Product Design for Colombia's Regulated Market

Peter Cramton
University of Maryland
and Market Design Inc.
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Three steps to market design

- Product design ➢Today!
- Auction design ➢June
- Transition ➢July

Purpose of market

- Efficient price formation
- Transparency
- Neutrality
- Risk management
- Liquidity
- Simplicity
- Consistency

Efficient price formation

- Reliable price signals based on market fundamentals
- Competitive
- Mitigate market power

Transparency

- Offers are comparable
- Clear why winners won
- Prompt regulatory review and approval
- Regulatory certainty

Neutrality

- All suppliers treated equally
- All demanders treated equally

Risk management

- Reduces risk for both sides of market
- Rate stability, yet responsive to long-term market fundamentals
- Shields from transient events
- Addresses counterparty risk

Liquidity

- Promotes secondary market
- Liquid market for primary product
- Liquid market for derivative products
  - Long-term strips
  - Short-term slices

Simplicity

- For participants
- For system operator
- For regulator

Consistency

- Consistent with other key elements
  - Spot energy market
  - Firm energy market
- Consistent with best practice in world

Colombia setting

- Hydro-dominated electricity market
  - 80% of energy
  - 67% of capacity
  - 50% of firm energy (exceptional dry period)
- Hourly bid-based spot energy
  - Single zone
- Firm energy market
  - Assures sufficient firm energy
  - Hedges prices above scarcity price (about $260/kWh)

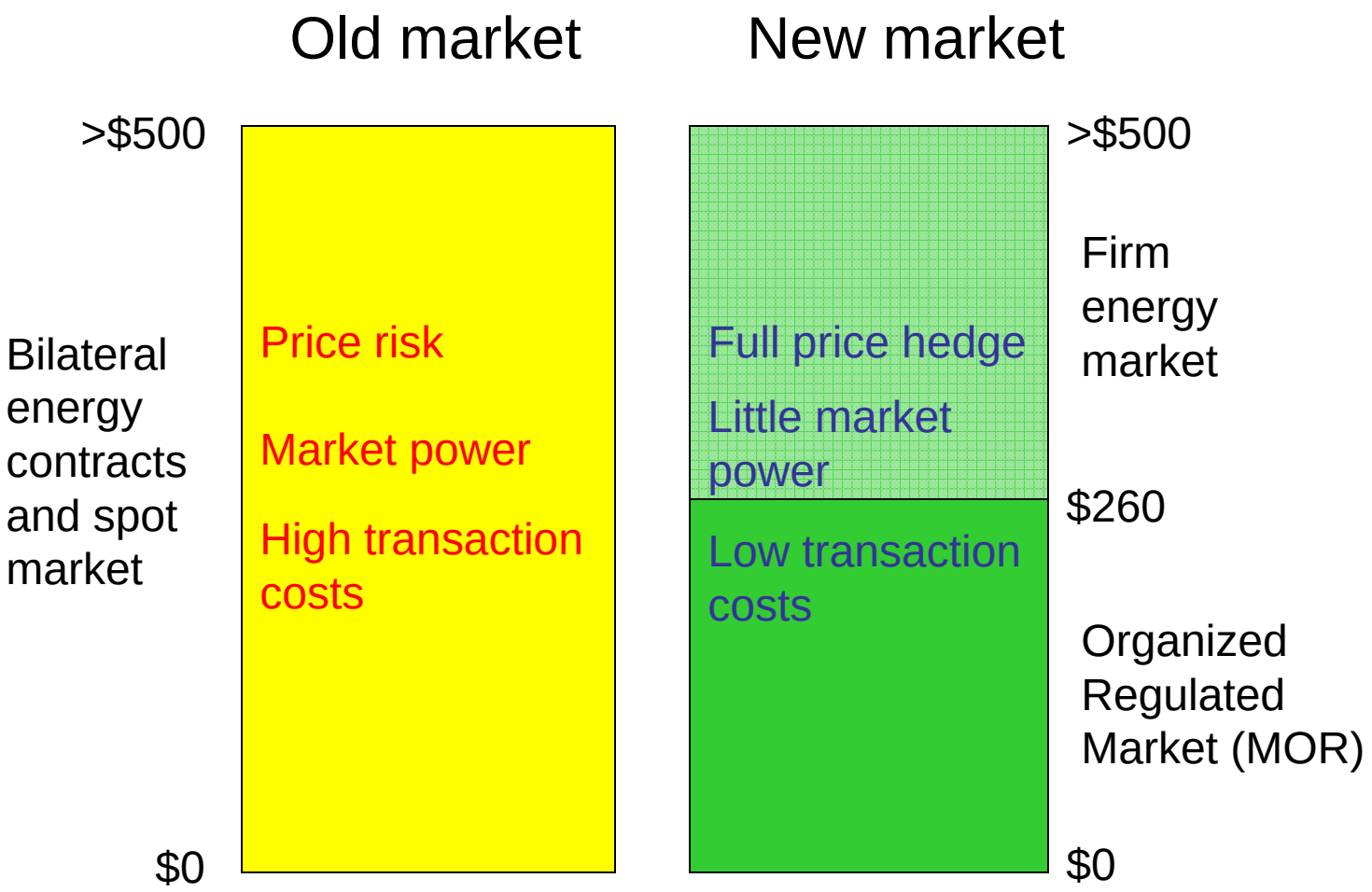
Market structure of firm energy (moderate concentration)

Company	ENFICC Declared (GWh)			Market share	HHI
	Hydro	Thermal	Total		
Emgesa	10,419	2,373	12,792	21%	455
Epm	8,523	3,295	11,818	20%	388
Corelca		9,873	9,873	16%	271
Isagen	5,099	2,327	7,426	12%	153
Epsa	1,487	1,655	3,142	5%	27
AES Chivor	2,925		2,925	5%	24
Gensa	57	2,594	2,651	4%	20
Termoflores		2,189	2,189	4%	13
Termoemcali		1,533	1,533	3%	7
Merielectrica		1,404	1,404	2%	5
Termotasajero		1,349	1,349	2%	5
Termocandelaria		1,062	1,062	2%	3
Proelectrica		708	708	1%	1
Menores	689		689	1%	1
Urra S.A	438		438	1%	1
Total	29,637	30,363	60,000	100%	1,374

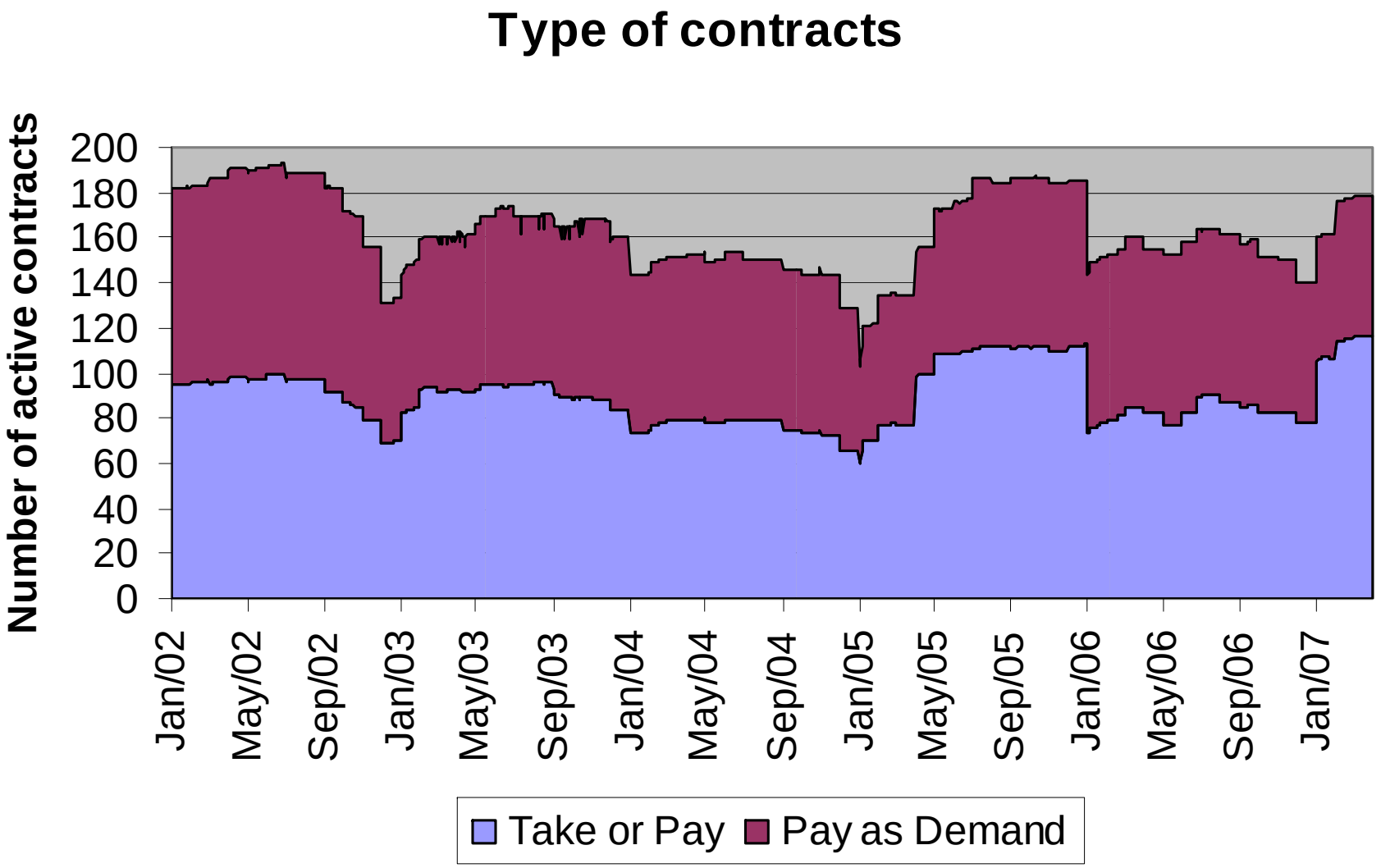
Product:
Energy share of regulated load

- Supplier bids for % of regulated load
- Supplier that wins 10% share has an obligation to serve 10% of regulated load in each hour
- Deviations between hourly obligation and supply settled at the spot energy price (or scarcity price if spot is higher)
- Pay as demand contract

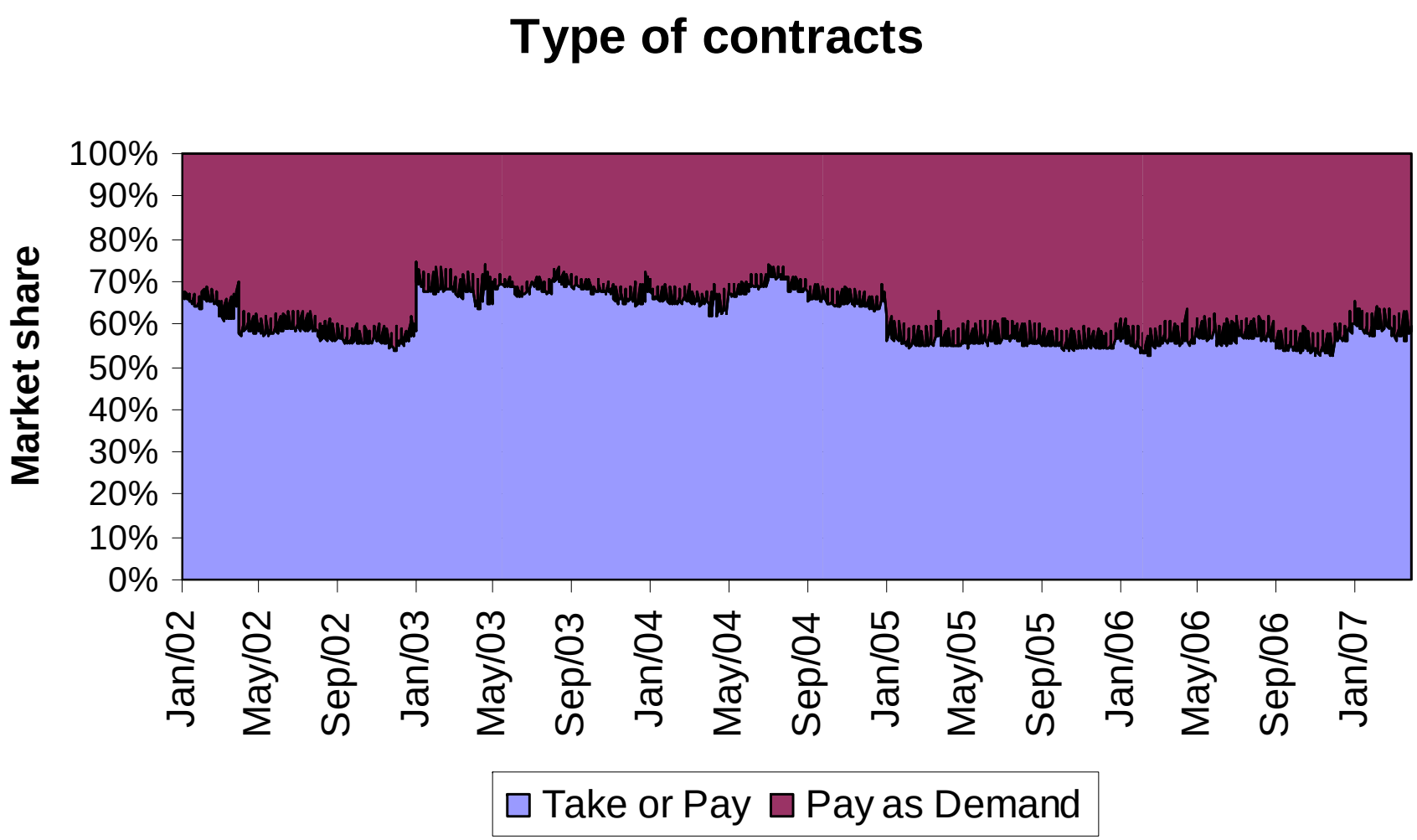
Price coverage of regulated customer



Pay-as-demand is common



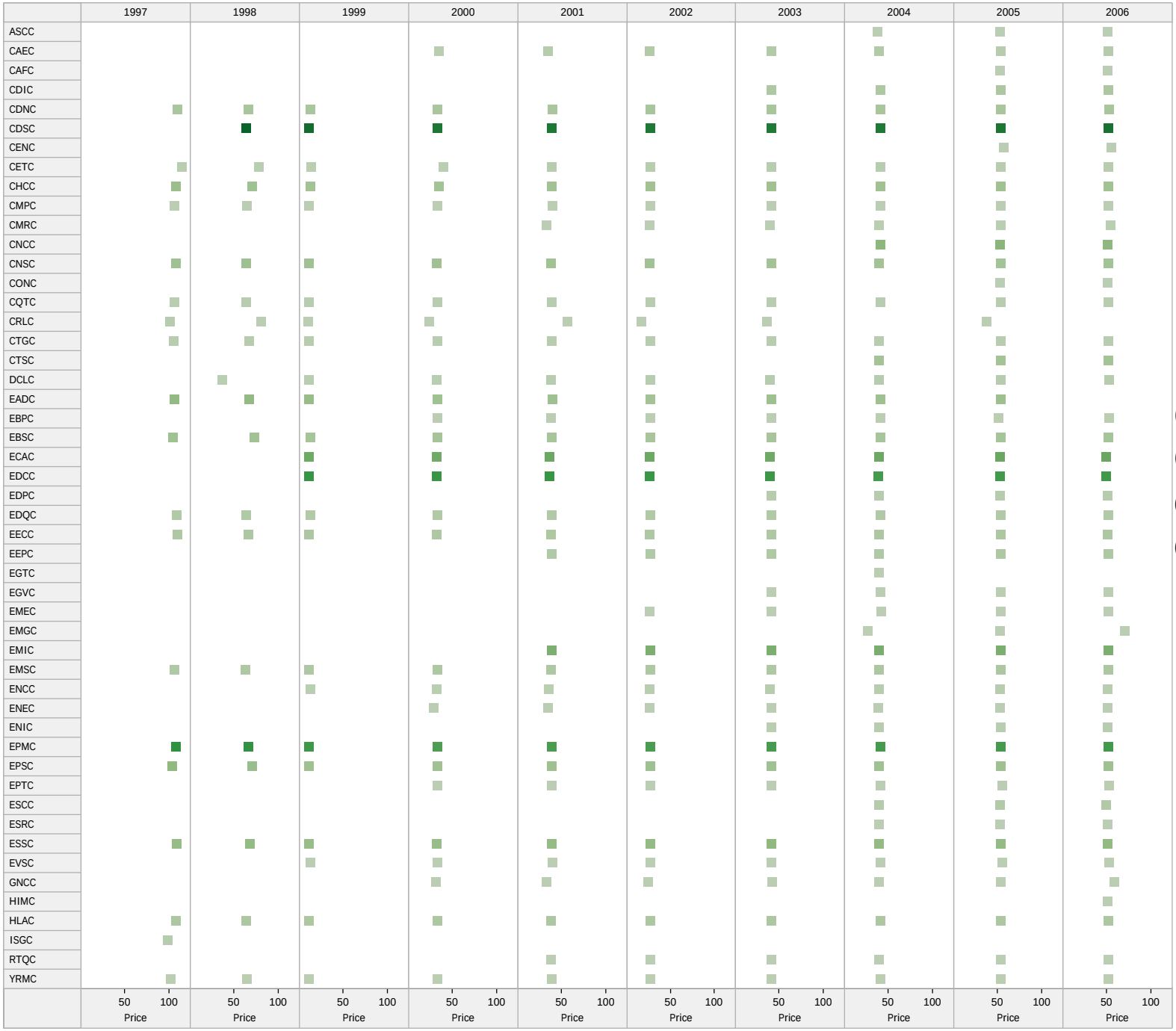
Pay-as-demand in energy terms



Product

- Regulated load is aggregate of all LSEs
- 100% of regulated load is purchased in auctions
- Mandatory for LSEs
- Voluntary for suppliers
- Accommodates multiple customer classes if required
  - For example, undesirable load shape of LSE

Average cost ($/kWh) by LSE and Year



Conclusion: Only one customer class!

Price for each LSE broken down by Year. Color shows details about Demand. The data is filtered on Days, which ranges from 350 to 366.

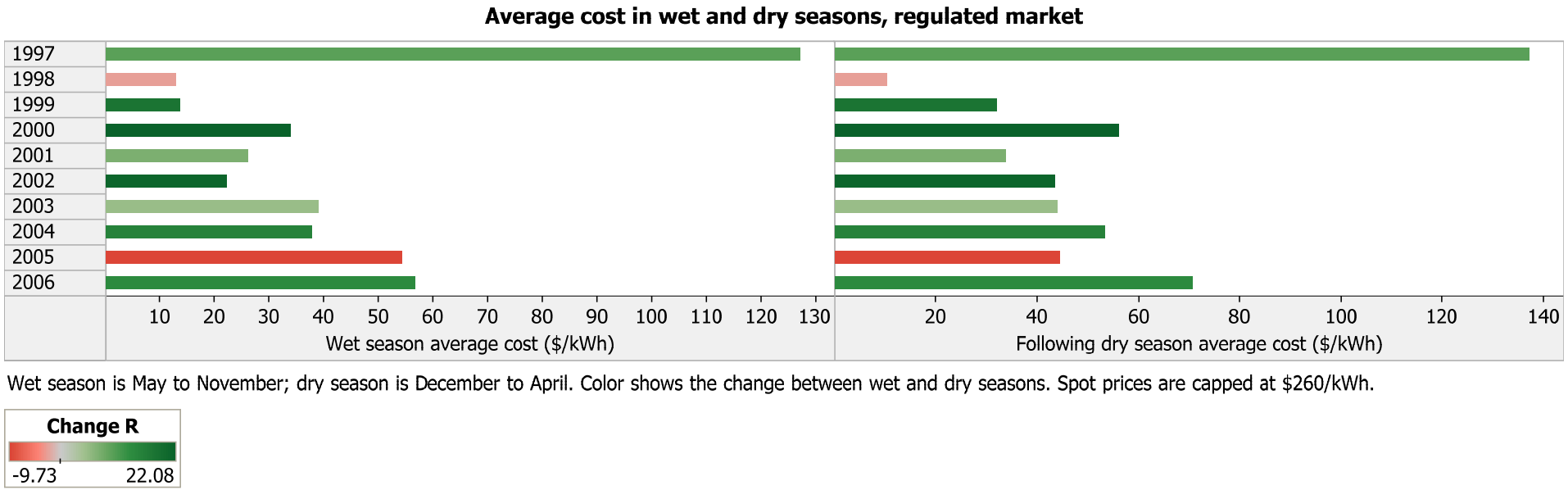
Comparison with CREG proposal

- Energy share is huge simplification
  - Improved liquidity
  - Enhanced competition
  - Reduced risk
- Greater frequency of auctions reduces risk
- Similar in other respects
  - Single centralized market
  - Standard contract
  - Bundled product across all LSEs

Further issues

Seasonal factor?

- Costs are about 19% higher in dry season
- Wet season .92; dry season 1.11
- Conclusion: seasonal factor not needed



Wet season is May to November; dry season is December to April. Color shows the change between wet and dry seasons. Spot prices are capped at $260/kWh.

Load-following not ideal for all

- Different resource types have different ideal dispatch
  - Baseload, peaker, limited-water hydro, etc.
- Difference in dispatch and obligation introduces risk and market power issues
- Problem mitigated by
  - Balanced portfolio of resources
  - Balanced portfolio of contracts (Reg. and NR)
- Conclusion: benefits of pay-as-demand greatly exceed costs

Regulated demand participation

- Participation by LSE is mandatory
- Retail choice has not worked well in US
- Boundary between regulated/non-regulated should be studied
- If demand does participate, it should be directly, not through LSE
  - Large sophisticated buyers could manage themselves

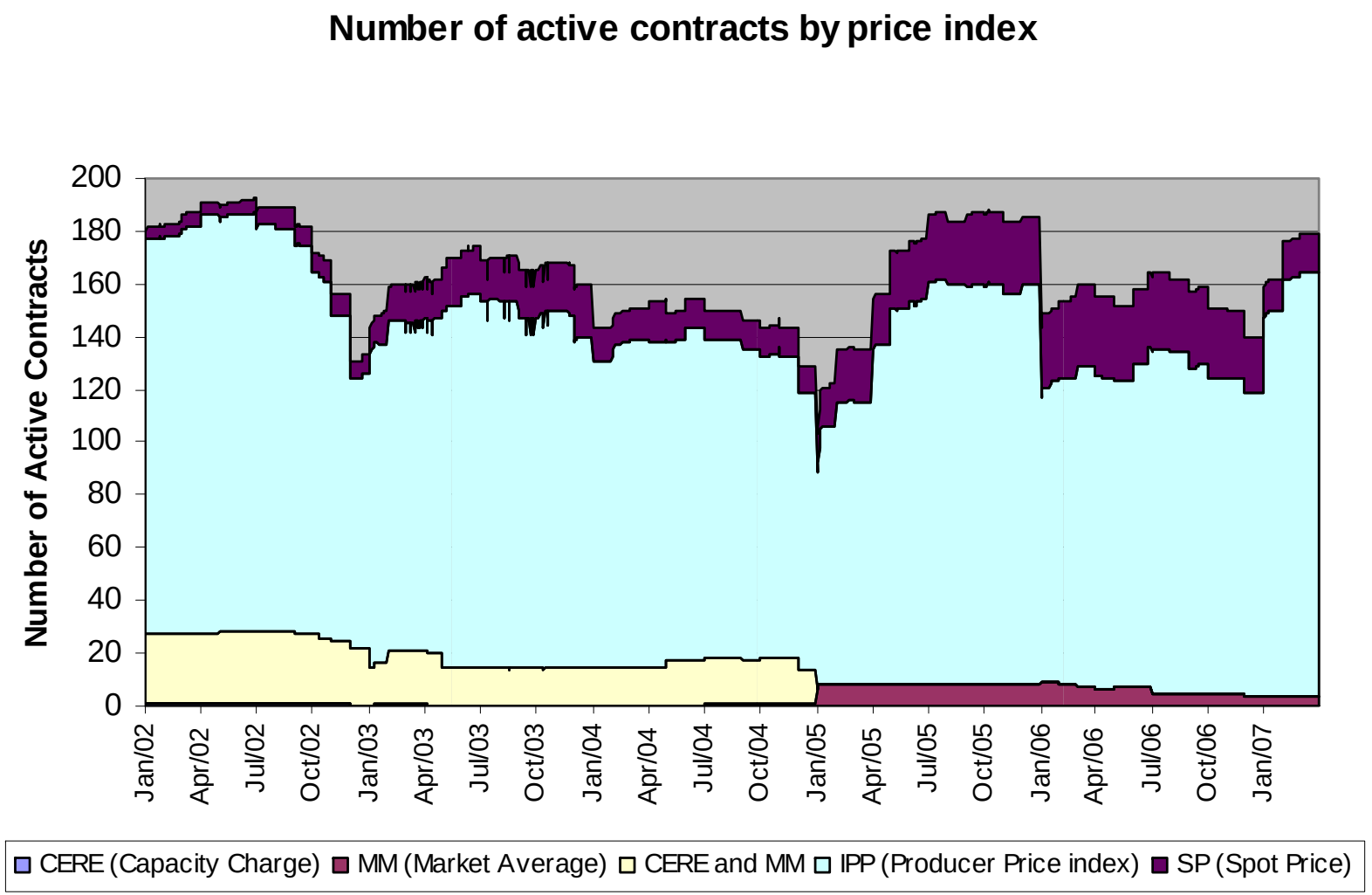
Non-regulated demand participation

- Non-regulated demand can participate
  - As separate customer classes
  - With separate product
- Product: expected energy, not actual energy
  - Still hourly, but based on expected energy demand
  - Hedges expected energy demand, but exposes customer to spot price *on the margin*
  - Requires hourly meter and demand management
- Participation benefits both regulated and non-regulated

Qualification and credit

- Beyond the scope of my task
- Guarantees depend on duration
- Reduce guarantees by recognizing physical assets and firm fuel contracts

Index multi-year contracts with IPP



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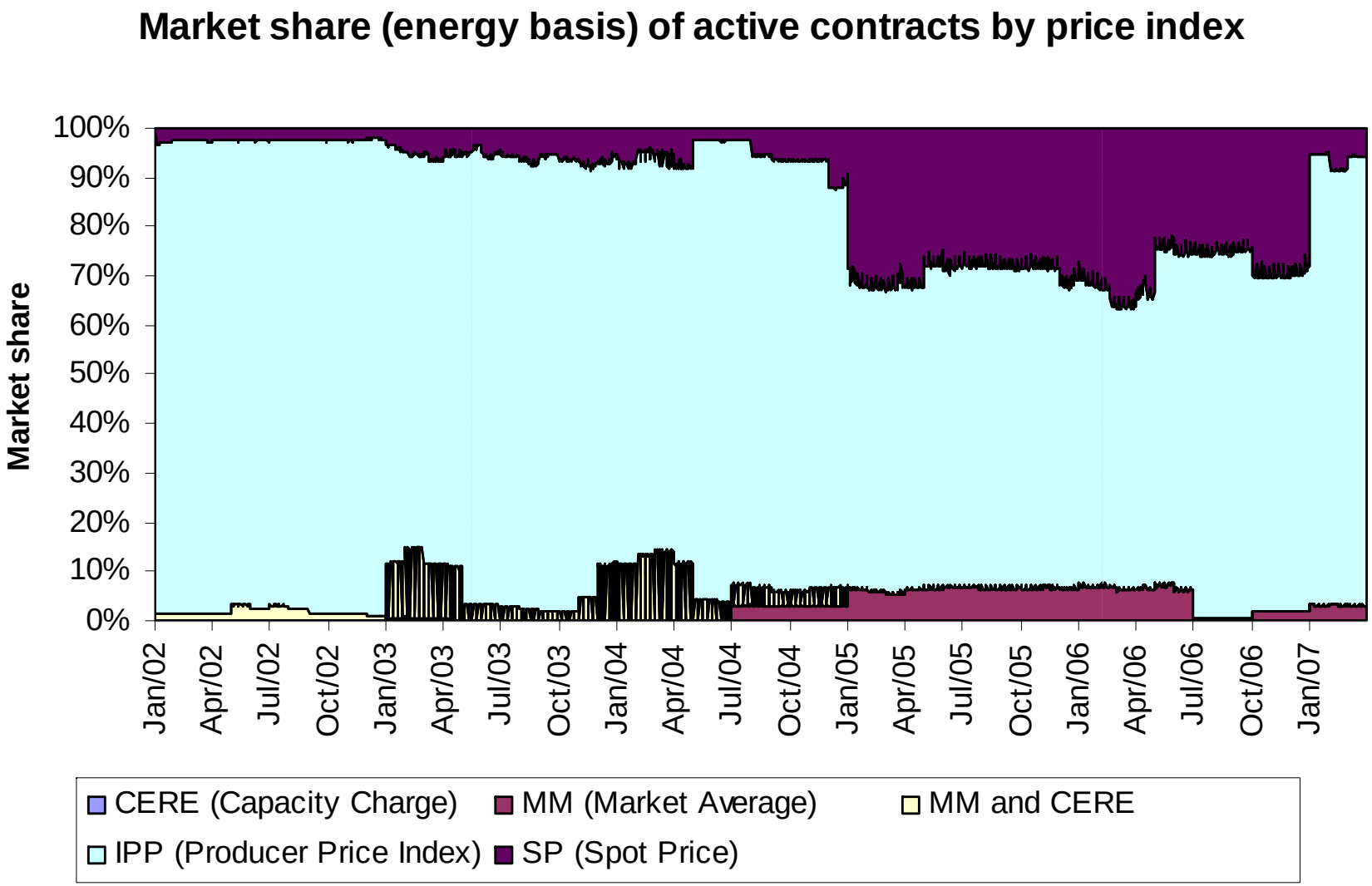


Small lot size

- 0.1% of regulated load (6 MW)
- Great flexibility in expressing quantity
- Accommodates small bidders
- Improves secondary market

Planning, commitment, and frequency

Planning period

- Time between auction and start of commitment
- Opportunity to make adjustments
- Impacts how much uncertainty has been resolved
- Longer implies price stability
- Longer implies more costly guarantees

Commitment period

- Time between start and end of commitment; contract duration
- Longer implies price stability
- Longer implies better financing
- Longer implies greater guarantees

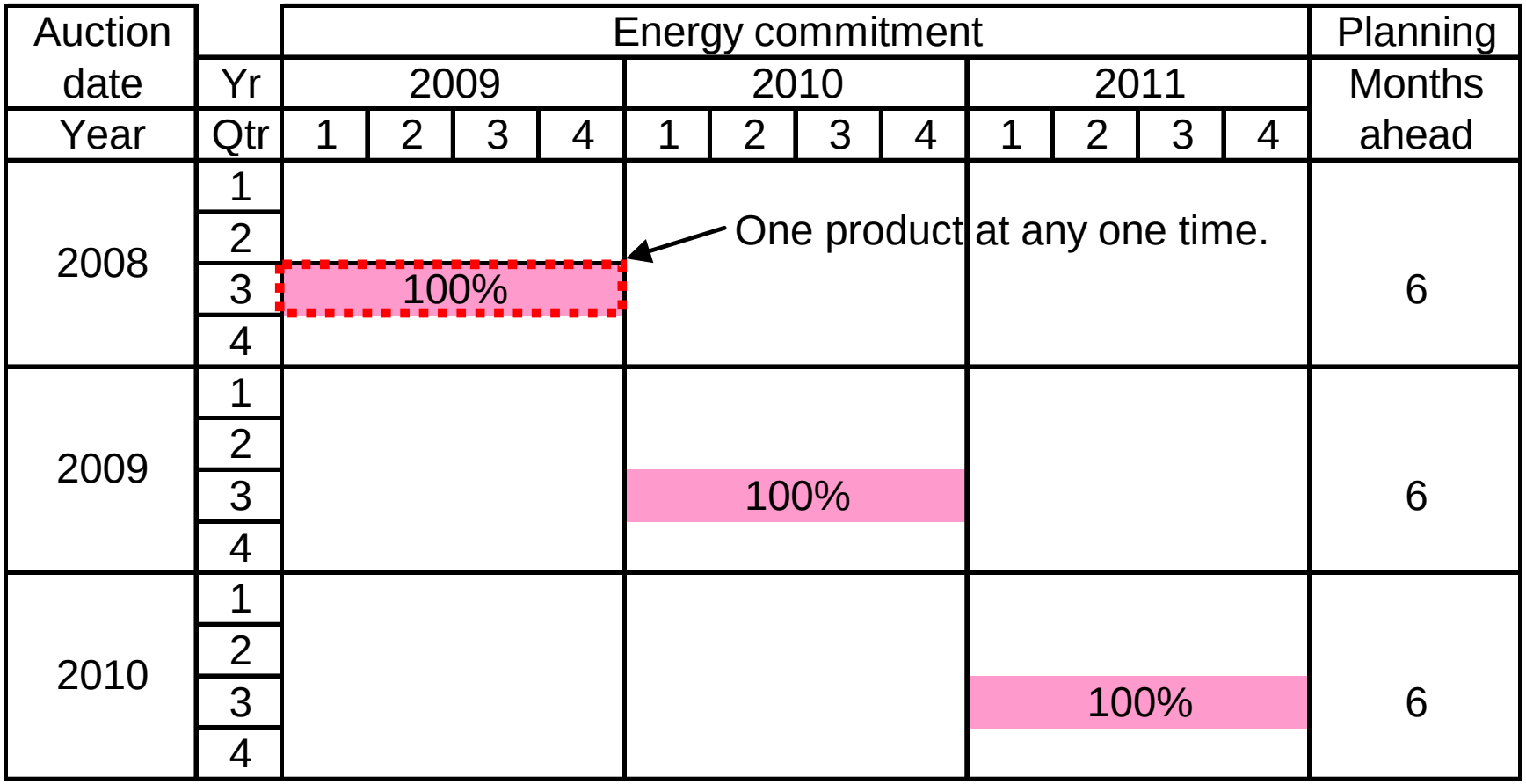
Frequency

- Number of auctions per year

Three instruments yield many options

- Single auction for a single commitment period
- Multiple auctions for a single commitment period (multiple planning lengths)
- Rolling auctions with a single commitment length (single planning length)
- Rolling auctions with multiple commitment lengths

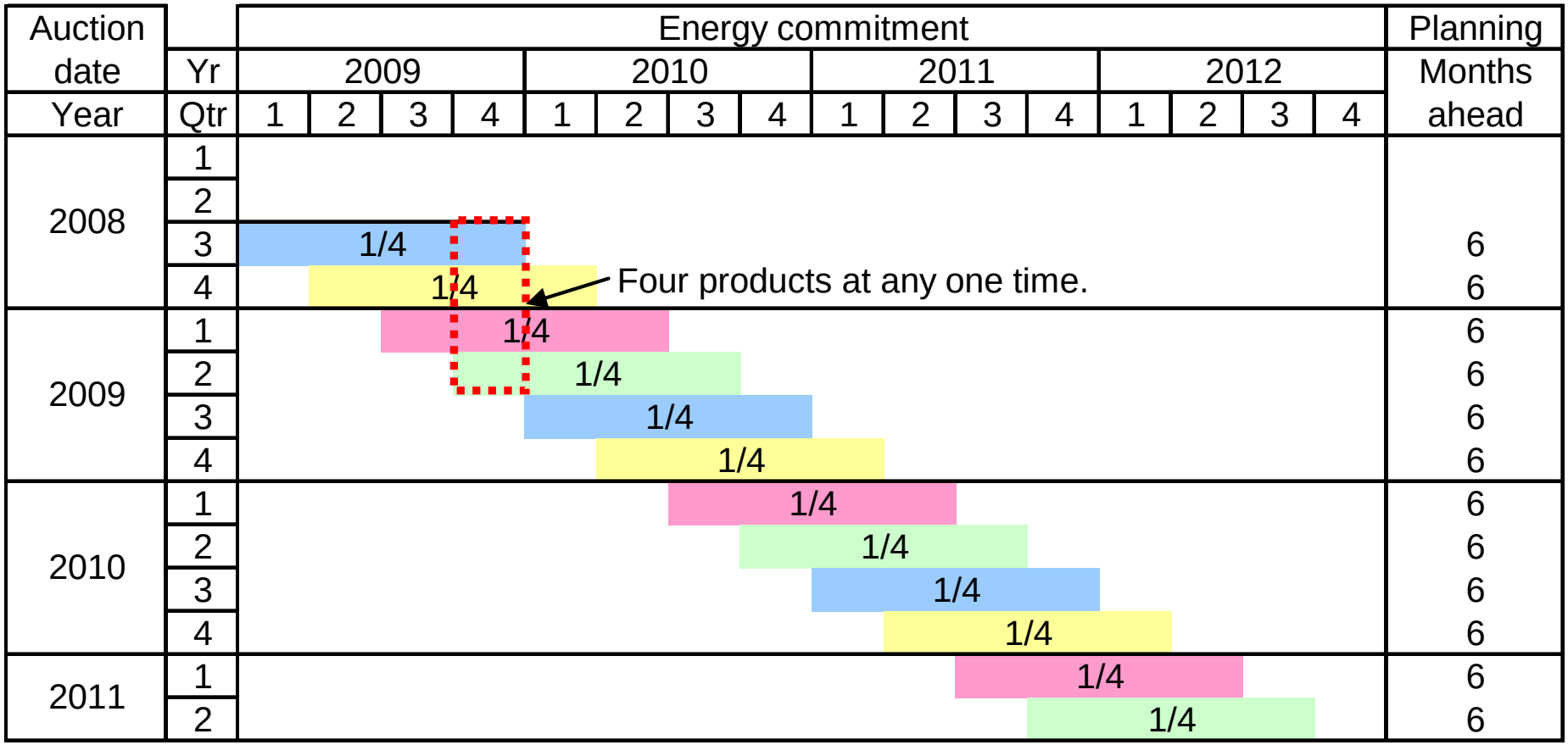
Annual auction for 1-year commitment (6-month planning period)



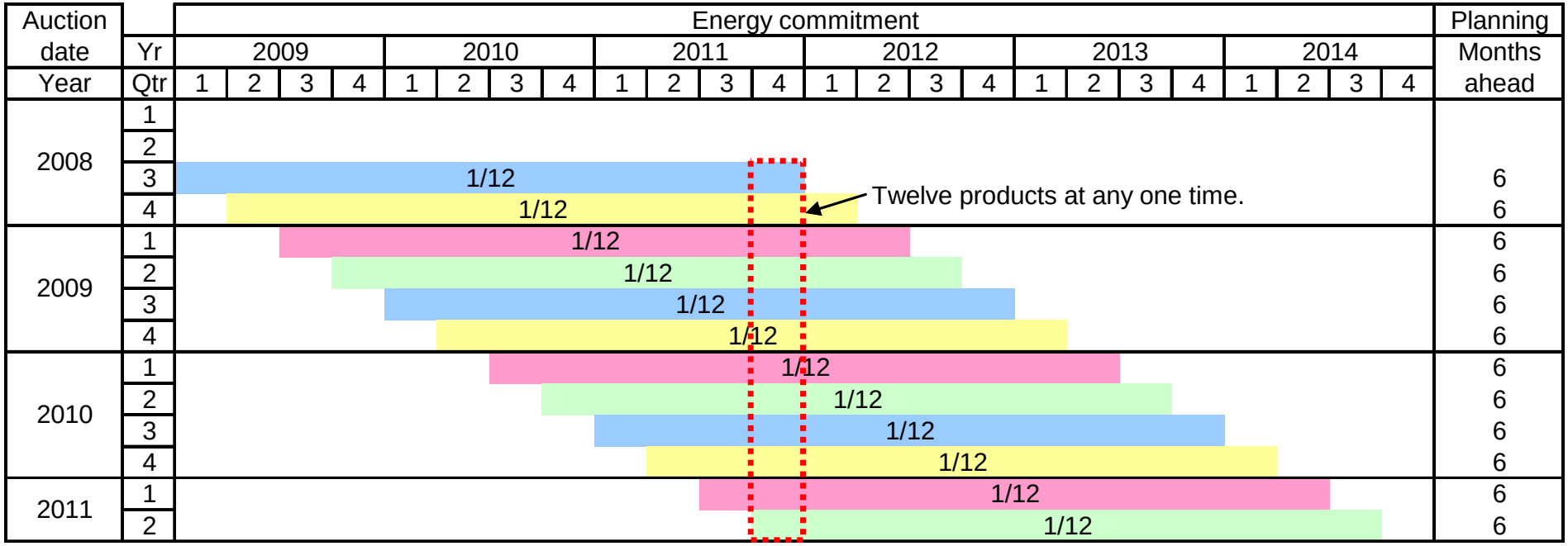
Quarterly auction for 1-year commitment (variable planning period)

Auction date		Energy commitment												Planning
	Yr	2009				2010				2011				Months
Year	Qtr	1	2	3	4	1	2	3	4	1	2	3	4	ahead
2008	1	1/4				One product at any one time.								12
	2	1/4												9
	3	1/4												6
	4	1/4												3
2009	1					1/4								12
	2					1/4								9
	3					1/4								6
	4					1/4								3
2010	1									1/4				12
	2									1/4				9
	3									1/4				6
	4									1/4				3

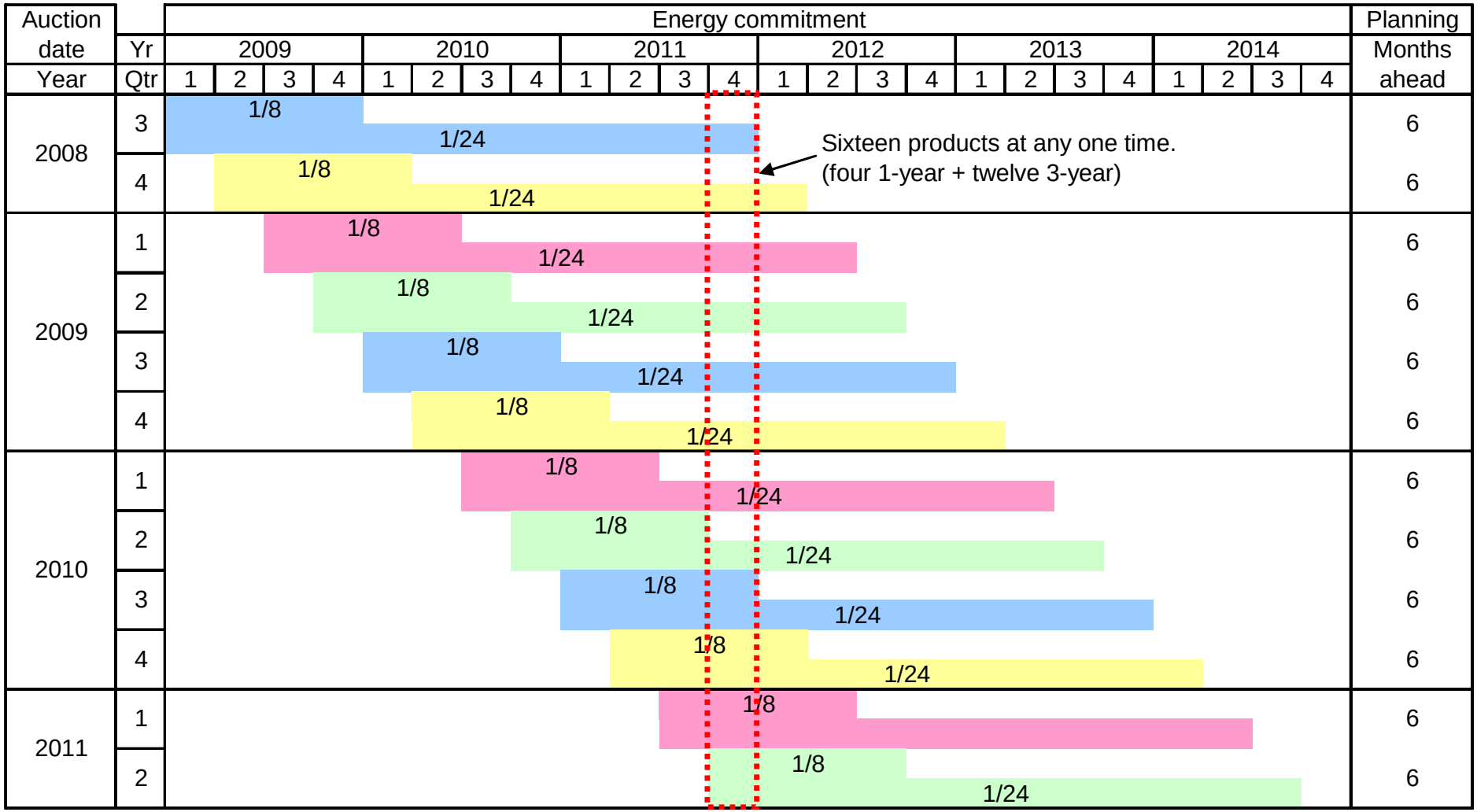
Rolling quarterly auction for 1-year commitment (6-month planning period)



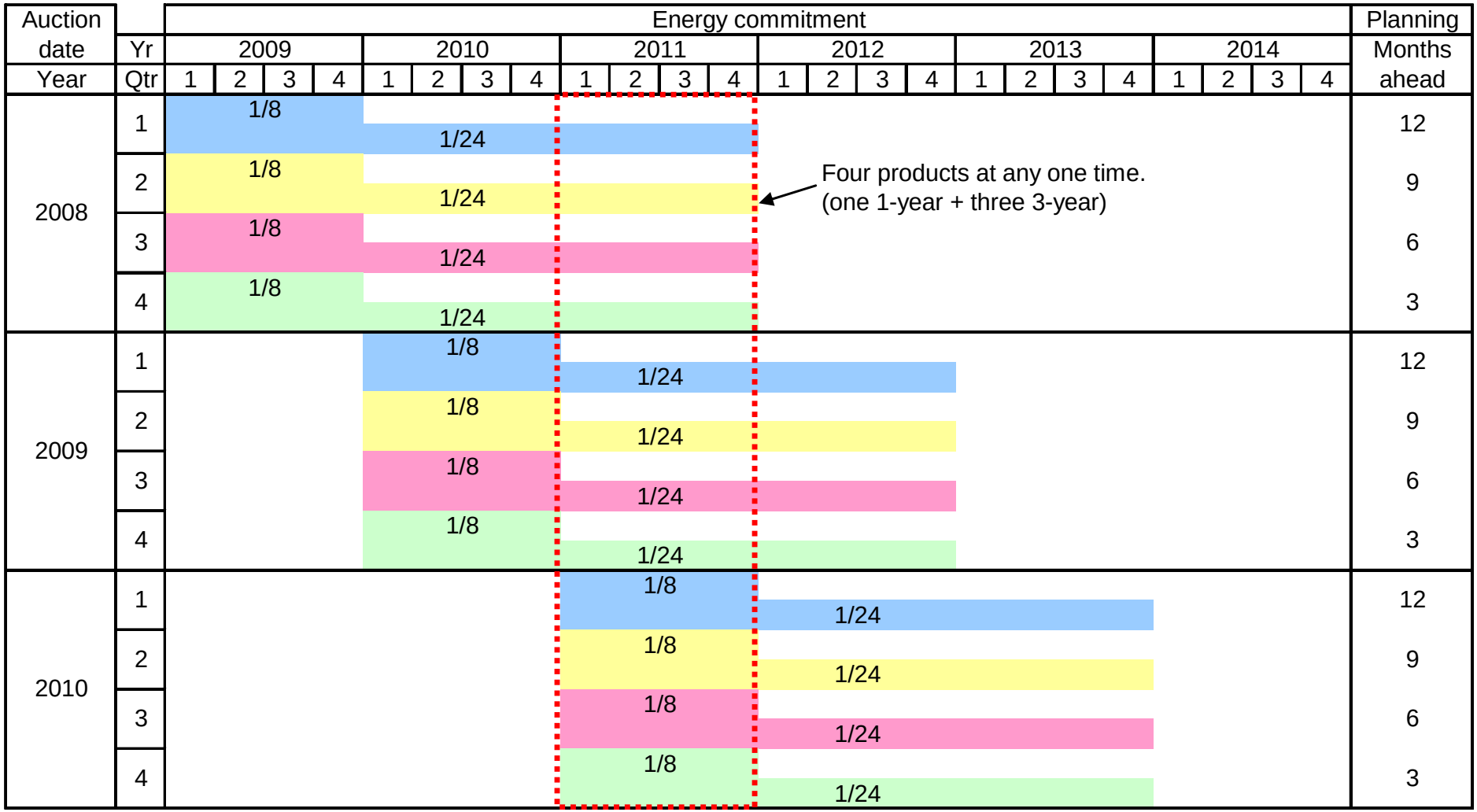
Rolling quarterly auction for 3-year commitment (6-month planning period)



Rolling quarterly auction for 1-year and 3-year commitments (6-month planning period)

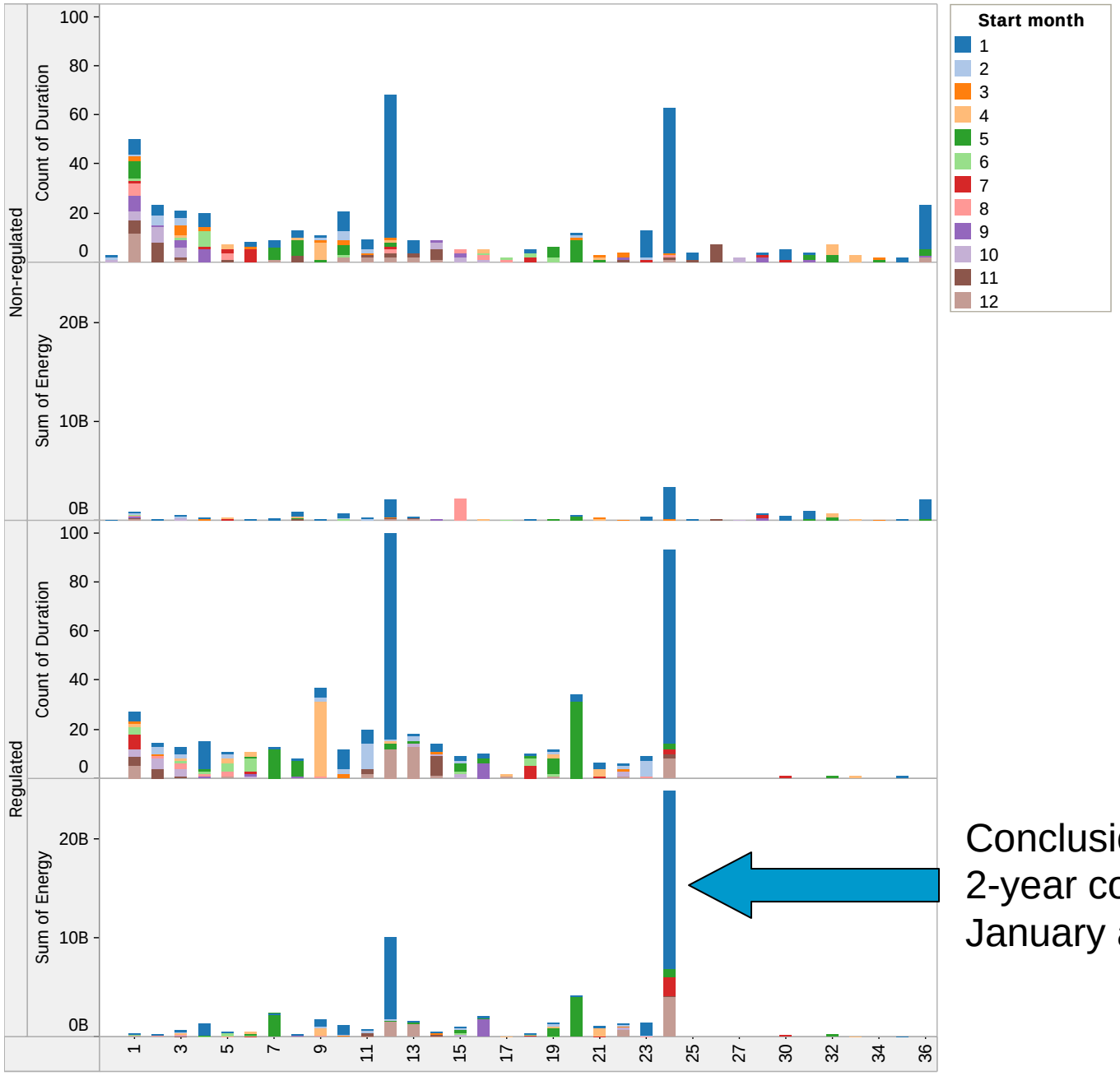


Quarterly auction for 1-year and rolling 3-year commitments (variable planning period)



Recommendation

Frequency of contract durations by months and market



Count of Duration and sum of Energy for each Duration broken down by Market. Color shows details about Start month. The view is filtered on Duration of 3 years or less.

Conclusion:
2-year contracts, starting in January are most common.

Recommendation:
Quarterly 2-year contracts, annual rolling

Auction date		Energy commitment												Planning
	Yr	2009				2010				2011				Months
Year	Qtr	1	2	3	4	1	2	3	4	1	2	3	4	ahead
2008	1	1/8								2 products, 8 prices at any one time.				14
	2	1/8												11
	3	1/8												8
	4	1/8												5
2009	1					1/8								14
	2					1/8								11
	3					1/8								8
	4					1/8								5

International experience

- Maryland
- New Jersey
- Illinois
- France
- Spain

Conclusion