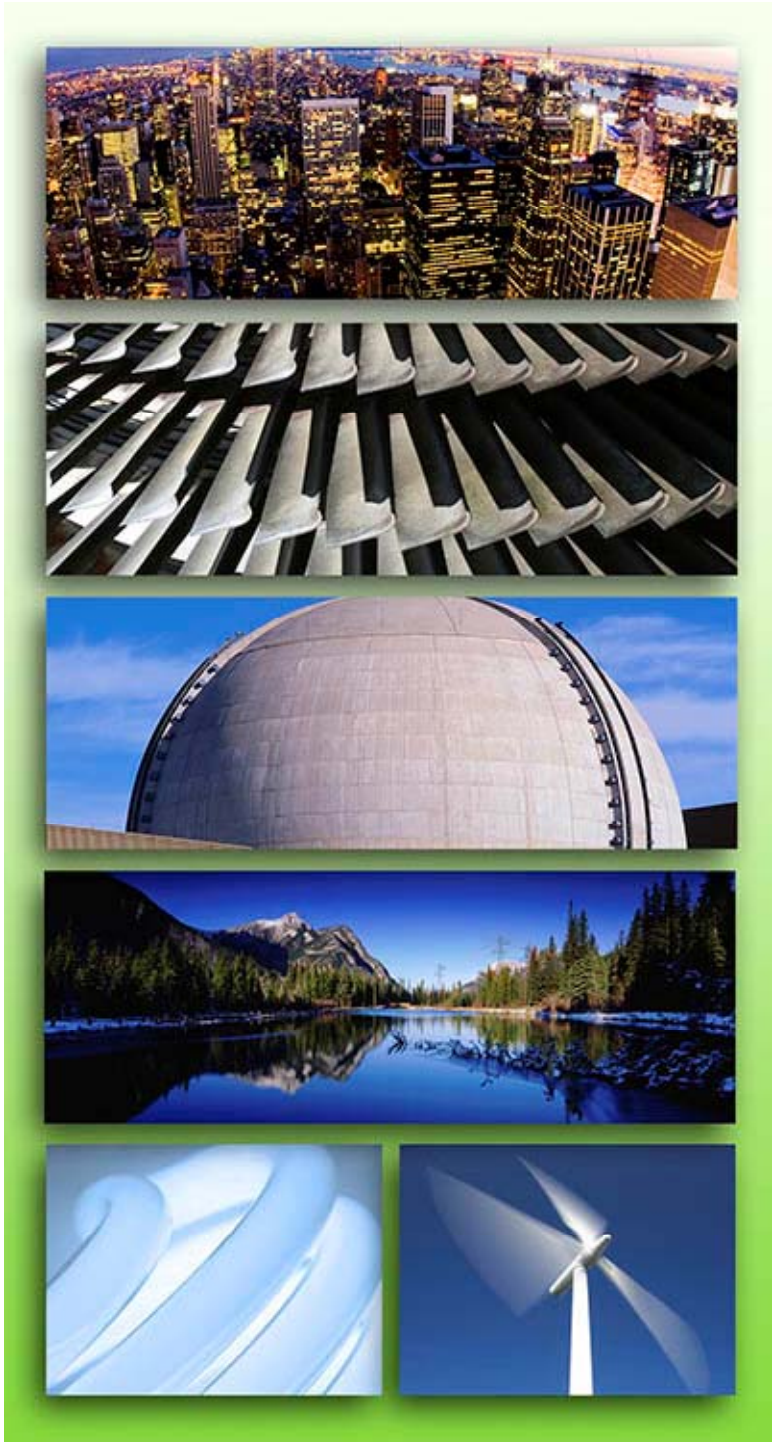
PUBLIC SERVICE COMMISSION OF UTAH

Docket No. 12-035-92

SIERRA CLUB EXHIBIT 8

EPRI Preliminary Analysis of Waxman-Markey



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Preliminary Analysis of Waxman-Markey (H.R.2454) Using NEMS for PacifiCorp

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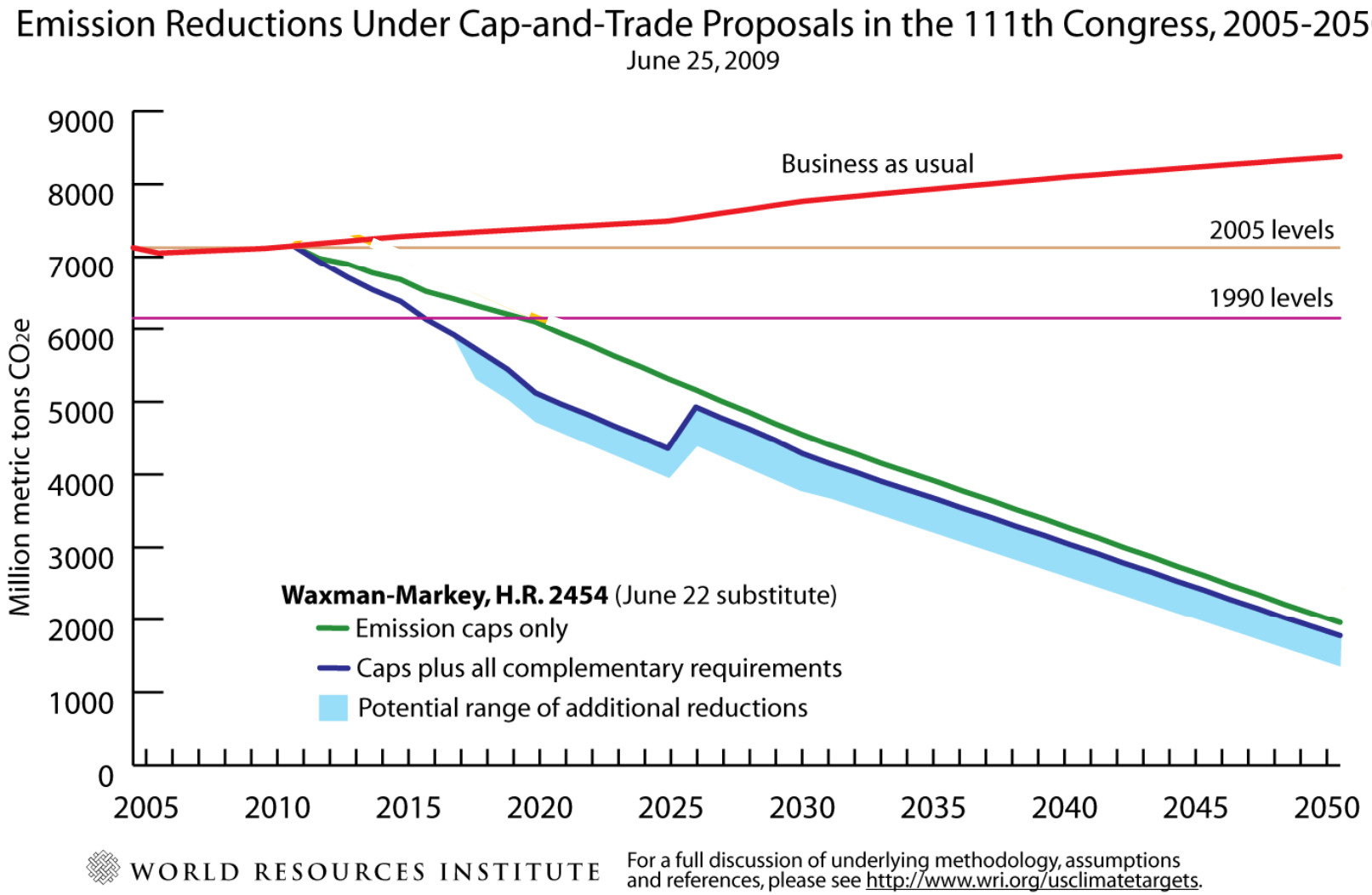
September 9, 2009

EPRI NEMS Analysis of Waxman-Markey (WM) for PacifiCorp

- NEMS (National Energy Modeling System) used by EIA for AEOs (Annual Energy Outlooks) and policy analyses
  - Lieberman-Warner (2008)
  - Waxman-Markey (2009)
- NEMS and detailed EIA results publicly available from EIA
- EPRI has worked extensively w. NEMS for over a decade
- EPRI applied model to represent Waxman-Markey on behalf of PacifiCorp
  - PacifiCorp assumptions on power plant costs (2008)
  - PacifiCorp/EPRI team set scenarios
- Goal is to better understand role of modeling assumptions in assessing climate policy impacts on energy sector

Waxman-Markey Passed House 219-212 on June 26th: Seeks to Cut CO_2 Emissions Well Below Historic Levels



Analysis Highlights Critical Role of Offset Availability Assumptions for WM

- Based on AEO 2009 updated with Stimulus Package and revised CAFE standards but no CO_2 cap and trade
- Best-effort representation of H.R.2454 (E&C version)
  - Cap-and-trade program
  - RES and Energy Efficiency provisions (15% + 5%)
- Updated with more recent/higher costs for new generation
- Some limits on biomass co-firing (limits to 7.5%)
- No link to macro economy
- Reference case has full 2b tons of offsets availability
- Three offsets sensitivity cases phase-in offsets from zero
  - Case 1 “Plentiful” 2 Billion Tons by 2030
  - Case 2 “Scarce” 1 Billion Tons by 2030
  - Case 3 “Very Scarce” half Billion Tons by 2030

Why Focus on Offsets Availability?

- WM allows up to 2 billion tons/year of offset use (50%-50% split between domestic and international sources with some opportunity for substitution)
  - Much greater potential use than Lieberman-Warner
  - Could cut need for emissions abatement from covered sources by over 50%
- Quantities allowed in legislation far exceed experiences in Europe's CO_2 trading system
- If low-cost offsets unavailable in quantities sanctioned, much higher CO_2 prices will be required to meet cap
- Market and regulatory uncertainty in offset supply dominates all other uncertainties in estimating impacts

What are GHG Offsets?

- "Credits" for GHG emissions *reductions*, *avoidance* or *sequestration* that occur in sectors or geographic regions ***outside*** of an emissions cap
- GHG emissions reductions must be
  - *Real*
  - *Additional*
  - *Permanent*
  - *Measurable*
  - *Verifiable*

Example Offset Project Types

- Methane (CH_4) Destruction
  - Animal waste digesters
  - Landfill gas
  - Coal-mine methane
- Soil Carbon and Agriculture
  - Conservation tillage practices
  - Reduced nitrogen fertilizer
- Forests
  - Afforestation
  - Reforestation
  - Reduced emissions from deforestation a
    degradation (REDD)

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Why Domestic Offset Supply May not Reach its 1 Billion Tons per Year Potential

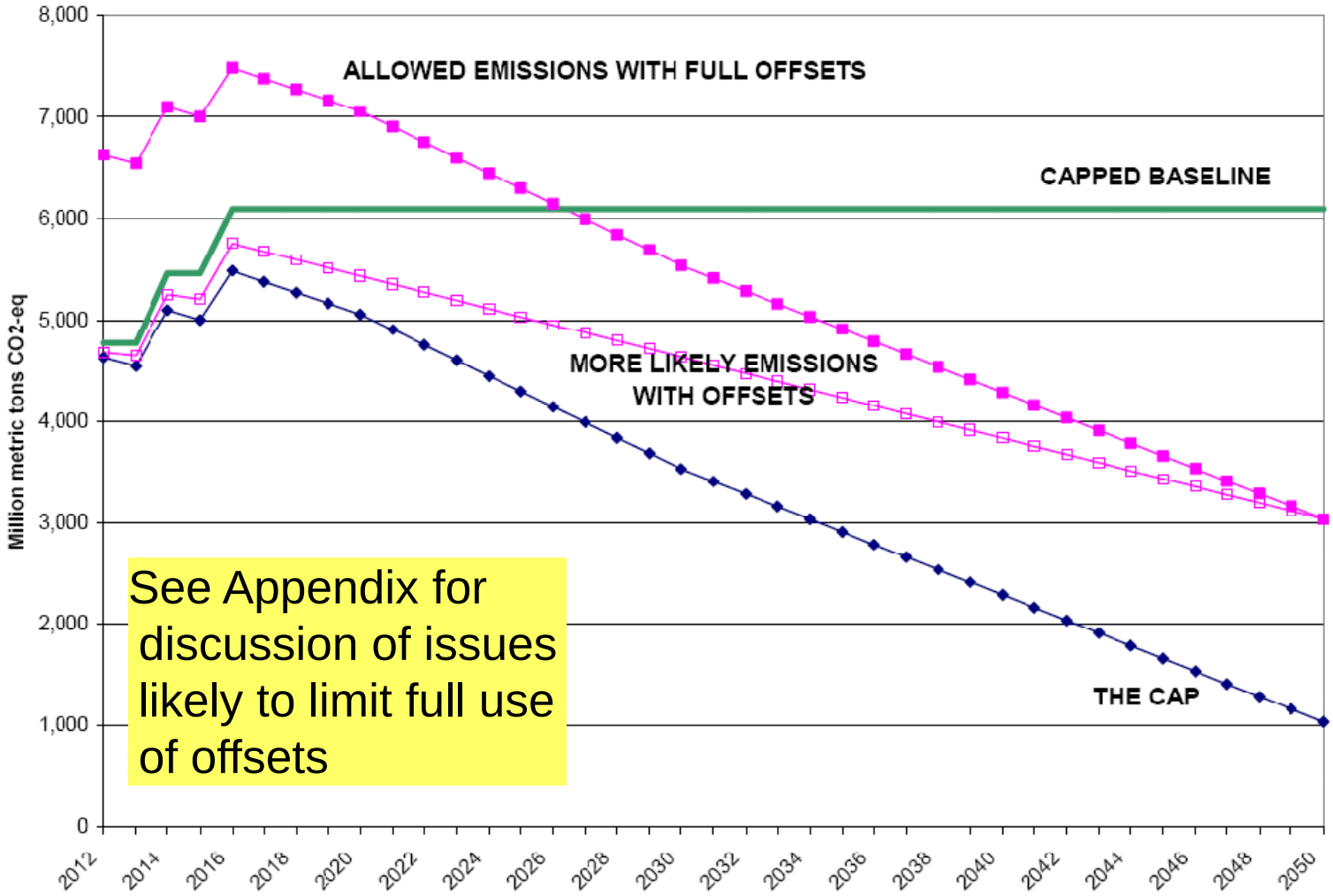
- EPA estimates only ~170+MtCO2 annually through 2020
- Forest management & afforestation expected to be largest sources
  - These are some of the most difficult offsets to implement – less than a handful of A/R projects have been done internationally or domestically and virtually no forest management projects have been completed that are generating offests
- CH4 offsets largely not available due to proposed new NSPS for coal mine and landfill gas
- Rulemakings / protocols / methodologies will take time to develop

Why International Offsets Will Have Trouble Closing the Gap

- "Sectoral" offsets
  - Potential large-scale, but never been done before
  - Require agreements & creation of new international "crediting" mechanism
  - Likely to take multiple years to develop like CDM and JI
  - Not clear how "compliance parties" gain access to these offsets
  - Most international discussions have centered on sectoral offsets based on improved CO_2 intensity, but WM would require absolute sectoral emissions reductions for offsets
- Offsets "Issued by an International Body"
  - Existing programs (e.g., CDM) have taken many years to evolve
  - CDM is expected to yield ~1.5 $GtCO_2$ over the entire 5 year "Kyoto" period (2008-2012)
  - U.S. faces future competition from EU-27, Australia, NZ, Japan…
  - Once countries qualify for "sectoral" under WM, they could no longer be a source of CDM credits for US compliance
- Reduced Emissions Deforestation and Degradation (REDD)
  - Located in somewhat "risky" countries
  - Lack of key expertise, institutional capacity & governance
  - Required to be supplemental to "national deforestation emissions baseline" which requires zero net deforestation in 20 years
  - Competition from EPA's "Supplemental Emissions Reduction" program

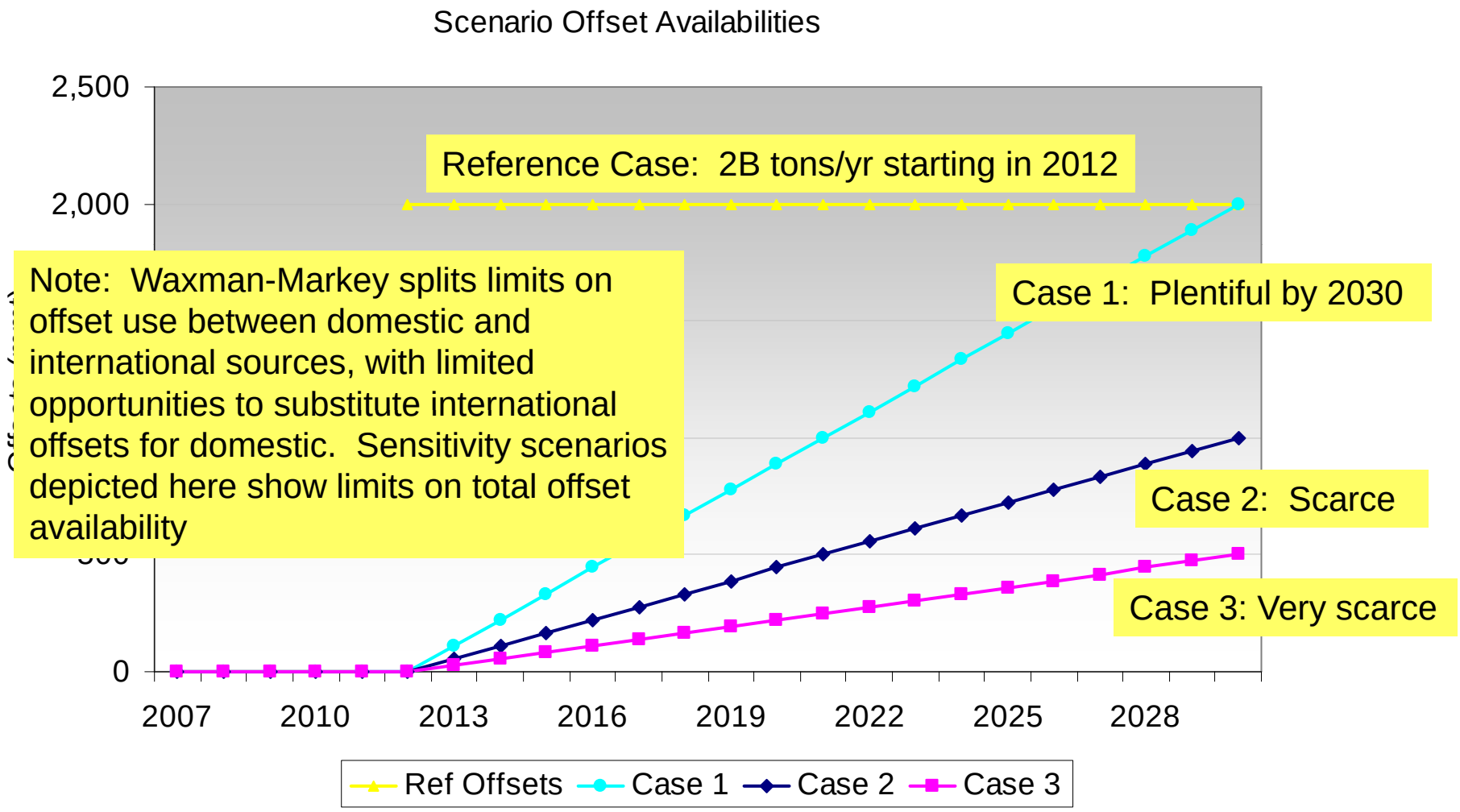
Concept for Reduced Offset Cases Based on MIT's Denney Ellerman Webcast

The Effect of Offsets: Practically Possible



See Appendix for discussion of issues likely to limit full use of offsets

Offset Sensitivity Cases Span Wide Range of Possible Availabilities of Offsets



Changes in Input Assumptions to EIA AEO 2009 Stimulus Case

- Resources costs and performance (based on PacifiCorp estimates)
- Increased CAFE requirement
- Further reduced residential energy demand by increasing end-use equipment efficiency or reducing capital cost and better weatherization
- Further reduced commercial energy demand by increasing efficiency or reducing capital cost and improved shell efficiency
- Incorporated Waxman-Markey including
  - Cap-and-trade with banking and offsets
  - Approximate CCS bonuses
  - Free allowances
  - Sector coverage
  - Renewable Electricity Standard – new nuclear and CCS are excluded from RES

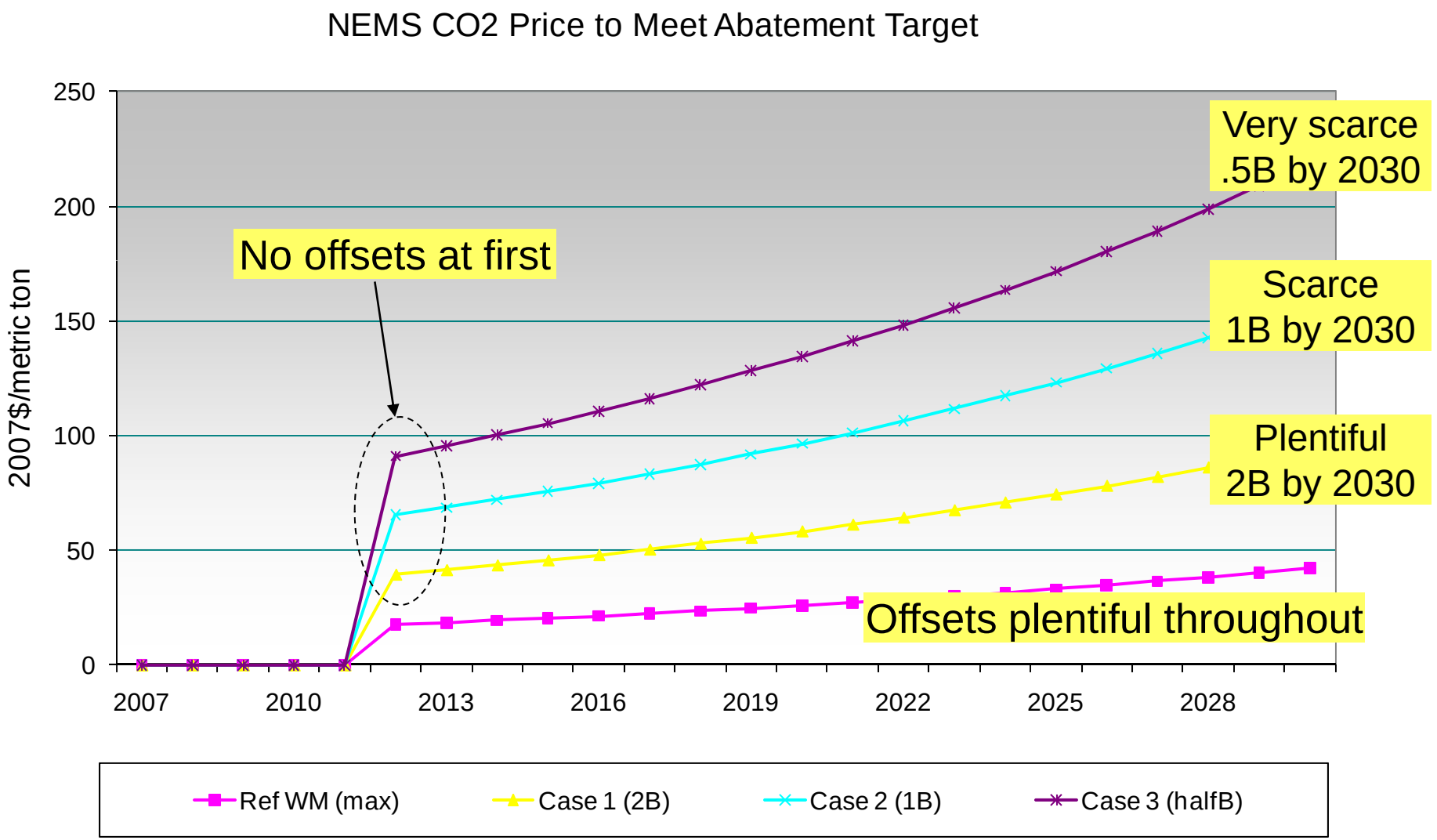
NEMS Solves for a CO_2 Price Trajectory That Meets Cumulative Cap in Emissions to 2030

- CO_2 price trajectory rises at 5%/year
- All prices in “real” 2007 dollars
- Model assumes banking and borrowing within solution period
- Set up to have ending bank balance of 5 billion tons to cover time periods after 2030
- Model contains detailed representations of electric and transportation sectors
- Detailed modeling of energy demand

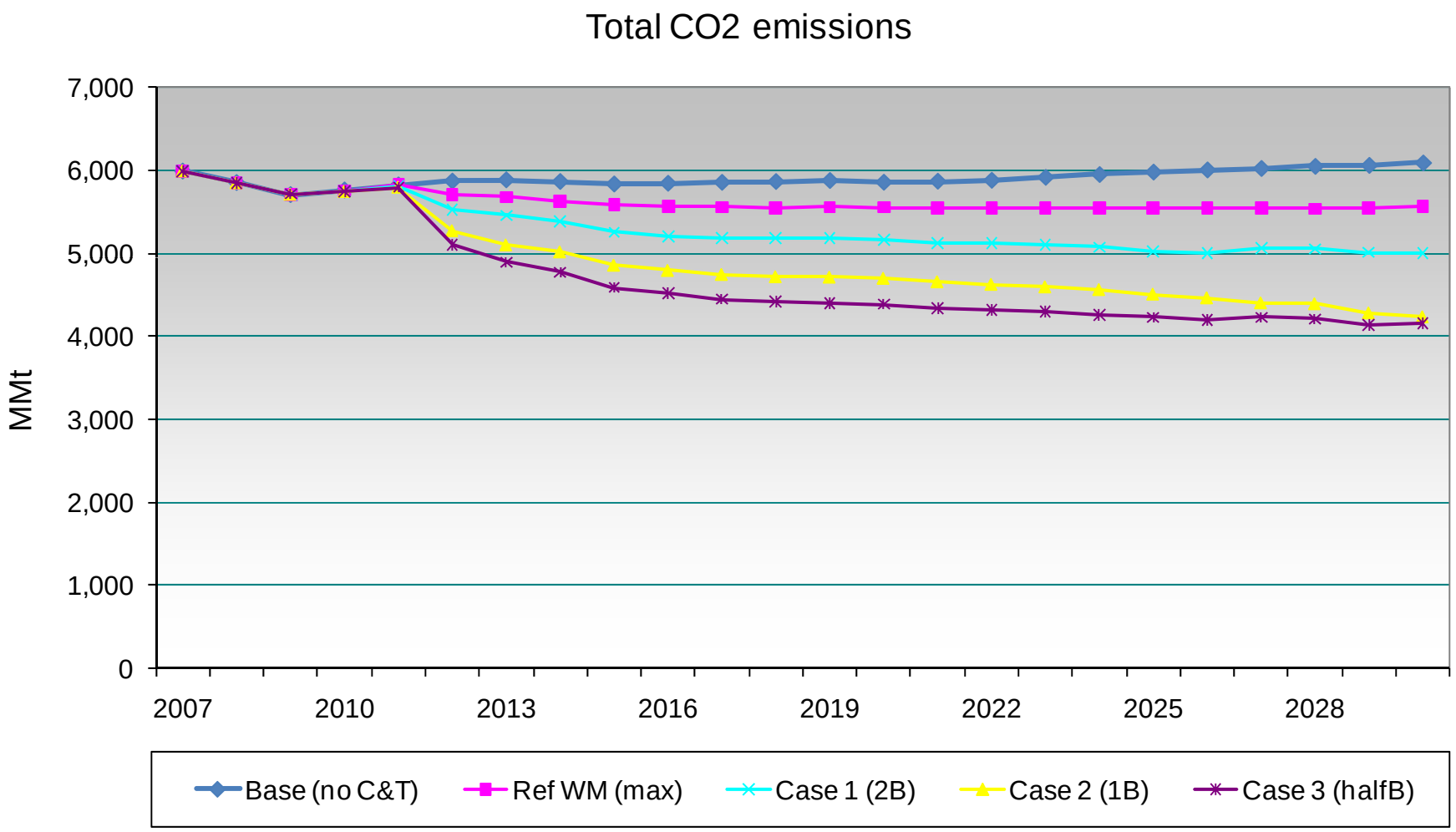
Guide to Results Covering Five NEMS Analyses

- Base no C&T is AEO 2009 (w. Stimulus), updated w. PacifiCorp assumptions, but no cap-and-trade for CO_2
- Ref WM (max) is the reference Waxman-Markey legislation case with the maximum possible use of offsets
- Case 1 (2B) is the sensitivity case with offsets ramping up from zero in 2012 to 2 billion tons per year in 2030
- Case 2 (1B) is the sensitivity case with offsets ramping up from zero in 2012 to 1 billion tons per year in 2030
- Case 3 (halfB) has offsets ramping from zero in 2012 to half a billion tons per year in 2030

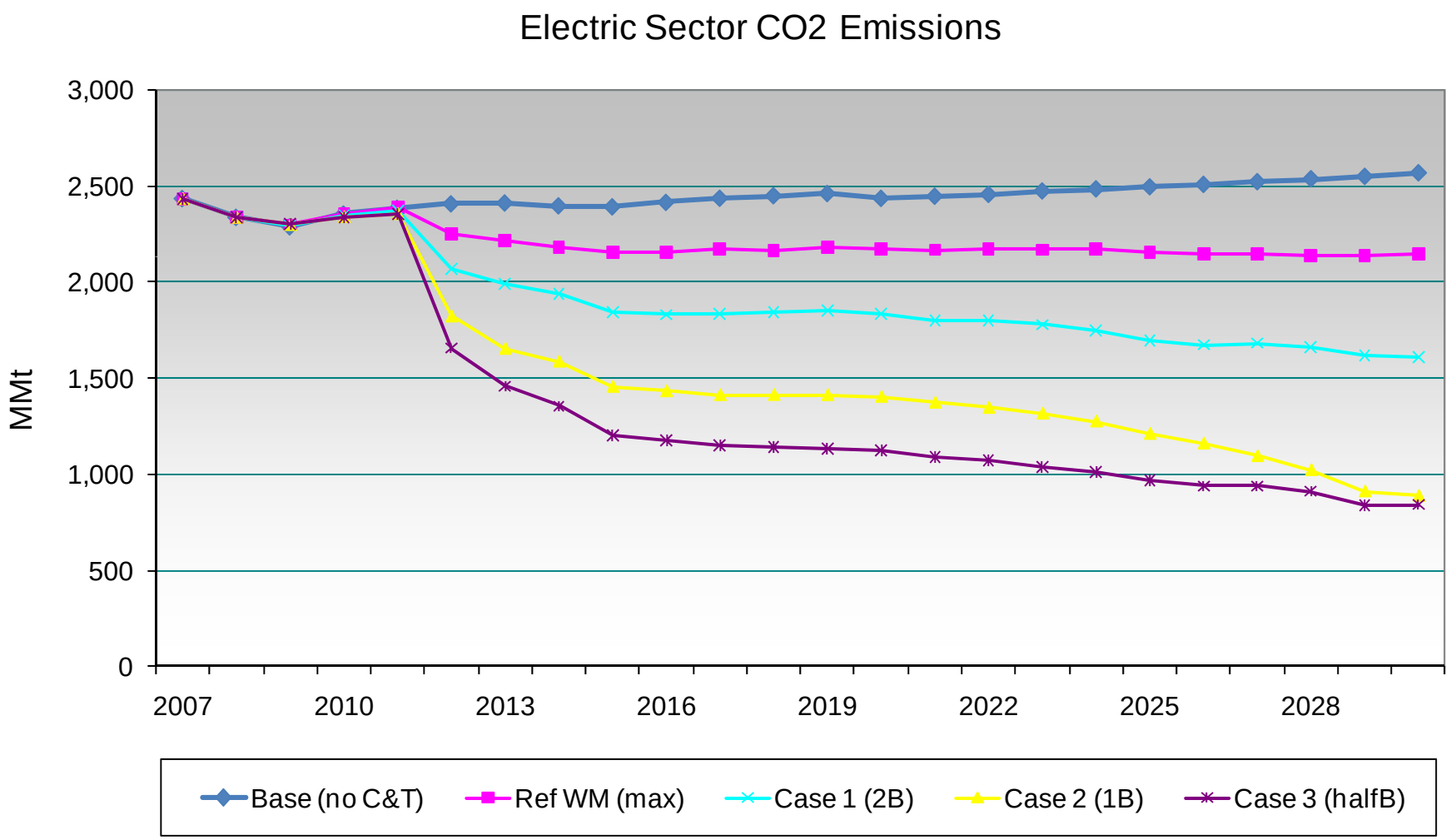
NEMS Results Highlight Critical Importance of Offset Availability for Cost Containment



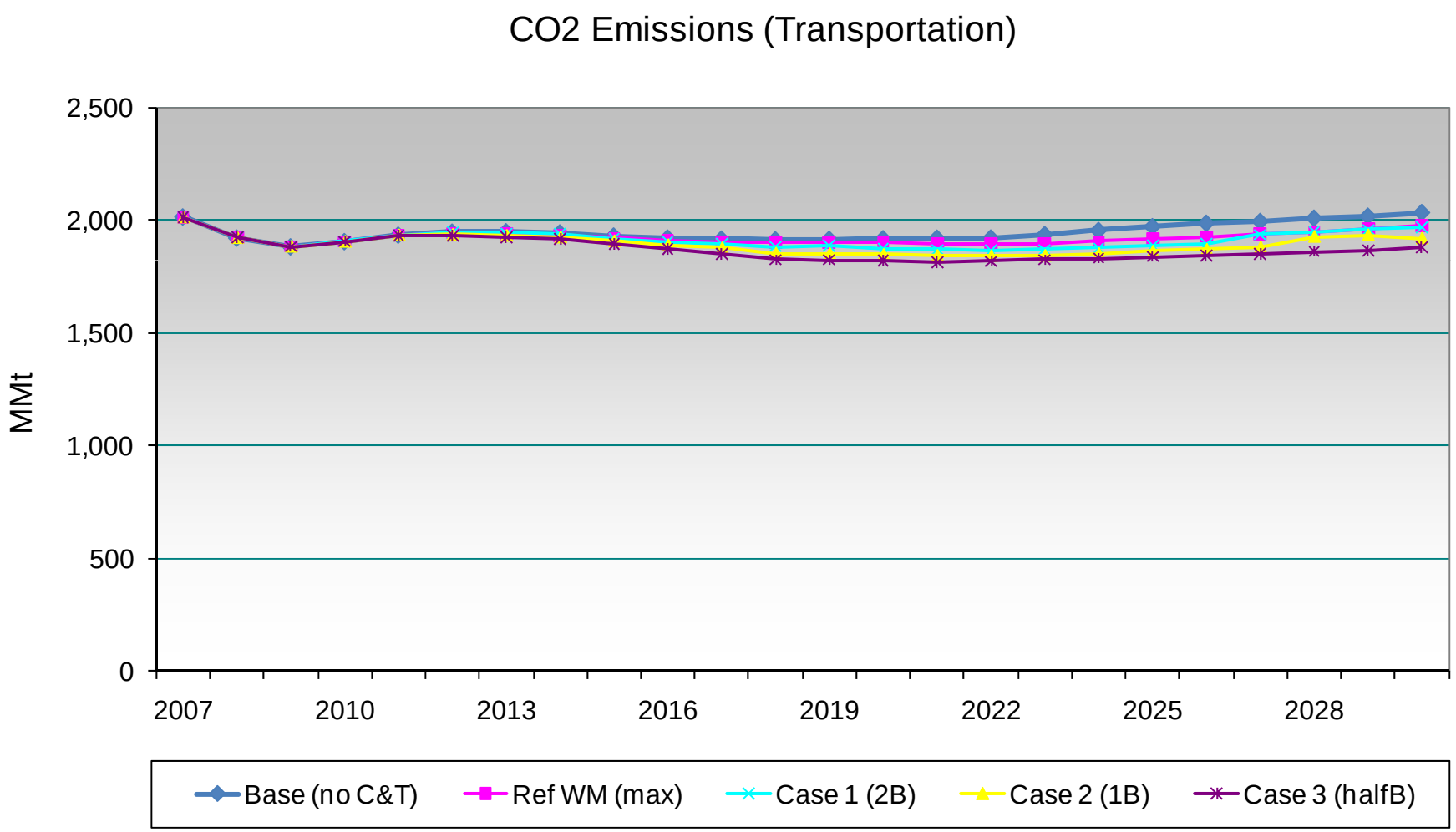
Total Economy CO_2 Emissions Covered by the Cap Fall, Particularly When Offsets are Limited



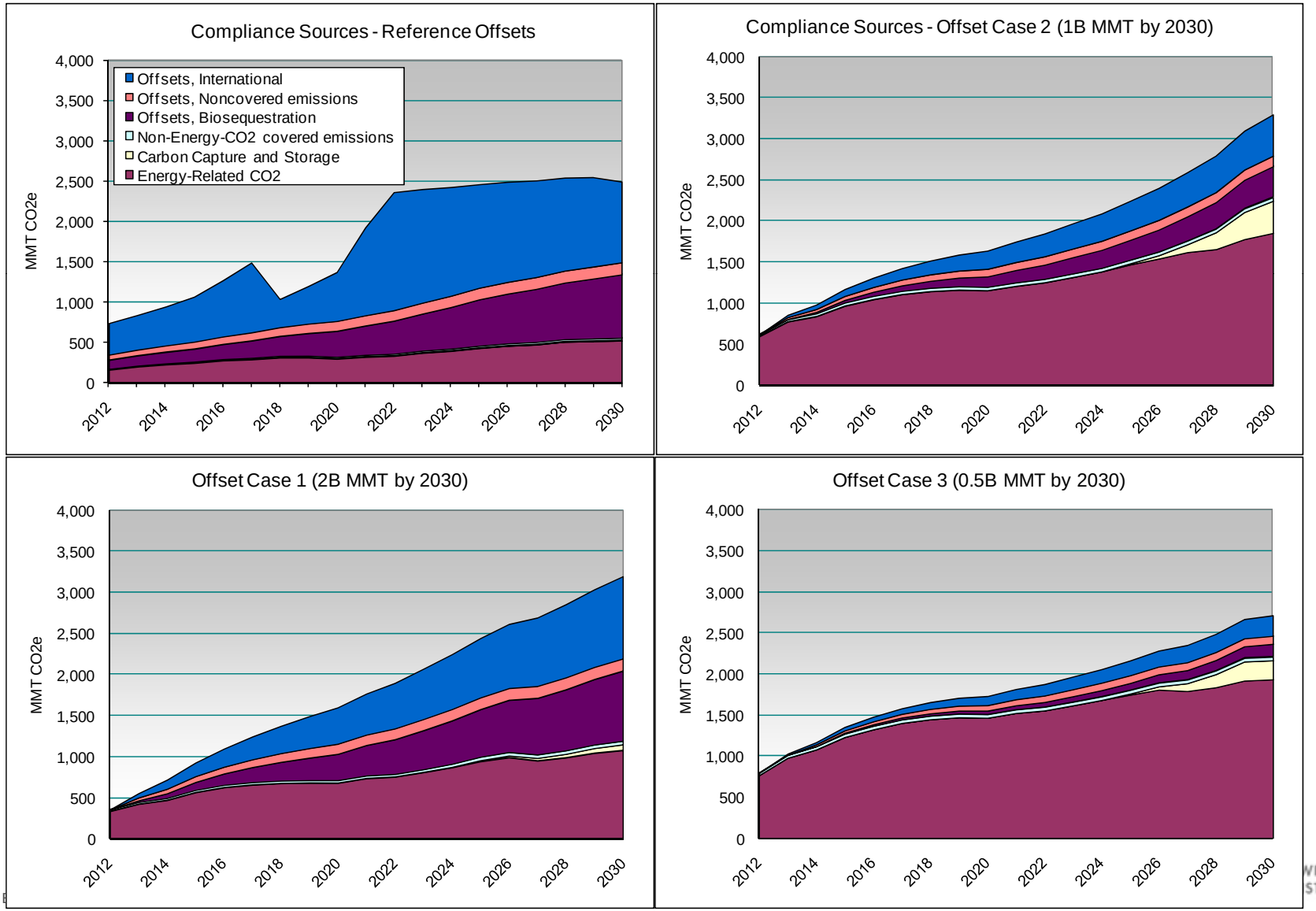
Electric Sector CO_2 Emissions Fall Dramatically When Offsets are Limited



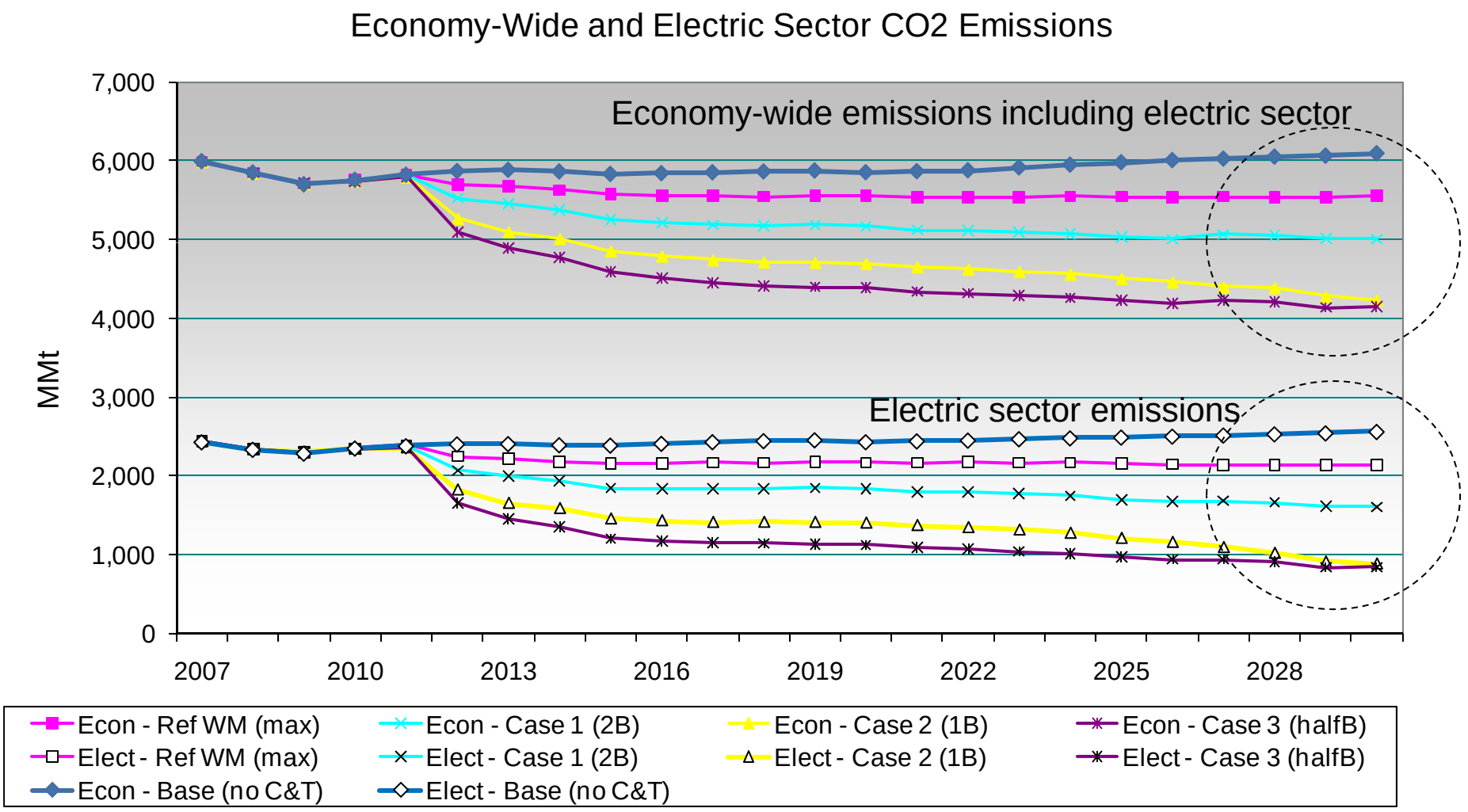
CO_2 Emissions by Transportation Show Little Change Across Scenarios



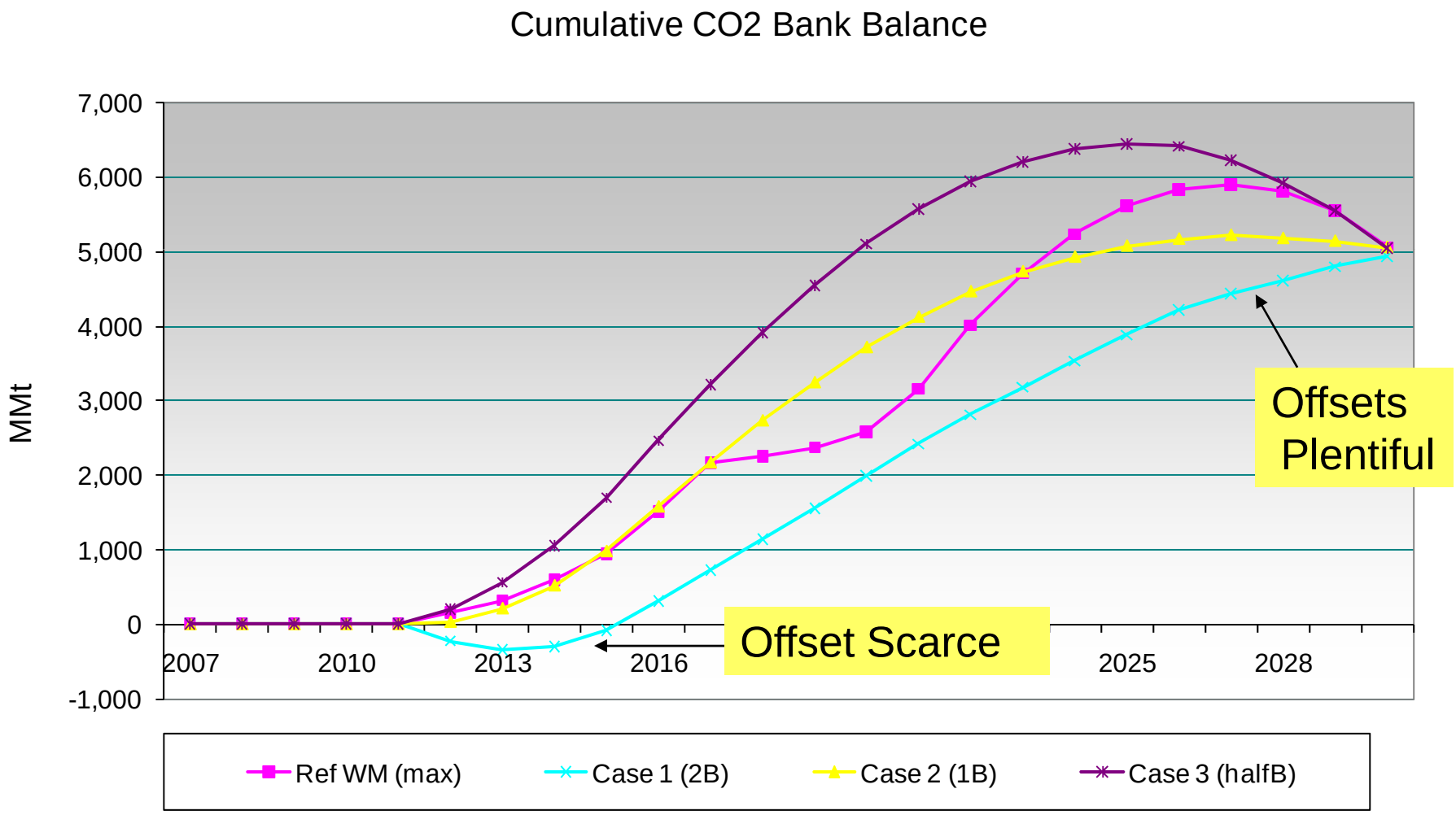
With Limited Offsets Energy Sector is Primary Source of Compliance



Most of Total Economy-wide Abatement Comes from the Electric Sector Reductions



Borrowing Shows up in Only Case 1 Scenario: Zero Offsets to Start With Rise to 2B/yr by 2030



Impacts on Electric Sector

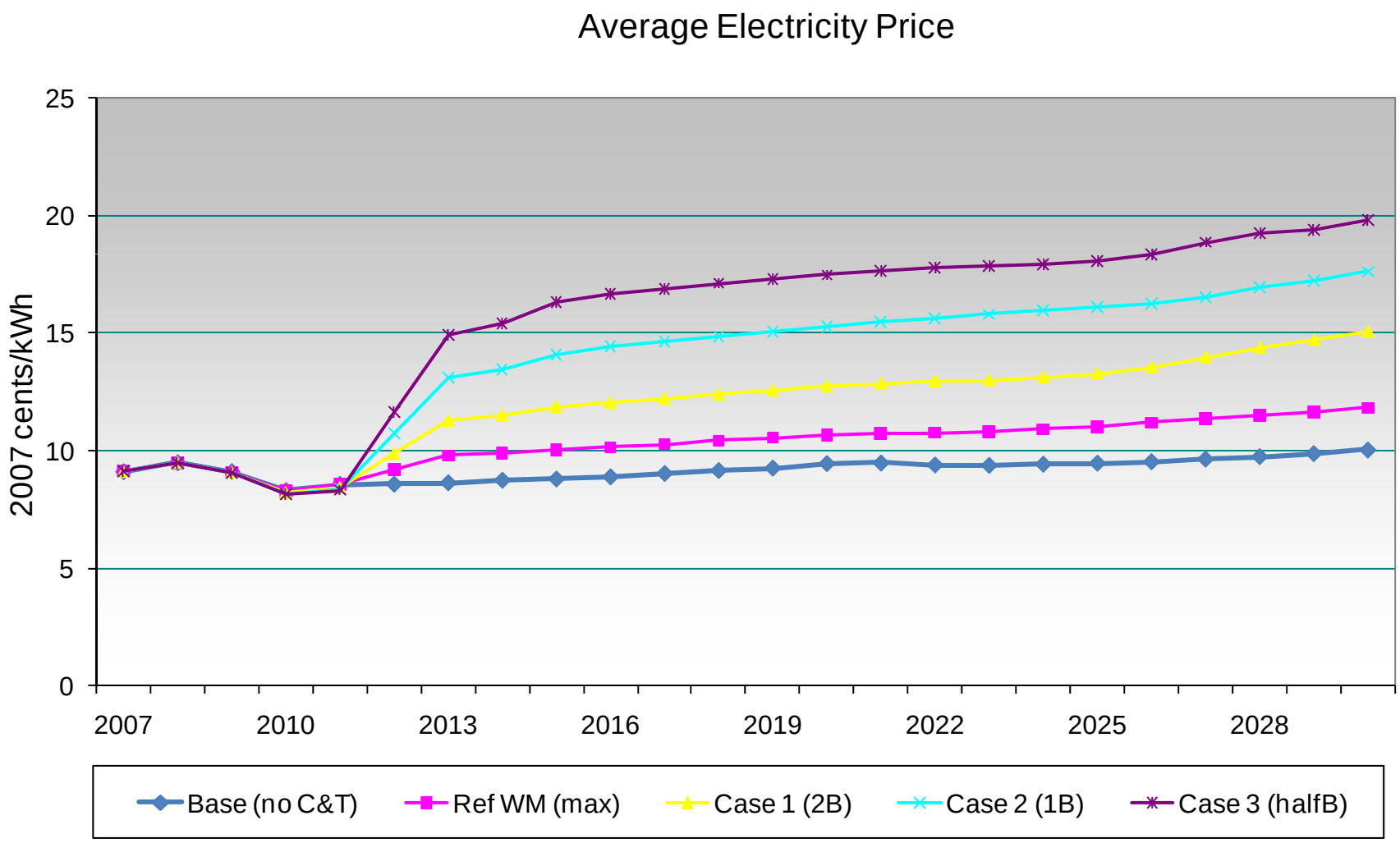
Analysis Assumes Policy Will be Implemented to Get Full Benefit of Customer Response

- Customers conserve in response to rate increases driven by CO_2 prices
- Value of allocations go into their incomes but don't impact their incentives to conserve electricity (like IRS refund)
- Result is reduced loads over time
- Lower loads imply less abatement needed
- Less abatement means lower CO_2 prices

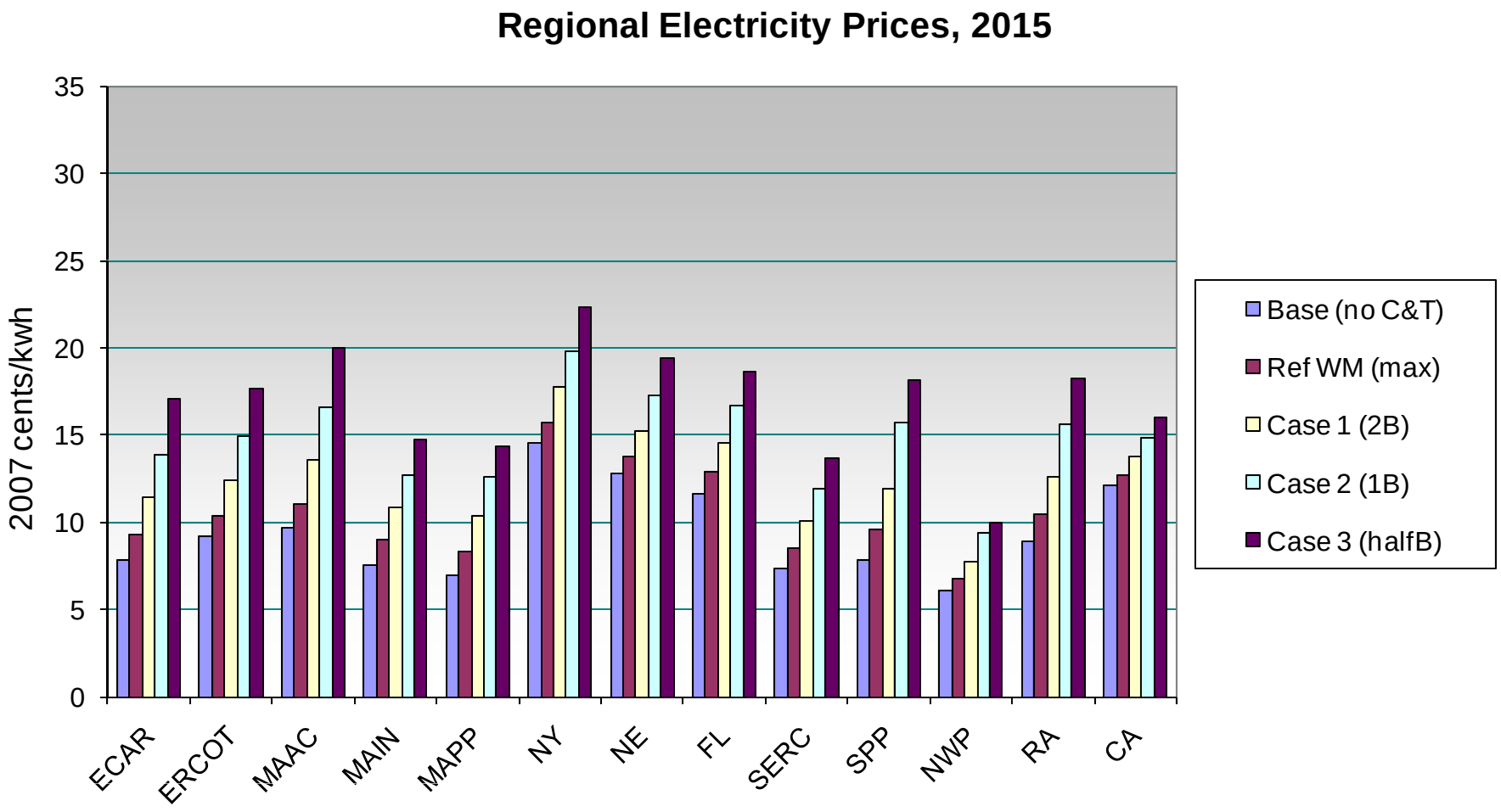
See Appendix for implications of rolling allocations into electric rates

- NOTE: many state regulators discussing directing revenues to demand-side programs in which case customers will see full rate impacts

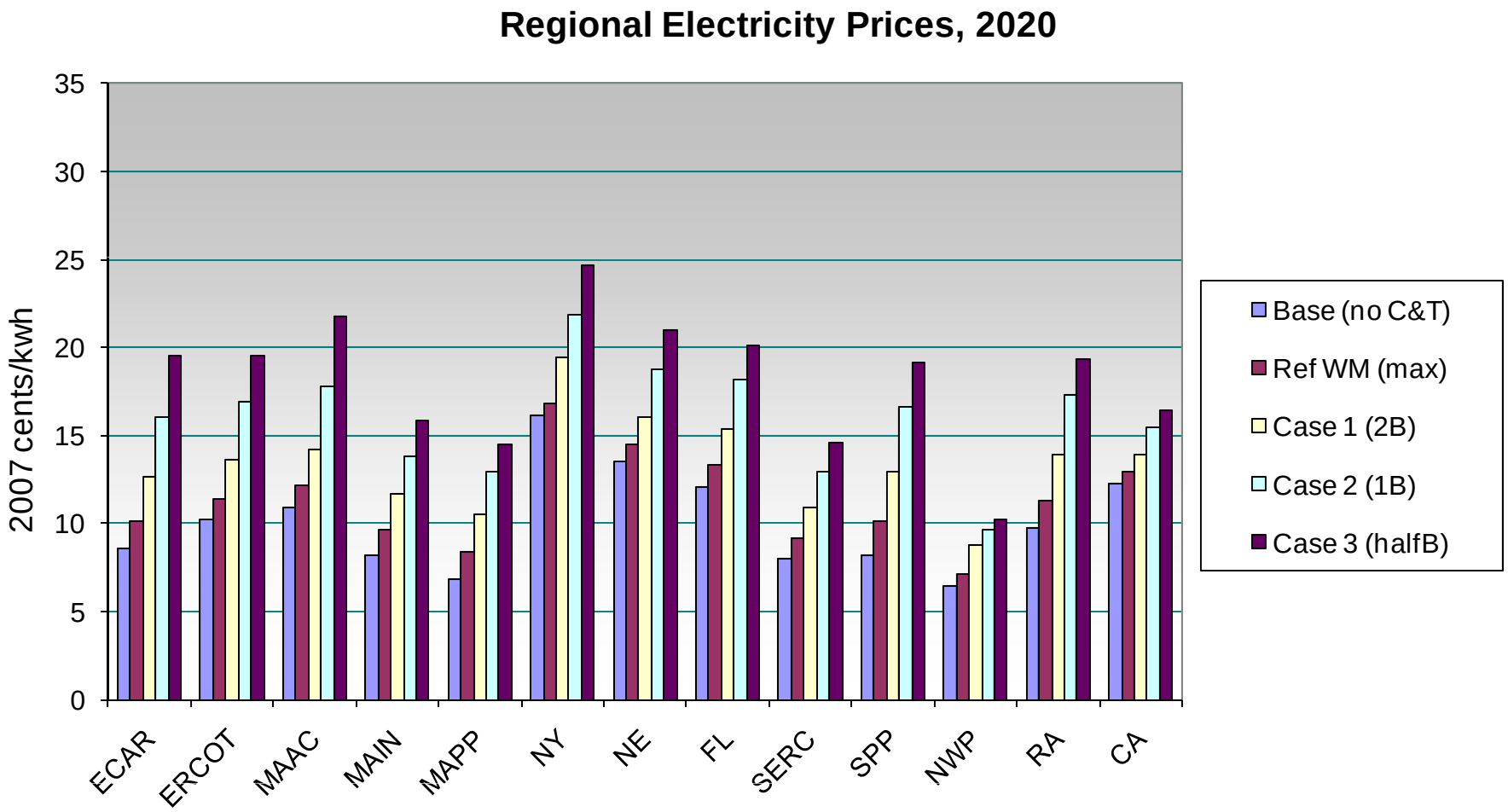
Electric Consumers See Dramatic Rate Increases (partly offset by allowance transfers – not shown)



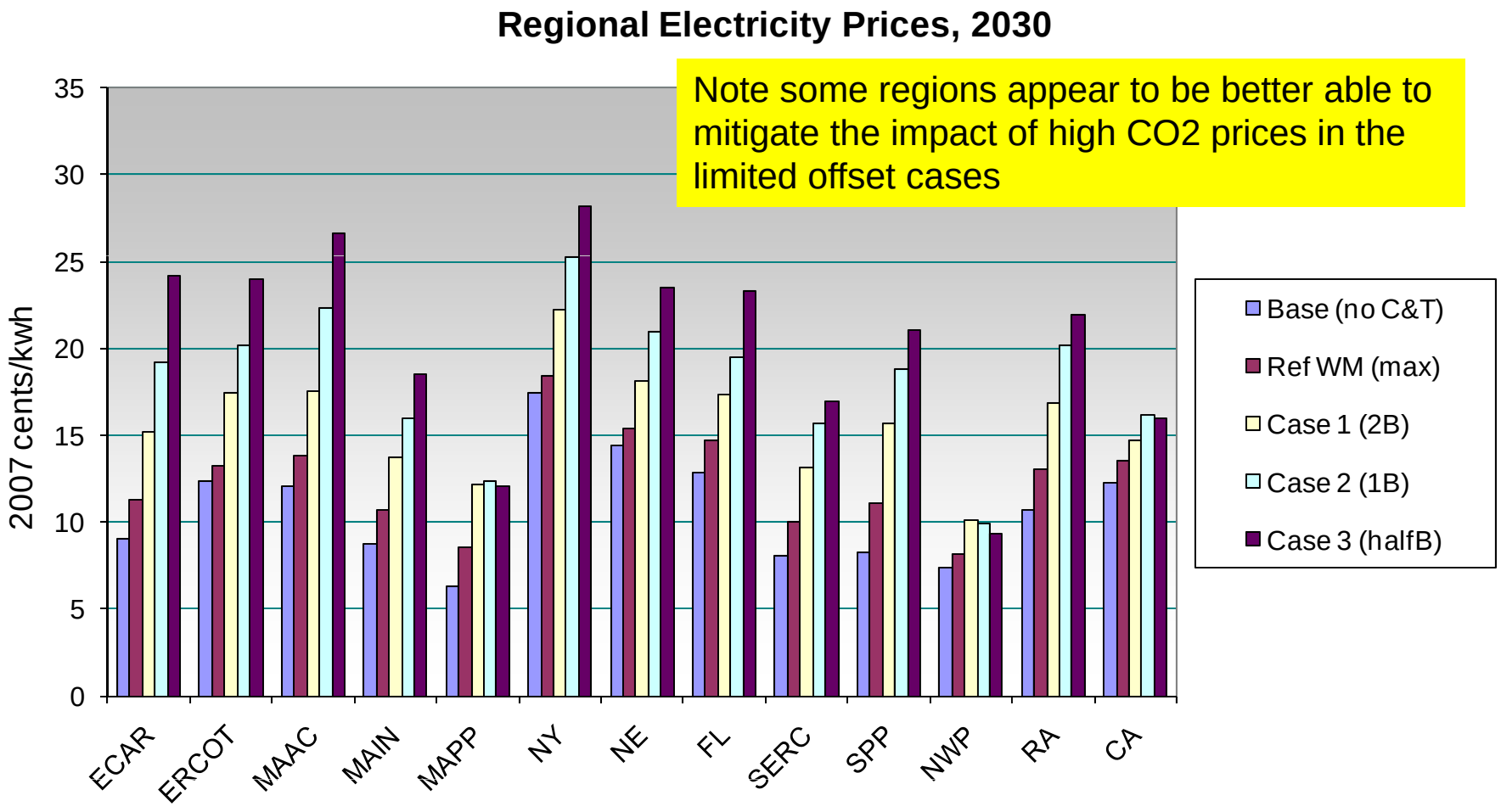
In 2015 All Regions Show Dramatic Electricity Price Increases for Limited Offset Cases



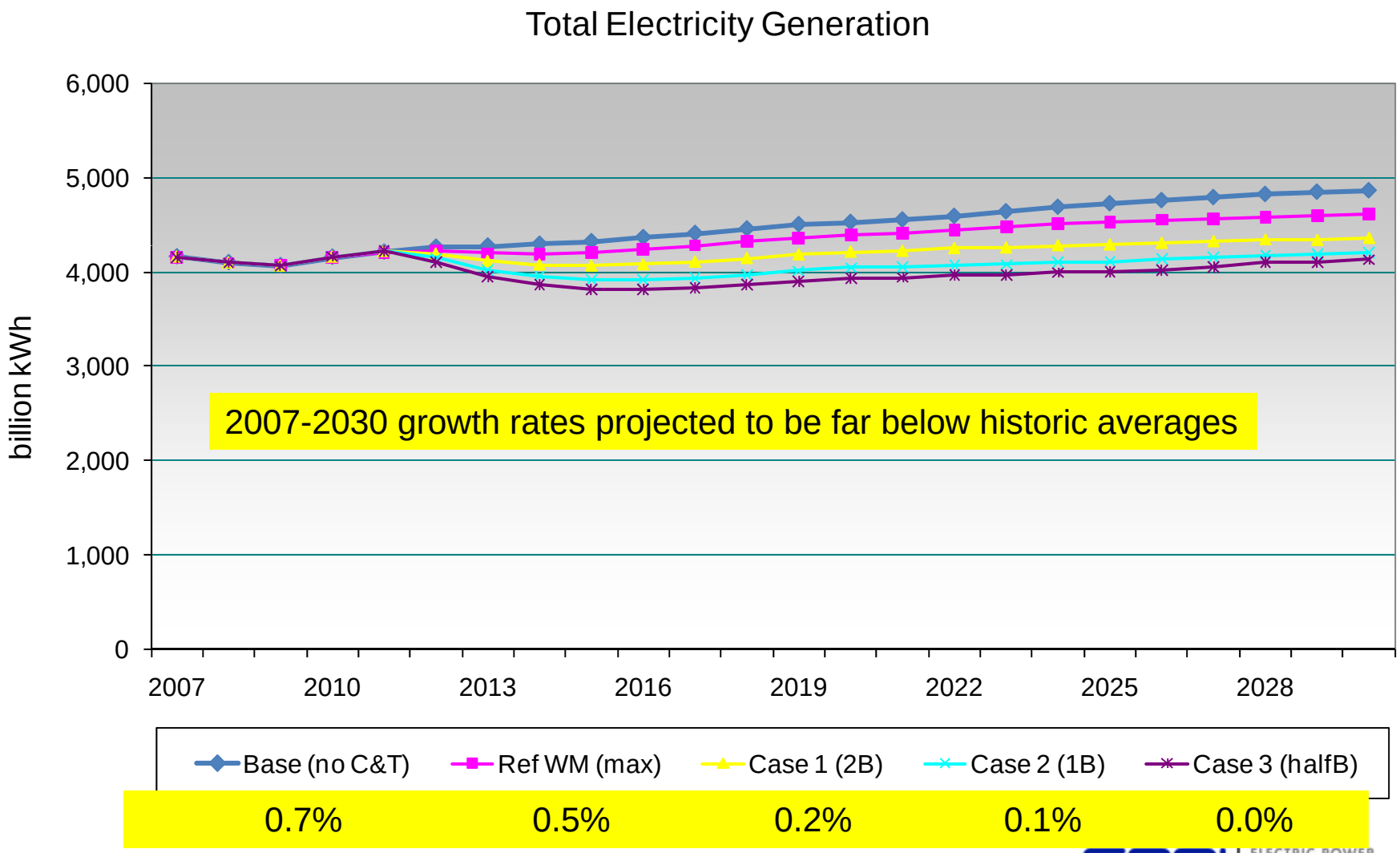
2020 Price Impacts and Sensitivity to Offset Availability are Higher Still



And Higher Still in 2030



CO_2 Prices Dampen Growth in Electricity Generation



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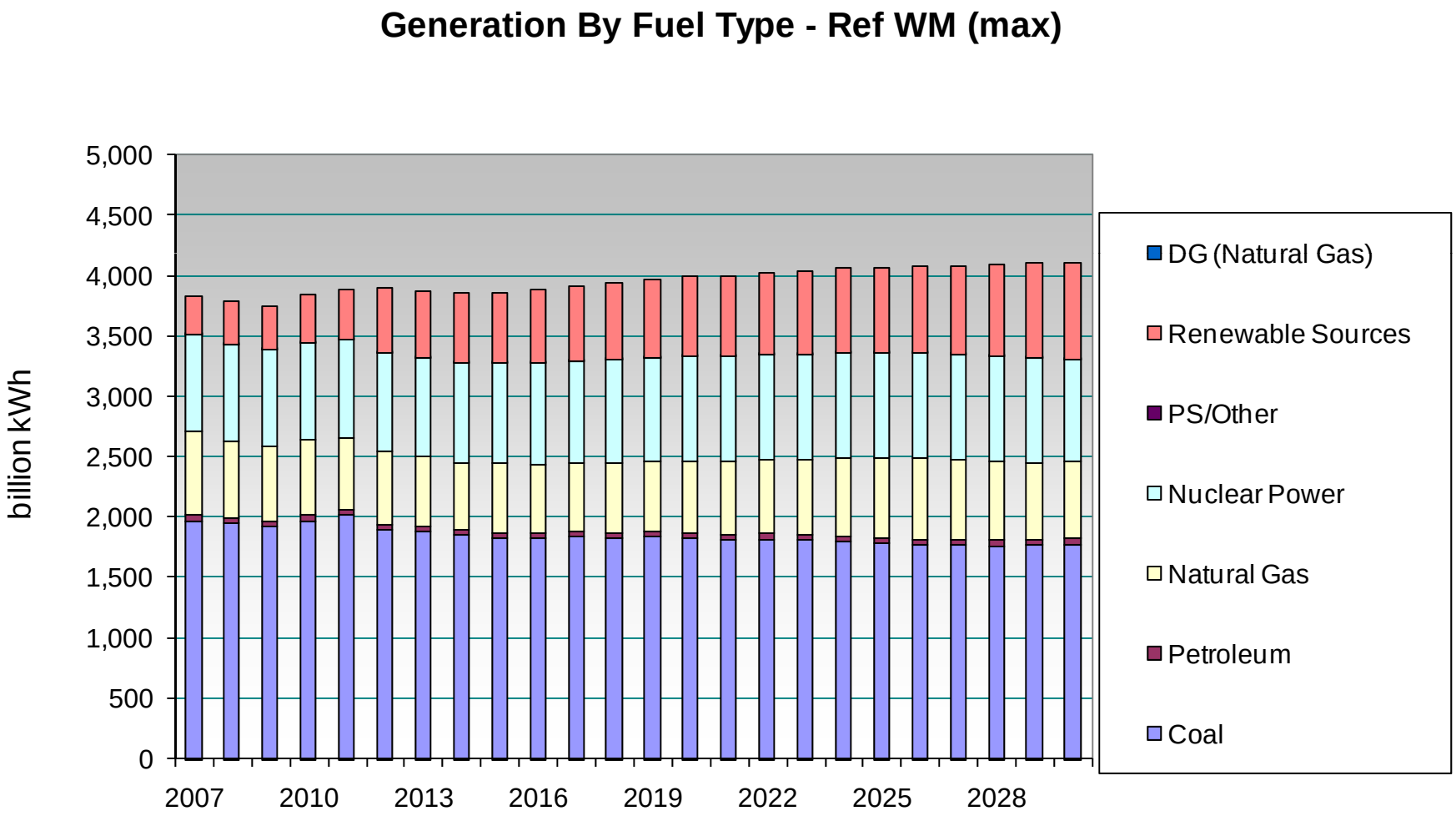
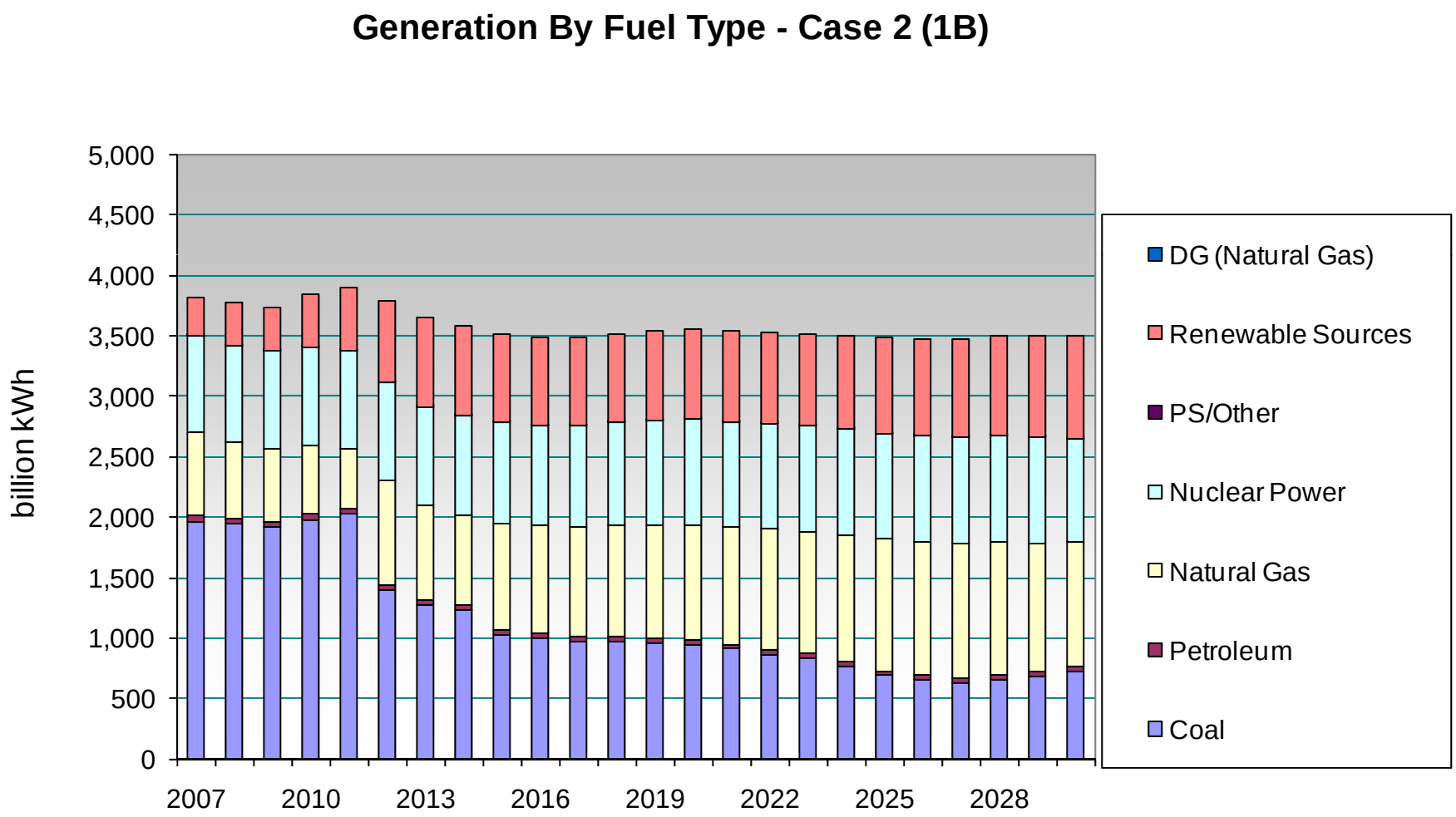
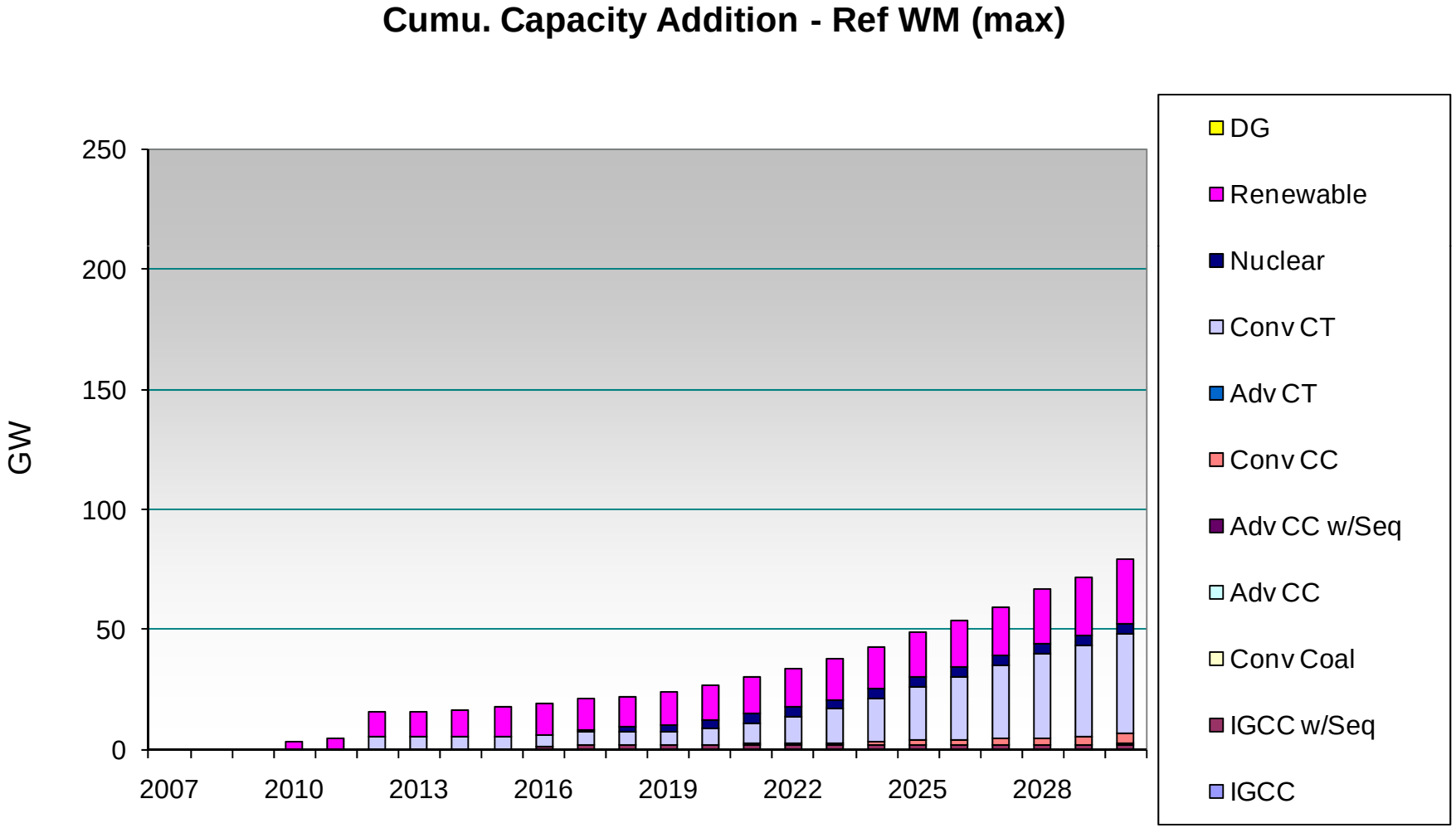
Generation By Fuel Type – Reference Case with Full Offsets



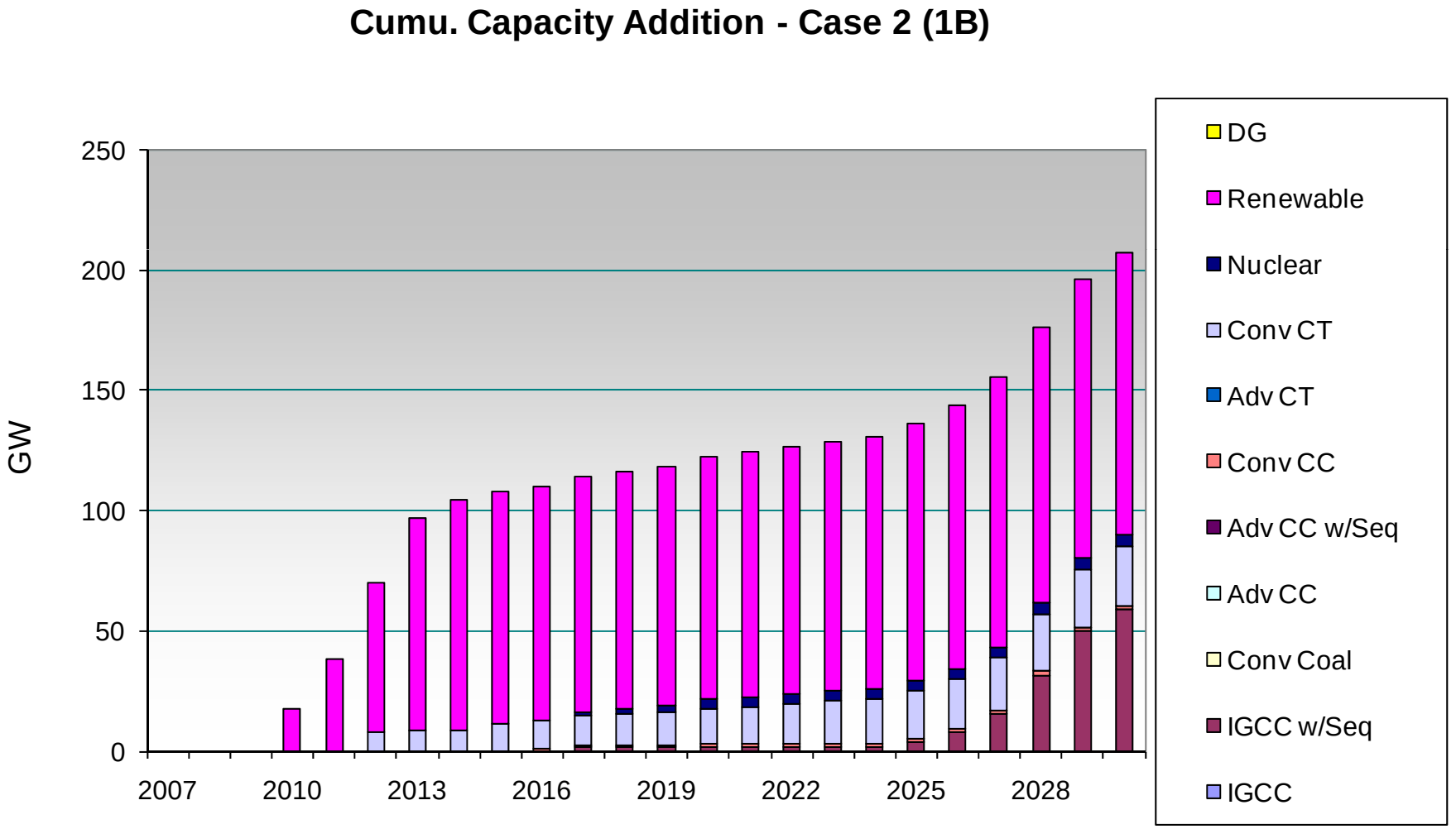
Generation By Fuel Type – Offsets Limited to 1B (mostly burns more gas)



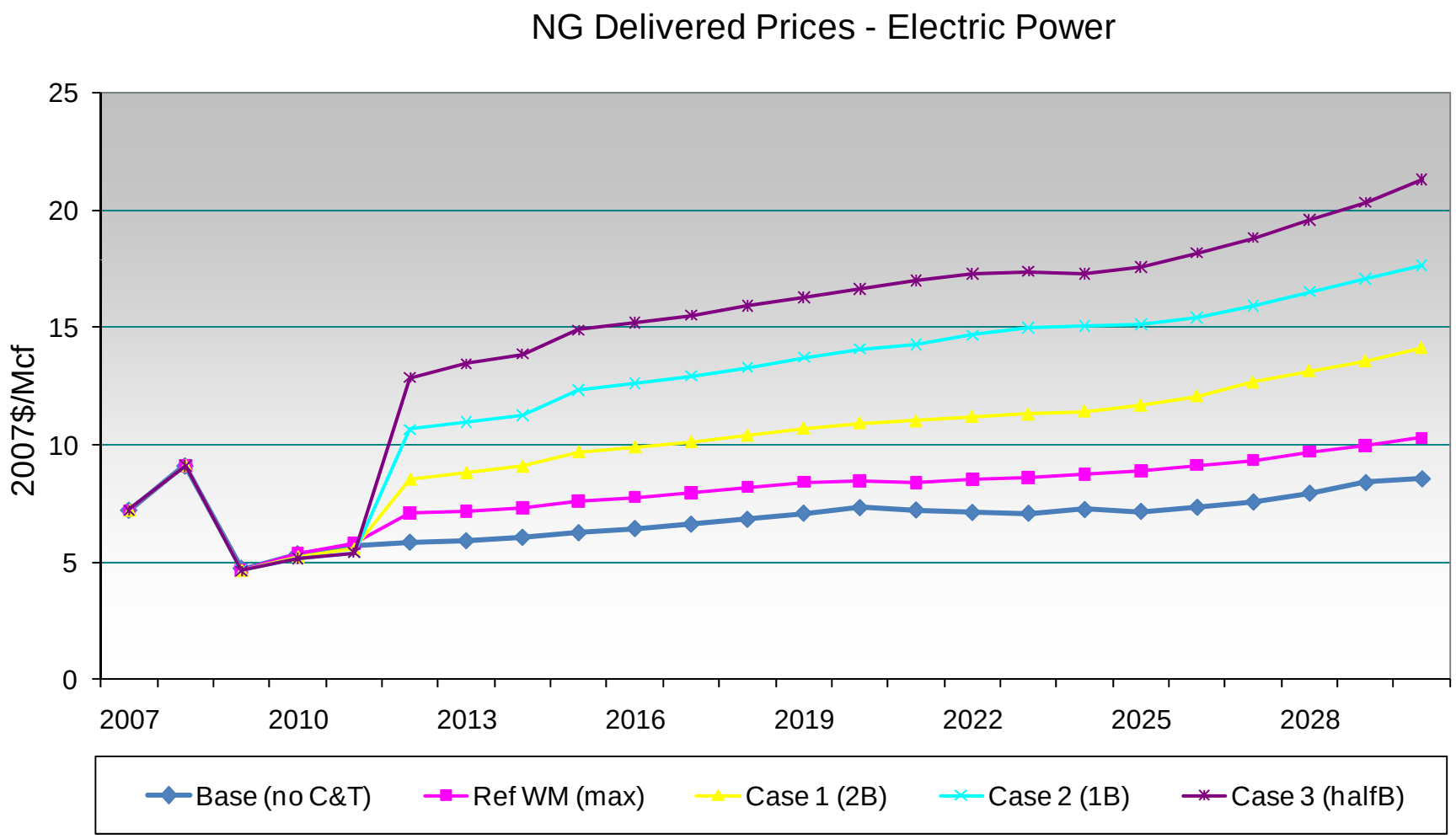
Cumulative Capacity Additions – Reference Case with Full Offsets



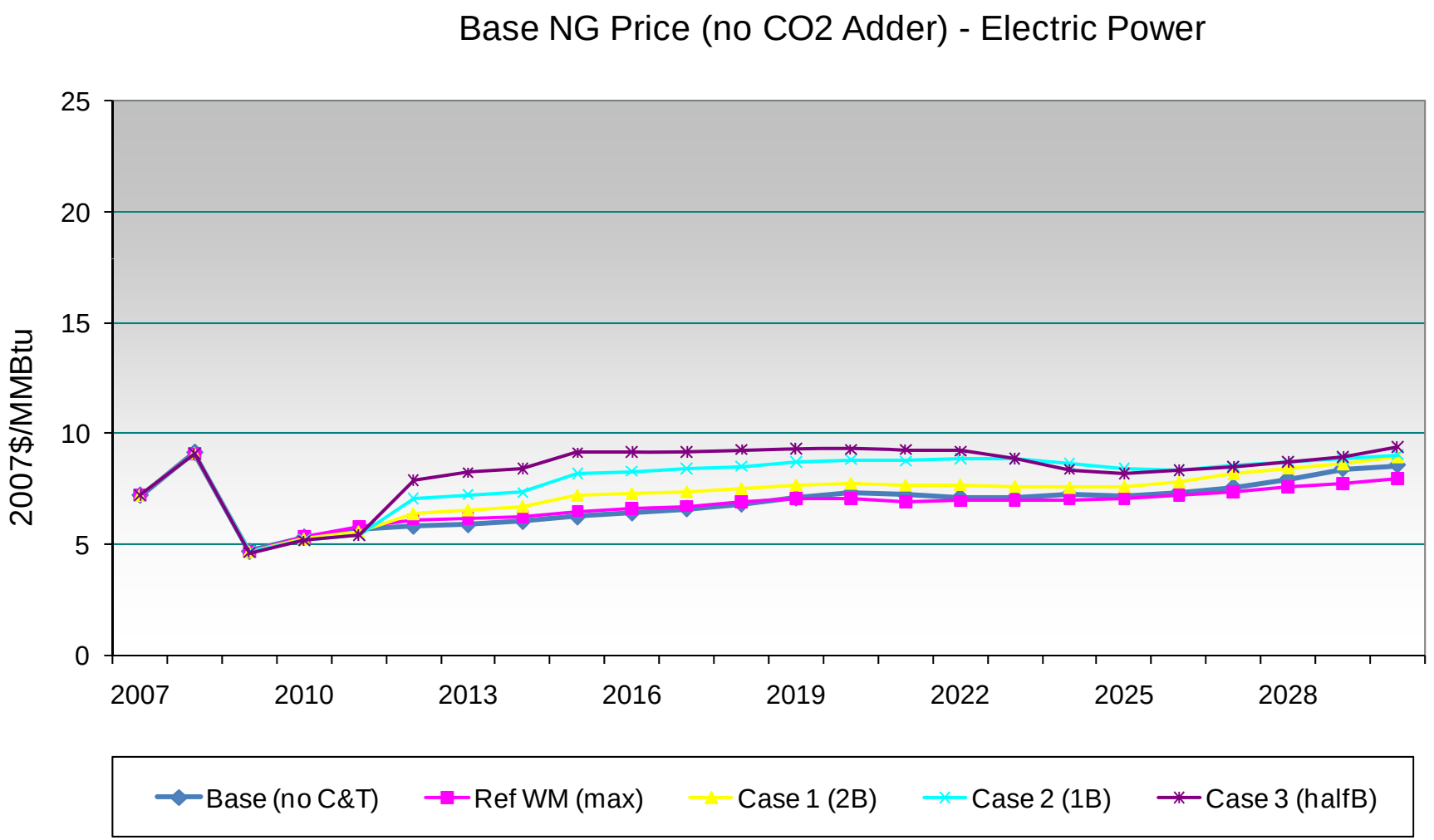
Cumulative Capacity Additions – Offsets Limited to 1B



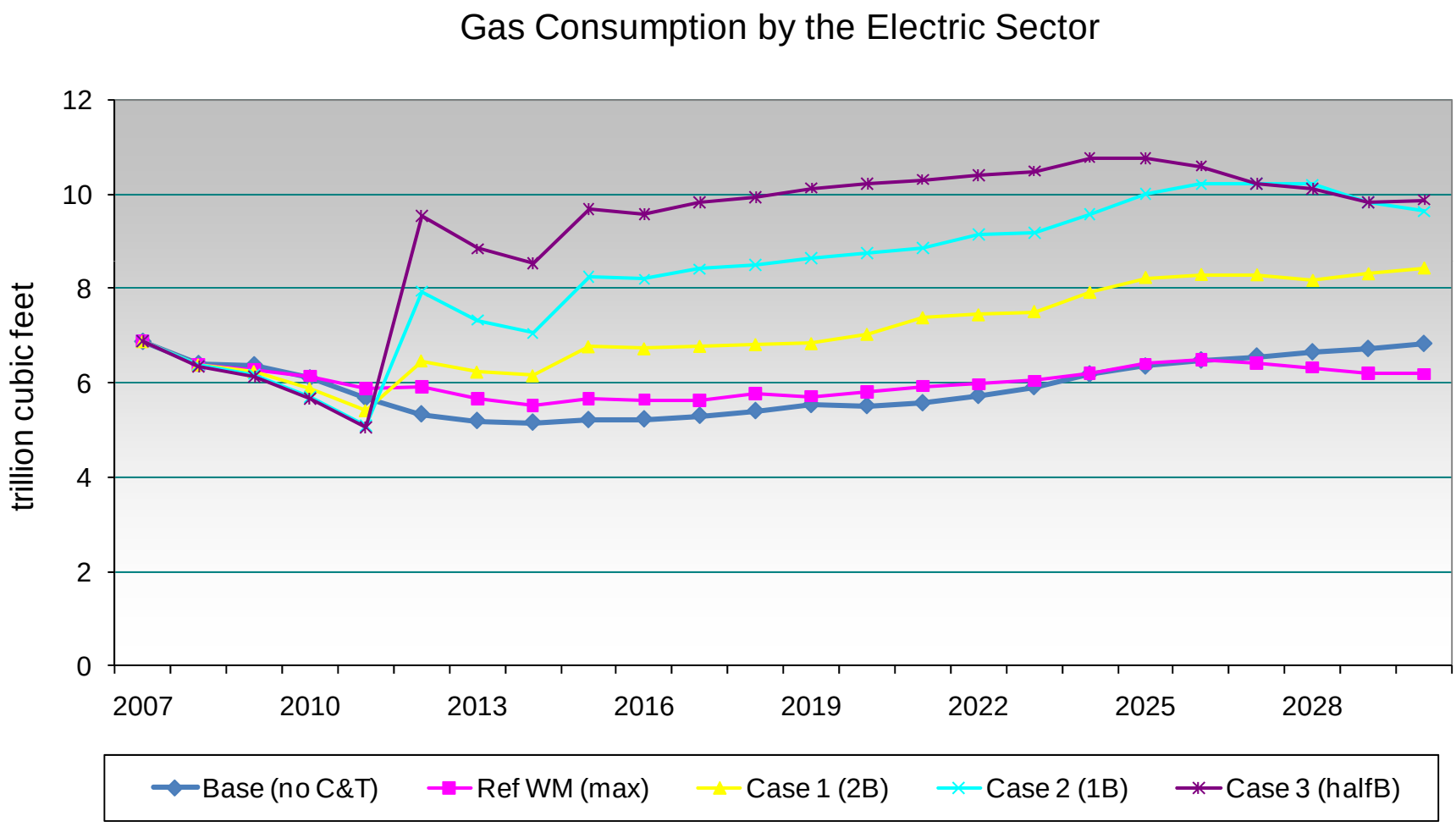
NG Delivered Prices for Electric Power Jump Dramatically (prices include CO_2 value)



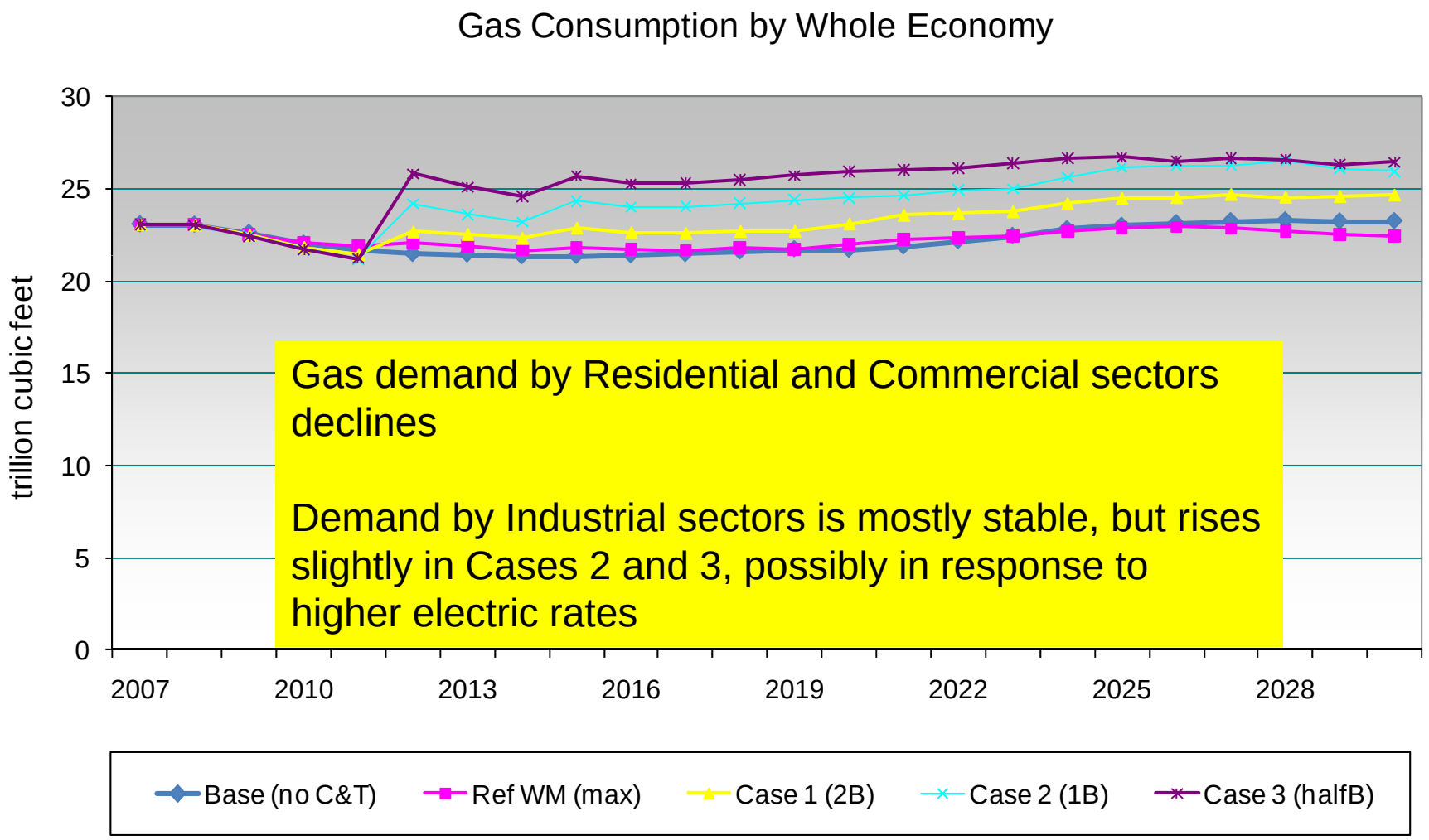
Base (pre-adder) Natural Gas Prices Increase As Well



NG Use by Electric Sector Jumps When CO_2 Prices High Enough to Justify Abatement



Total Demand for Gas Rises Driven by Electric Sector Increases



Conclusions and Observations

- Abundant offsets allows the economy to meet the cap with only limited abatement from cap-and-trade program
- If offsets are limited most of the abatement is done by the electric sector
  - Increased use of gas
  - Increased installation of wind generation
- Abatement efforts require high CO_2 prices
- High CO_2 prices impact electric rates but allocations of allowances to consumers via LDCs reduce the impacts
- Results most sensitive to assumptions about offsets
- Uncertainty about customer response, generation costs and timing of nuclear availability also impact results

Appendix: Comparison with EIA's Analysis of Waxman-Markey Using NEMS

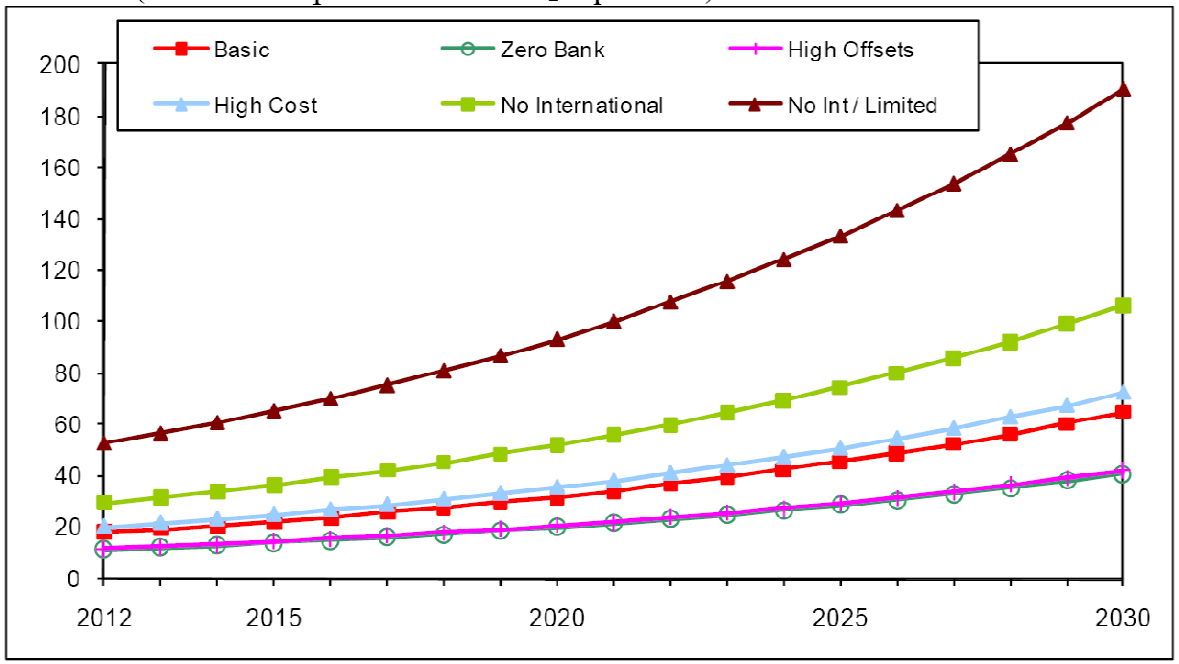
Models and Starting Points the Same but Key Assumptions Differ

- Most EIA scenarios covered narrower range of offset availability, only one EIA case significantly restricted (leads to a cluster of low CO_2 price cases)
- EIA electric generation costs approximately 2/3's lower
- EIA used 7.5% CO_2 price growth rate vs. 5% in this analysis (a higher rate lowers CO_2 prices in early years and raises them in later years)
- Most EIA cases accumulated a bank balance of 13b tons in 2030 vs. a 5b ton balance in our and in past EIA analyses (essentially banking abundant offsets); this raises EIA's estimated CO_2 prices
- EIA assumes allocations roll into rates
- EIA allows greater use of nuclear generation but it is the lower cost assumptions (~$4,000/kW) that make the difference

Despite Differences EIA and PacifiCorp-EPRI Results Similar for Similar Offset Cases

Figure 5. Projected Allowance Prices in ACESA Main Cases, 2012-2030

(2007 dollars per metric ton CO_2-equivalent)



Source: National Energy Modeling System runs, IIR2454CAP.D072909A, IIR2454NOBNK.D072909A, IIR2454HOFF.D072909A, HR2454HC.D072909A, HR2454NOINT.D072909A, and HR2454NIBIV.D072909A.

Similar to Case 2 (1B)

Similar to Ref WM (max) case

Another similarity is reliance on electric sector to cut emissions when offsets are limited

Appendix: Impact of Including Free Allowance Allocations in Electric Rates

Key Challenge is Allowing Price Increases to Encourage Price-driven Conservation

- Legislation seeks to keep incentives for price response
- Substantial allocations of emission allowances (EAs) to local distribution companies (LDCs) intended to offset impact of higher generation costs in electric rates
- LDCs Face requirement to not “solely” distribute value on a kWh basis, arguing for lump-sum givebacks (may be hard to implement)
- Key question is will customers cut electric usage as though they had a rate increase despite the givebacks?
- Without full price response from consumers more abatement is required from other sources to meet cap
- Result is higher CO_2 prices (and higher electric rates after allocations are phased out)

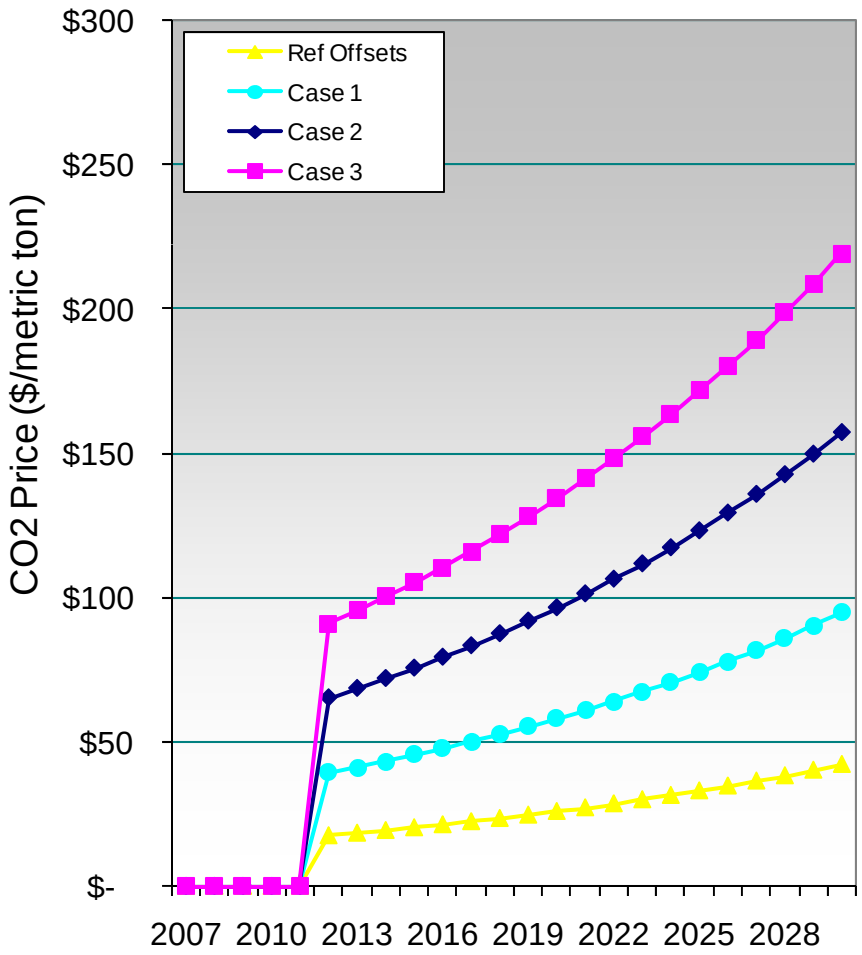
Lower Price Response Means Higher CO_2 Prices Needed to Meet the Cap

CO2 Price in 2012 Needed to Meet Cap ($/metric ton)			
		EA Allocations in Rates	
Case	**Offsets**	**None**	**Full**
Ref Offsets	2B from start	$18	$18
Case 1	2B by 2030	$39	$46
Case 2	1B by 2030	$65	$80
Case 3	0.5B by 2030	$91	$110

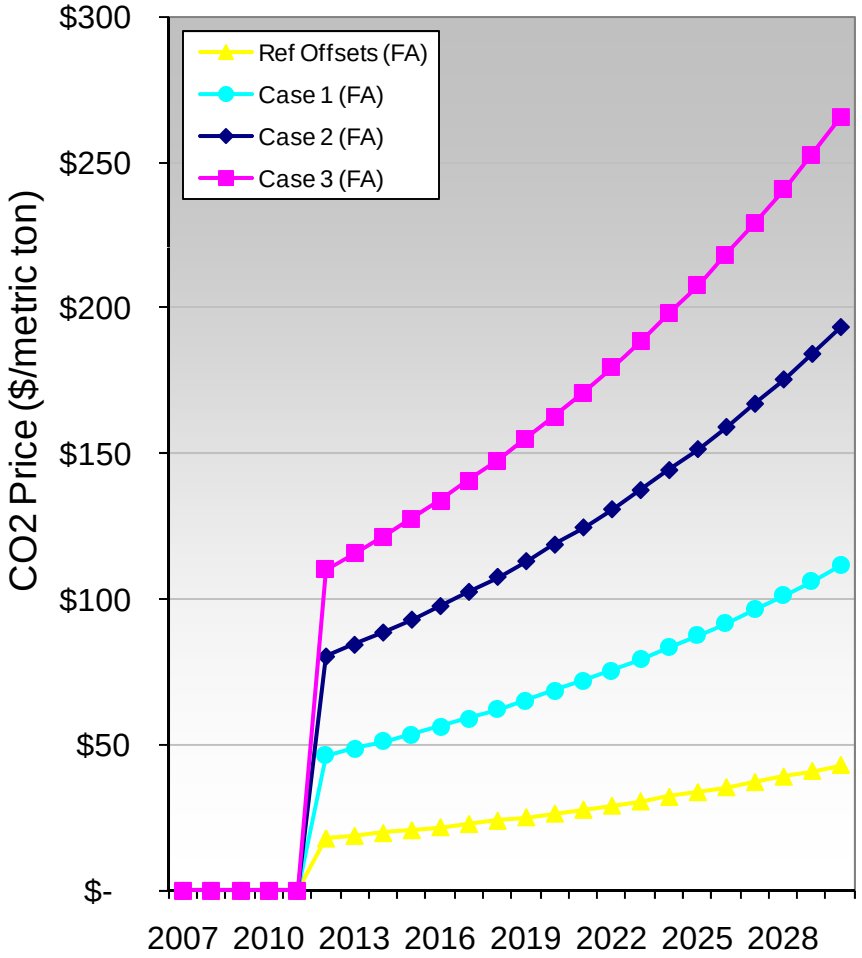
- Plentiful supply of offsets in Reference Case cuts importance of price response by customers
- At lower and lower levels of offset availability more abatement is needed and lack of price response by customers has bigger impact

How Free Allowances in Rates Increases CO2 Price Required to Meet Cap

CO2 Price Path to Meet Abatement Target



CO2 Price Path to Meet Abatement Target w Free Allowances in Rates



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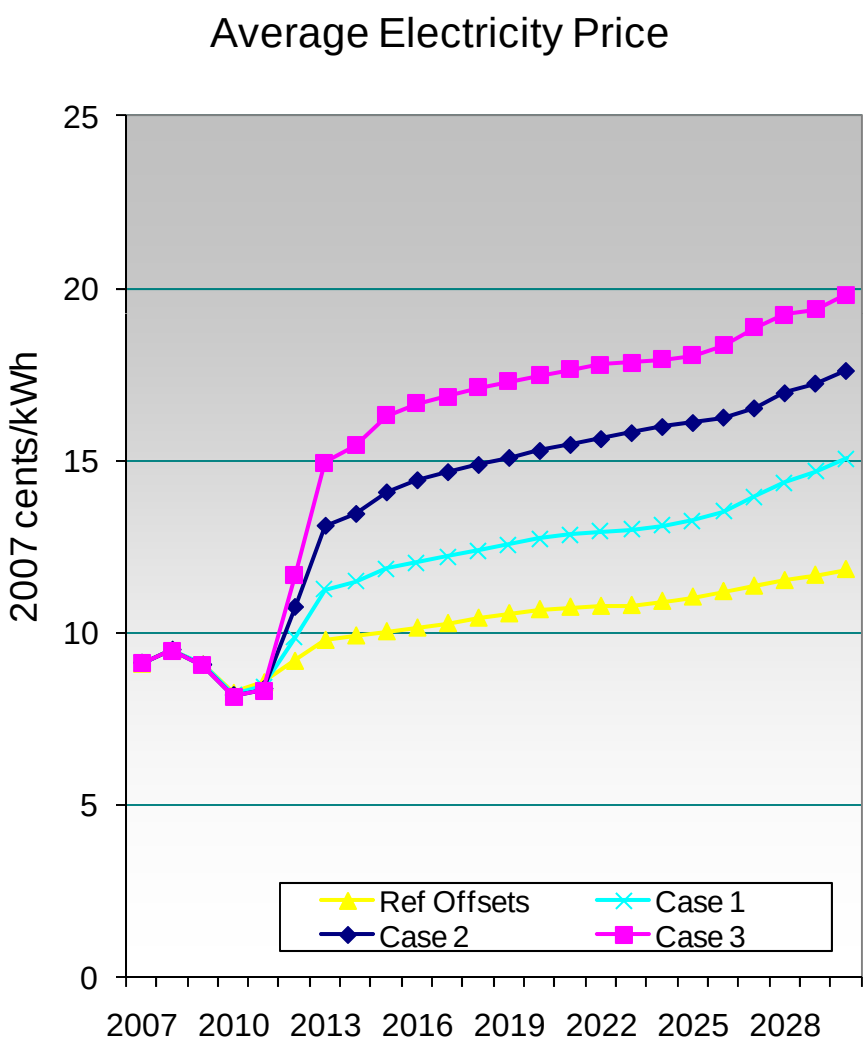
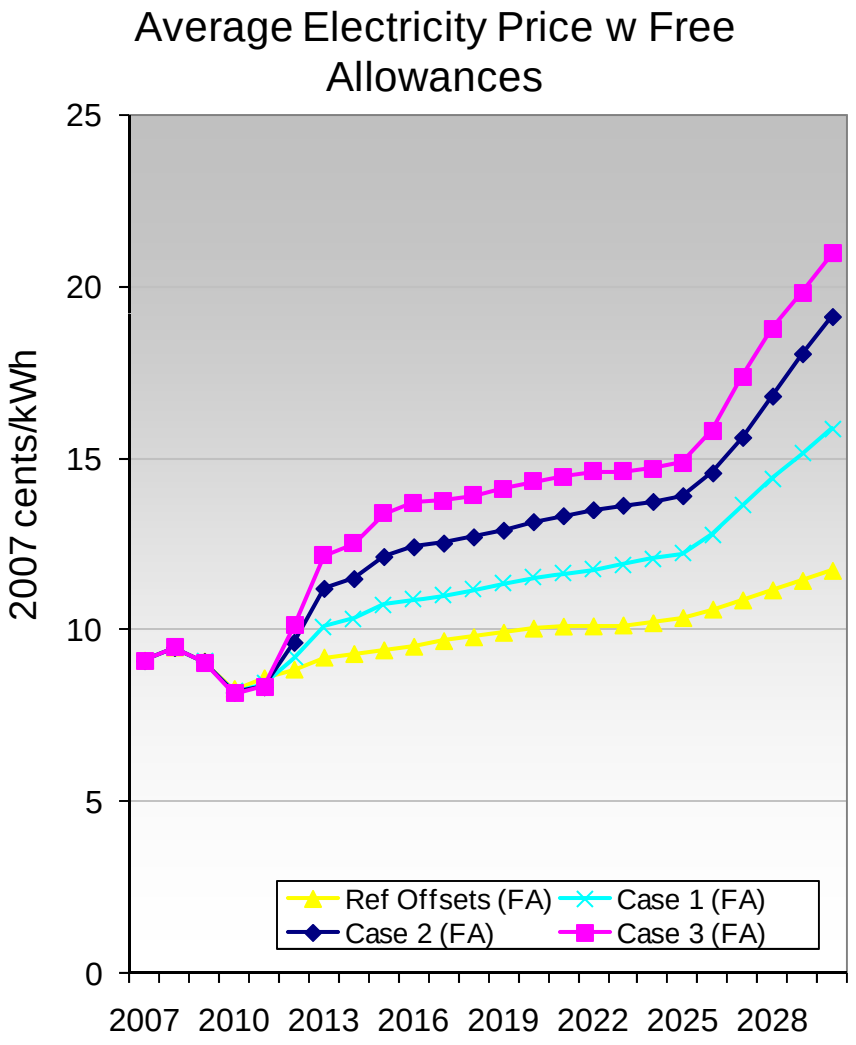
Allocations to LDSs Ameliorate Rate Impacts Until Phase-out of Free Allocations After 2025





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