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Electricity Markets Analytics

Specifying the delivery point of energy under MRTU is critical as it impacts several aspects of your business and influences efforts to optimize your assets. Utility companies are facing greater regulatory oversight, record fuel prices, higher operating costs, overseas competition, and incentives for renewable energy. Below is a brief description of the delivery risks associated with MRTU and the services ZGlobal Inc. can offer to minimize these risks while helping you prepare to more effectively compete in the complex electricity sector.

Daily Business Support

ZGlobal Inc. provides daily on and off site technical advice, supporting your staff on the Real Time, Hour Ahead, and Day Ahead energy markets in California. Assistance includes Real Time supplemental energy, utilization of adjustment bids, wheeling, linking congestion and curtailment priorities, and ancillary services imports. We also provide a technical review of the impact of various components of settlements charges and their financial and operational effects.

Delivery Risks

Under the new California and Texas Modal Markets, the delivery risks associated with energy require comprehensive assessment. For instance, under CAISO MRTU, ownership of Point to Point (PTP) Congestion Revenue Rights (CRRs) entitles the holder to be paid the difference in the congestion components of the locational prices between the specific point or points of receipt and the specified point or points of injection. PTPs are directional and may be defined either as obligations or options.

PTP obligation holders will be entitled to receive payments based upon the difference in the congestion components of the locational prices when those differences are positive, and will be obligated to make payments when the locational differences are negative. It should be noted that when the difference in locational prices is negative, a transmission customer is paid for scheduling transmission between the points specified in the PTP. Therefore, there is no net cost for scheduling transmission services matching the PTP held by the transmission user, regardless of whether the difference in locational prices is positive or negative. PTP option holders will be entitled to receive payments based upon the difference in the congestion components of the locational prices when those differences are positive, but will not be obligated to make payments when the locational differences are negative.

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PTP CRRs that are defined as obligations are essential in maximizing efficient use of the grid. In essence, an obligation means that the holder may either have to pay the marginal cost of re-dispatch or provide the re-dispatch itself, in which case it will be paid the difference in locational prices. In either situation, the counter-flow schedules associated with the obligation rights function to relieve constraints within the system and allow other schedules to flow in the opposite direction. A system that offers at least some rights in the form of obligations will therefore expand access to the grid, allowing more transmission rights to be allocated and additional schedules to flow.

As new business rules change the way energy contracts and transactions are scheduled, traded, and settled, the role of uplift charges, marginal losses, and other charges becomes increasingly important. In many cases, these changes in the energy sector will have significant financial impact and likely require significant adjustments in today's business practices. To mitigate these potential impacts, ZGlobal Inc. can provide business rule definitions, explanations, settlement examples, and crucial information in other areas of specific interest as needed to support our clients. Issues of concern may include topics such as:

- Bid Mitigation - When, why, and how mitigation occurs. Bid adder rules.
- Bidding Rules - Validations, RA Resources, Ancillary Services (A/S), restrictions to changes.
- Market Power Mitigations - Full assessment of various CAISO Day Ahead mitigation rules and how these rules work.
- Self Scheduling - Market treatment, opportunity for change schedules and settlements implications.
- Trades - Physical and financial trades. Explain the rules of trade, how to schedule, and how the money flows.
- Congestion Revenue Rights (CRR) - Transmission allocations, CRR auctions, transmission risk, and how to alleviate congestion and marginal loss risks.
- Reliability Unit Commitment (RUC) - Bidding requirements and allocation of costs.



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- Resource Adequacy and Local Capacity Requirements - Explain the various components and integration of Reliability Must Run, the Reliability Service Capacity Tariff (RSCT) under the FERC Must Offer, Resource Adequacy, and Local Capacity Requirement.

ZGlobal Inc. provides assistance in better understanding the risks and rules impacting business in the energy market. We explain business rules and settlement practices and supply references to relevant CAISO and ERCOT Tariff and Business Practice Manual sections. Additionally, we report on CAISO and ERCOT market and infrastructure development, tariff filings, and major WECC, ERCOT, and PUC activities. Through an assortment of reliable methods, we impart current and pertinent knowledge that gives our clients a valuable advantage in the field.

Asset Valuation and Financing

A required responsibility within every successful business is asset valuation. Gas prices, market changes, and regulatory uncertainty place added pressure and importance on achieving the bottom line for both existing and planned assets within the electricity sector.

Critical tasks associated with asset valuation include the assessment of market dynamics, regulatory risks, discount rates, options, profitability measures, and transaction costs. Adequate execution of these tasks requires a sophisticated understanding of electric transmission planning and operation, engineering, and finance with in-depth knowledge of the energy industry.

With a unique combination of experience in market and grid analysis, forecasting, and commodity pricing, the ZGlobal Inc. team is well positioned to evaluate existing assets and operations of businesses participating in the California and Texas markets.

Strategic Planning

Globalization, deregulation, and competition are three essential trends in which ZGlobal Inc. staff share a multitude of experience. Often times, unprepared companies react to change and associated risk with avoidance in an effort to buffer themselves against the unknown. However, greater success may come from a more proactive and open-minded attitude. ZGlobal Inc. works with your team to develop and refine your business model and regulatory strategies, become more familiar with new product markets and processes, and better face the stressors associated with changes and business trends while flourishing in the industry.

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Regulatory Support

ZGlobal Inc. provides a monthly report summarizing various market developments, tariff filings, and activities in the West, including frequency of congestion, location, system configuration, impact of outages on congestion, and seasonal energy flow patterns. We prepare periodic technical examination of key design and policy changes that have material impact on your “bottom line.” We advise your management personnel of specific regulatory and business assessment subjects associated with future market developments of California, ERCOT, the Pacific Northwest, Southwest and Province of Alberta. This sort of information can assist your organization in better positioning itself for success in several related markets.

The Federal Energy Act of 2005 emphasized the role of the Federal Government in the reliability of the nation’s electric transmission grid. This Act placed mandatory reliability standards on utilities, grid operators, and suppliers. Members of the ZGlobal Inc. team are certified to ensure that our client’s personnel are adequately trained, thorough processes are in place, and documentation is sufficient to support compliance with the mandatory reliability standards.

Regulatory risks connected to potential changes in the law can negatively impact investments and existing assets. Utilities, suppliers of electricity, marketers, and brokers have to comply with a multiplicity of regulations and standards from many different entities, such as:

- Federal Energy Regulatory Commission (FERC)
- Northern Electric Reliability Corporations (NERC)
- Public Utility Commissioner (PUC)
- California Independent System Operator (CAISO)
- Electric Reliability Council of Texas (ERCOT)
- Western Electric Coordinated Council (WECC)

ZGlobal’s familiarity and practical experience with these regulatory policies put us in a unique position to assist you in better managing and complying with the full range of regulations present in today’s business environment while concurrently working to help ensure an effective balance between existing market risks and your business objections.

Transmission and Generation Economic Analysis

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ZGlobal’s technical expertise in the areas of calculation of LMP prices for energy, transmission losses, and congestion is central to the services we provide. ZGlobal Inc. has developed *eGrid*^{™ 1}, an essential tool used to perform economic analysis that can accurately estimate the financial impact of MRTU on your operations. *eGrid*[™] employs the same optimization software utilized by CAISO and applies a similar methodology while modeling all major transmission constraints to produce multiple year calculations of LMP prices at each node. With the use of *eGrid*[™], ZGlobal Inc. is able to model CAISO transmission constraints when calculating potential congestion cost and marginal losses at each bus while hydro output, gas prices, load and generation patterns, outages, and bidding patterns are concurrently varied. This type of intelligence is critical in planning ahead and assessing the magnitude and type of risk your organization could be exposed to. For support in planning your successful future, ZGlobal Inc. offers the following:

- In depth analysis using analytical methodologies to better estimate your asset opportunities based on LMP prices and provide comprehensive information about vital issues relating to the LMP variations.
- Quantified financial and operational impacts associated with accurately projected exposure of CAISO MRTU and the Texas Nodal Market on your organization’s current and future operational strategies.
- Correct settlements forecasting based on the charge codes and type for various transaction fees.

Example of Economic Analysis:

Consumer Benefit, Producer Benefit, and Transmission Owner Benefit

In a two-zone model, Zone 1 and Zone 2 are connected by a transmission line with capacity. Suppose we plan to expand the line limit to $T + \Delta T$ and would like to measure the benefit resulting from this expansion. The line may still be congested even after expansion. With the transmission expansion, it is

¹ ZGlobal Inc. Inc. has developed a tool that models all transmission systems within the CAISO, replicates the transmission constraints and various operating procedures, and uses a commercial optimization engine (PLEXOS) to calculate LMP prices at all nodes while simultaneously varying hydro output, gas prices, load and generation pattern, outages, and bidding patterns. *eGrid*[™] is also able to take the LMP, decompose prices, and calculate E-z Gen Hub prices and Load Aggregation Points (LAP) for each hour. *eGrid*[™] calculates congestion, marginal cost, and various transaction costs for multiple points of injection and withdrawal.

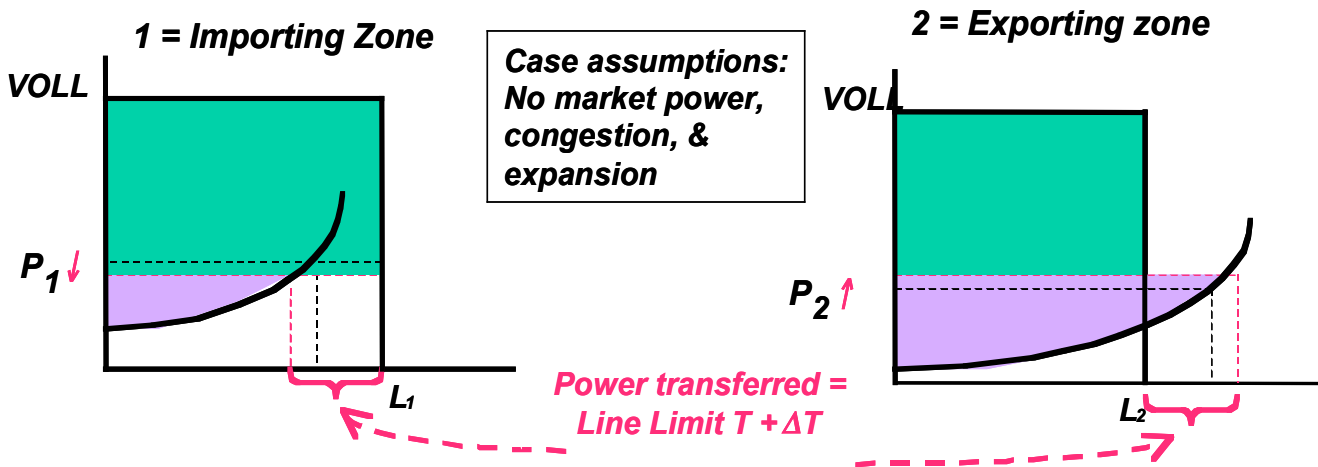
likely that generators in Zone 1 will produce less output and generators in Zone 2 will produce more output than they would without expansion. It is also likely that the price in Zone 1 will be lower and the price in Zone 2 will be higher when compared to the non-expansion case.

In order to quantify the impact of transmission expansion on welfare, the following needs to be done:

- Compute all welfare measurements (i.e., all surpluses) for cases with and without expansion.
- Subtract surplus without expansion from surplus with expansion.
- Obtain the net impact of transmission expansion on surpluses.

We call the change in surpluses, caused by a transmission expansion, the “transmission benefit.” Figure 1 shows how consumers and producers in each zone are benefited or harmed by a transmission upgrade in this two-zone example.

Figure 1: Transmission Upgrade Benefit in the Two-Zone Example



If the amount of power transferred from Zone 2 to Zone 1 is increased, then consumers in Zone 1 may benefit from a lower price and consumers in Zone 2 may be harmed by a higher price.

$$\Delta CS_1 = -\Delta P_1 * L_1 > 0$$

$$\Delta CS_2 = -\Delta P_2 * L_2 < 0$$

However, producers in Zone 1 are harmed as a result of having less of their output dispatched and from receiving a lower price for their dispatch. On the other hand, producers in Zone 2 benefit from expansion due to having more of their output dispatched and from receiving a higher price for their dispatch.

$$\Delta PS_1 = \Delta PR_1 - \Delta PC_1 < 0$$

$$\Delta PS_2 = \Delta PR_2 - \Delta PC_1 > 0$$

Transmission owners (or CRR holders) of the line may or may not benefit from expansion depending how much the flow is increased and how much the price difference is changed.

$$\Delta CR = CR_w - CR_{w/o} = (\Delta P_1 - \Delta P_2) * T + \Delta T * (P_{1w} - P_{2w})$$

If the line is no longer congested with expansion, Transmission owners (or CRR Holders) may have a net loss.

The method of calculating consumer benefit, producer benefit, and congestion revenue benefit can be generalized from the simple two-zone model and applied to the complicated California network. One way to check the validity of the partitioning of total benefits among different market participants is to check whether the following identity holds at the system level:

$$SB = -\Delta PC = \Delta CS + \Delta PS + \Delta CR$$

Therefore, the first step in benefit evaluation of any transmission or generation project is to make sure the total societal benefit calculated can be correctly disaggregated into three major components: consumer benefit, producer benefit, and transmission owner (or CRR holder) benefit. If the project's total societal benefit exceeds its total project cost, the project is beneficial to society as a whole. However, such a project may not benefit everybody as some market participants will benefit while others may not. Thus it is important to further examine the distributional impacts of a transmission project on the various market entities. The project developer will evaluate the client's benefits and costs and decide whether or not the project would be of benefit.

Wholesale Energy Settlements and Transaction Evaluation

Every participant in the energy industry, whether they are one who buys or sells, must settle their energy transactions. A settlement statement should contain the charge or payment information for a market participant. The ZGlobal Inc. team is skilled and qualified in analyzing a range of charges, performing shadow settlements, and tracing errors within the following:

- Grid Management charges
- Wheeling, Imports, Exports, and Market Uplifts
- Congestion, Transmission Losses, and Congestion Revenue Right (CRR)
- Energy, Ancillary Service, Capacity, Reliability Services, and Trades

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- Imbalance Energy
- Allocation Methodology

eGrid™ Capabilities

The eGrid™ tool is intended for use by market participants to perform an economic analysis that estimates projected transaction costs of the MRTU design for their planned operations. This financial intelligence is critical for entities in planning ahead and assessing the magnitude and types of risk they may be exposed to while operating within the Nodal Market. As a sample, the information provided by eGrid™ can be used to perform the following studies and analysis:

- Estimate market participant exposures to LMPs and provide more comprehensive information on the various aspects surrounding those exposures.
- Develop strategies for CRR allocation and auction.
- Forecast electricity costs to ratepayers.
- Quantify financial and operational exposure of the Nodal Market on current and future operations.

The eGrid™ tool is capable of performing the below listed modeling features:

- Integrated Optimal Power Flow (OPF) and Generator Unit Commitment
- Simulation of entire WECC Network
- Explicit modeling of contracted power and generation terms and provisions
- Extensive Generator Unit Commitment parameters
- Hydro and Pumped Storage optimization

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- Forced and Maintenance outage optimization
- Emissions parameters and calculations
- Combined Energy and Ancillary services optimization
- Contract specificity
- Capacity and Generation
- Endogenous New Generation entry
- Nodal and Zonal depiction and calculation
- Generation Nomograms
- Conversion of industry standard load flow data formats (e.g. PTI, PSLF)

By using eGrid™, ZGlobal Inc. has the ability to evaluate all of your existing contracts and any future contracts or investments, calculate the energy, congestion, marginal losses and CAISO transaction costs, estimate the resource adequacy and capacity value of these assets, and quantify your potential transaction costs. eGrid™ can therefore produce the following outputs:

- Point to Point transactions
- Point to Hub and Hub to Point transactions
- Hub to Hub transactions
- Individual and total cost for each transaction
- Hourly, seasonally, yearly, and multi-year calculations
- CRR obligation exposure

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- Value of CRR Options and CRR Obligations
- Locational value of generation and transmission
- Value of participating Load and Demand Response
- Calculation of CAISO and ERCOT market uplift charges per transaction

Study Selection		
CASE	2008 CAISO LMP Basecase	
Month	May	
Period	Peak	

Day Ahead Transaction Costs (Trade Hour)				Hour Ending	15
Transaction Details		FROM	TO	Quantity (MW)	
Transaction		Palo Verde	SP15	100	
LMP (\$/MWh)		75	85		
Marginal Costs		Price	Cost		
Energy (\$/MWh)		75	\$ 7,500.00		
Congestion (\$/MWh)		4	\$ 400.00		
Losses (\$/MWh)		6	\$ 600.00		

Transaction Cost Notes:

- 1) Transaction costs reflect energy, congestion and loss cost for selected "from" location and "to" location and user-entered quantity.
- 2) LMPs are for the selected Trading Hour in the LMP basecase year, time period and/or sensitivity scenario.
- 3) "From" and "To" locations are per defined pricing nodes (PNodes) in the relevant market.

Study Selection	
Scenario Filename	may_transactions
Description	Forecasted transactions for month of May.

Notes:

- a) Settlement Charge rates summarize the total per MWh cost for the location types contained in the entered Scenario file and based on the conditions in the selected CASE.
- b) Real Time prices calculated if deviation scenario provided in the file data.
- c) Cost Recovery Allocation rates are currently based on historical or user-defined costs as submitted via the scenario file. Emissions rate per published rate.
- d) Costs based on published rates.

Settlement Charge Rates ^(a) (\$/MWh)						
Location Type	In-area Generator	In-area Load	Locational Load	Import	Export	Trades
Day Ahead Market						
Forward Market Settlement	\$71.52	72.08		65.19		
Energy	71.98	71.98		71.98		
Congestion	-1.62	0.66		-4.47		
Losses	1.17	0.44		-2.32		
Loss Surplus Allocation	0.00	1.19		n/a		
Trades	1.00	TBD				71.87
Real Time Charges^(b)						
In-area Generator				Import	Export	Trades
Instructed Energy	1.5					
Uninstructed Energy	1.75					
UFE	0	1.1				
Congestion Offset	0.75	0				
Imbalance Energy Offset	1.1	0				
Cost Recovery Allocation^(c)						
In-area Generator		In-area Load	Locational Load	Import	Export	Trades
Forward Market Tier 1 Allocation	TBD	no data		TBD	TBD	0.00
Forward Market Tier 2 Allocation	TBD	no data		TBD	TBD	0.00
Unit Commitment Tier 1 Allocation	TBD	0.15		TBD	TBD	0.00
Unit Commitment Tier 2 Allocation	TBD	0.31		TBD	TBD	0.00
Emissions Allocation	TBD	0.04		TBD	TBD	0.00

ISO Access and Administrative Costs ^(d) (\$)						
Access Charges	In-area Generator	In-area Load	Locational Load	Import	Export	Trades
HV Wheeling	n/a	2.93	2.93	2.93	2.93	2.93
LV Wheeling	n/a	1.87	1.87	1.87	1.87	1.87
Grid Management Charges						
In-area Generator		In-area Load	Locational Load	Import	Export	Trades
Core Reliability Services - Peak Load	0.91	0.91		0.91	0.91	0.91
Core Reliability Services - Off-Peak Load	0.91	0.91		0.91	0.91	0.91
Core Reliability Services - Export Energy	0.00	0.00		0.00	0.54	0
Energy Transmission Services - net withdrawals	0.29	0.29		0.29	0.29	0.29
Energy Transmission Services - net injections	0.32	0.32		0.32	0.32	0.32
Energy Transmission Services - Deviations	0.65	0.65		0.65	0.65	0.65
Energy Transmission Services - PIRP	0	0.74		0	0.75	0
Forward Scheduling	1.01	1.01		1.01	1.01	1.01
Forward Scheduling Trades	1.01	1.01		1.01	1.01	1.01
Market Usage - Forward Scheduling	0.75	0.75		0.75	0.75	0.75
Market Usage - Instructed Energy	0.66	0.66		0.66	0.66	0.66
Market Usage - Uninstructed Energy	0.66	0.66		0.66	0.66	0.66
Settlements, Metering, Client Services						