



TABORS CARAMANIS & ASSOCIATES

MEMORANDUM

TO: ERCOT

FROM: Bruce Tsuchida, Alex Rudkevich, Tabors Caramanis & Associates (TCA)

SUBJECT: Fuel Price Forecast for the ERCOT Region

DATE: April 22, 2004

This memo documents the ERCOT Cost-Benefit study fuel price forecast. The source of coal price data is provided, and the TCA forecast includes prices for natural gas, distillate (#2) and residual (#6) fuel oil. All price figures used in this memo are as of April 14, 2004 and are meant for illustration purposes. The fuel forecast will be updated using the most recent available data once the methodology is agreed upon.

Coal Prices

TCA's simulation will employ a coal price forecast licensed from RDI. Coal forecasts are unit-specific and based on RDI's research about coal supply sources for each unit. TCA will provide coal data associated with each coal facility with its database of generators to ERCOT staff for review.

Natural Gas and Fuel Oil Prices

Geographical Markets

The forecast covers the entire ERCOT region.

Basis Forecasts

The key underlying forecasts are projected prices for crude oil (Light Sweet Crude) and for natural gas (Henry Hub and other regional hubs). All other forecasts are derived from these two basic forecasts using projected and/or historical basis differentials as explained later in this memo.

Note that all prices are in real 2003 US dollars.

The results of TCA's forecasts are provided in the accompanying Excel workbook.

Figure 1 presents TCA's proposed forecast of crude oil prices, together with historical prices, NYMEX futures prices for the light sweet crude oil (as of April 14, 2004), and a long-term forecast for crude oil prices from EIA's *Annual Energy Outlook 2004*. As one can see in the figure, the proposed forecast is a composition of futures prices in the near term (2003–2010) and EIA's forecast in the long term (2011–2020). Similarly, Figure 2 presents TCA's proposed forecast of the spot price of natural gas at Henry Hub, together with average NYMEX futures prices (as of April 14, 2004) and a long-term forecast from EIA's *Annual Energy Outlook 2004*.¹

¹ AEO-2004 does not forecast Henry Hub price, instead it predicts prices at the wellhead. A historical multiplication factor of 1.129 is used to derive the Henry Hub price forecast. .



The proposed forecast is a composition of futures prices in the near term (2003–2008), and EIA's long-term forecast in the long term (2011–2020). The forecast prices for the interim years (2009–2010) are interpolated.

Figure 3 presents a regional comparison of the natural gas prices along with the prices for #2 and #6 fuel oil.

Natural gas prices – methodology

TCA forecasts natural gas prices for the following trading points in Texas:

- Agua Dulce
- Carthage
- El Paso Permian
- Houston Pipeline
- Houston Ship Channel
- Katy
- Lone Star
- MID 1–6
- NGPL, South Texas
- WAHA
- NGPL, Mid Continental

Generators are mapped to these trading points based on the county in which the gas-fired generating unit is located. A county could be mapped to one or two trading points. In the former case, the gas delivered into that county is priced at the corresponding trading point price. In the latter case, the gas price for that county is assumed to be the average of the two trading point prices.

The generator-to-county mapping is based on the ERCOT 2003 Capacity Demand and Reserve Annual Report May 2003. Table 1 shows the mapping of counties to trading points.

The location-specific gas prices are generated based on several components.

1. The burner-tip price for natural gas is a sum of two components: the regional price at one of the above trading points and local delivery price. The regional price is the sum of the forecast price at Henry Hub and the basis differential from the Henry Hub to the trading point.

For new gas-fired plants, the local component is assumed to be \$0.07/MMBtu to reflect pipeline lateral charges. For older plants, a local delivery charge of \$0.03/MMBtu is further added to this local component. Thus the estimated deliverability burner-tip component for the older plants would be \$0.10/MMBtu (\$0.07/MMBtu pipeline lateral charge + \$0.03/MMBtu local delivery charge).



2. For selected trading points, forward basis differentials are available directly from NYMEX ClearPort (NYMEX Hubs). For example, Houston Ship Channel forecasts are obtained by applying the Houston Ship Channel Swap clearing of the NYMEX ClearPort to the Henry Hub futures. Thus, Houston Ship Channel is NYMEX Hub. For future years where no clearing exists for the NYMEX Hub, TCA scales the last available year's data by the Henry Hub gas price. For example, if the 2008 forecast is needed for the Houston Ship Channel while the basis differential is only available to 2005 from the NYMEX ClearPort Swaps, then TCA will scale the 2005 basis differential by the Henry Hub price ratio between 2008 and 2005.
3. For other trading points that are not NYMEX Hubs, TCA selects those NYMEX Hubs that are best correlated with these trading points. To forecast prices for such trading points, TCA uses an in-house regression model, which correlates historical regional prices to prices at NYMEX Hubs. For example, Katy pricing point, while reported by Gas Daily, is not a NYMEX Hub. TETCO South Texas trading point, however, is both reported by Gas Daily and is a NYMEX Hub. TCA regresses historical basis differentials between Katy and TETCO South Texas to prices at TETCO South Texas. Then the regression results are applied to the TETCO South Texas forward prices, which are calculated from the NYMEX ClearPort Swap clearings and Henry Hub futures prices as described above, to forecast the basis differential from the TETCO South Texas to Katy. Finally, this derived basis differential is added to the TETCO South Texas hub forward price to calculate the forward price for Katy. For each trading point, TCA uses two regression models, one for summer months (April through October) and one for winter months (November through March). Table 2 shows the mapping of Texas trading points to NYMEX ClearPort Hubs.



Table 1: Mapping of Counties to Trading Points

County	Trading Points		County	Trading Points
Atascosa	Houston Ship & NGPL, STX		Kaufman	Houston Ship & Carthage
Bastrop	Houston Ship & NGPL, STX		Lamar	Houston Ship & Carthage
Bexar	Houston Ship & NGPL, STX		Limestone	Houston Ship & Carthage
Bosque	Houston Ship & Carthage		Llano	Houston Ship & NGPL, STX
Brazoria	NGPL, STX		Matagorda	NGPL, STX
Brazos	Houston Ship & Carthage		Maverick	MID 1-6
Burnet	Houston Ship & NGPL, STX		McLennan	Houston Ship & Carthage
Calhoun	NGPL, STX		Mitchell	MID 1-6 & El Paso Permian
Cameron	Houston Pipeline		Nolan	MID 1-6 & El Paso Permian
Chambers	Houston Ship		Nueces	Agua Dulce
Cherokee	Lone Star		Palo Pinto	MidCon
Coke	MID 1-6 & El Paso Permian		Parker	MidCon
Coleman	MID 1-6 & El Paso Permian		Pecos	MID 1-6
Collin	Houston Ship & Carthage		Presidio	MID 1-6 & WAHA
Comal	Houston Ship & NGPL, STX		Red River	Houston Ship & Carthage
Crockett	MID 1-6		Robertson	Houston Ship & Carthage
Dallas	Houston Ship & Carthage		Rusk	Lone Star & Carthage
Denton	MidCon & Carthage		San Patricio	Agua Dulce
Ector	MID 1-6		Somervell	Houston Ship & Carthage
Ellis	Houston Ship & Carthage		Starr	Houston Pipeline
Fannin	Houston Ship & Carthage		Tarrant	MidCon
Fayette	Houston Ship & NGPL, STX		Taylor	MID 1-6 & El Paso Permian
Fort Bend	NGPL, STX		Titus	Houston Ship & Carthage
Freestone	Houston Ship & Carthage		Tom Green	MID 1-6
Frio	Houston Ship & NGPL, STX		Travis	Houston Ship & NGPL, STX
Galveston	Houston Ship		Val Verde	MID 1-6
Goliad	NGPL, STX		Victoria	NGPL, STX
Gonzales	Houston Ship & NGPL, STX		Ward	MID 1-6
Grayson	Houston Ship & Carthage		Webb	Houston Pipeline
Grimes	Houston Ship & Carthage		Wilbarger	MidCon
Guadalupe	Houston Ship & NGPL, STX		Young	MidCon
Hardeman	MidCon		Liberty	Katy
Harris	Katy		Nacogdoches	Carthage
Haskell	MID 1-6 & El Paso Permian		Howard	MID 1-6 & El Paso Permian
Hays	Houston Ship & NGPL, STX		Culberson	MID 1-6 & WAHA
Henderson	Lone Star		Jeff Davis	MID 1-6 & WAHA
Hidalgo	Houston Pipeline		Upton	MID 1-6
Hood	Houston Ship & Carthage		Jack	MidCon & Carthage
Hunt	Houston Ship & Carthage		Wise	Houston Ship & Carthage
Johnson	Houston Ship & Carthage		Winkler	MID 1-6
Jones	MID 1-6 & El Paso Permian			



Table 2: 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	

4. Seasonal patterns are developed as follows:

For both the NYMEX ClearPort swap and Henry Hub futures, TCA estimates the seasonal pattern based on the last year swap/futures pattern for which swap/futures prices were used. For other pricing points, regression models are applied monthly, resulting in monthly prices for these pricing points.

Fuel oil prices – methodology

TCA assumes that fuel oil prices do not vary by region within Texas. To derive fuel oil prices for electric generation, TCA employs an in-house linear regression model, which links crude oil prices with #6 and #2 fuel oil in the Northeastern United States (New York Harbor). For petroleum prices in Texas, TCA used state-specific basis differentials derived from the EIA Form 423 data for 1997–2000 and historical spot prices for #2 and #6 fuel oil at New York Harbor. Table 3 shows these basis differentials. TCA assumes a modest seasonal pattern for #2 fuel oil prices. Prices for #6 fuel oil are assumed to be flat.

Table 3: Fuel Oil Basis Differential

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