

April 22 CBCG Status Report: Data Collection, Modeling Assumptions

Presented By

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Outline: Today will continue to focus on Energy Impact Assessment (EIA) Modeling

- **Status of Data Collection & Outcome of modeling discussions**
- **Detailed Assumptions**
 - Assumptions Memo
 - Fuels Memo

***This afternoon KEMA will discuss
Implementation Impacts Analysis***

***Next meeting or one after will address Other
Market Impact Assessment (OMIA)***



ERCOT Staff delivered substantial set of data since last CBCG meeting

- **ERCOT staff has fulfilled on all time-critical core data requested by TCA**
 - Such as...
 - load flow models
 - identification of transmission contingencies
 - nodal mapping to regions identified under the Regional analysis (above)
- **Data remaining includes items necessary for post-processing**
 - attribution of location load to Muni and Electric Cooperative organizations as required for segment analysis
 - identification of generation ownership to Independent Power Producers as required for the segment analysis
 - identification of the fraction of load served by REP in each Region as required for the segment analysis
- **+ new Backcasting elements**
 - 2003 load flow model
 - Generators mapped to busses in load flow
 - 2003 actual unit outage data in data base



Known critical path open issues from Core Data are limited

- **TCA is working with ERCOT to further refine constraint definitions**
 - [put in details from Prashant's email]
- **TCA and ERCOT deferred defining and gathering backcasting data**
 - Determining the appropriate backcasting data requires further discussion with ERCOT Staff to ensure consistent sets of data are used (i.e. load flow, transmission upgrades, outages, etc.)
 - Parties believe establishing a later timeline for the backcasting simulation is prudent to allow sufficient discussion
 - TCA proposes to finalize data definition prior to, or soon after, the freeze of the balance of the assumptions



TCA is finalizing approach to modeling Base Case

- **TCA and ERCOT met on 4/6 to discuss in detail the Base Case representation**
 - Based on ERCOT's representation with upcoming software releases
 - In the sense of representation in GE MAPS
- **TCA is capturing outcome of discussions and proposed treatment in modeling for staff review**
- **TCA intends to finalize any remaining details prior to May 4, or ask to meet again with staff around the May 4 CBCG meeting to resolve any open issues**



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Assumptions Memo – Updated

- **Assumptions memo has been updated based on a variety of input**
 - 4/6 CBCG input
 - 4/7 Discussions with ERCOT staff about format of data and modeling approaches
 - Improved source data provided by ERCOT
- **Substantial changes throughout much of the Assumptions memo**
 - Redlined file is available but cumbersome
 - We'll review changes today

Objective is to have TNT-ready version for Friday with any open issues articulated



Load and Thermal Unit Enhancements

- **Load Inputs**

- Substantial detail added about proposed approach to develop load inputs based on available data from 4/7 TCA-Staff meetings

- **Thermal Unit Characteristics**

- Generic unit characteristics addressed based on 4/6 requests
 - Start-up fuel cost added
 - Footnote to note that generic full-load heat rates and emission data do not exist, rather unit-specific data are used
- Clarified that ERCOT staff will review full data base of unit-specific data
- Added discussion of Co-generating plant modeling based on ERCOT input of modeling self-scheduled loads and based on TCA's established methodology for dispatching co-gen units



Nuclear, Hydro and Renewable Enhancements

- **Nuclear Units**

- To respond to request that TCA provide in the memo nuclear fuel costs...
 - Clarification that units are treated as must-run, do not have specific cost data in TCA's model

- **Hydro Modeling**

- Memo clarified that TCA intends to use hourly hydro schedules (anticipated from LCRA) to the extent possible

- **Renewable Modeling**

- Wind – several clarifications
 - Monthly or seasonal wind schedules will be used to the extent possible
 - The capacity for wind in ERCOT may be more than 10% (TCA requesting info from ERCOT)
 - That RECs will likely not affect the dispatch of wind given likely modeling approaches, but that TCA will try to incorporate RECs into the resulting revenues for renewables



Capacity Additions and Retirement Model – Several Enhancements

- **We will discuss in each of these in more detail**
 - Incorporated Coal to Model
 - Added coal addition parameters to model
 - Added note about coal premium for value of fuel diversification
 - Added factor for increased cost in metropolitan areas
 - Added un-mothball model parameters
 - Added table of mothballed units to be considered
 - Updated new entry and retirement tables from ERCOT documents
 - Specified proposed source of new wind additions based on input from ERCOT staff
 - Added discussion of RMR unit treatment



Addition of Coal parameters to Addition Model

Coal parameters added to economic addition model based on TCA's assumptions about cost structures

Cost Component	CCGT	SCGT	STc
All-In Capital Cost (\$/kW)	600-700	350-450	2000
Debt: Equity Ratio	45:55	40:60	50:50
Return on Equity	16%	19%	12%
Cost of Debt	8%	8%	8%
Term of Debt	20 years	20 years	20 years
Fixed O&M (\$/kW-yr)	15	5	25
Variable O&M (\$/MWh)	2.0	3.5	1.0
Full Load Heat Rate (Btu/kWh)	6,900	10,000	9,000
Forced Outage Rate	3%	4%	4%
Planned Outage Rate	4%	3%	9%

Footnote added to note that TCA will adjust parameters for value of fuel diversity if quantified by CBCG



Additions in Metropolitan Areas

- **TCA proposes to use a 25% burden to the carrying charge of resources in the Dallas-Ft. Worth and Houston-Galveston areas**
 - 25% value is consistent with what we have used in other metropolitan areas in the U.S.



Mothballed plants: incorporation into economic addition model

- **Updated list of mothballed plants in Assumptions Memo**
- **TCA proposes to use a cost of \$4/kWh (CC) or \$6/kWh (gas- or oil-fired steam) to return to service if within 2 years of mothballing**
- **Proposed 20% increase in cost for additional years in lay-up**

Table 4: Mothballed Units

Unit	County	Zone	Type	MW
Abilene 4	Taylor	West	STgo	18.0
E S Joslin 1	Calhoun	South	STgo	254.0
Hays Energy Facility 1-4	Hays	South	CCg	989.0
Lake Pauline 1-2	Hardeman	West	STgo	35.0
Lon C. Hill 1-4	Nueces	South	STg	559.0
Nueces Bay 5-7	Nueces	South	STgo	560.0
Oak Creek 1	Coke	West	STgo	85.0
P H Robinson 1-4	Galveston	Houston	STg	2265.0
Paint Creek 1-4	Haskell	West	STgo	217.0
Rio Pecos 4A-5	Crockett	West	CCgo	42.0
Rio Pecos 6	Crockett	West	STgo	98.0
Victoria 4-6	Victoria	South	STgo	491.0



Wind additions based on input from Ken Donohoo

- **TCA proposes the following wind additions based on**
 - Renewable requirements of 2000 MW by 2009 as specified by the CBCG
 - Those already announced
 - Where Ken suggests development will take place and given the transmission capacity

Table 5: Wind Generation

Project/Location	County	Zone	Install Date	Size (MW)
Existing wind plants (post 1999)	Various	West	2001-2003	1027.8
Silverstar	Eastland	West	May 2004	225.0
Sweetwater Wind 2	Nolan	West	May 2005	400.0
Culberson County Wind 1	Culberson	West	May 2006	175.0
Near McCamey	Upton	West	Jan 2008	100.0
Near San Angelo	Runnels	West	Jan 2009	75.0
Total 2001-2009				2002.8



RMR Treatment

- **Based on input from ERCOT that RMR units current meet local congestion needs only,**
- **TCA proposes treatment variations between the base case and change cases**

Base Case

- **Dispatch based on congestion needs**
- **Payments based on marginal cost, consistent with TCA's other OOME payments (recognizing contract payments outside the market results)**
- **Units kept operational for duration of the study (unless CBCG or ERCOT states they are not needed after some date)**
- **Model reporting of profitability [-] will serve as metric for contract payments**

Change Cases

- **Dispatch based on congestion needs**
- **Payments are based on LMPs (no contract payments are assumed)**
- **Based on the assumption that sufficient market signals exist to entice new generating units, RMR units will be retired if uneconomical**
- **New units will be added as the economical model parameters dictate**



Transmission System Assumption Enhancements

- **Distinction made between > 69 kV and ≤ 69 kV**
 - We're hopeful we can mirror the ≤ 69 kV constraints that ERCOT planning and operations folks use in their evaluations
- **Special Protection Schemes noted**
 - TCA will assume SPSs are effective and will relax the constraints impacted accordingly
- **Switchable loads**
 - TCA intends to emulate the modeling strategy ERCOT planning staff use to model these loads
 - Implementation of this approach requires some further clarification of the bus data provided by ERCOT



Environmental Modeling Assumption Enhancements

- **Environmental modeling has been further specified based on extensive discussions with Cantor Fitzgerald and discussions with TCEQ**
- **Further details of Dallas Area counties have been forwarded to TCA**
- **One significant open issue remains:**
 - How to value the Dallas area allowances given that there has been no liquid trading in that area to provide a price forecast basis



DC Tie modeling has been proposed in detail in memo

- **The East DC tie at Oklaunion - modeled as 8,000 BTU/kWh gas generator**
 - MCPE or LMP < the 'marginal cost' of this generator => 660 MW of export from ERCOT
 - MCPE or LMP > the marginal cost => an import of 600 MW
- **The North DC tie at Oklaunion - modeled as an 8,000 BTU/kWh unit, similar to the East tie, but with a 200 MW capacity in each direction.**
- **The existing South DC tie in Maverick County will be modeled as zero flow.**
- **The proposed DC tie at Laredo will be modeled as a 12,000 BTU/kWh gas unit, but will run only as an import.**
 - => flow = zero unless the price signal would justify running the equivalent gas generator, in which case 150 MW of import is simulated.
- **Switchable resources are modeled as in the ERCOT market**
- **Additional info needed: The ERCOT EIA-411 shows firm imports from Southwestern Electric Power Company and USCE Tulsa District through 2013 and indicates firm exports to Oklahoma Municipal Power Authority and the Public Service Company of Oklahoma through 2013.**
 - Need to know if these are transactions over the DC links, and if so, the temporal variation in these transactions, if any



Reserves

- **TCA proposed reserve requirements based on discussions with ERCOT staff and “ERCOT Methodology for Determining Ancillary Service Requirements”**
 - Installed Capacity = 12.5%
 - Operating Reserves = 4600 MW
 - Quick start = 1250 MW
 - Spinning = 3350 MW



Review: What additional input is needed on Assumption memo items?

- **From TCA:**

- Follow-up to obtain wind capacity and schedules
- Proposed treatment of Dallas area allowances
- Finalized counties for Dallas attainment area

- **From ERCOT Staff/Stakeholders:**

- From ERCOT Staff:
 - Some load information and mapping of busses within Northern zone
 - Review of TCA Thermal Generation Database (timeline TBD)
 - Support regarding constraints modeling
 - Additional guidance on flows with neighboring areas in response to EIA 411
- From CBCG/Stakeholders:
 - Hydro schedules (from LCRA)
 - Provide input on value of coal fuel diversity – if any
- All: Review of balance of TCA-proposed assumptions



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Three Primary Fuel Types

- **Gas**
- **Oil**
- **Coal – By plant by fuel type –
purchased price forecast**



Gas is most complex

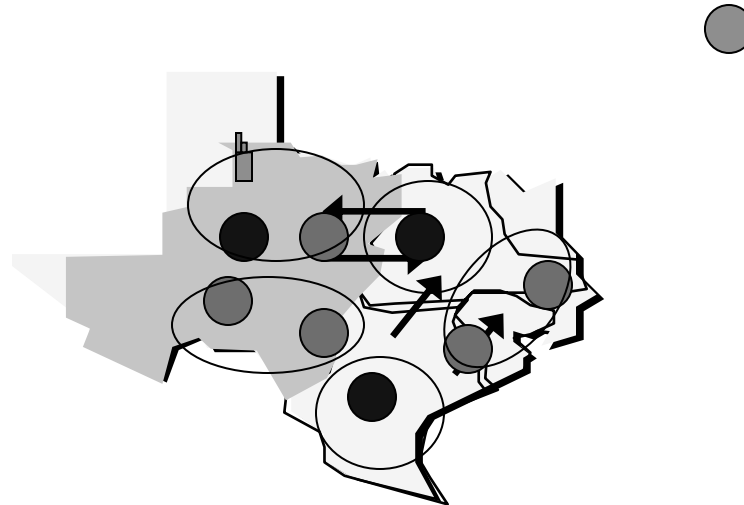
- **Commodity forecast at Henry hub**
- **Basis differentials to trading points**
- **Local delivery price to generating plants**

- **Let's look at these in more detail**



Henry Hub prices provide the commodity forecast from published sources

Henry Hub

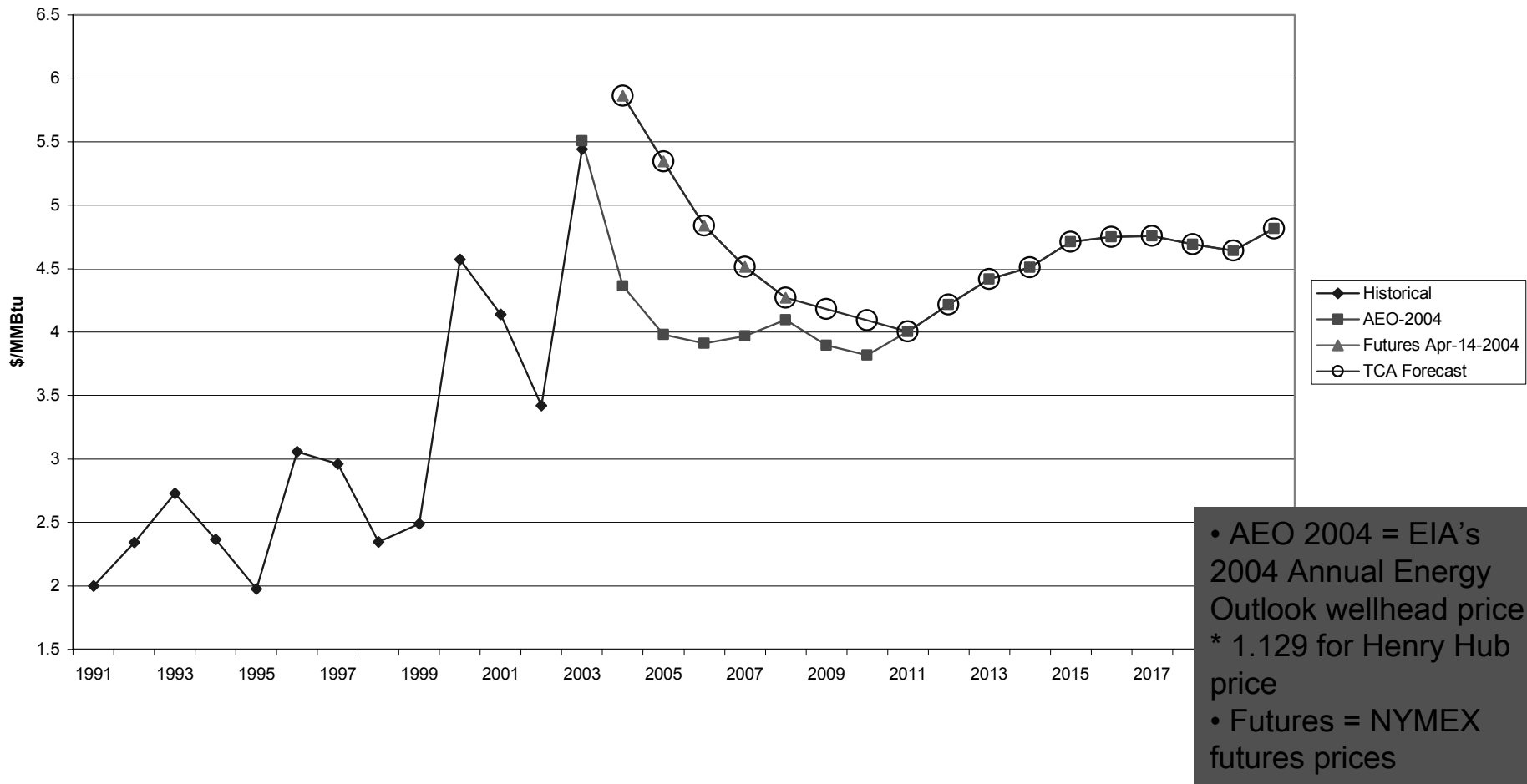


- **Henry Hub prices are used to as a base commodity forecast**
- **TCA uses a combination of EIA's forecast (short term)**
- **NYMEX futures prices (long-term)**
- **(See next)**



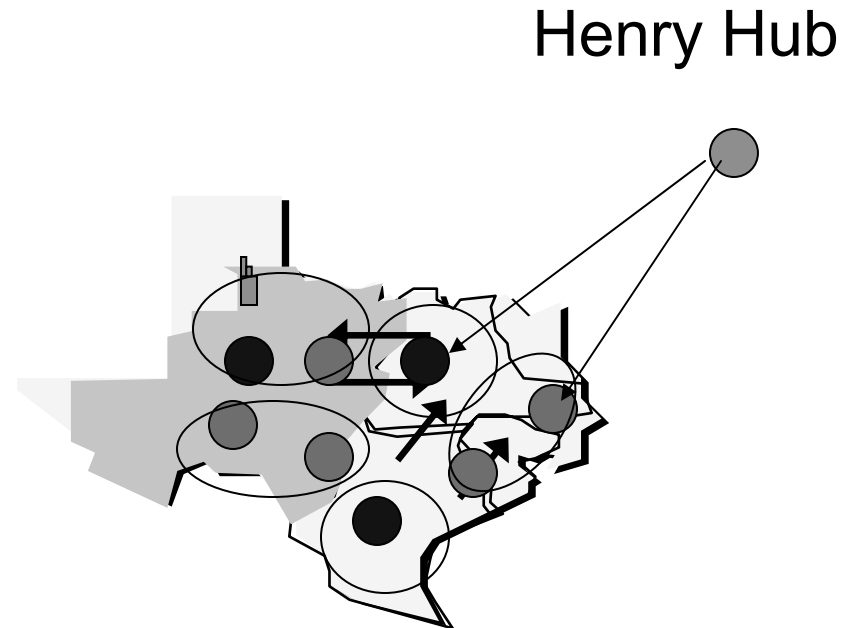
Hub prices are from published sources

Figure 2. Natural Gas Spot Prices at Henry Hub: History and Projections (2003\$/MMBtu)



TCA uses swap prices and historical relationships to get Regional pricing points

- **For regions where NYMEX ClearPort Swap clearing prices are available, TCA uses those 2005 swap prices to determine regional prices**
- **TCA uses regression analysis to determine – based on the historical relationships – the prices at other pricing points with respect to the NYMEX points**
 - Two models are used: one for summer months and one for winter months



Results showing pricing sources

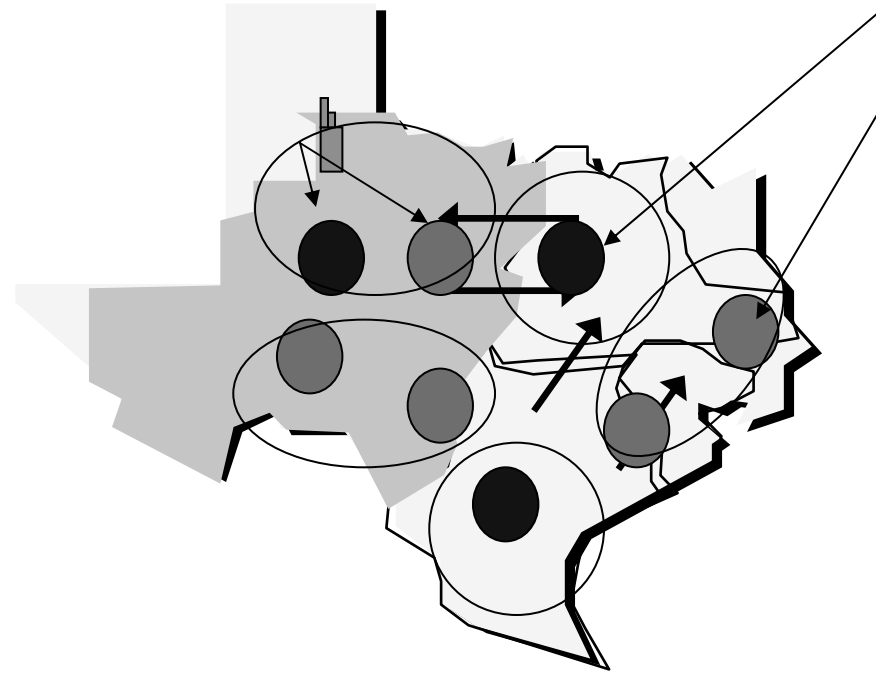
Table 3: Mapping of Trading Points to NYMEX ClearPort Hubs

No.	Trading Point:	NYMEX Hub used for Trading Point Regression	
		Summer	Winter
1	Agua Dulce	TETCO South Texas	Houston Ship Channel
2	Carthage	MidCon	MidCon & Houston Ship Channel
3	El Paso Permian	Direct from NYMEX ClearPort	
4	Houston PipeLine	Houston Ship Channel	
5	Houston Ship Channel	Direct from NYMEX ClearPort	
6	Katy	TETCO South Texas	
7	Lone Star	MidCon	Houston Ship Channel
8	MID 1-6	Permian	
9	NGPL, STX	TETCO South Texas	Houston Ship Channel
10	WAHA	Direct from NYMEX ClearPort	
11	MidCon	Direct from NYMEX ClearPort	



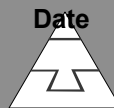
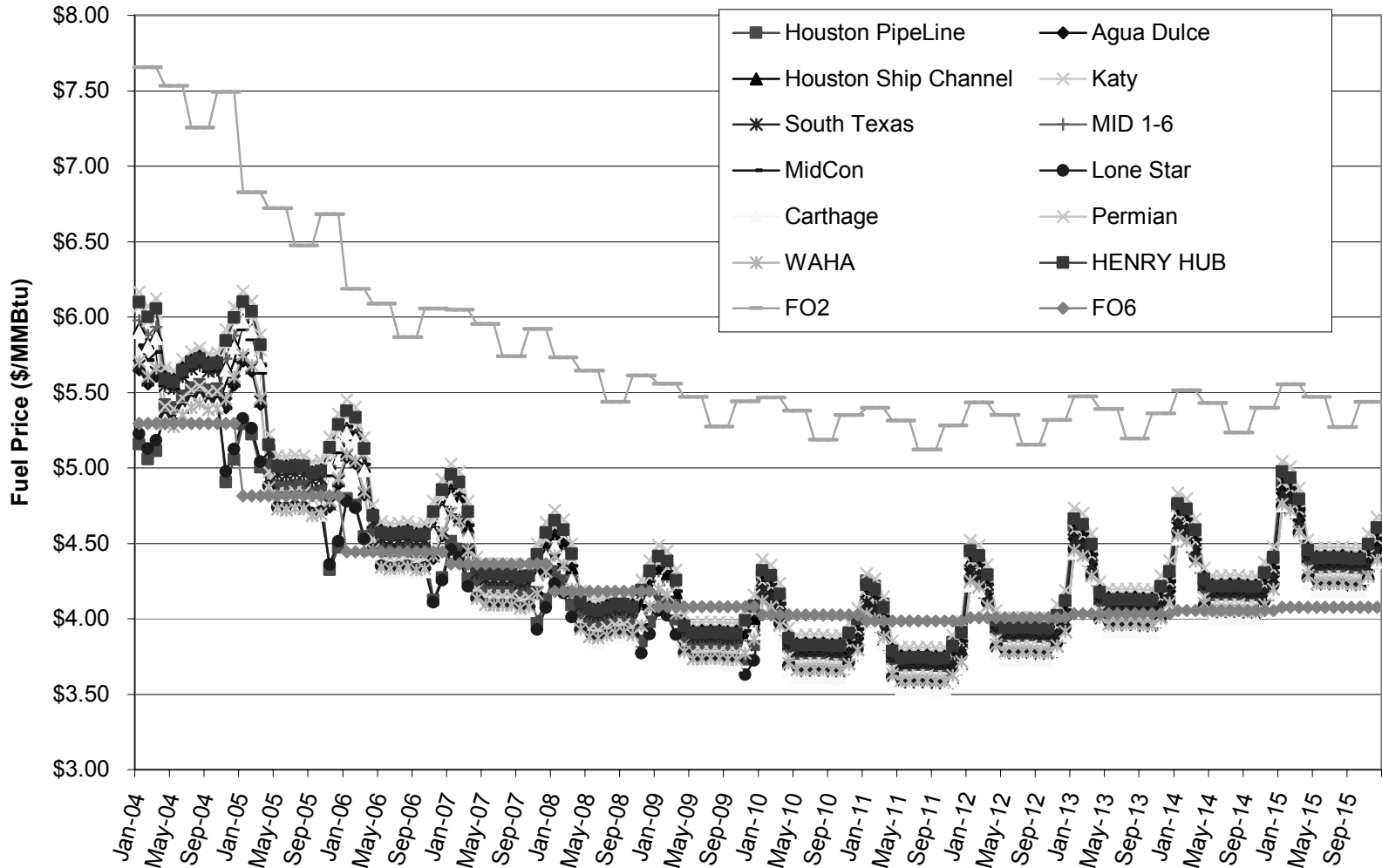
Counties are mapped to one or two trading points, local distribution costs are added

- **If a county maps to one trading point the trading point's regional price is used for each generator in the county**
- **If two pricing points are contained within a county the average is used**
- **Table 2 shows a mapping of counties to trading points**
- **Local delivery prices of \$0.10 /MMBtu for older plants and \$0.07/MMBtu for new plants (>1998) to generate burner-tip prices**



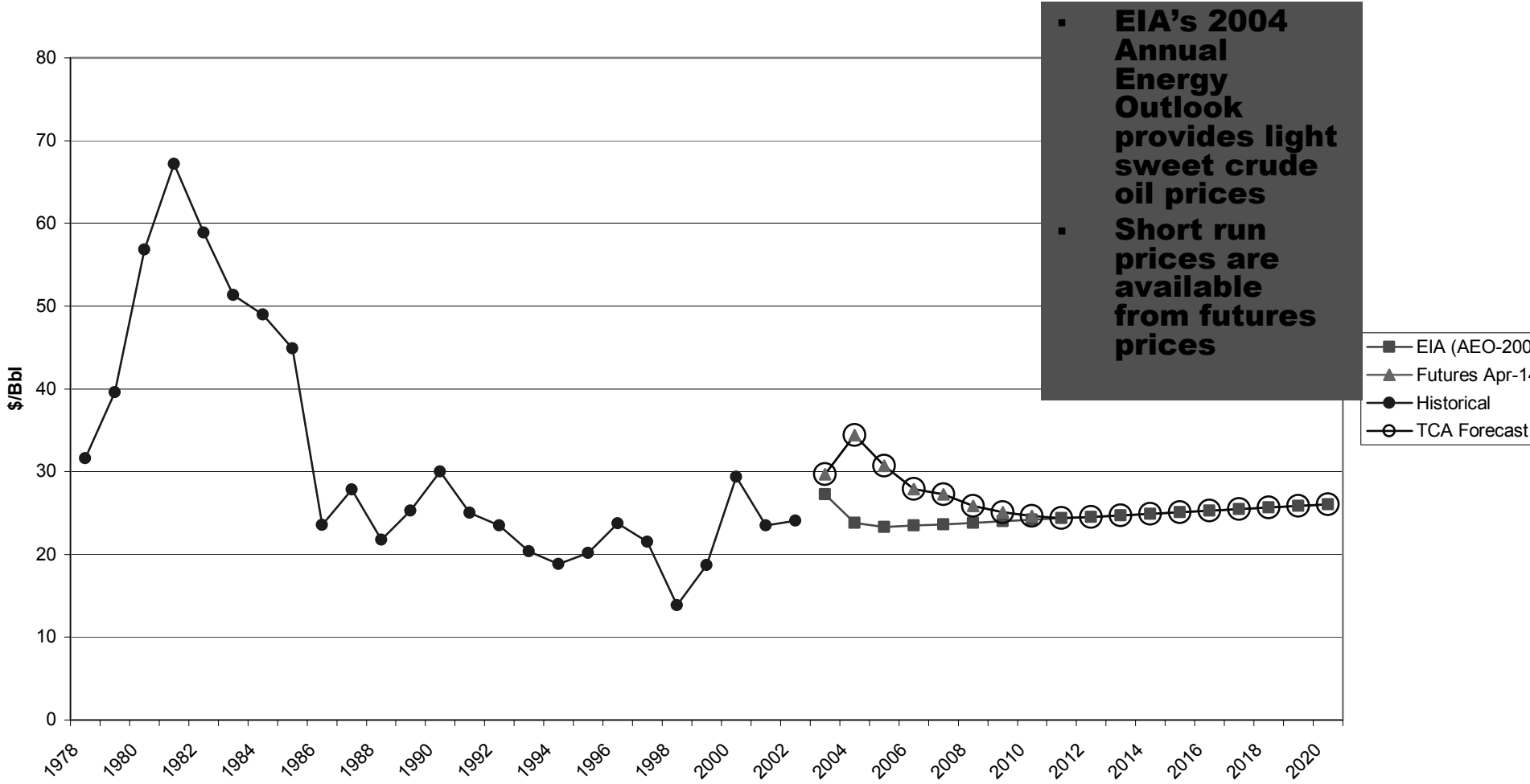
Regional pricing results:

Figure 3 Comparison of Regional Monthly Natural Gas Prices (2004-2015)



Oil prices are based on commodity forecasts

Figure 1. Crude Oil Prices: History and Projections (2003\$/BBL)



- **EIA's 2004 Annual Energy Outlook provides light sweet crude oil prices**
- **Short run prices are available from futures prices**



TCA uses basis differentials to determine location-specific prices

- **TCA assumes single price for ERCOT**
- **In-house regression model which links crude oil prices with #6 and #2 fuel oil prices**
- **State-specific prices from EIA Form 423 data for 1997 – 2000 and historical New York harbor prices provides a basis differential for oil in Texas**
- **TCA assumes a slight season pattern for #2 fuel oil and assumes the price of #6 oil is flat throughout the year**

Table 1: Fuel Oil Basis Differential

	Basis Differentials (\$/MMBtu)	
FO2	\$	0.37
FO6	\$	0.81



Questions?

- **Any questions on the fuel price methodology?**



Next steps?

- **TNT meeting on 4/26**
- **CBCG on 5/4**
- **Final assumptions input needed on 5/6 to freeze assumptions on 5/7**
- **How can TCA help facilitate the finalization of the assumptions?**



Near-term Milestones are Critical

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
March	28	29	30	31	1	2	3
April	4	5	6 CBCG Meeting	7	8	9	10
	11	12 Core Data Due to TCA	13 Core Data Frozen	14	15	16	17
	18	19 Draft Assumptions from TCA	20	21	22 Draft Assumptions from TCA. CBCG meeting	23	24
May	25	26 TNT review of Assumptions (EW phone in?)	27	28	29	30	1
	2	3	4 CBCG Meeting	5	6 Assumptions Feedback due to TCA	7 Assumptions frozen	8

