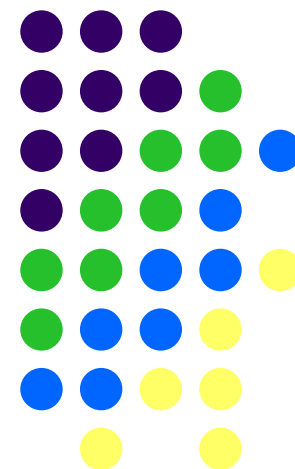


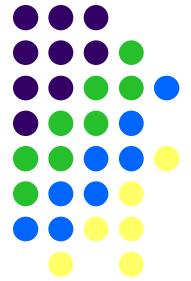
California's Market Price Referent: Setting the Bar for Renewables

ICEPAG 2010
February 9, 2010
Costa Mesa, California

Lori Smith Schell, Ph.D.

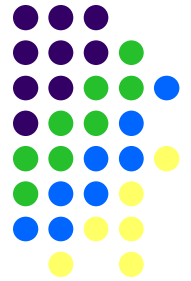


Market Price Referent (“MPR”): Tool of RPS Implementation



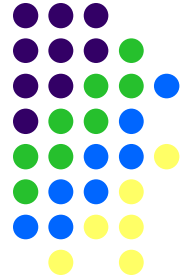
- Renewables Portfolio Standard (“RPS”)
 - Mandated 20% by 2010 (Senate Bill (“SB”)107, 9/26/2006)
 - Targeted 33% by 2020 (Executive Order S-14-08, 11/17/2008)
- California Public Utilities Commission (“CPUC”) Decisions
 - CPUC D.03-06-071
 - Order Initiating Implementation of the Senate Bill 1078 Renewables Portfolio Standard Program (6/19/2003)
 - Mandated 1% increase per year to reach 20% retail sales by 2017
 - CPUC D.04-06-015
 - Opinion Adopting Market Price Referent Methodology (6/9/2004)
 - CPUC D.08-10-026
 - Decision on Market Price Referent for the California Renewables Portfolio Standard (10/16/2008)

MPR Proxy Plant: A Means to Apply Towards the End



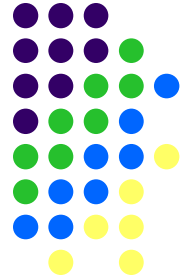
- **The End:** Establish market price referent (“MPR”) at or below which costs of long-term contracts with eligible renewable energy resources will be deemed reasonable and authorized in utility rates
- **The Means:** Define a “proxy plant” to model the long-term costs of fixed-price baseload electricity from a new natural gas-fired combined cycle generating facility
- **The Application:** Identify above-market costs of acquiring renewable resources and allocate funds to compensate
 - Compares NPV of contract price and MPR over contract term
 - Limits RPS obligations of retail sellers to quantity that can be procured with available funding
 - Initially, Supplemental Energy Payments (“SEPs”) awarded by the California Energy Commission (“CEC”), funded through Public Goods Charge
 - Now Above-Market Funds (“AMFs”) awarded by the CPUC

MPR Cash Flow Model: Major Cost Categories



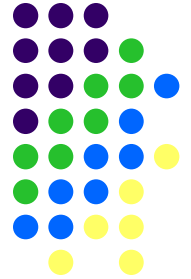
- Solves for revenue needed to generate sufficient cash flow to cover all costs + provide required Internal Rate of Return
- Updated Every Year
- Major Cost Categories
 - Plant (Capital) Costs
 - Fixed Costs
 - Variable Costs
 - Property Taxes
 - Insurance
 - Natural Gas Fuel Costs

I – MPR Proxy Plant: Financial Inputs



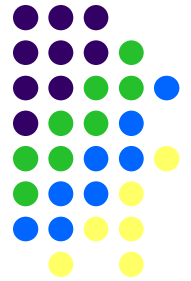
- Debt
 - 50-70% of Plant (Capital) Costs
 - 6.5-8.03% Interest Rate
 - 20-Year Term
- Return on Equity (%)
 - 20-Year Target
- Depreciation
- Tax Rates
 - Federal: 35%
 - State: 8.84%
 - Total Effective: 40.75%

II – MPR Proxy Plant: Plant (Capital) Costs (\$)



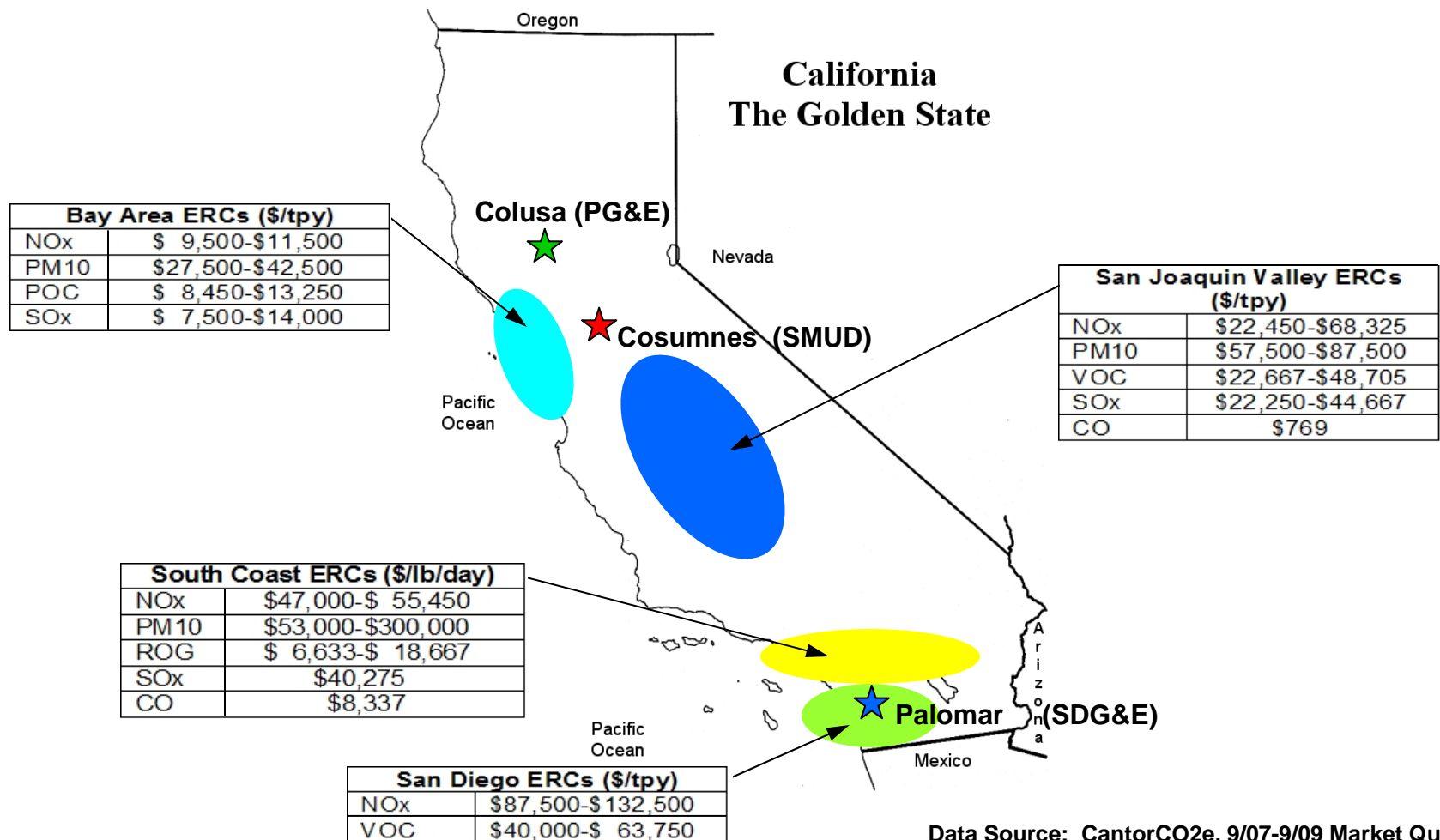
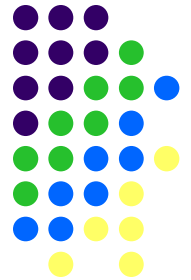
- Turbines
- Balance of Plant
- Transmission/Gas/Water Interconnections
- Land
- Permitting/Siting
- Interest During Construction/Financing Cost
- Emissions Reduction Credits (“ERCs”)
- Initial Working Capital
- Initial Spare Parts
- Local Benefit & Mitigation Costs
- Insurance During Construction

MPR Plant (Capital) Costs: Based on Actual Generators



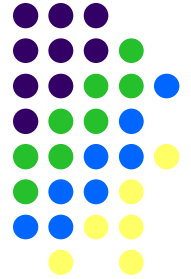
- Capital Costs
 - California natural gas combined cycle (“NGCC”) generating plants used as capital cost “go-by”
 - Palomar (SDG&E); as of 2005 MPR
 - 546 MW, San Diego County, Online 4/1/06
 - Cosumnes (SMUD); as of 2005 MPR
 - 500 MW (Phase 1), Sacramento County, Online 2/24/06
 - Colusa (PG&E); as of 2008 MPR
 - 660 MW, Colusa County, Estimated Online 10/1/10
 - Dry cooling assumed (+ \$20 MM)
 - Little room for attributing incremental benefits to renewables or distributed generation that requires any water use

MPR Environmental Compliance Costs Depend on Geography



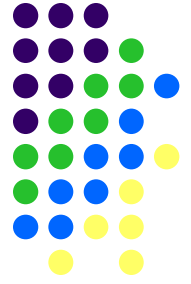
Data Source: CantorCO2e, 9/07-9/09 Market Quotes.

III – MPR Proxy Plant: Fixed Costs (\$/kW-yr)



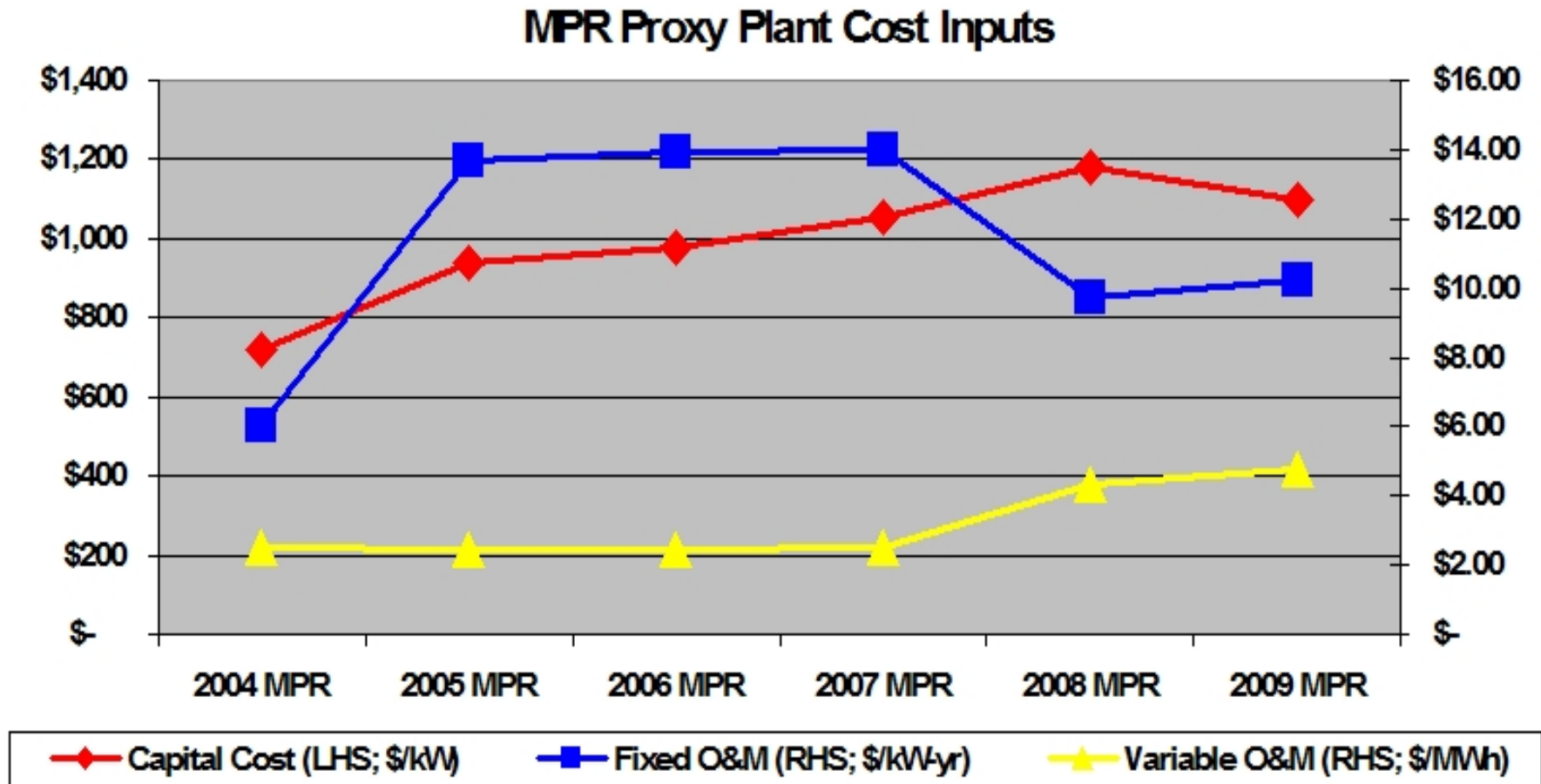
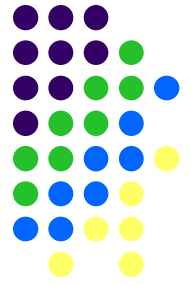
- Administrative & General
- Labor
- Other O&M
- Station Power
- Transmission O&M
- Capital Additions (Not Major Maintenance)
- Ongoing Spare Parts
- Negative Initial Working Capital

IV – MPR Proxy Plant: Variable Costs (\$/kWh)

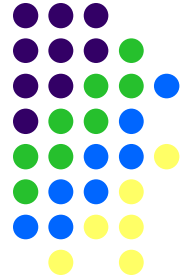


- Major Maintenance
- Water/Consumables/Chemicals
- Source of Fixed and Variable O&M Costs:
 - CEC's Report: "Comparative Costs of California Central Station Electricity Generation"
 - Updated every other year
 - Includes fossil fuel, nuclear and renewable generation
 - Used to provides input to biannual Integrated Energy Policy Report

MPR Proxy Plant: Cost Trends Over Time

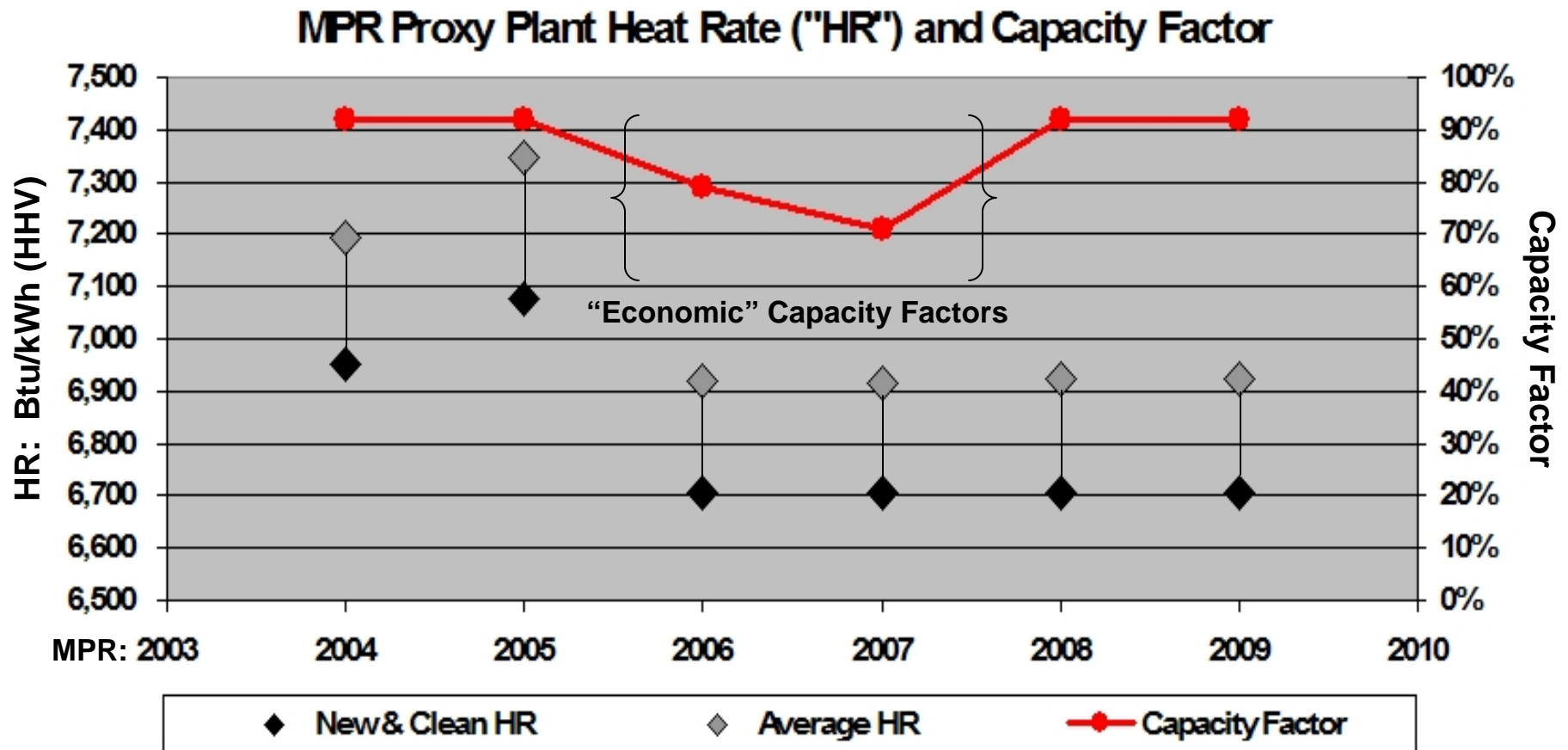
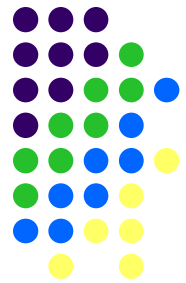


V – MPR Proxy Plant: Operational Inputs

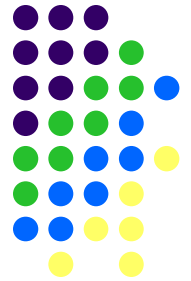


- Capacity and Capacity Factor
- Heat Rate (“HR”)
 - New and Clean (Btu/kWh, HHV)
 - Annual Degradation Factor (Range: 1.69-3.50%)
 - Average (Btu/kWh, HHV)
- First Operational Year
- Losses (%)
 - Transformer Losses (0.50%)
 - Losses to Load Center (1.50%)
 - Not Location-Specific
 - Optimal location of renewables or distributed generation may **avoid** even greater losses

Capacity Factor and Heat Rate: Clean & New vs. Average

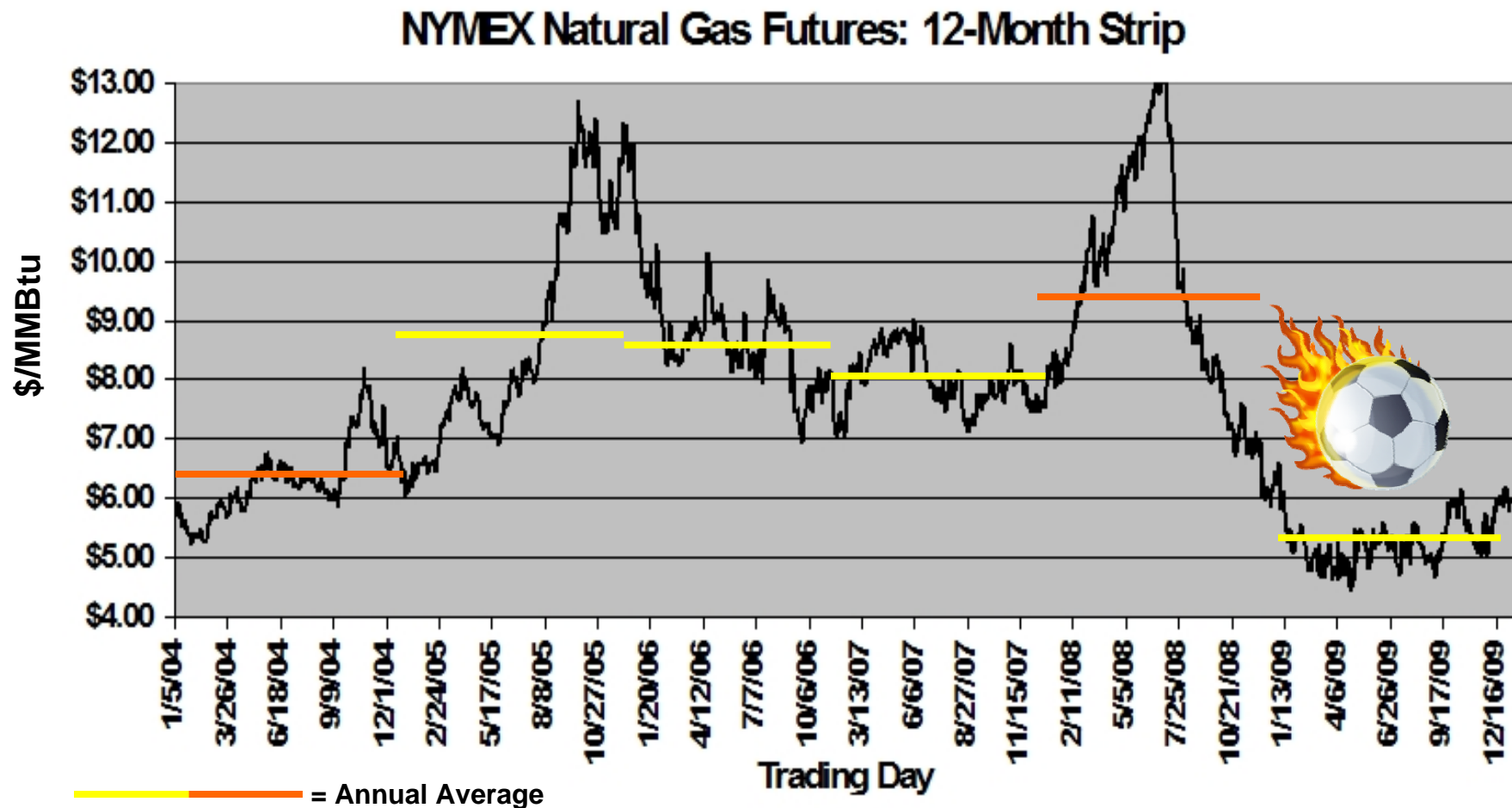
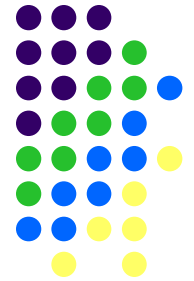


VI – MPR Proxy Plant: Other Costs

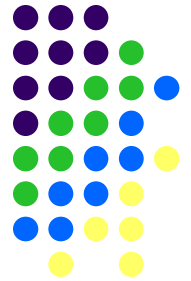


- Property Taxes
 - 1.20% of Plant (Capital) Costs
- Insurance
 - 0.60% of Plant (Capital) Costs
- Natural Gas Fuel Costs
 - Embedded 20-Year Forecast
 - Futures + Fundamentals
 - Levelized Cost Basis
 - MPR Range (2004-2009): \$6.02-\$10.42/MMBtu

Natural Gas Market Volatility Confounds Forecast Accuracy

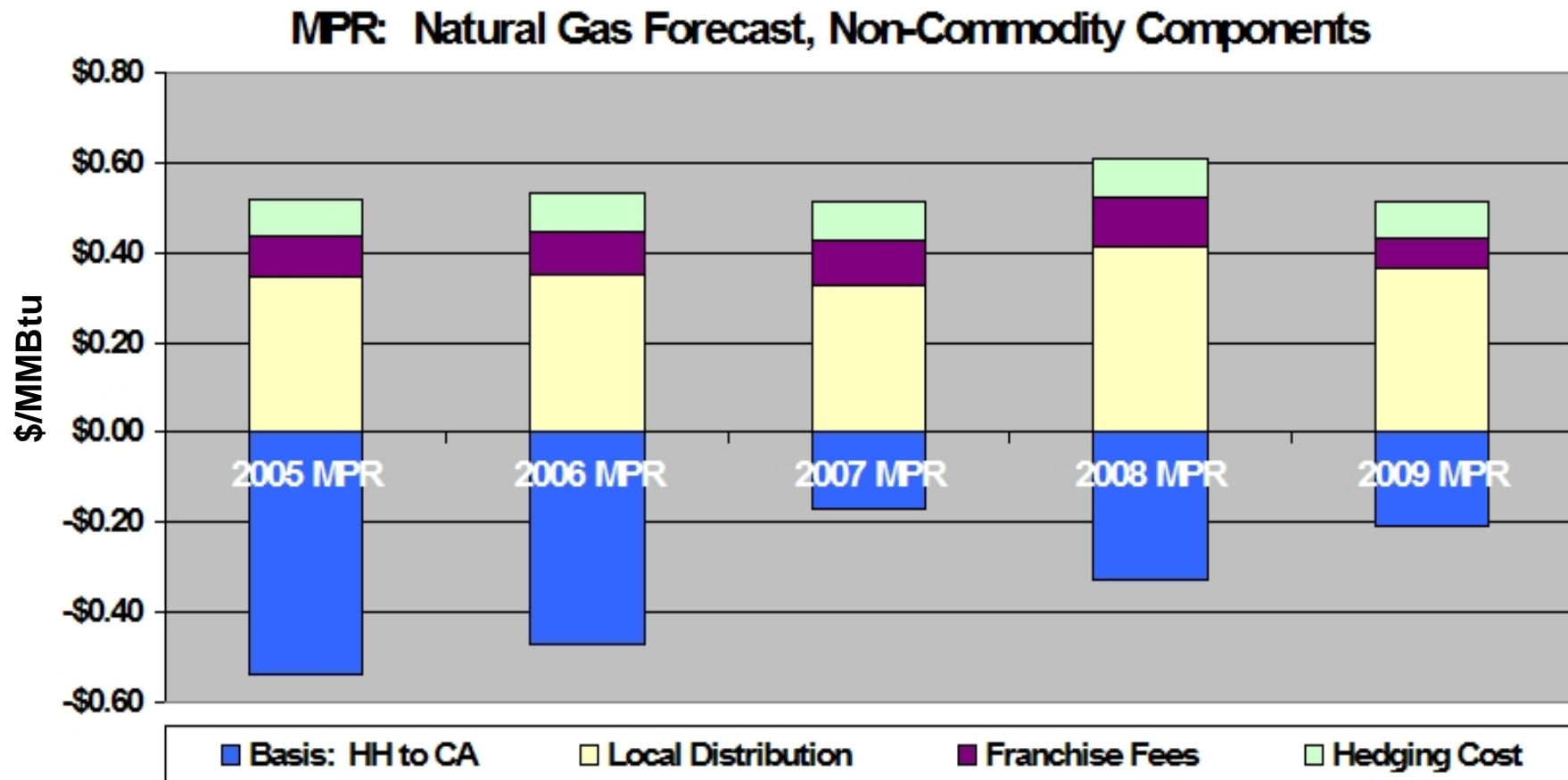
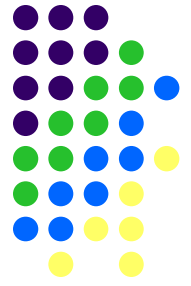


MPR Natural Gas Forecast: Futures + Fundamentals

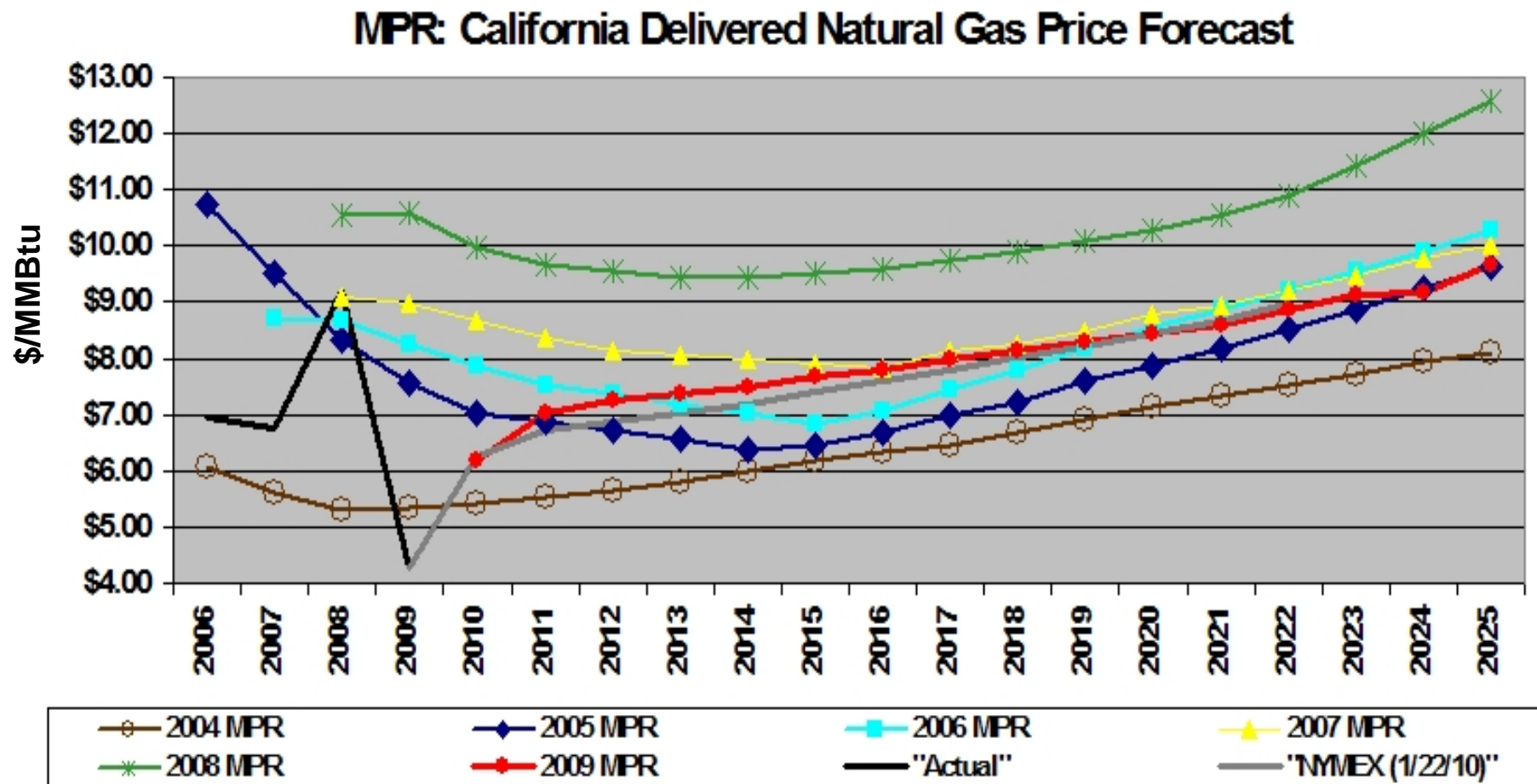
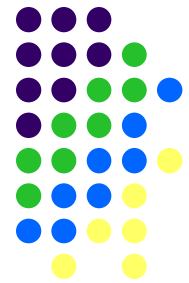


- New York Mercantile Exchange (“NYMEX”) natural gas futures contract prices to end of trading horizon
 - Current trading horizon is 12 years
 - Since 1990, NYMEX trading horizon has varied from 18 months to 12 years
- Purchased & proprietary longer-term fundamental forecast used beyond NYMEX trading horizon
 - Trend NYMEX pricing to connect to 3 (unidentified) out of 4 longer-term fundamental forecasts
 - Cambridge Energy Research Associates
 - Global Insight
 - PIRA Energy Group
 - Wood Mackenzie

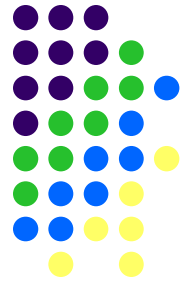
Non-Commodity Components Also Affect Natural Gas Forecast



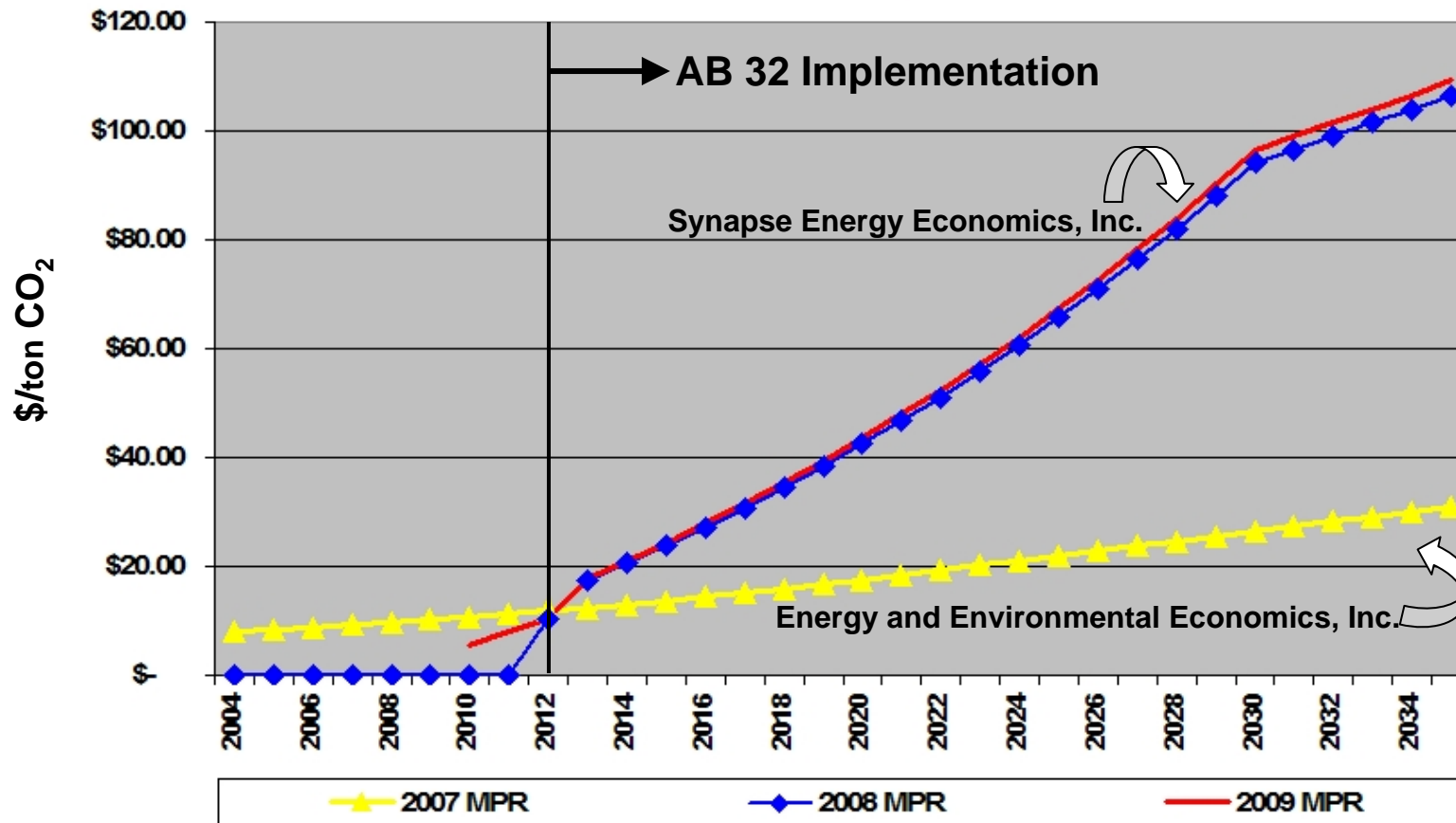
Embedded Natural Gas Price Depends on Forecast Timing



Greenhouse Gas Compliance: Starts with AB 32* Implementation

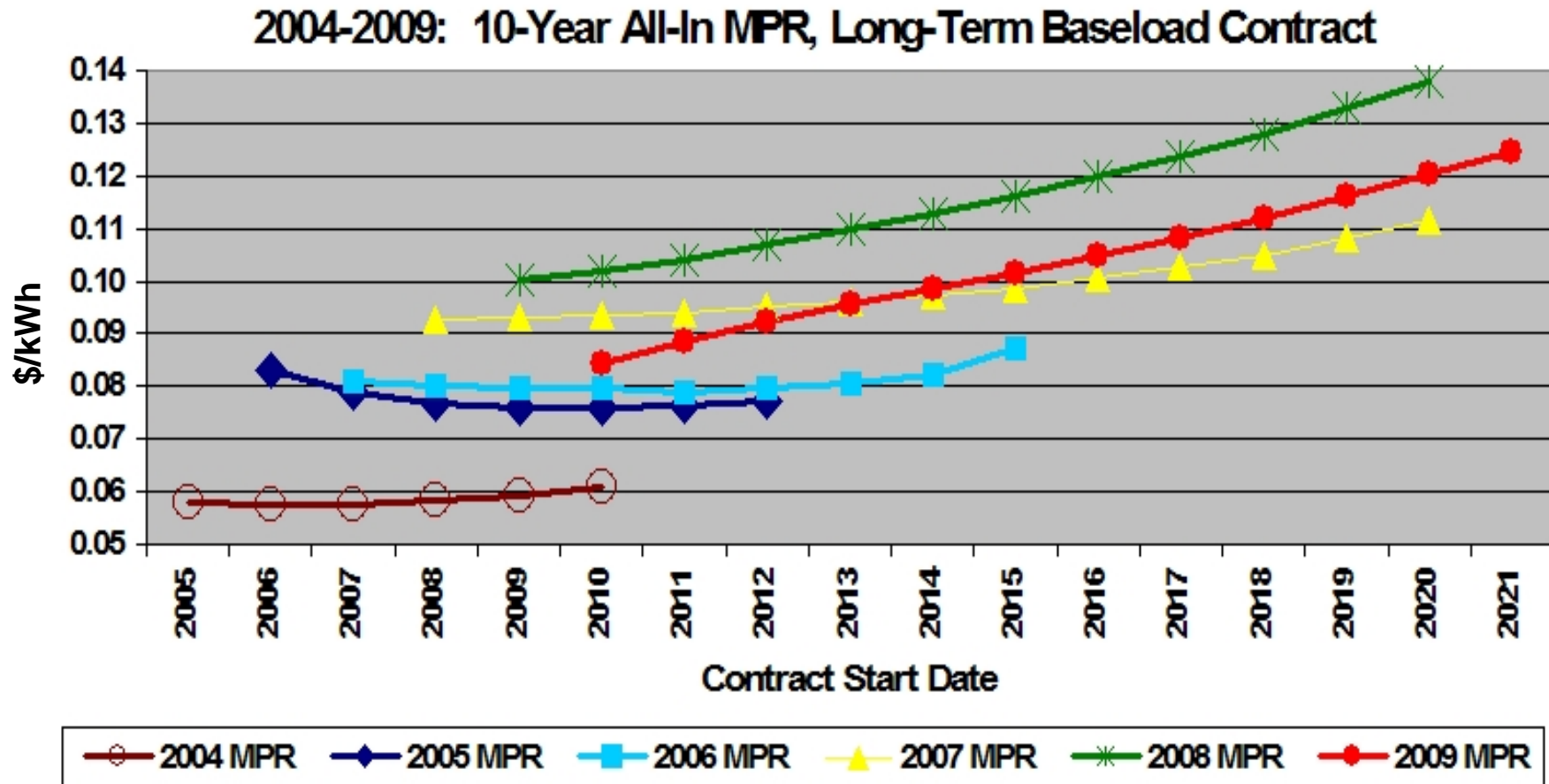
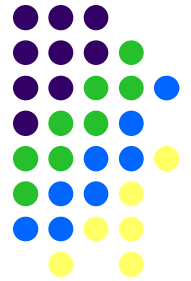


MPR: Greenhouse Gas Compliance Cost

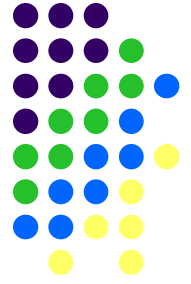


* AB32 = California Global Warming Solutions Act of 2006; to be implemented by the California Air Resources Board ("CARB").

Adopted MPR, 10-Year Baseload Contract

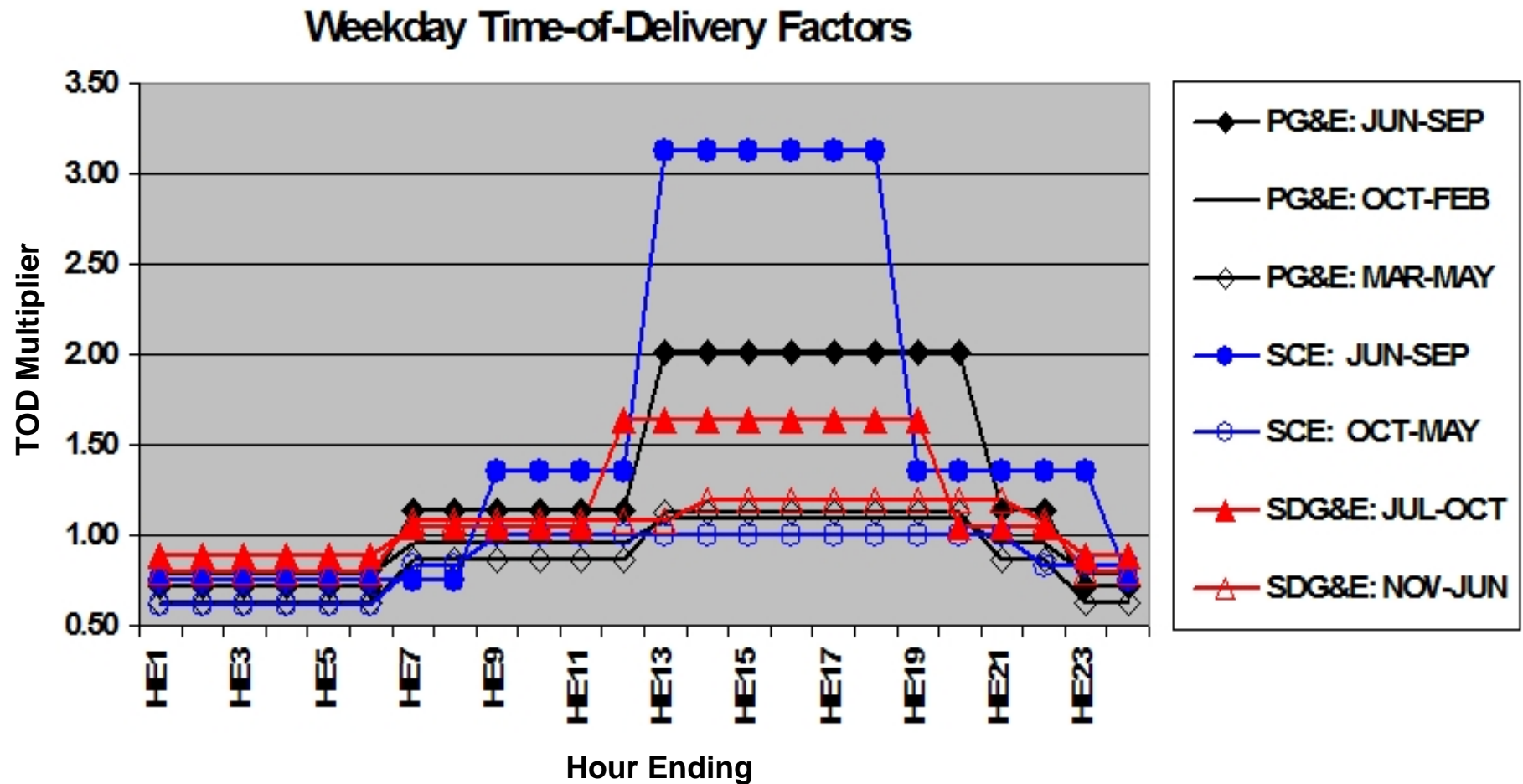
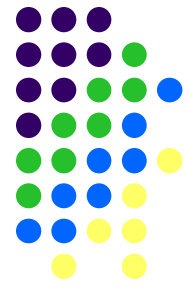


Time-of-Delivery Adjustment Used to Value Product Slate

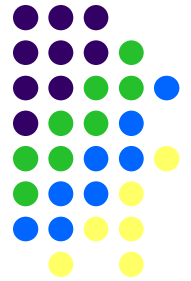


- 2004 MPR: Separate MPR for baseload vs. peaking
 - Baseload MPR based on combined cycle gas turbine
 - Peaking MPR based on combustion turbine (5x8 peaking product over 12 months)
- Post-2004 MPR: Actual utility time-of-delivery (“TOD”) factors applied to baseload-only MPR to value different products
 - Baseload
 - Peaking
 - As-available

TOD Factors Vary Widely by Utility, Season, and Hour

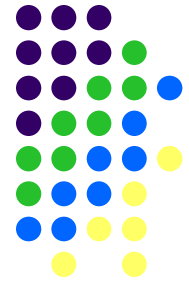


Feed-In Tariff (“FIT”) Design Provides New MPR Applications

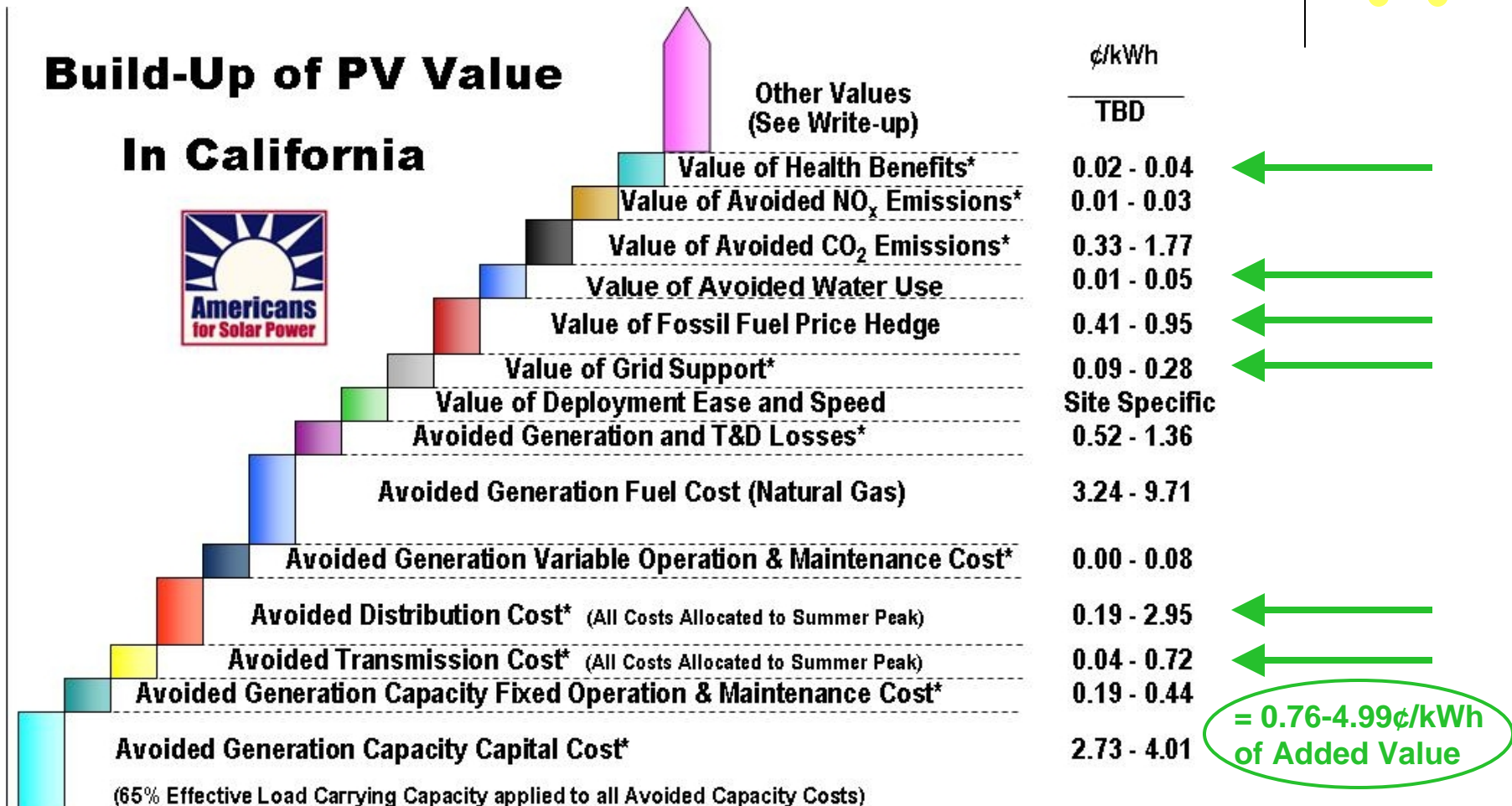


- SB 32: Renewable FIT
 - For eligible renewable generation ≤ 3 MW
 - Eases difficulties of bidding into RPS solicitations
 - All-In MPR + Value for Other Attributes:
 - Environmental benefits
 - Includes current and anticipated environmental compliance costs
 - Peak demand & congestion reduction benefits
 - Expedited interconnection if peak demand is offset
 - CPUC may establish additional value if peak demand is offset
 - Avoided transmission & distribution improvements
 - Adjusted for TOD
 - Specific pricing formula not yet determined
 - Separate CPUC proceeding for renewable FIT up to 20 MW

Solar PV: Value Above MPR for Renewables Feed-In Tariff



Build-Up of PV Value In California

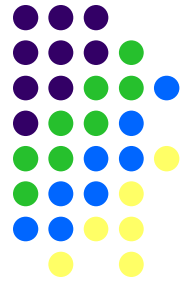


CPUC R1 4/13/05

RANGE OF TOTAL VALUE OF PV:

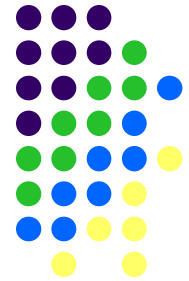
7.8 – 22.4 ¢/kWh

AB 1613: Combined Heat and Power (“CHP”) Feed-In Tariff



- CHP Sized for Thermal Load, Exporting ≤ 20 MW
 - (1) Fixed Component of 2008 MPR (based on 10-year contract) **minus** GHG Compliance Costs
 - GHG Compliance Costs to be Paid by Purchaser
 - (2) Monthly Natural Gas Index (@ 6,924 Btu/kWh, 2008 MPR HR) **plus** Cost of Local Distribution
 - Allows for efficient natural gas price hedging
 - Keeps most volatile component of MPR “fresh”
 - (3) 2008 MPR Variable O&M Cost Component
 - Sum of (1)-(3) Multiplied by Applicable TOD Factor
 - 10% Location Bonus Possible
 - CHP in areas with Local Resource Adequacy requirements (defined, transmission-constrained local areas)

CHP FIT: Illustrative Calculation for FEB 2010 Contract Date



2010 MPR Fixed Component: **\$0.02230/kWh**

+

FEB 2010 NYMEX Settlement: **\$5.32/MMBtu**

Basis to CA Border: **(\$0.22/MMBtu)**

Local Distribution: **\$0.35/MMBtu**

NG Component (\$/MMBtu): **\$5.32/MMBtu - \$0.22/MMBtu + \$0.35/MMBtu = \$5.45/MMBtu**

NG Component (\$/kWh): **\$5.45/MMBtu x 6,924 Btu/kWh x 0.000001 MMBtu/Btu = \$0.03774/kWh**

+

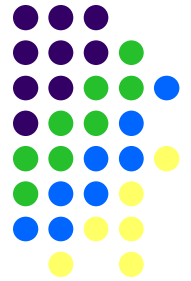
2010 MPR Variable Component: **\$0.00451/kWh**

Operation Year	Inputs from 2008 MPR	\$/kwh
2009	Fixed component	0.02186
	Variable O&M Adder	0.00443
2010	Fixed component	0.02230
	Variable O&M Adder	0.00451
2011	Fixed component	0.02274
	Variable O&M Adder	0.00459
2012	Fixed component	0.02319
	Variable O&M Adder	0.00466
2013	Fixed component	0.02365
	Variable O&M Adder	0.00474
		0.02367
		0.00483

$$\text{CHP FIT} = \$0.02230/\text{kWh} + \$0.03774/\text{kWh} + \$0.00451/\text{kWh} = \$0.0645/\text{kWh}^*$$

* Prior to TOD Factor and Locational Adder

Conclusions: MPR Provides Critical California Policy Link



- Use of MPR expanding into new applications
 - Renewables FIT
 - Recognizes incremental renewables value vs. MPR
 - CHP FIT
 - Replaces embedded MPR natural gas forecast with monthly market index & site-specific delivery costs
 - Enables natural gas price hedging and financing
- Leverages existing in-depth MPR review process
 - Increasing transparency over time
- Links related efforts of CPUC, CEC and CARB to benefit of California's RPS & climate change efforts