The Physical Rights Model for Transmission Access

Summary of Presentation to the
NWRTO Congestion Management Working Group

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June 7, 2000

Purpose of Presentation

- **Describe the physical rights model for transmission access, as *generally* proposed for implementation in the Mountain West Independent Scheduling Administrator (MWISA) and the Desert STAR ISO**

- **<u>Caveats</u>:**
  - **Mountain West ISA has unique characteristics: two physically-unconnected control areas; and the boundaries of each control area are the same as the boundaries of the congestion zones**
  - **However, the Mountain West model was generalized to a multi-zone model in the Desert STAR working groups**
  - **The DSTAR ISO model is still being debated**
    - **Authority of the ISO vs. authority of incumbent control area operators in the dispatch of ancillary services**
    - **Details of ancillary services and balancing energy markets**
  - **For brevity, this presentation generalizes both the MWISA and DSTAR approaches and discusses both the "zonal" and "flowgate" approaches**

The Physical Rights Model: Objectives

- **Provide truly non-discriminatory access using efficient, market-based mechanisms**
- **Maximize opportunities for efficient decentralized decision-making (access and pricing) by market participants**
  - **Market-driven processes which rely on continuous trading between market participants will always be more efficient than model-driven central "optimization" programs operated by an RTO**
  - **Essential conditions**
    - **Transparency of RTO processes (RTO models, pricing and operations)**
    - **Unbundling of energy, transmission and ancillary services**
    - **RTO requirements (ancillary services and losses) conveyed ex ante**
    - **Reliance on continuos markets in which market participants may trade energy, transmission and ancillary services - up to and into real-time**

The Physical Rights Model: Objectives

- **Minimize the RTO's role in (and interference with) forward energy, transmission and ancillary services markets**
  - **Institutions (RTOs) should not do anything that can be done efficiently by markets**
  - **Coexistence between RTO-operated "markets" and real markets is not possible**
    - **RTO-operated "markets" will ultimately lead to complete rebundling of energy, transmission and ancillary services because that is the only way that RTOs can centrally-"optimize"**
    - **If RTOs operate "markets" in competition with the marketplace, they will always discriminate in favor of their own markets and against their competitors' markets. They will view markets as *competitors* and threats to the RTO**
  - **RTO-defined "markets" necessarily restrict markets and products in the markets, creating barriers to innovation, efficiency and liquidity**

Physical Rights Model: Prerequisites

- **Minimize RTO role in pricing and decision-making**
  - **No role or interference in forward energy markets**
  - **No role in transmission market, except to bring transmission rights to marketplace**
  - **No "accept all schedules," in which RTO acts as a energy broker**
  - **No role in forward ancillary services markets, except as "provider of last resort" and for unanticipated real-time conditions**
- **Firm transmission rights (FTRs) must be defined and released to the marketplace**
- **RTO model must adopt reasonable commercial simplifications of grid operation**
  - **No different than FedEx, United Airlines gas transport…**

Physical Rights Model: Prerequisites

- RTO scheduling protocols must accommodate continuous markets operating close to real-time
- Important premise: efficient external-to-the-RTO markets will exist
  - Transmission Exchanges
  - Power Exchanges
  - Ancillary Services Exchanges

  If these markets do not come into existence on their own, the RTO will ensure that they exist by issuing an RFP for creation of such markets

Preferable for the RTO to "jump-start" external markets rather than to "design" an internal "market" based on central "optimization" rules

Evolution of the Model

- The various models being implemented in the Western Interconnection are closely-related. They are the products of continuing evolution
- 1996-1997: CA ISO
  - Unbundled PX from ISO
  - Many attributes of physical rights model… but much complexity because CA retained many aspects of the financial rights model as well
  - 1997-1998: IndeGO
  - Many attributes of physical rights model… but "accept all schedules" placed ISO in the role of a central broker of transmission rights, and added complexity and ISO interference with the market
  - 1998-1999: MWISA
  - Physical rights model applied to simple, two-zone system
  - 1998-2000: DSTAR
    - Physical rights model applied to multi-zone system
  - 2000: NWRTO
    - Physical rights model with flowgate implementation?
    - CAISO/ DSTAR could also adopt such an approach, eliminating many seams issues

The Physical Rights Model

- **Commercially-significant congestion:**
  - **Managed by attributing related costs to grid users**
  - **Grid users acquire FTRs**
    - **In zonal model, these are zone-to-contiguous zone rights**
      - **Zones are defined based on commercially-significant paths**
    - **In flowgate model, these are rights to schedule on commercially-significant paths**
- **All other congestion (small, unpredictable, system not in normal state…):**
  - **Managed by the grid operator**
  - **These costs are allocated to all grid users through an uplift (or to transmission owners, in return for performance-based ratemaking)**

The Physical Rights Model

- Define transmission facilities that experience commercially-significant amounts of congestion
  - "Inter-zonal interfaces" (CAISO, MWISA, DSTAR)
  - "Commercially-significant constraints" (ERCOT)
  - "Flowgates" (IndeGO, APX, NWRTO?)
- In the zonal approach: define zones as regions of the grid that are separated by inter-zonal interfaces/flowgates
- In the flowgate approach, define zones as regions of the grid in which incremental injections (or withdrawals) have substantially-similar impacts on the flows across flowgates
- The two approaches are very similar, and each has advantages and disadvantages

The Physical Rights Model

- If costs of managing congestion that occurs within a zone become commercially-significant: define a new zone
- If costs of managing congestion that occurs on a path that is not a flowgate becomes commercially-significant: define a new flowgate
- Objective is to have a reasonable balance between:
  - Simplicity of the commercial model (to enhance trading and liquidity (i.e., efficiency)
  - Reasonably small amounts of congestion cost treated as uplift
  - Consistency of the commercial model and the operations model
- These same tradeoffs are made in every other industry

The Physical Rights Model: FTRs

- **RTO auctions 100% of the Firm Transmission Rights (FTRs)**
  - **TTC minus capacity that must be reserved for Existing Contracts**
    - **Existing Contracts are contracts that obligate the Participating TO to provide service to an entity other than another Participating TO**
    - **Existing Contracts do *not* include set-asides for the TO's affiliated retail energy merchant**
      - **"Native load" uses are fully-protected by allocating FTR auction revenues to the native load**
- **FTRs are rights to schedule from zone-to-zone (or in the flowgate approach, rights to schedule the use of flowgates)**
  - **Long-term release (e.g., at least one year in advance) to marketplace**
  - **Continual release (month-ahead, week-ahead, day-ahead) to the marketplace of any additional capacity that cannot be made on a long-term basis but can be made available on a shorter-term basis due to system conditions**

The Physical Rights Model: FTRs

- **FTRs are rights to schedule and flow - they are *not* "financial rights"**
  - **FTRs are required in order to submit schedules that use inter-zonal interfaces or flowgates**
  - **If FTRs are not scheduled day-ahead, the RTO releases the associated unused transmission capacity to the marketplace as RTRs (Recallable Transmission Rights)**
  - **The FTR-holder can schedule the use of the FTR up to 60 (90?) minutes prior to real-time**
    - **If the FTR-holder does this, the RTO recalls an RTR**
    - **If not, the RTR becomes a firm right at 60 (90?) minutes prior to real-time**
  - **RTRs are sold to the marketplace on an "as-bid" basis**
    - **When RTRs are recalled, the RTRs which were sold for the lowest price are recalled first. Thus, an RTR purchaser's bid determines the purchaser's likelihood of having its right recalled**

The Physical Rights Model: FTRs

- **FTRs are tradable in continuously-operating secondary markets**
  - **The RTO does not make payments to FTR-holders, as would be the case in the financial rights models**
  - **Instead, the FTR-holder recovers the value of the FTR by:**
    - **Scheduling the use of the FTR**
    - **Selling the FTR to another grid user in a secondary market**
- **FTRs are *options* to schedule, not *obligations* to schedule**
  - **Can be used to schedule energy or capacity (ancillary services)**
  - **If the FTR-holder schedules an FTR, the holder is not exposed to congestion costs**
  - **If the FTR-holder does not schedule an FTR, the holder is not exposed to congestion costs (as would be the case in the PJM/NY/NE models)**

The Physical Rights Model: FTRs

- Revenues received by the RTO from auction of FTRs are credited to the parties who pay for the embedded costs of the transmission grid
- Crediting mechanism is designed to keep "native load" (and anyone else who contributes to the grid access charge) whole
- FTRs are "derated" for large disturbances which impact the Operating Transfer Capability of the interfaces
  - Similar to conditions under which transmission rights are derated today
- FTR holders are protected against impacts of small disturbances, modeling errors and other phenomena which would otherwise reduce the ability to use the FTR
- RTO either buys-back FTRs or purchases counter-flows to keep FTR-holders whole
  - RTO's costs are passed on to the TOs or to those who pay the g rid

The Physical Rights Model: Scheduling

- **Scheduling Coordinators**
  - **Entities that want to use the grid do so through "Scheduling Coordinators"**
  - **Scheduling Coordinators are entities certified by the RTO to submit schedules**
    - **Must be able to follow RTO scheduling protocols**
    - **Must be able to respond to RTO operating instructions (7 *24)**
    - **Must be able to participate in the RTO's settlements processes**
  - **Every generator,load, energy services provider, aggregator, marketer, etc. that wants to use the grid must designate a Scheduling Coordinator**
  - **Any generator or load may, of course, be its own Scheduling Coordinator, provided that it meets the RTO's technical and financial certification requirements**
  - **Scheduling Coordinator concept makes retail access manageable: the RTO does not have to deal directly with thousands/millions of users**
  - **SCs are very similar to the entities who are currently entitled to submit schedules to transmission providers**

The Physical Rights Model: Scheduling

- The marketplace operates continuous-clearing exchanges
  - Power exchanges (PX)
  - Transmission exchanges (TX)
  - Ancillary Services exchanges (AX)
- There may be more than one of these exchanges
- These exchanges operate before the day-ahead scheduling deadlines and after the day-ahead scheduling deadlines
- Scheduling Coordinators use these exchanges (and bilateral trades) to acquire transmission rights, or to make buy-sell arrangements in lieu of transmission rights
- The latter arrangements are in essence arrangements for counterflows: the same types of arrangements which the RTO would have made if it performed an “accept all schedules” function
- The RTO posts transmission losses requirements and

The Physical Rights Model: Scheduling

- **The RTO operates a day-ahead scheduling *process*, not a "day-ahead *market*"**
  - **Scheduling Coordinators must submit *balanced schedules* to the RTO: production + transportation = consumption**
    - **Injections + allocated transmission losses = withdrawals + trades to other Scheduling Coordinators**
    - **Scheduling Coordinator must submit FTRs or RTRs which correspond to the Scheduling Coordinator's use of inter-zonal interfaces or flowgates**
    - **Scheduling Coordinators encouraged - but not required - to self-provide their pro rata shares of ancillary services requirements**
    - **Unbalanced schedules are rejected**
    - **The RTO does *not* "accept all schedules" - i.e., the RTO does *not* broker trades between various Scheduling Coordinators**
  - **If a Scheduling Coordinator does not have the necessary transmission rights at the day-ahead deadline, it can acquire the rights from an Exchange after the day-ahead deadline and submit schedules to the RTO in the post-day-ahead scheduling process**

The Physical Rights Model: Scheduling

- After accepting balanced schedules, the RTO determines whether or not any residual congestion (intra-zonal congestion or non-flowgate congestion) exists
- If so, the RTO eliminates this congestion by purchasing incremental energy from Scheduling Coordinators and selling decremental energy to Scheduling Coordinators, using a cost-weighted minimum shift algorithm
- The RTO also procures from the ancillary services marketplace any additional ancillary services
  - Some Scheduling Coordinators may not have self-procured, or the RTO's needs may have increased
    - In the former case, the procurement costs are allocated to the individual Scheduling Coordinators who were deficient
    - In the latter case, the costs are spread to all grid users pro rata
  - The RTO does not operate an internal ancillary services procurement process

The Physical Rights Model: Scheduling

- The RTO's post-day-ahead scheduling process is a first-come, first-served continuous scheduling process
  - The RTO only accepts balanced schedules which would not create any additional transmission congestion
    - Alternative option: the RTO accepts *balanced* schedules with appropriate FTRs and RTRs; and the RTO deals with additional intra-zonal (or non-flowgate) congestion - but it charges these costs to the Scheduling Coordinator
    - This provides an incentive to parties to schedule in the day-ahead process
  - During this process, FTR-holders that did not use their rights may recall them for the purpose of submitting schedules
- The post-day-ahead scheduling process ends 60 (30? 90?) minutes before the start of the real-time operating hour

The Physical Rights Model: Real-Time

- Scheduling Coordinators may also change their schedules in real-time
  - Small changes (<25MW) can be made without notification
  - Larger changes require a request to the RTO, which will be granted as long as it does not cause real-time congestion
- After-the-fact, but before assessment of penalties (if any) for large imbalances, Scheduling Coordinators may net out (trade) their positive imbalances with Scheduling Coordinators with negative imbalances
- The RTO would only assess penalties (if any) for any residual large energy imbalances
- This allow Scheduling Coordinators to effectively trade with one another in real-time
  - An efficient real-time market could therefore be operated outside the RTO

The Physical Rights Model: Real-Time

- **Should the RTO assess any penalties for large energy imbalances (where energy imbalances are calculated on a zonal basis and are equal to a Scheduling Coordinator's total injection in a zone minus its total withdrawals in a zone)?**
- **If no, the RTO will be operating a deep, real-time energy market**
  - **This may be viewed as economically-efficient**
  - **But many view this as creating operational problems for the RTO**
  - **It also means that the RTO may need to acquire more reserves pre-real-time in order to be prepared to deal with large imbalances**
  - **If yes, the RTO's real-time market will be smaller**
  - **This may cause fewer operational problems and keep the RTO out of the forward markets**
  - **But this may create inefficiencies in the marketplace**
    - **This might be OK if the RTO allows a real-time market to operate, as described earlier**

The Physical Rights Model: Real-Time

- If the RTO *does* assess penalties for large imbalances:
  - The "deadband" (within which the RTO simply charges or pays for imbalance energy in a zone at the real-time clearing price for energy in the zone) must be wider than the Order 888 deadband
  - To facilitate intermittent resources
    - To facilitate retail access
- The RTO could also assess penalties for large scheduling errors, to incite Scheduling Coordinators to schedule most of their loads in the day-ahead process
- Here again, the tradeoff is between allowing as much flexibility as possible to grid users, and minimizing burdens on system operators
- Both MWISA and DSTAR allow for penalties for imbalances and for bad scheduling
  - Penalties are not punitive (10%, 20%…) and they are progressive
  - MWISA has decided to set the penalties equal to zero, with the

The Physical Rights Model: Real-Time

- In real-time, the RTO continually balances injections and withdrawals to meet NERC control performance standards
  - The RTO relies on the balancing energy that it obtains from the resources in the ancillary services stacks and from Scheduling Coordinators that have submitted Supplemental Energy bids
  - Also under discussion as a longer-term goal: an alternative approach in which the RTO would post continuously-changing prices for real-time balancing energy in each zone (prices changing every 30? seconds) and update those prices to achieve desired response
  - If the RTO has insufficient bids or insufficient ancillary services, it can use its authority - as a last resort after having exhausted all other approaches - to command grid users to respond

The Physical Rights Model: Real-Time

- **Under dispute in DSTAR: whether the RTO or the control area operators (CAOs)should dispatch the grid in real-time**
  - **If the CAOs perform dispatch, concerns include:**
    - **Inefficient dispatch (some generators incremented by CAO_1 at the same time that other generators are decremented by CAO_2, even when there is no congestion)**
    - **Balkanized, inefficient ancillary services markets and increased market power problems**
    - **Discrimination by CAOs that remain affiliated with other business functions**
  - **If the RTO performs dispatch, a hierarchical control scheme would be implemented:**
    - **RTO dispatches to a grid-wide Area Control Error**
    - **RTO sends dynamic schedules to each CAO to net out each CAO's Area Control Error**

Physical Rights Model: Summary of RTO Role

- RTO sells 100% of the physical capacity of the grid through release of FTRs to TXs
- RTO operates simple, continuous schedule acceptance and validation processes, *not* markets
  - No role in counterflow-based transmission capacity
    - This is handled by grid users through buy/sell commitments in PXs
- All parties, including the RTO, use TXs, AXs and PXs
  - No internal-to-the-RTO procurement processes
  - RTO's role as a "provider of last resort" of ancillary services: RTO simply acts as an agent for deficient grid users
- Dispatch of a residual real-time balancing energy and elimination of intra-zonal congestion:
  - Managed by the RTO, <u>not</u> Control Area Operators

How Does this Differ from IndeGO?

- Reduced RTO role and more reliance on markets
  - Physical scheduling rights
  - No “accept all schedules”
- RTO ensures existence of external-to-RTO exchanges (if necessary) rather than creating internal procurement processes for counterflows and for ancillary services
- MWISA and DSTAR are zonal, not flowgate… but the differences between the two are very small
- No pre-allocation of FTRs
  - Instead, FTR auction revenues are allocated to the parties who have entitlements and/or pay the grid access charge

The Physical Rights Approach: Summary

- **Why the physical rights approach is appealing:**
  - **Minimizes the RTO's role in the commercial marketplace**
  - **Manages access and pricing through markets, not models**
  - **Avoids the non-transparency and hyper-complexity of model-based RTOs**
- **Why the alternative (nodal pricing and financial rights approaches) are not appealing:**
  - **Must rely on central optimization programs which become more-and-more complex as they strive to mimic the complexity of the marketplace**
  - **Substitute a one-shot central-optimization program for all of the knowledge of all of the market participants as constantly updated through continuous trading**