EnergyRisk Awards 2020 Winner Exchange of the year

FTR Clearing at Nodal Exchange

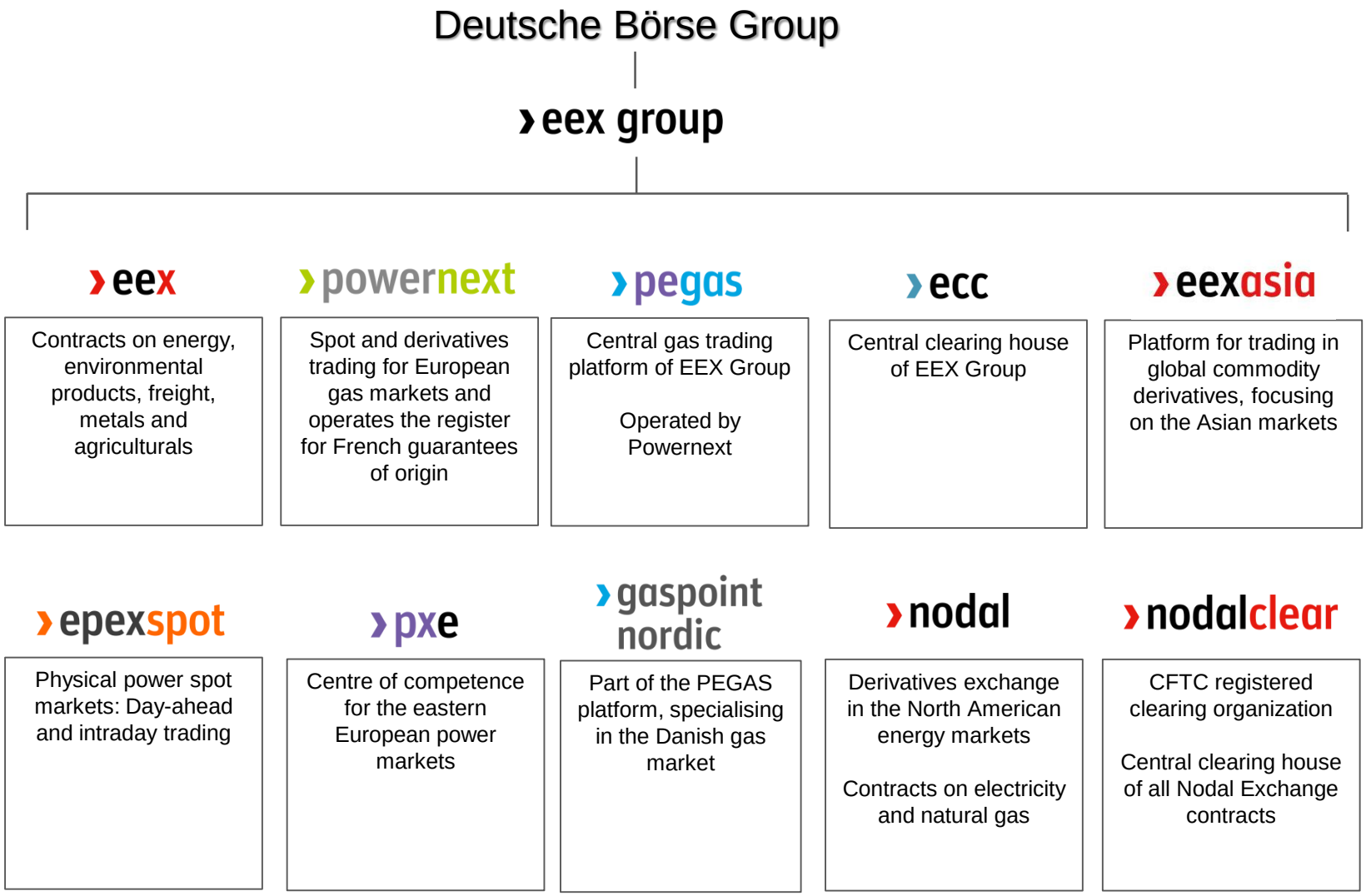
PJM FRMSTF

July 21, 2020

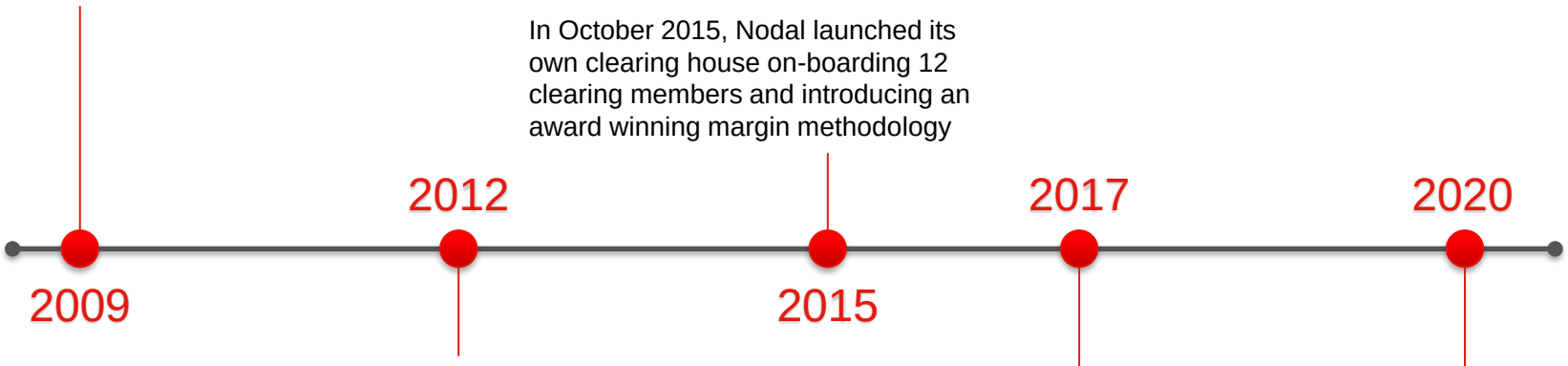
Nodal Exchange Overview

- **Commodity exchange**
  - Designated Contract Market under U.S. CFTC jurisdiction; all contracts are futures contracts
  - >50% market share of U.S. power futures open interest with over 1 Billion MWh
    - 59% market share of PJM power futures open interest end of June 2020
    - Growing quickly with 79% growth rate in traded volume in 2019 over 2018
- **Power, natural gas, environmental and trucking freight contracts**
  - Providing ability to trade power futures and options on hundreds of hubs, zones, and nodes across seven organized markets (and Mid-C)
    - ISO-NE, NYISO, PJM, MISO, ERCOT, SPP & CAISO
  - Natural gas futures and options contracts for Henry Hub
  - Environmental futures and options on renewable energy certificates, carbon and SO2/NOx emission allowances (largest set of environmental contracts in the world)
- **Multiple platforms:**
  - Nodal LiveTrade trading screen as well as Deutsche Börse Group's T7 matching engine with CQG front-end for select contracts
  - Block trades (e.g., broker) submission for clearing
- **All contracts are cleared by Nodal Clear using innovative portfolio margining**
  - Nodal Clear, LLC has been permitted to elect Subpart C under Part 39 of the Commodity Exchange Act
  - Nodal Clear was recognized as a third-country central counterparty by ESMA in March 2017
- **Nodal Exchange became part of the EEX Group on May 3, 2017; EEX Group is in turn part of the Deutsche Börse Group**

Nodal Exchange & Nodal Clear are part of a global exchange family



Nodal Exchange's History is Rooted in Granular Risk Management



Nodal Launches April 2009

First exchange to offer cleared nodal power futures with DC Energy, NextEra, and Macquarie Bank as shareholders

FTR Look-alike Contracts Added

In the spring of 2012 Nodal Exchange launched contracts to provide congestion only spreads to assist PJM participants looking to address underfunding risk

Nodal Clear is Launched

In October 2015, Nodal launched its own clearing house on-boarding 12 clearing members and introducing an award winning margin methodology

EEX Group Purchases Nodal

In May 2017, EEX Group, part of the Deutsche Börse Group, acquired Nodal Exchange & Nodal Clear

Nodal Largest Power Futures Exchange

On May 1 2020, Nodal had the largest congestion trading day in it's history and later in May Nodal became the largest power futures exchange in North America with the majority of open interest

About one year after the financial crisis storm, world leaders met to agree on a global solution…

The G-20 Leaders in Sep 2009 concurred that:

- *"All standardized OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties by end-2012 at the latest."*
- *"OTC derivative contracts should be reported to trade repositories."*
- *"Non-centrally cleared contracts should be subject to higher capital requirements."*

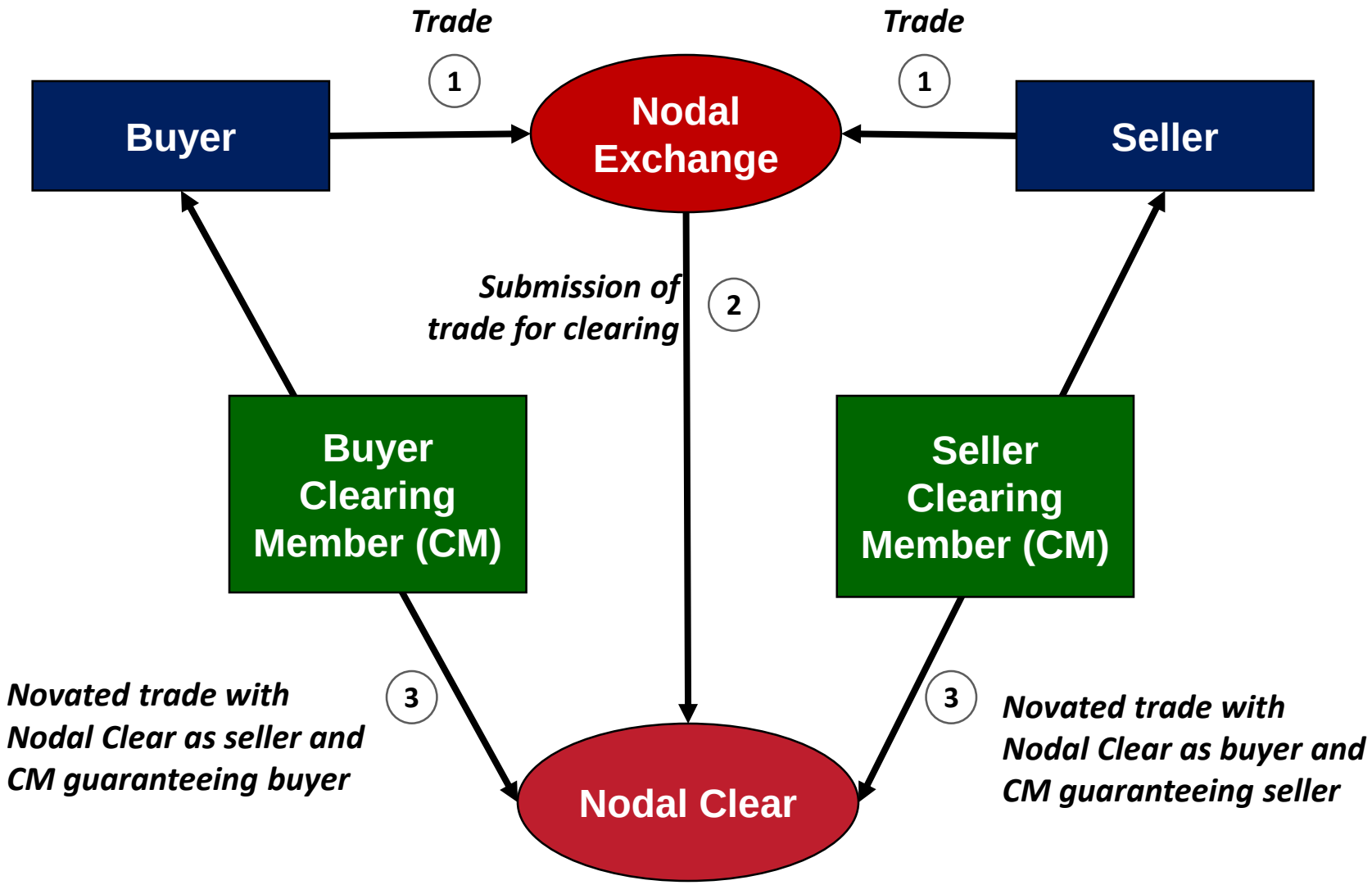
Risk management approaches to forward price, credit, and liquidity risk in energy markets

- **Bi-lateral/swaps trading**
  - ***Typically low to zero margin requirements in energy markets where risk is managed by direct counterparty credit limits***
  - ***Key Risk: Daisy chain of defaults***

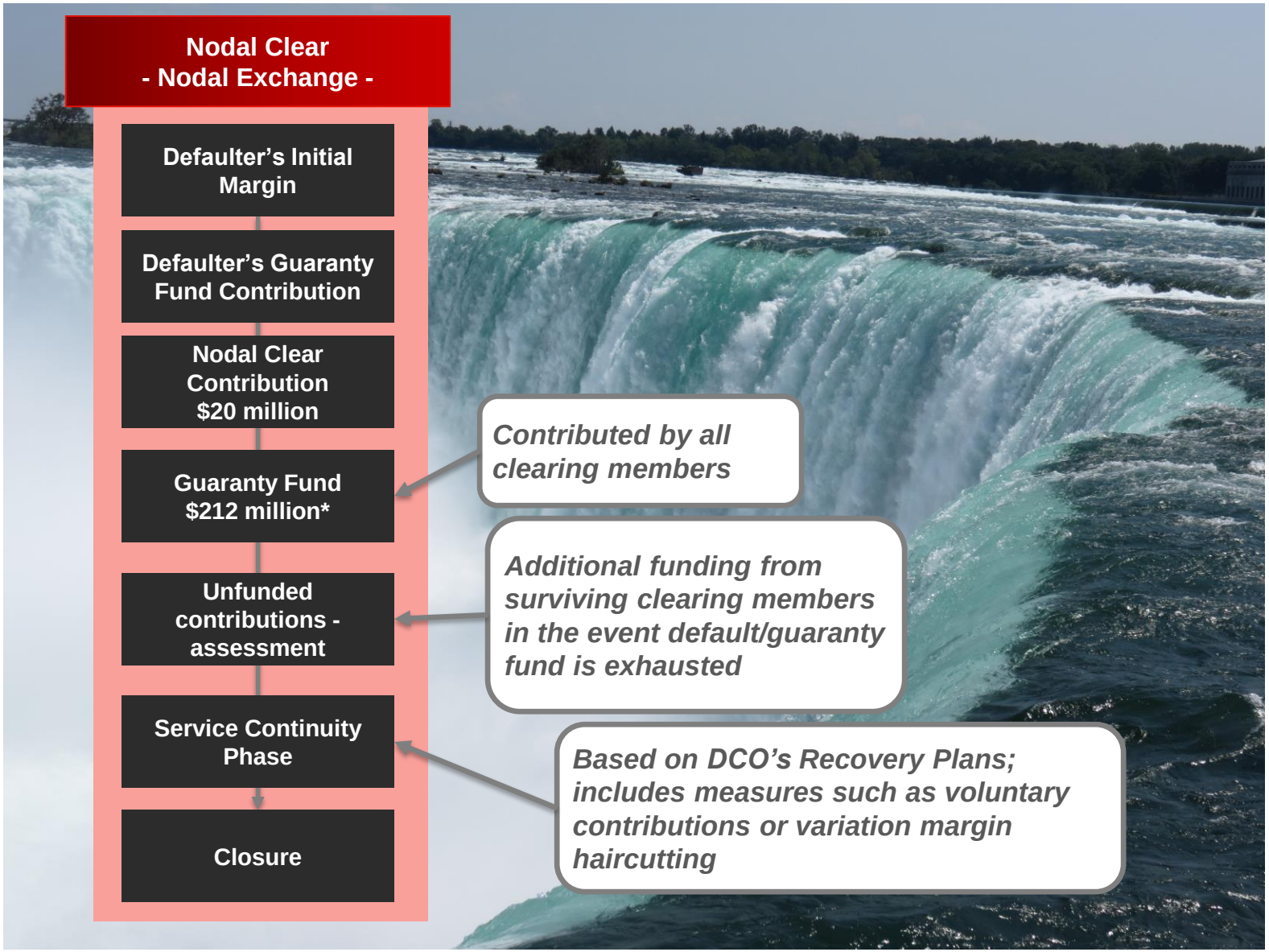
- **Pooled Mutualized Risk**
  - ***Solution for organized markets that addresses daisy chain risk***
  - ***Key Risk: Once collateral is exhausted, default is mutualized among trading participants***

- **Exchange/futures Clearing**
  - ***Approach recommended by G20 countries for risk management that relies on two-tiered credit infrastructure, variation margin and initial margin (regulated by the CFTC in the USA)***
  - ***Multiple layers of protection before any possibility of mutualized risk***

“Novation” in cleared market trading leaves the clearinghouse as the central counterparty; clearing members provide an extra layer of protection



Default Waterfall – the clearinghouse has several layers of protection to insulate participants from defaults



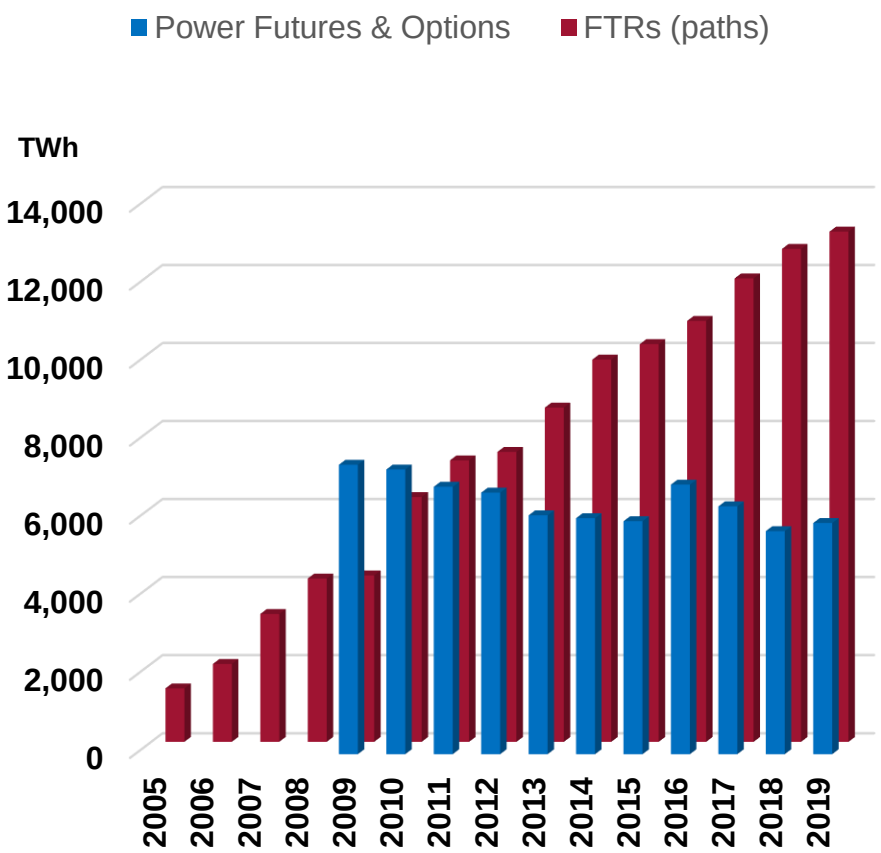
* As of June 16, 2020

Nodal Clear clearing members

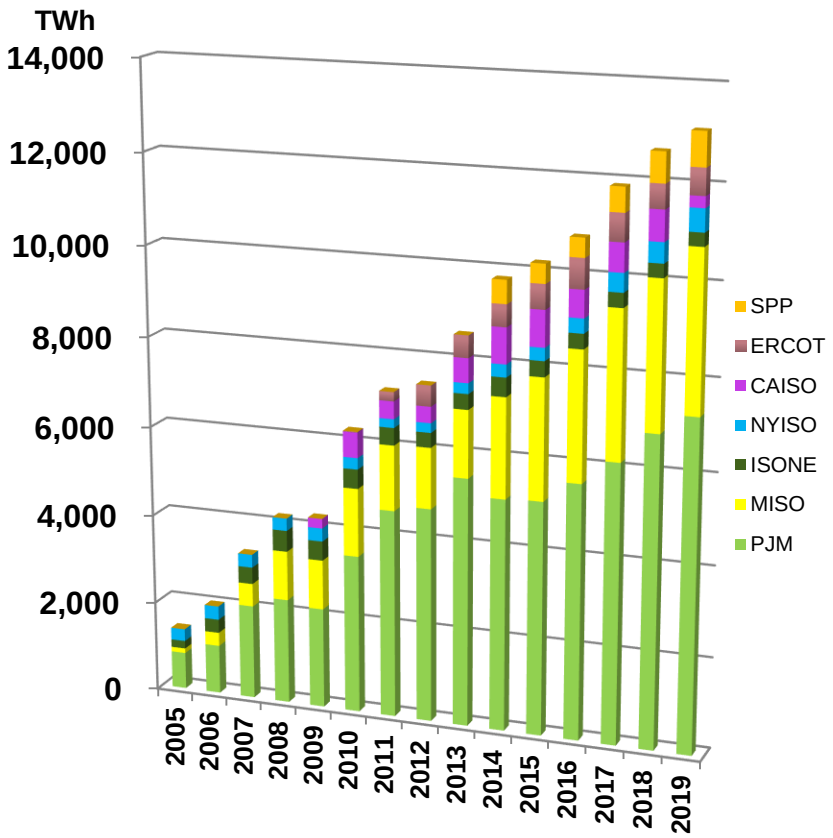
- ADM Investor Services Inc. (FCM)
- BNP Paribas Securities Corp. (FCM)
- BofA Securities, Inc. (FCM)
- Citigroup Global Markets, Inc. (FCM)
- ED&F Man Capital Markets Inc. (FCM)
- Goldman Sachs & Co. (FCM)
- Macquarie Futures USA LLC (FCM)
- Mizuho Securities USA Inc. (FCM)
- Morgan Stanley & Co. LLC (FCM)
- RBC Capital Markets LLC (FCM)
- Royal Bank of Canada
- SG Americas Securities LLC (FCM)
- Wells Fargo Securities LLC (FCM)
- Wedbush Securities, Inc. (FCM)

ISO/RTO FTR volumes exceed the cleared market and continue to grow, with trading up 33.5% over the last five years (2014-2019)

U.S. Power Traded Volume

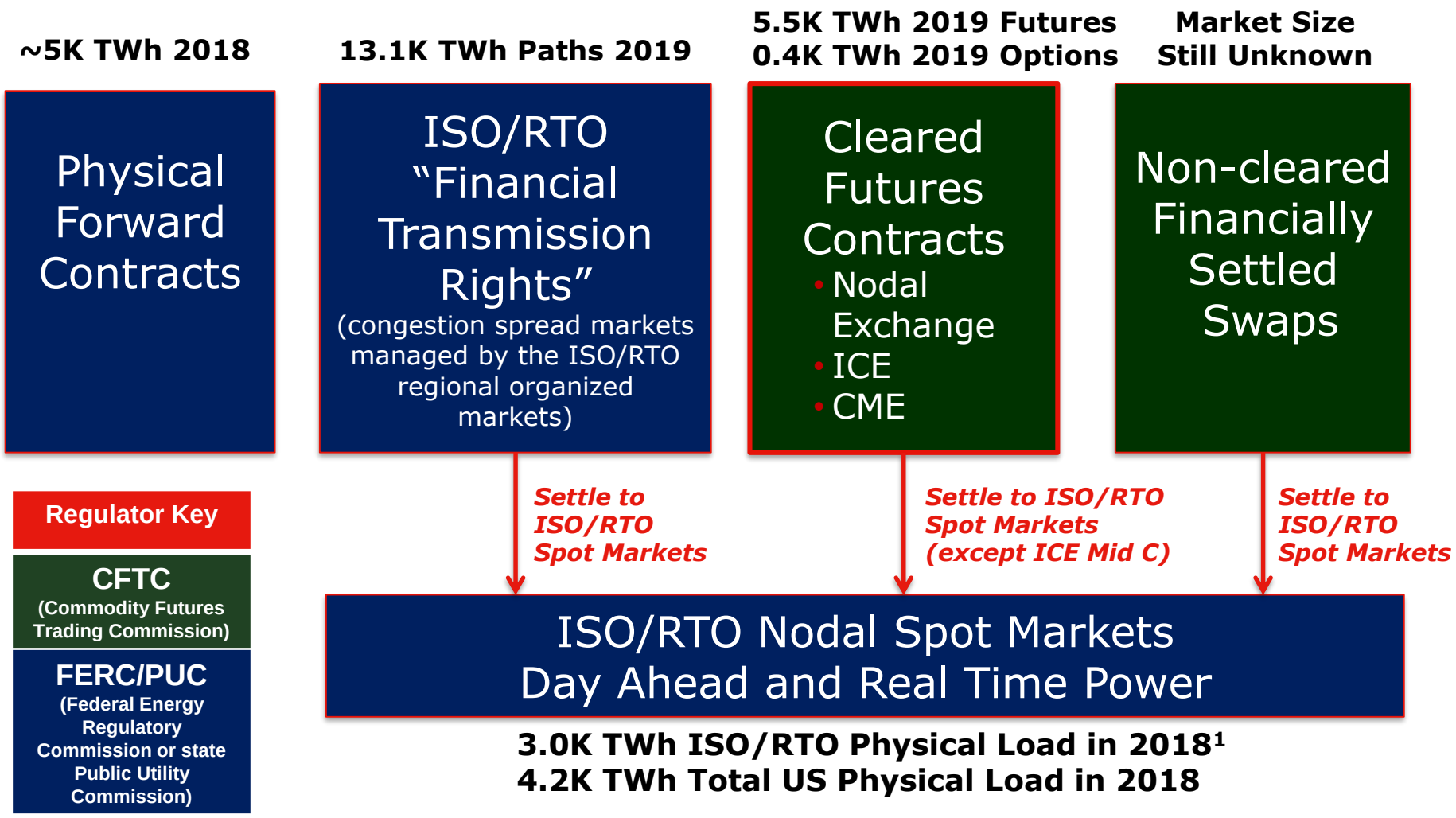


FTR Market Path Volume by Year



Note: The volume is based on awarded obligation volume on the path level.

United States Power Markets



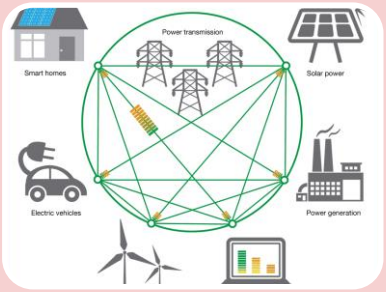
1. *Approximation based on ISO/RTOs serve ~72% of U.S. population and 2018 generation was about 4,178 TWh*

What does it mean to settle FTRs through futures by Exchange for Related Position (EFRP) transactions?

- FTR auctions run by the ISO continue to create the FTR positions
- FTR is exchanged for Nodal Exchange futures contracts (i.e., a spread with one futures contract at source and another futures contract at sink) – via execution of an Exchange for FTR (EFTR), a new type of EFRP
- ISO is a counterparty in each EFTR transaction (other counterparty is one of various FTR holders/traders)
- ISO payment mechanism to deliver congestion revenue to FTR holders is replaced with variation margin payments in the futures market; similarly, any payment delivery obligations by the FTR holders are handled through variation margin
- ISO retained congestion revenues will balance any ISO variation margin payments by settlement of the FTR term; similarly, if the FTR is out of the money, the variation margin receipts by the ISO will cover payment obligations to transmission capacity owners

EFTRs bring together superior capabilities across entities into one market solution

ISO/RTO

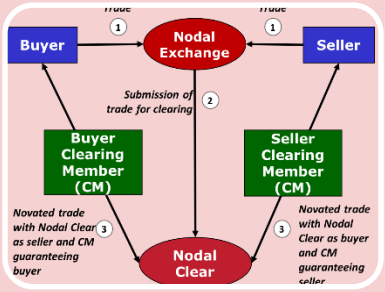


Unique capability to run the FTR auctions as a match between individual paths vs. transmission system capacity operating on a simultaneous feasibility constraint

Nodal Exchange

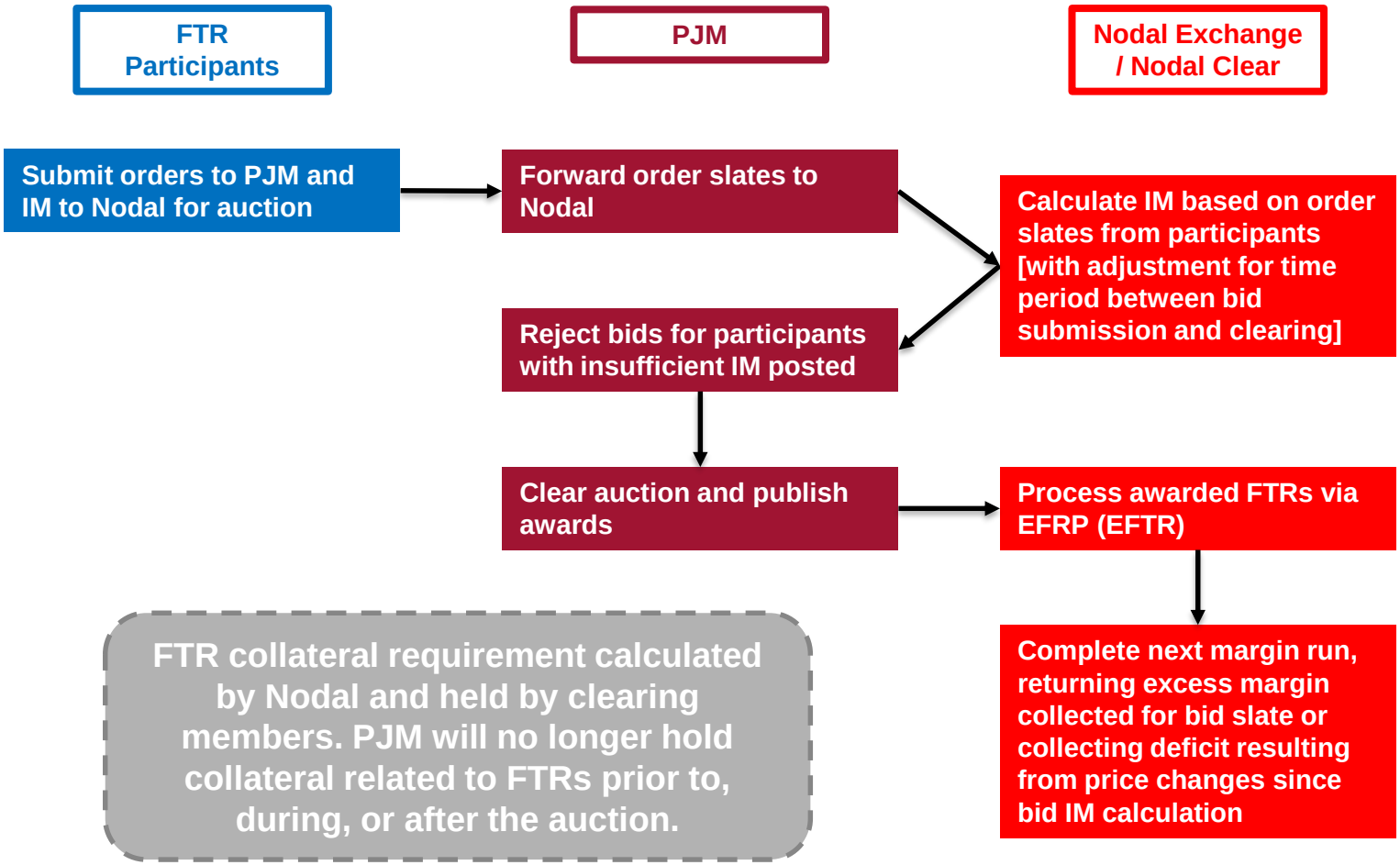
Competitive market services focused on product management, facilitating liquidity growth and transparency, surveillance, and twice daily pricing of tens of thousands of futures contracts

Nodal Clear

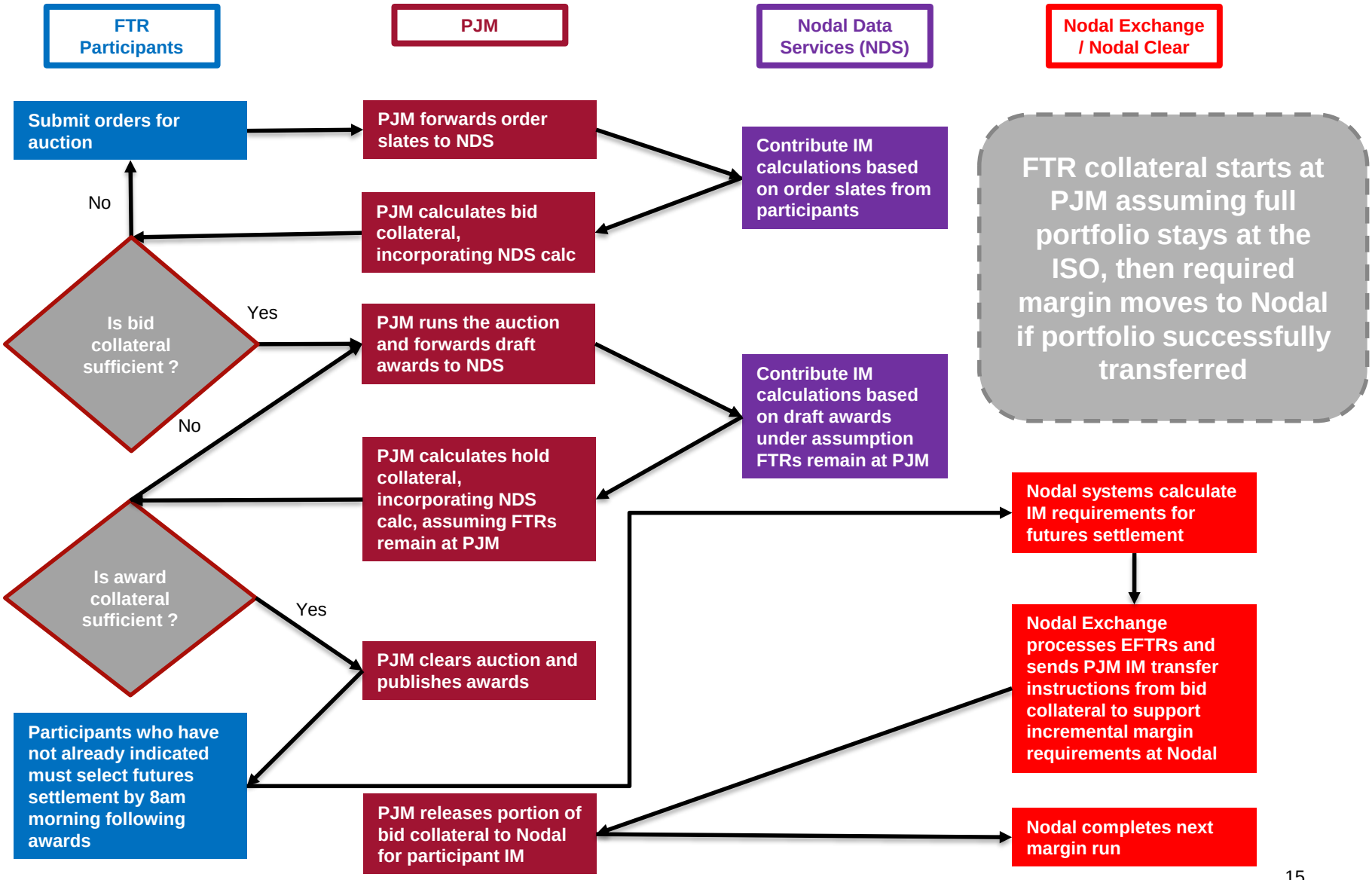


Expert quantitative and qualitative risk supervision managing price risk, credit risk, and liquidity risk for commodity futures

In a mandatory clearing model, PJM clears FTR auction with Nodal margin calculations, then exposure is transferred to Nodal via EFRP



Auction workflow under optional model requires input from an additional entity, Nodal Data Services, and iterative collateral checks



After the EFRP, cleared FTR payment obligations are fulfilled via margin payments of the economically equivalent futures

FTR Market

ISO Awards FTR to Holder/Trader at a price of $2,112 per MW ($6.00/MWh)

FTR: 50 MW Hub A (source) to Zone B (sink), Peak, April 2020 (i.e., B/A Spread)

Holder/Trader Position: Long B/A Spread at $2,112 per MW ($6.00/MWh)

ISO Position: Short B/A Spread at $2,112 per MW ($6.00/MWh)

=

Futures Market

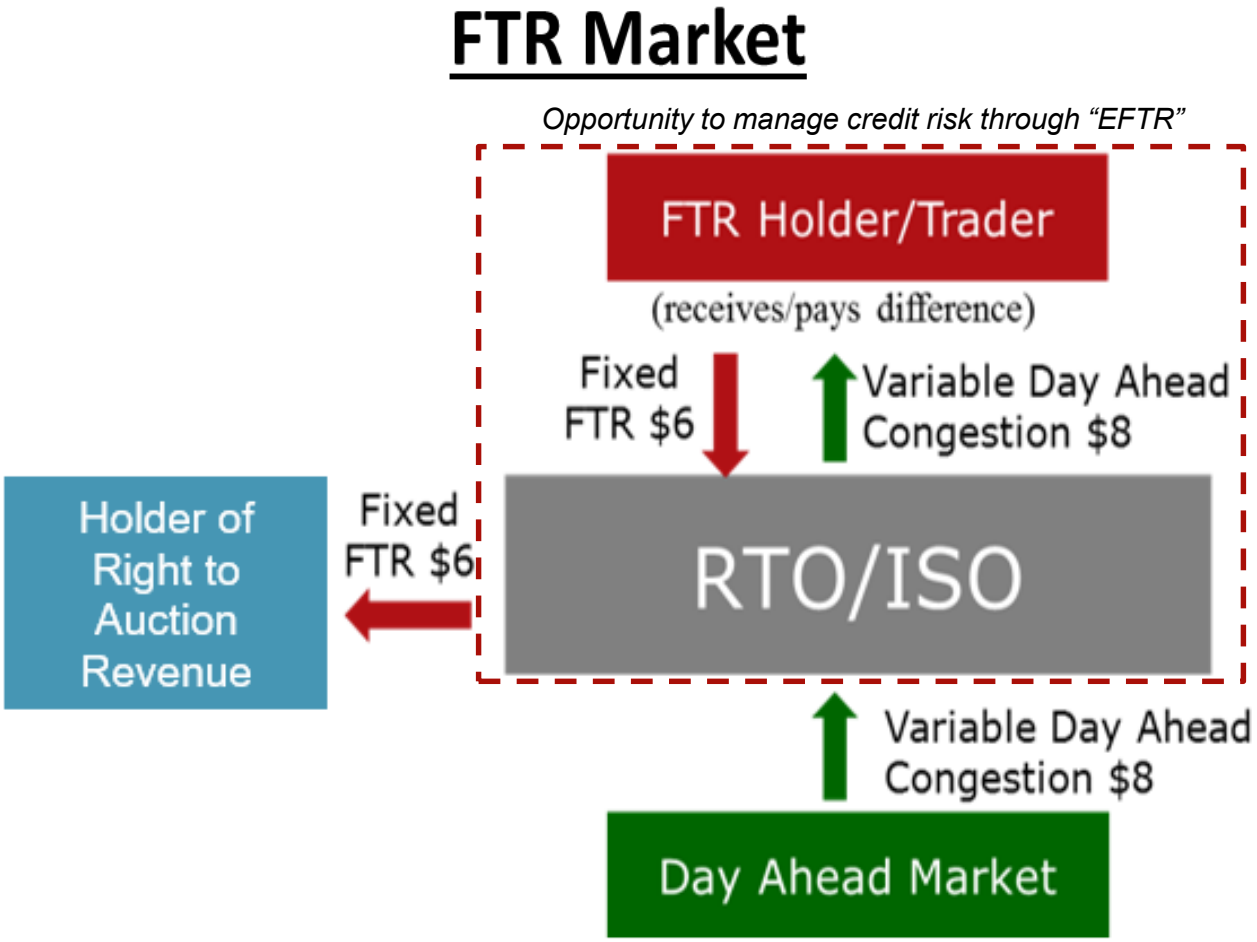
Economically Equivalent Futures

Holder/Trader Position:
Long 50MW Zone B, Peak, April 2020 at $39/MWh
Short 50MW Hub A, Peak, April 2020 at $33/MWh
Trader is Long B/A spread at $6.00/MWh = FTR Position

ISO Position:
Short 50MW Zone B, Peak, April 2020 at $39/MWh
Long 50MW Hub A, Peak, April 2020 at $33/MWh
ISO is Short B/A spread at $6.00/MWh = FTR Position

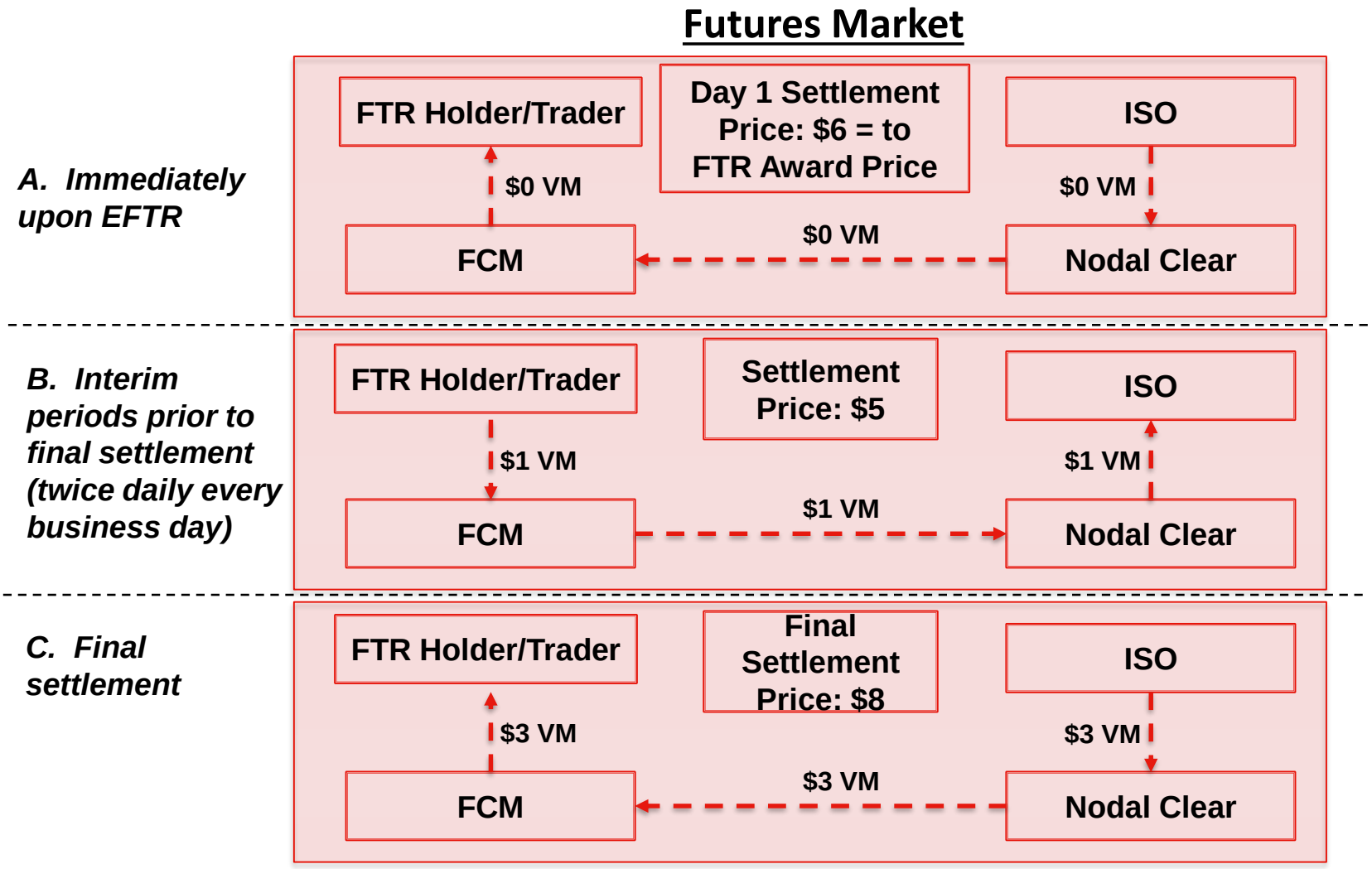
FTRs exchanged via EFRP to Nodal Exchange and cleared via Nodal Clear using Energy + Congestion futures contracts. As a spread, the energy component drops out as energy is the same value at any given time within an ISO

The current FTR market cash flows ensure that owners of transmission capacity receive the fixed payments due from the FTR auctions, while the FTR traders take the difference between the FTR auction price and the realized congestion in the spot market . . .



. . . Moving the open interest to a futures market ensures the same ultimate cash flows are paid, but shifts the timing of the payments in accordance with market expectations

Illustration



Participating in FTR clearing will require PJM to obtain a line of credit (LOC) to meet variation margin obligations to the participants

LOC Description:

- Required to meet Nodal twice daily variation margin obligations on the full FTR portfolio
- The LOC will be sized to meet at least 99% of Cumulative cash outflows from the previous 5+ years
- In case the LOC is not sufficiently sized to meet a variation margin call, there is no liquidation. Instead, the ISO portfolio is transferred back to the FTR market prior to an impending default at the current settlement prices
- The impacted counterparties to the ISO are left in an equivalent forward position in the FTR market, minimizing disruptions to their business
- As soon as the LOC is expanded, positions can return to Nodal Exchange to resume full clearing function

LOC is not responsible for:

- Credit risk posed by the trading participants.
  - Nodal Exchange and its clearing members guaranty that performance
  - Size of the credit line not linked to exposure to Nodal Exchange
  - A large draw on the line implies the participants are relatively cash flush
  - Should an unlikely clearing member default occur with a large draw on the line, the protections afforded by the clearing model only need to cover the liquidation process, not the collective variation margin that has been paid out
- Meeting traditional initial margin obligations for PJM's portfolio or guaranty fund requirements. Nodal Clear's solution removes the need for initial margin and guaranty fund deposits from PJM itself

LOC Cash Outflows = VM Payments + ARR Payments – Congestion Revenue Collection

Key benefits of exchanging FTRs for cleared futures contracts

- **Opportunities for secondary market trading, providing much greater liquidity to adjust positions and improve hedges**

- **Improves transparency: Nodal Exchange provides market participants with additional market intelligence on pricing expectations with twice daily marks (i.e., mark to market)**

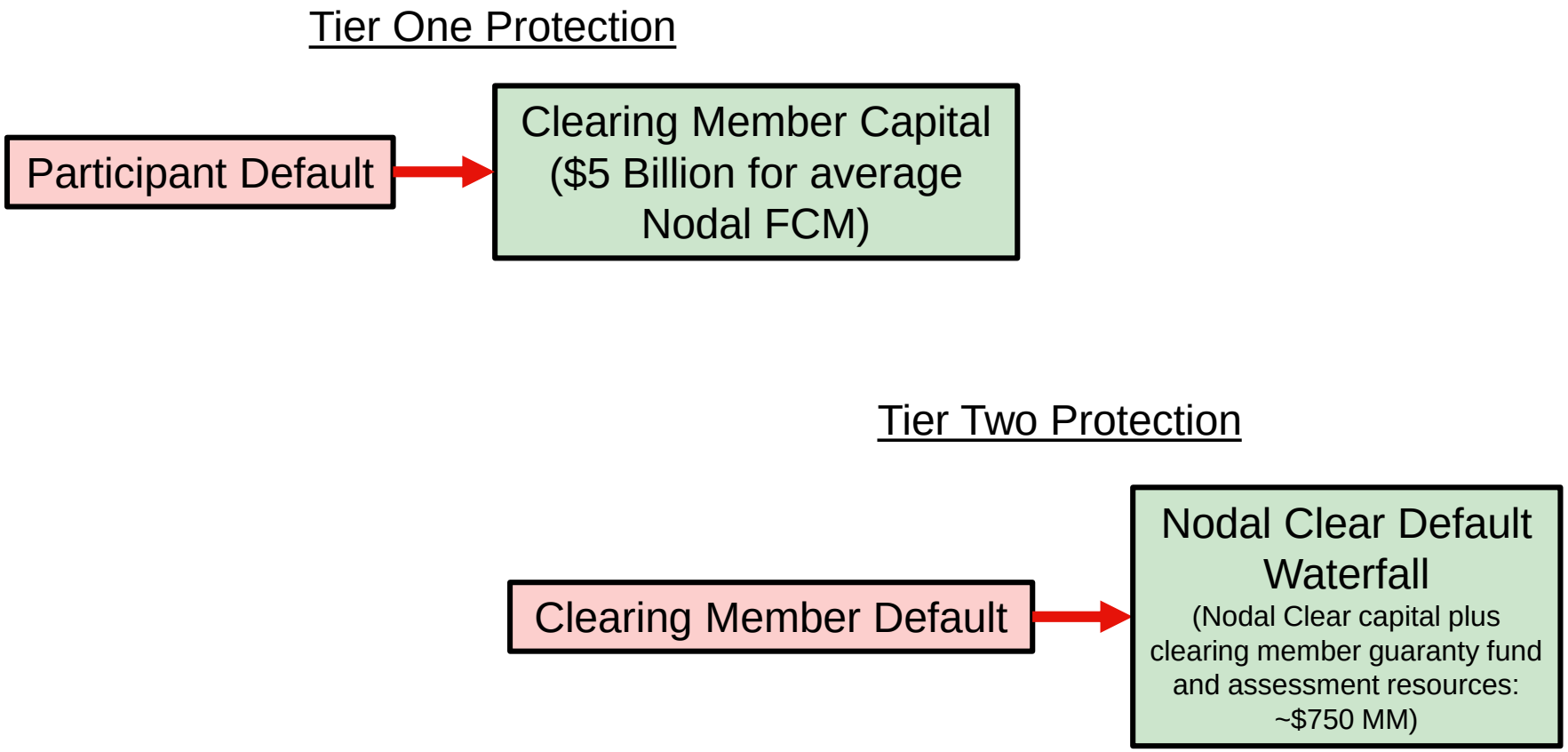
- **Improved default protection for all ISO FTR participants: credit risk management solution through guaranteed delivery of FTR payment obligations**
  - Defaults handled in cleared environment rather than losses shared by surviving ISO members—***from the participants' perspective, delivery obligations receive enhanced protection***
  - Replaces ISO collateral requirements for holding FTRs with margining related to clearing

- **Enables netting and cross margining of FTR originated positions:**
  - With other power positions (e.g., cleared transactions)
  - With other non-power positions (e.g., natural gas)
  - With futures positions based on power at multiple ISOs

Two flavors of Nodal proposal for FTR credit risk management

Proposals for Long Term Solution for Credit Default Risk Management	KYC/ Onboarding	Credit and Position Monitoring	Margining Methodology	Risk Reducing Measures	Default Protection beyond Initial Margin	
Mandatory Clearing	14 Clearing Members + Nodal Exchange manage this	14 Clearing Members + Nodal Exchange manage this	Nodal Clear solution that combines participants' FTR and power and gas futures exposures at Nodal Exchange	Twice daily variation margin, ensuring minimum drift from latest expected settlement prices	CM balance sheet + Nodal Clear Contribution + Guaranty Fund + Assessments:	
Optional Clearing	See mandatory	See mandatory	See mandatory	See mandatory	See mandatory	CLEARED
	PJM	PJM + Nodal Data Services ("NDS") consultation	Greater of new PJM model or NDS calculation	Potential for Mark to Auction with NDS price input	Potential for NDS-advised participant guaranty fund	NOT CLEARED

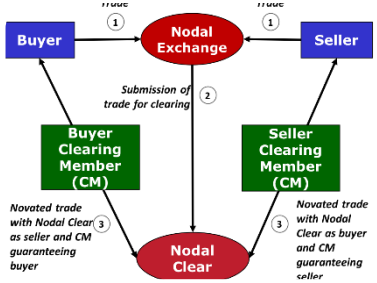
Handling a participant default under FTR Clearing shifts the burden and responsibility for credit risk management to a CFTC-regulated, two-tiered model



Clearing FTRs at Nodal Clear provides the following credit default protections[1] to PJM before any socialized risk sharing could take place:

Clearing Member Adjusted Net Capital[2]

Nodal Clear Contribution



Nodal Clear Guaranty Fund

Nodal Clear Assessment Power[3]

Tier	Participant Default	Clearing Member Default		
Low	$162 MM	$20 MM	$323 MM	$246 MM
Average	$5,160 MM	$20 MM	$382 MM	$341 MM
High	$18,661 MM	$20 MM	$440 MM	$436 MM

Clearing at Nodal provides significant capital protection ($~5 Billion plus ~$750 MM on average) to all but eliminate credit risk for FTRs traded at the ISO

1. Clearing Member adjusted net capital (ANC) figures and Nodal Clear contributions as as of May 15, 2020. Nodal Clear Guaranty Fund figures are estimates based on modeling FTR clearing activity on Nodal Exchange from summer of 2019, with updates for increases in the current GF included in the average and high estimates.
2. The high and average estimates exclude Royal Bank of Canada, which clears for its house business, and has $78.2 billion in ANC. Also ANC figures exclude any financial support from parent companies—this is regulatory capital on the books of the FCMs alone.
3. Nodal Clear assessments only apply to surviving clearing members. The range of reduced calls are explored in the low, average, and high estimates.

Thank you!