London Economics International LLC

Review of potential alternatives to financial transmission rights

prepared for PJM ARR/FTR Market Task Force

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LEI asked to review alternative mechanisms to FTRs to address congestion overpayment by load under LMPs

Objective

Review alternative mechanisms to FTRs to address the issue of over-payment by load under a locational marginal pricing-based market system

Flowgate rights ("FGRs") alone would not solve the complexities of returning excess congestion payments to LSEs

- FGRs may be difficult to use for hedging point-to-point transactions
- FGRs never implemented in LMP setting

Other jurisdictions have relied on allocation schemes to return congestion payments to load (or offset other costs to load)

- Allocation schemes are rules-based and do not guarantee equitable distribution of excess congestion payments to LSEs
- In some of these jurisdictions, LSEs do not have a hedging instrument to manage locational price risk – but there is less need for such an instrument

Agenda

1	**Introduction**
2	Flowgate rights
3	Jurisdictions with nodal energy markets, without or with limited FTRs

- South American power markets
- New Zealand power market

LEI scope of work emerged as a result of specific request from OPSI

Research, summarize and analyze any other **existing or previously conceived mechanisms** that could be utilized to address the **problem** that required adoption of FTRs/ARRs as identified by LEI in its report entitled "Review of PJM's Auction Revenue Rights and Financial Transmission Rights."

The analysis of any such existing mechanisms should include a **discussion of the pros and cons of each mechanism from the perspective of load** who is most concerned with receiving optimal value from the system for which it funds.

What is the problem?

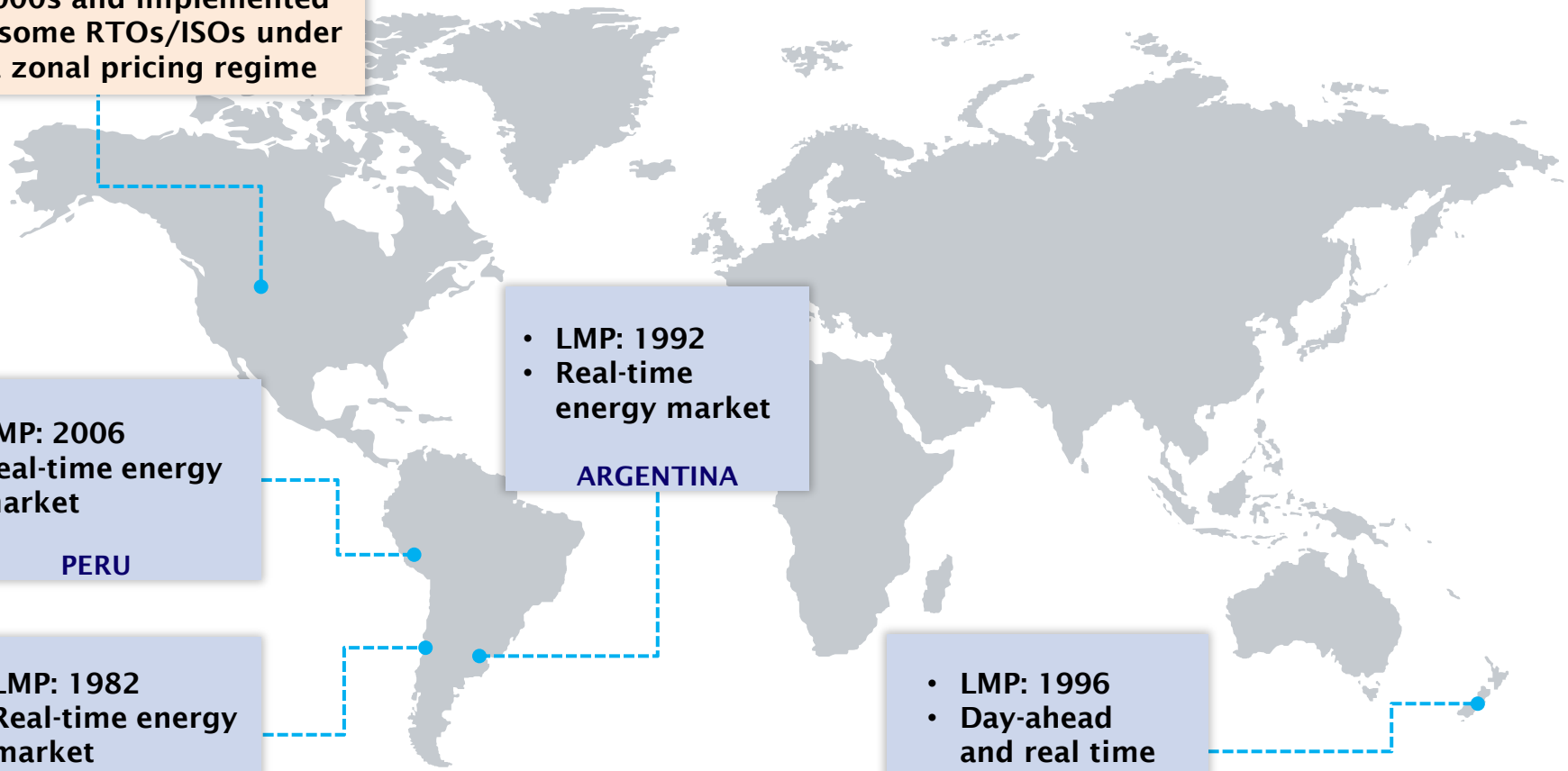
Congestion charges collected from load in LMPs exceeds the total congestion payments made to generators

What matters to load?

- **Are LSEs getting back the amount they overpaid?**
- **Are LSEs able to hedge congestion risk?**
- **How complex is the implementation?**

LEI reviewed the flowgate rights and the approach taken by other deregulated power markets that use LMPs in their spot market

Flowgates rights discussed by economists in the late 1990s to mid-2000s and implemented in some RTOs/ISOs under a zonal pricing regime



- LMP: 1992
- Real-time energy market

ARGENTINA

- LMP: 2006
- Real-time energy market

PERU

- LMP: 1982
- Real-time energy market

CHILE

- LMP: 1996
- Day-ahead and real time energy market

NEW ZEALAND

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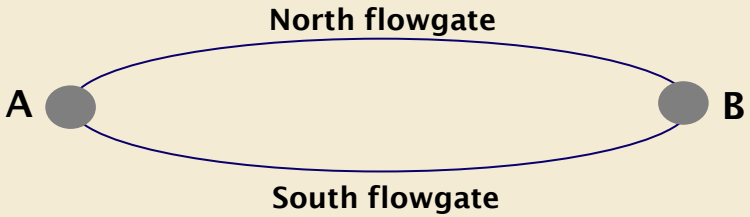
A flowgate is a transmission facility or a group of facilities that is associated with some power transfer capability

- An FGR holder receives congestion rents based on the shadow price associated with the transmission capacity on the flowgate at the time of congestion
- No experience with FGRs in a nodal pricing set-up, although FGRs were used under zonal market design

Simplified illustration of a Flowgate



FTR	FGR
Point-to-point	**Path-based**
FTR holder defines the specific FTR **based on the points (nodes)**	FGR holder specifies the FGR needed on a **transmission path** (e.g., holder determines if they want North or South flowgate)
FTR holder is entitled to the **congestion component difference in LMPs at point A versus point B**	Holder of North FGR is entitled to the **congestion rent based on the shadow price on North flowgate transmission line** in the west to east direction
A **simultaneous feasibility test ("SFT")** or optimization is conducted to determine amount of rights	**Technical analysis and power flow studies** are used to identify transmission constraints that are 'commercially significant' to derive the amount of FGRs

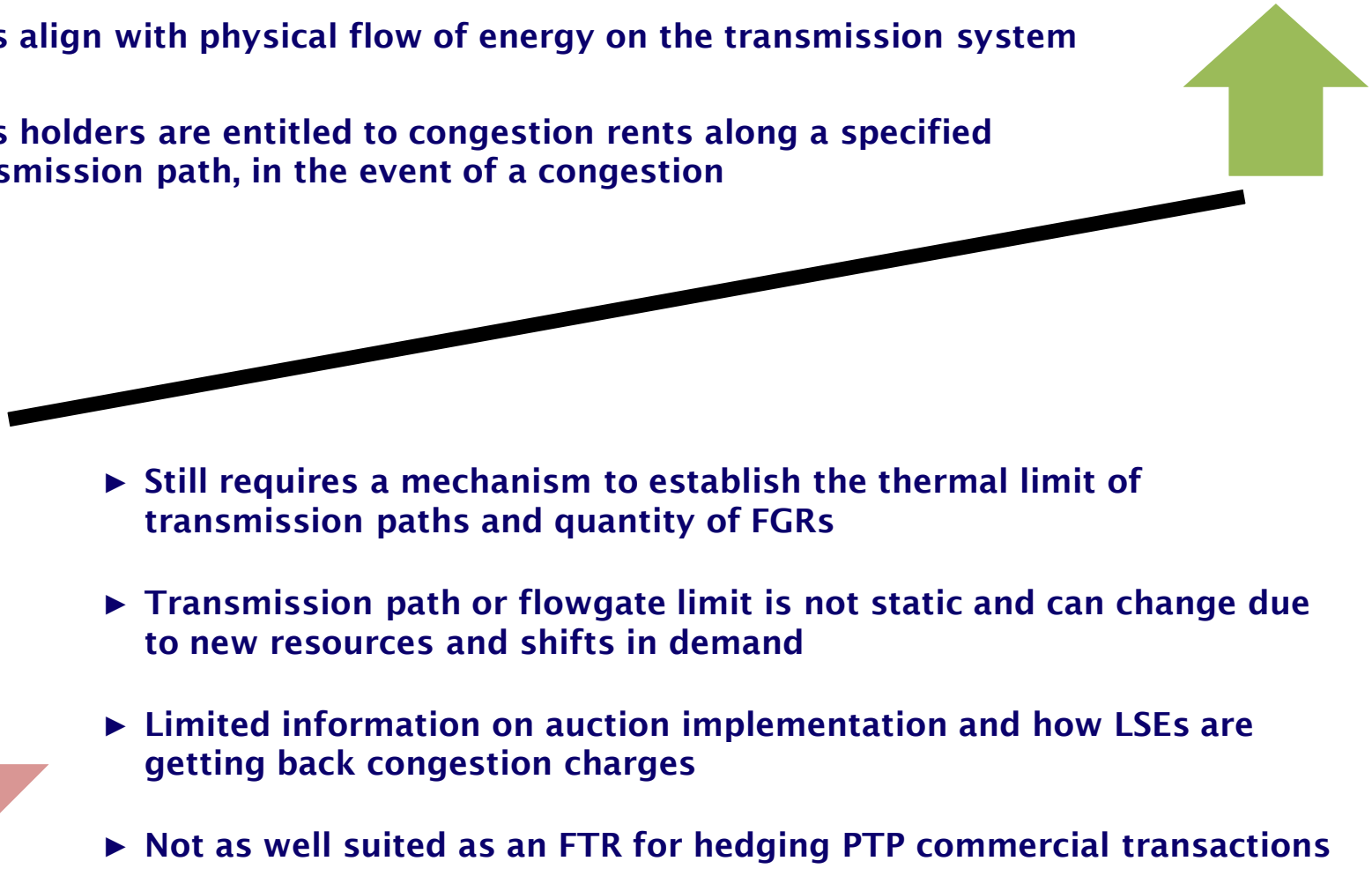
Application of FGRs has been debated amongst economists with no consensus on its implementation

Perspective shared by economists

Steps	Proponents	Opponents
Definition and identification of FGRs	• **No need for SFT** • Quantity of FGRs will **not depend** on the **network configuration** and **physical capacity limits**	• Definition of flowgates in a complex transmission system **may not be constant**
Allocation of FGRs	• FGRs initially intended to be **distributed** through **annual auctions**, and once distributed, these rights could be **freely traded** in **secondary markets**	
FGR as a tool to hedge actual commercial activity	• Number of FGRs needed to hedge is relatively **small and stable** • An FGR holder has the right to collect the congestion rent on a flowgate based on the **shadow price**	• Accurate **prediction** of congested flowgates would be a **challenge** • Creating a **viable hedge may not be possible**

FGRs never implemented in LMPs, but theoretical "cons" likely outweighed by theoretical "pros" for PJM

- FGRs align with physical flow of energy on the transmission system
- FGRs holders are entitled to congestion rents along a specified transmission path, in the event of a congestion



- Still requires a mechanism to establish the thermal limit of transmission paths and quantity of FGRs
- Transmission path or flowgate limit is not static and can change due to new resources and shifts in demand
- Limited information on auction implementation and how LSEs are getting back congestion charges
- Not as well suited as an FTR for hedging PTP commercial transactions

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South American power markets

New Zealand power market

Several South American countries have nodal spot markets, but do not use FTRs

- **Argentina, Chile, and Peru have a spot (real-time) energy market that uses LMPs and a forward contract market**
  - Load is contracted in advance in most of these countries; therefore, the relevance of the nodal spot market is reduced, as well as the meaningfulness of the exposure to congestion charges
- **FTRs are not used in these countries; but given LMP system, there are still overpayments (excess funds after settlement)**

Peru

- Congestion was disregarded from 2007 until 2016
- Congestion charges are paid to generators since 2016 (with an exception)

Chile

- Pre-2016, congestion charges were used to reduce transmission charges
- Currently, congestion charges are used to compensate negatively affected generators due to new transmission related issues

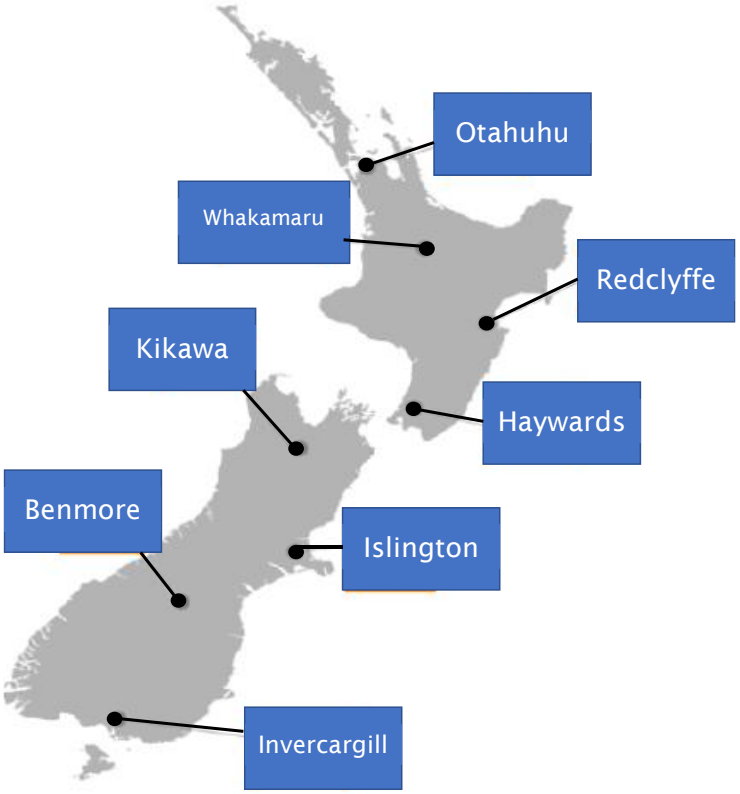
Argentina

- Congestion charges collected were initially used to reduce transmission charges
- From 1994 until 2017, they have been used to fund transmission investments

New Zealand has relied (mostly) on pro rata refund system for congestion charges collected in its nodal market

- **Full LMP market design was introduced in 1996, but without FTRs**
  - **Little congestion** and participants have **made their own arrangements**
  - Congestion rents were **allocated back to those parties paying for various parts of the transmission system** in proportion to peak load
- **Introduced FTR in 2013 to manage the risk of congestion and to promote competition in the industry**
  - Started with **two FTR "hubs" (nodes)** to manage **inter-island** locational price risk
  - Three **additional hubs were added** in 2014 to manage *both* inter-island and intra-island locational price risk
  - **Presence of gentailers** helped managed locational price risk
  - Congestion rent allocation for non-FTR nodes **continues to this day**

Key hubs in New Zealand



Allocation schemes used in South America and New Zealand may not work as well in PJM

- ✓ Transmission tariff design is not the same
- ✓ Market characteristics are different between PJM and these countries
- ✓ In most South American countries, electricity buyers marginally relying on the spot market
- ✓ New Zealand is dominated by vertically integrated companies (or gentailers)
- ✓ Replacing FTRs with an allocation scheme would take away LSE's choices around hedging and use of ARRs/FTRs

Pros

- Allocation schemes less complex than FTRs
- Congestion charges collected are return to load in the aggregate (directly or indirectly), but require settling on a set of rules or allocation factor(s) which some LSEs may not find equitable
- Does not require significant trading effort from market participants

Cons

- Congestion rents returned to load do not track actual transmission system constraints and level of congestion charges paid
- LSEs do not have a hedging instrument to manage locational price risk (except New Zealand)
- Assignment of congestion rents to promote transmission expansion benefits only future market participants (Argentina)