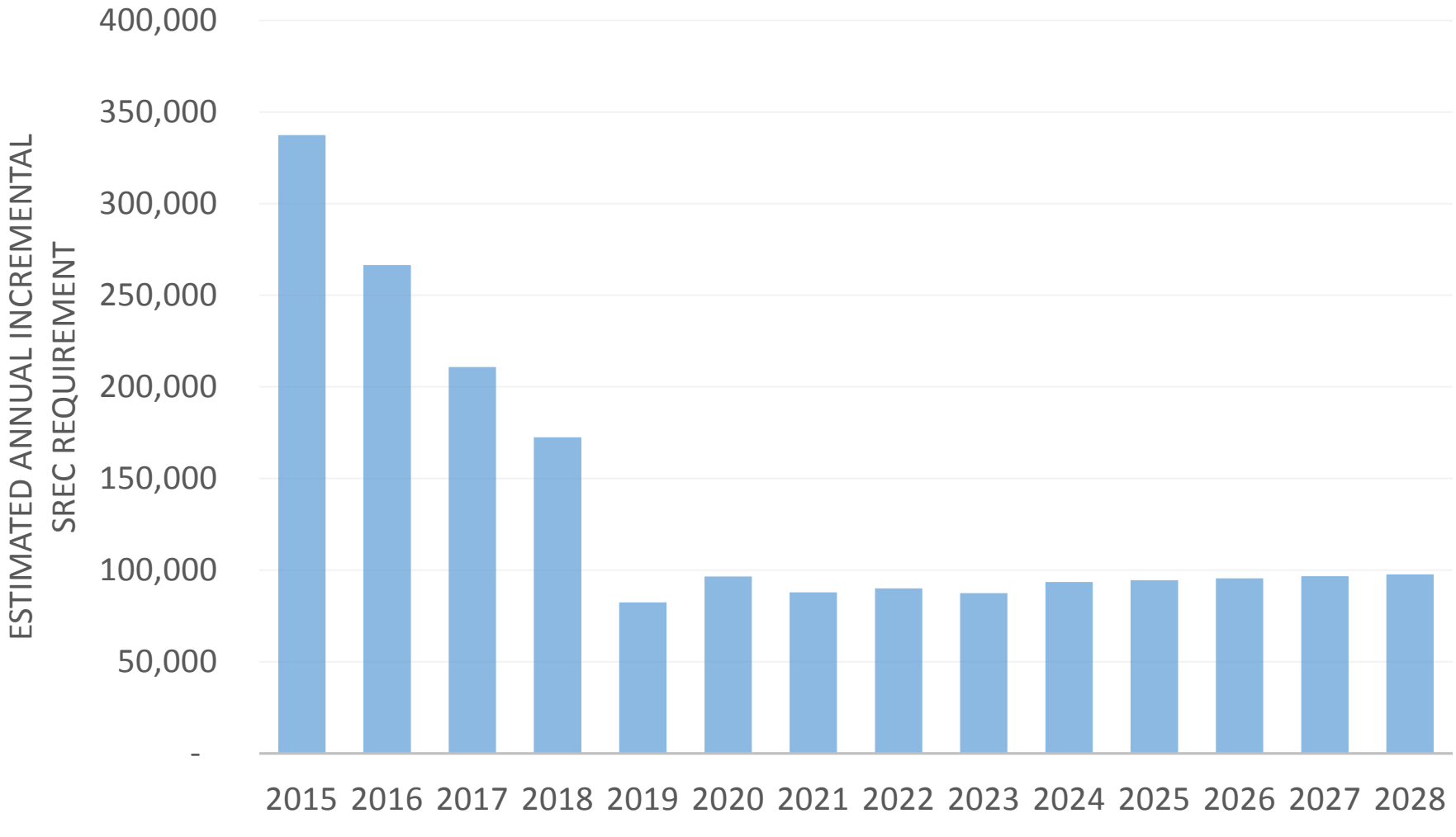
Potential Market Volatility Drivers

SREC Requirement Schedule



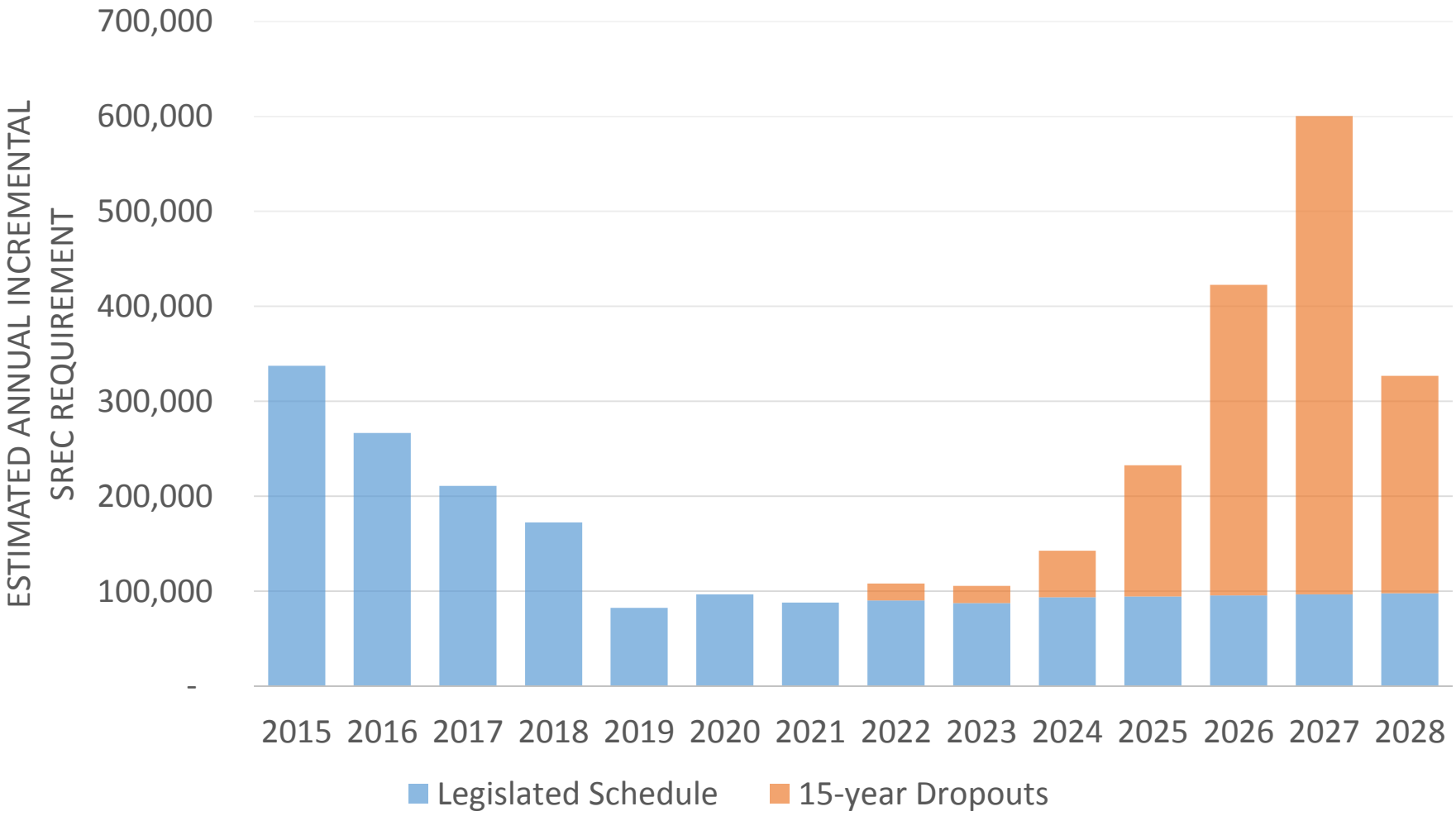
Potential Market Volatility Drivers

Annual Incremental SREC Requirement Schedule



Potential Market Volatility Drivers

15-Year SREC Generation Life



Potential Market Volatility Drivers
Federal Tax Credit Expiration

- Federal Business Energy Investment Tax Credit (ITC) & Residential Renewable Energy Tax Credit currently at 30%
  - After 2016, ITC declines to 10 percent
  - Residential credit is eliminated
- Accelerated development prior to incentive expiration deadline is common phenomenon
  - Prior spike driven by expiration of Sec. 1603 cash grants, bonus depreciation
- Could lead to significant over-build in 2016 as developers race to meet deadline

Market Development Volatility Mitigants

Existing Market Characteristics

- EDC Programs
  - Regular capacity additions promote market stability
  - Agreements to adjust programs to prevent SREC market over-supply
- Solar Act Constraints on Grid-Supply Projects
  - Reduces future potential for rapid market imbalances
- Relatively High Electricity Revenues
  - Creates substantial and relatively stable PV project revenue stream
- BGS Auction – Three Year Tranches
  - Supports 3-year forward SREC market hedging

Example Policies

Example Policies

Development and Evaluation Criteria

- Example policies generated from stakeholder process and literature review of models used elsewhere
- Policy review based on BPU-provided criteria:
  - Promotion of sustained orderly market development
  - Minimization of ratepayer costs
  - Creation of diverse marketplace, open to participation from many ratepayer classes
  - Long-term reductions in incentives leading to market transformation
  - Consistency with current legislation

Policy Evaluation Criteria

Market Development Stability	• Stable quarterly market capacity growth rate
Ratepayer Cost	• Relative cost imposed on ratepayers per quantity of installed PV capacity
Ratepayer Cost Volatility	• Variability of ratepayer costs for MWs of installed solar systems over time
Implementation Feasibility	• How difficult is policy implementation • Likelihood of changes being broadly acceptable to stakeholders
Market Diversity	• Support variety of supplier and host-project types • Allow both large & small firms and hosts
Long-term incentive reduction	• Encourage market to move away from incentives
Consistency with Current Framework	• Consistent with existing RPS & SREC framework • Operate best as a stand-alone or separate policy

Example Policies

- Expand EDC Programs
- Green Bank Financing
- Standard Offer Contracts with Volume-based Price
- Competitive Procurement of Long-term Contracts
- SREC Price Floor
- Supply-responsive Demand Formula
- BGS SREC Auction Tranche
- RPS Assignment to EDCs

Policy Framework
Market Development Quantity Controls

EXPAND EDC PROGRAMS
POLICY DESCRIPTION

- Stakeholders noted EDC programs were effective and should be continued/expanded
- Recently approved program extensions provide roughly a third of market development requirement over the next several years
- Could leaded to decreased potential future market volatility
  - Provides long-term SREC price certainty to sub-set of market
  - Requires roll-out schedule that syncs with SREC demand schedule
- Further expansion would not require major changes in market structure
- Could crowd-out 'unstructured market' development

Expand EDC Programs

Criteria Review

- **Increase Stability**
  - If implementation is coordinated with demand schedule
- **Minimize Ratepayer Cost**
  - Significant administrative costs
  - Relatively high rates of return for loan program
  - Ratepayer risk related to long-term contracting
- **Implementation Feasibility**
  - Likely easily implemented through existing structures

Options	Increase Stability	Minimize Ratepayer Cost	Ratepayer Cost Volatility	Implementation Feasibility	Increase Market Diversity	Long-term Incentive Reduction	Complementary vs. Stand-alone
Expand EDC Programs	Medium	Low	Unknown	High	Medium (Loan + Solicitation) Low (EDC Direct Ownership)	Medium	Complementary

Green Bank Financing
Policy Description

- Decreasing PV financing costs would lower required SREC revenues
  - Accelerates transition to market not bound by SREC demand schedule
- Green Banks implement initiatives to attract private sector capital by lowering financing risk
  - Credit enhancements, interest rate buy downs, commercial PACE
- New Jersey's proposed Resilience Bank follows a similar model
- Number of states implementing Green Bank programs
  - New York, Connecticut, Mass.

Green Bank Financing
Criteria Review

- **Increase Stability**
  - Moderate long-term stability increases from reduced SREC incentive requirements
- **Minimize Ratepayer Cost**
  - Direct ratepayer impact would depend on funding model
- **Implementation Feasibility**
  - May require new legislation and creation of a new entity to coordinate activities

Option	Maximize Market Development Stability	Minimize Ratepayer Cost	Minimize Ratepayer Cost Volatility	Implementation Feasibility	Maximize Market Diversity	Compatibility with long-term incentive reduction	Maximize Consistency with Current Framework
Green Bank Financing	Medium	Medium/Low	Low	Medium	High	Medium	Complementary

Standard Offer Contracts with Volume-based Price

Policy Description

- New generation of standard offer programs include volume-responsive pricing adjustments (California, Germany)
- Limited volume available over short period of time
  - If fully subscribed, price decreased in next round
- Provides upper-bound for market build rate
  - Could result in market under-performance if contract failure rate is high

Standard Offer Contracts
Criteria Review

- **Increase Stability**
  - Significant increase in market development stability
- **Minimize Ratepayer Cost**
  - Long-term contracting could lead to lower SREC incentive requirements
  - Can be structured to be market-responsive with declining prices
  - Ratepayer risk if technology prices decline substantially
- **Implementation Feasibility**
  - Requires significant change to existing model
  - Central contracting authority or EDCs
  - Potential transition issues for existing system owners

Options	Increase Stability	Minimize Ratepayer Cost	Ratepayer Cost Volatility	Implementation Feasibility	Increase Market Diversity	Long-term incentive reduction	Complementary vs. Stand-alone
Standard Offer Contracts	High	Moderate	High	Low	Potentially high depending on policy choices	High	Stand-Alone

Competitive Procurement of Long-term Contracts

Policy Description

- EDCs or central authority procure all SRECs through competitive solicitation process for entire market demand
- Solicitations scheduled over relatively short, regular intervals to maintain market activity
- Could be structured to provide support for range of system types
- Variations of model used in Del., N.Y., Ct. and R.I.
- Requires carefully-tailored market entry barriers to prevent speculative bidding while allowing new players to enter market

Competitive Procurement
Criteria Review

- **Increase Stability**
  - Significant increase in market development stability
- **Minimize Ratepayer Cost**
  - Long-term contracting could lead to lower SREC incentive requirements
  - Lowest cost systems built – drives competition
  - Risk of over-payment if technology costs decline significantly
- **Implementation Feasibility**
  - Requires significant change to existing model
  - Central contracting authority or EDCs
  - Potential transition issues for existing system owners

Options	Increase Stability	Minimize Ratepayer Cost	Ratepayer Cost Volatility	Implementation Feasibility	Increase Market Diversity	Long-term incentive reduction	Complementary vs. Stand-alone
Competitive Procurement	High	High	High	Low	Potentially High	High	Stand alone

SREC Price Floor

Policy Description

- Can be structured either as a firm floor or a soft floor
  - Firm floor requires credit-worthy counterparty
  - Soft floor could include market mechanisms to raise SREC value
- Improves certainty around minimum SREC market values and can improve project financing
- Challenges in setting appropriate floor price in a diverse market
- Likely best implemented with supply responsive demand formula

SREC Price Floor
Criteria Review

- **Increase Stability**
  - May prevent significant market declines, but could result in over-build in absence of modulating demand
- **Minimize Ratepayer Cost**
  - Could support lower cost financing
  - Risk of floor being too high
- **Implementation Feasibility**
  - Few viable examples of setting an effective floor; (effectiveness)
  - Likely best implemented with other policies

Options	Increase Stability	Minimize Ratepayer Cost	Ratepayer Cost Volatility	Implementation Feasibility	Increase Market Diversity	Long-term Incentive Reduction	Complementary vs. Stand-alone
SREC Price Floor	Low to Moderate, depending on details	Low to Moderate, depending on details	Medium	Low	Unclear	Low	Complementary

Supply-responsive Demand Formula

- Establishes a preliminary SREC target which adjusts based on an established formula
- Results are SREC obligations that respond to supply changes and price signals
  - Response is somewhat delayed
  - SREC price swings are mitigated because market participants can anticipate adjustments in SREC demand
  - Complementary to banking

$$\begin{aligned} &Total\ Compliance\ Obligation\ (Current\ Year) \\ &= \text{Total Compliance Obligation (CY} - 1) \\ &+ [(\text{Total Projected SRECs Generated CY} - 1) - (\text{SRECs Generated CY} - 2)]\text{x } 1.3] \\ &+ (\text{Banked Volume CY} - 2) + (\text{Auction Volume CY} - 2) \end{aligned}$$

Example from Massachusetts' model

Supply Responsive Demand Formula
Evaluation Criteria Notables

- **Increase Stability**
  - Allows market to adjust to external influences
- **Minimize Ratepayer Cost**
  - Could raise or flatten near-term demand
- **Implementation Feasibility**
  - Complexity
  - May require new legislation

Options	Increase Stability	Minimize Ratepayer Cost	Minimize Ratepayer Cost Volatility	Implementation Feasibility	Increase Market Diversity	Long-term Incentive Reduction	Complementary vs. Stand-alone
Supply-Responsive Demand Formula	High	Neutral	High	Medium	Neutral	Neutral	Complementary or Stand-Alone

BGS SREC Auction Tranche

- Basic Generation Service (BGS) procurement would include tranches for long-term SREC contracts with the overarching goals to:
  - Separate the BGS retail load obligations of one or three years from the SREC obligations.
  - Auction procures SRECs thru distinct tranches over longer duration than the current BGS obligation (e.g., 10 years)
  - Intermediary entities (e.g., non-utility, credit-worthy organizations potentially called Renewable Serving Entities [RSEs]) respond, taking on long-term responsibility for procuring and retiring SRECs; and,
  - Ultimately provide a market composed of credit-worthy entities purchasing long-term strips from SREC owners / solar generators… who then retire SRECs associated with BGS load

BGS SREC Auction Tranche

Evaluation Criteria Notables

- **Increase Stability**
  - Dependent on RSE's procurement strategy (duration)
  - Dependent on load served by BGS tranche (% of market)
- **Minimize Ratepayer Cost**
  - Uncertain (depends on RSE's portfolio strategy; perception of quantity risk)
  - Could also increase transaction and administration costs
- **Implementation Feasibility**
  - Defining role of, qualifying, policing of, etc. RSEs
  - May require new legislation

Options	Increase Stability	Minimize Ratepayer Cost	Lower Ratepayer Cost Volatility	Ease of Implementation Feasibility	Increase Market Diversity	Long-term Incentive Reduction	Complementary vs. Stand-alone
BGS Tranche	Unclear	Unclear	High	Low	Low	Medium	Complementary

RPS Assignment to EDCs

- Shift SREC obligation from LSEs to EDCs
- EDCs could be encouraged / legislated to take a portfolio approach to SREC contracting
  - LSEs have limited interests in longer-term SREC contracts
  - Developer interest in long-term contracts
- EDCs are highly creditworthy
  - SREC contracts with EDCs would likely lead to lower system financing costs

RPS Assignment to EDCs

Valuation Criteria Notables

- **Increase Market Stability**
  - Would depend on EDC SREC portfolio procurement SREC structure
- **Minimize Ratepayer Cost**
  - Long-term contracts could lower SREC incentive requirements, lowering ratepayers cost
- **Implementation Feasibility**
  - Would be a major change from current policy and disruptive to current business models.

Options	Increase Stability	Minimize Ratepayer Cost	Lower Ratepayer Cost Volatility	Implementation Feasibility	Increase Market Diversity	Long-term Incentive Reduction	Complementary vs. Stand-alone
RPS Obligation to EDCs	Medium	Medium	High	Low	Neutral to Low	Medium	Stand-Alone

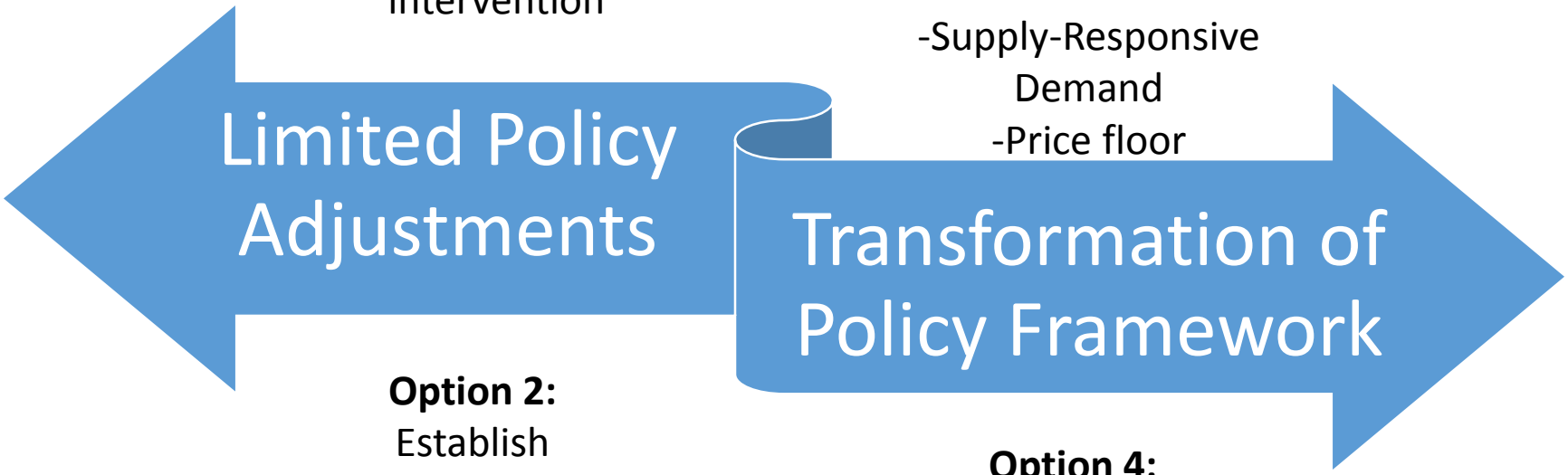
Tentative

Potential NJ Policy Options

Potential Policy Options

Option 1:
No future policy intervention

Option 3:
Moderate intervention in current framework
-Supply-Responsive Demand
-Price floor



Option 2:
Establish complementary policies
-Green Banks
-EDC Program Expansion

Option 4:
Adjust market structure to *capped quantity incentives*
-Procurement Model
-Standard Offer Contracts

Option 1: No Future Policy Intervention

- Implement existing policies and programs, but make no new adjustments to incentive programs
  - The Solar Act of 2012 included major changes to stabilize market development:
    - Future caps on grid-supply projects
    - Extension of banking provisions
    - Near-term acceleration of demand
    - Decrease in SACP levels
  - Other recently implemented policies include:
    - Reporting requirements for large projects
    - Extension of EDC financing programs
  - These should reduce solar market development volatility

Option 1: No Future Policy Intervention
Benefits

- Enhances regulatory certainty
- Implementation of Solar Act has reduced potential solar market development volatility
- Existing system owners and other market stakeholders protected from regulatory change
- Acknowledges perspective of many stakeholders

Option 1: No Future Policy Intervention

Challenges

- Current demand schedule creates conditions for potential future market volatility
  - Decline in build rates built into schedule from 2019-2022
  - Projects limited to 15-years of SREC eligibility suggests demand spike thereafter
- Market may or may not be able to adapt to Federal ITC
  - Loss of major incentive in 2016
  - Potential over-supply event in 2016 due to increased build rates to capture 30 percent ITC
- Development stability bolstered by credible commitment to a “hands-off” approach during periods of over-supply

Option 2: Policy Intervention with Complementary Policies

- Implementation of one or more complementary initiatives to further stabilize solar development:
  - 2.1 Expansion and long-term extension of EDC financing programs
    - Goal is to increase the proportion of the market participating in procurements
  - 2.2 Implementation of PV financing initiatives under a Green Bank
    - Goal to reduce financing costs, diminish relative reliance on volatile SREC revenue streams, and accelerate transition away from SREC market as required incentive
  - Policies could be implemented in complementary fashion or independently

Option 2: Policy Intervention with Complementary Policies
Benefits

2.1 Expanding EDC Programs

- Implemented through existing models
- Significant past experience and market acceptance
- Competitive procurement drives market transformation

2.2 Green Bank

- Could be implemented through adapting existing structures (e.g., Resilience Bank)
- Reduces cost of capital, leading to market transformation away from SREC incentives

Option 2: Policy Intervention with Complementary Policies
Challenges

2.1 Expanding EDC Programs

- Administrative cost of programs may be high
- Increased ratepayer exposure under current model
  - Ratepayer impact may be positive or negative, but increased program size increases potential risk
  - Non-procured market segment will either shrink, or exacerbate market development volatility

2.2 Green Bank

- Models are immature, limited experience
- May require legislation, initial capitalization and significant program design/implementation
- May not be able to attract private-sector investment as planned
  - Experience limited, CEFIA and NYSERDA models currently in early stages

Option 3: Moderate Intervention within Current Market Framework

- Implement supply-responsive demand curve with, or without, SREC price floor, through new legislation
  - Supply-responsive demand curve would use a predetermined formula to adjust market demand in response to supply conditions
  - SREC price floor could be either a ‘soft’ or ‘firm’ floor depending on legislated mechanism, risk appetite and credit-worthiness of buyer-of-last resort

Option 3: Moderate Intervention within Current Market Framework

Benefits

- Expected to dampen market development volatility
- Allows market to better respond to shifting conditions
  - Changes to global module prices, changes to federal tax incentives, etc.
- Reduces potential for iterative legislative intervention in demand schedule
- Floor mechanism creates enhanced revenue certainty → allows for lower cost financing →lower overall program costs
  - Firmer floor leads to lower SREC price volatility and increased potential for debt financing

Option 3: Moderate Intervention Within Current Market Framework

Challenges

- Supply-Responsive Demand Curve:
  - Lag-time in supply-responsive demand formula impacts effectiveness
  - Increase in demand may increase ratepayer costs relative to current policy
- Price Floor:
  - Establishing and funding floor mechanism could be challenging
  - Establishing a proper floor price will be critical to ensuring market diversity and limiting buyer-of-last resort's exposure
  - Procedure for surplus SRECs when market reaches floor
    - Purchase vs. Banking/Reserves
  - Floor is a transfer of risk from system owner to another entity
- Complexity

Option 4: Implement Quantity Incentive

- Convert entirety of market to either:

  4.1 Competitive procurement or

  4.2 Standard offer contract with volume-based price

- Central procurement entity (or entities) provide long-term contracts in advance of system installation
  - Would include regular awards over short time intervals to ensure continuous market activity
  - Could include mixed-policy model with procurements for large grid-supply projects and standard offers for smaller system types

Option 4: Implement Capped Quantity Incentive
Benefits

- Benefits: Auction & Standard Offer (4.1 & 4.2)
  - Long-term contracts lower system cost of capital leading to lower incentive requirement
  - Reduced opportunity for developer windfall
    - Allows incentive levels to adapt to external market forces
    - Can be structured to support market diversity
- Benefits: Auction (4.1)
  - Most assured potential reduction of market development volatility, if speculative bidding minimized
  - Least-cost award model drives competition at project level
- Benefits: Standard Offer (4.2)
  - Drives supply chain competition

Option 4: Implement Capped Quantity Incentive Challenges

- Challenges: Auction & Standard Offer (4.1 & 4.2)
  - Disruptive to existing business models
  - Similar options already evaluated during prior market transition
  - Requires significant new responsibilities for procurement entity
- Challenges: Auction (4.1)
  - Speculative bidding vs. barriers to participation (i.e., security, etc.)
  - Build rates may be less than expected due to speculative bidding
  - Prices set based on speculative bids could cause developers to exit market
  - Winning projects are unknown
    - Requires developers to develop/sell more projects than succeed, increasing costs
    - Host customer frustration with losing bids
- Challenges: Standard Offer (4.2)
  - Speculative queuing may result in less than expected build rates

Discussion

MEISTER
CONSULTANTS GROUP