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# *Black Sea Regulatory Initiative:*

## *Cross-Border principles and guidelines*

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**January 2014**

OMS
Organization of MISO States

# *Black Sea Regulatory Initiative*

- Formed in 2010
- Partners:  Regulators of Armenia, Azerbaijan, Georgia, Moldova, Turkey, Ukraine, Organization of MISO States
- Sponsored by US Agency for International Development and National Association of Regulatory Utility Commissioners

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# PRINCIPLES OF REGULATION TO PROMOTE THE DEVELOPMENT OF RENEWABLE ENERGY IN THE BLACK SEA

## WORKING DRAFT

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# PRINCIPLES OF REGULATION TO PROMOTE THE DEVELOPMENT OF RENEWABLE ENERGY IN THE BLACK SEA

- The document collects fundamental assumptions, approaches, mechanisms, tools, best practices, and national experiences in the field of renewable energy.
- Among the useful tools discussed are regulatory coordination, efficient, transparent, and stable regulation,.
- It analyzes support methods that promote investment in renewable sources, and how regulators can respond to technical issues with renewables.
- It also discusses ways to certify renewable generation.

# PRINCIPLES OF REGULATION TO PROMOTE THE DEVELOPMENT OF RENEWABLE ENERGY IN THE BLACK SEA

- http://www.naruc.org/International/Renewable%20Principles.pdf

- § 1 Context of the Principles
- § 2 The definition of RES
- § 3 General principles to guide regulatory action in promoting RES penetration
- § 4 The relationship between policy making and regulation promoting RES-E
- § 5 RES-E support schemes
- § 6 Grid access and integration
- § 7 Licensing and monitoring of the RES-E market
- § 8 Certifying renewable electricity
- § 9 Cross-border cooperation in RES-E utilization

# Additional Principles to Harmonize Cross-Border Trade and Regulatory Cooperation for Market Integration - added 2013

- Cross-border electricity trading provides benefits for renewable energy sources.
- Cross-border trading and wholesale market integration can also improve economic welfare of the countries involved.
- http://www.naruc.org/International/CB_MarketIntegration_Principles.pdf

- § 10 - Harmonized Market Rules for Cross-Border Trade
- § 11 - Market Integration and Regional Regulatory Cooperation
- § 12 - Market Monitoring for Cross-Border Trade and Additional Regulatory Recommendations

# Cross-border Exchange compared to Cross Border Trade

- *Cross-border electricity exchange:* transmission capacity is traded between monopolies.
- *Cross-border electricity trade:* third party market participants (generating companies, consumers, traders) may use interconnection capacity.
  - The TSO owns interconnection capacity, provides access. and organizes the cross border capacity market
  - The TSO allocates available interconnection capacity
  - The TSO manages congestion when demand exceeds available capacity

# Harmonized Market Rules for Cross-border Trade

- Harmonized electricity cross-border trading rules support *electricity market integration* between two countries. Market integration requires
  - Functioning electricity markets in both countries
  - Both countries allow direct transactions across the border
  - TSOs offer a cross-border capacity market
- A higher level of integration involves national reserve markets.

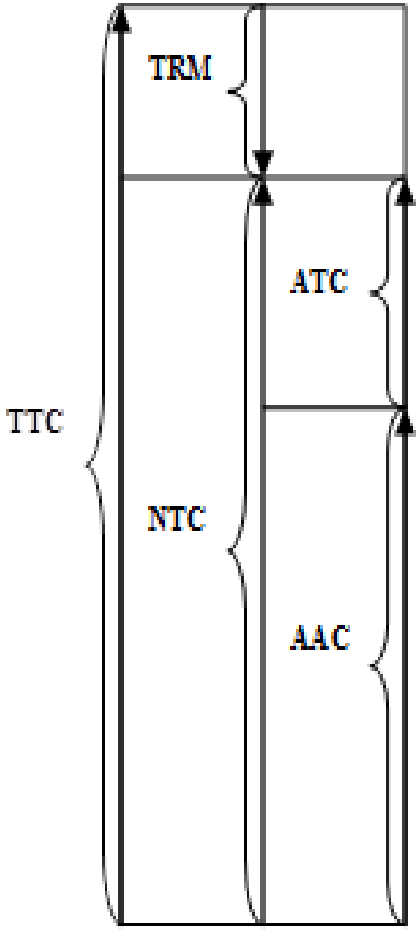
# Trade – Exchange – Integration

- Georgia 
  - Current Situation
  - Goals
- Turkey 
  - Current Situation
  - Goals

# *General congestion management scheme*

- Congestion occurs when the demand for power transmission exceeds the physical capabilities of the network.
- Congestion can be experienced in internal systems, but more often on cross-border network sections.
- Congestion management is a series of actions to limit access -
  - *Determination of available capacity*
  - *Capacity allocation*
  - *Congestion forecast*
  - *Generation re-dispatch*
- Process should be transparent.
- Regulators should approve congestion management rules.

# *Measuring transfer capacity*




TTC: Total transfer capacity

TRM: Transmission Reliability Margin

NTC: Net Transfer Capacity

$$NTC = TTC - TRM$$

AAC: Already Allocated Capacity

ATC: Available Transmission Capacity;

$$ATC = NTC - AAC$$

# *Measuring Transfer Capacity: Net Transfer Capacity*

- TSOs calculate and announce the transmission capacity at each border:
  - Total Transfer Capacity (TTC) is the maximum power flow between two interconnected systems.
  - Transmission Reliability Margin (TRM) is a part of TTC that is reserved to cover forecast uncertainties.
  - TSO uses historical cross border physical and commercial flow data and load-flow models to calculate the TRM.
- Net Transfer Capacity (NTC) is the maximum volume of transmitted power available for commercial transactions.
- The NTC allows the TSO to offer annual, monthly and daily capacities.

# *Determining Transfer Capacity*

- TSOs jointly determine ATC on cross-border facilities.
  - The general practice is that each TSOs states its NTC; the smaller will be announced as the NTC.
- TSOs allocate forward capacities – annual, quarterly, monthly, weekly, daily, intraday.
- Consistency and early posting assist market participants.
- Maximizing capacity increases trade benefits.

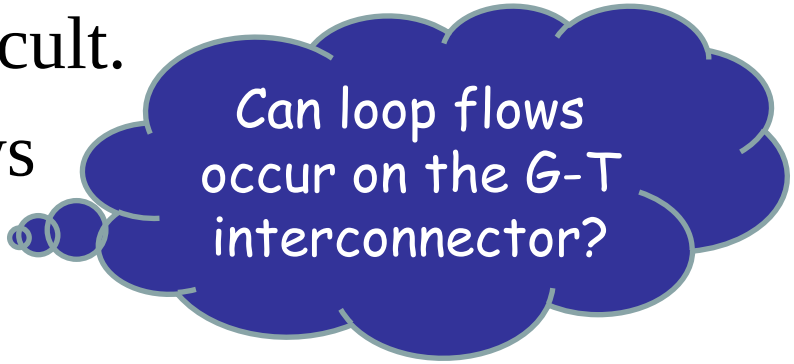
# Transfer Capacities

- Georgia
  - Current Situation
  - Goals

- Turkey
  - Current Situation
  - Goals

# Congestion relief

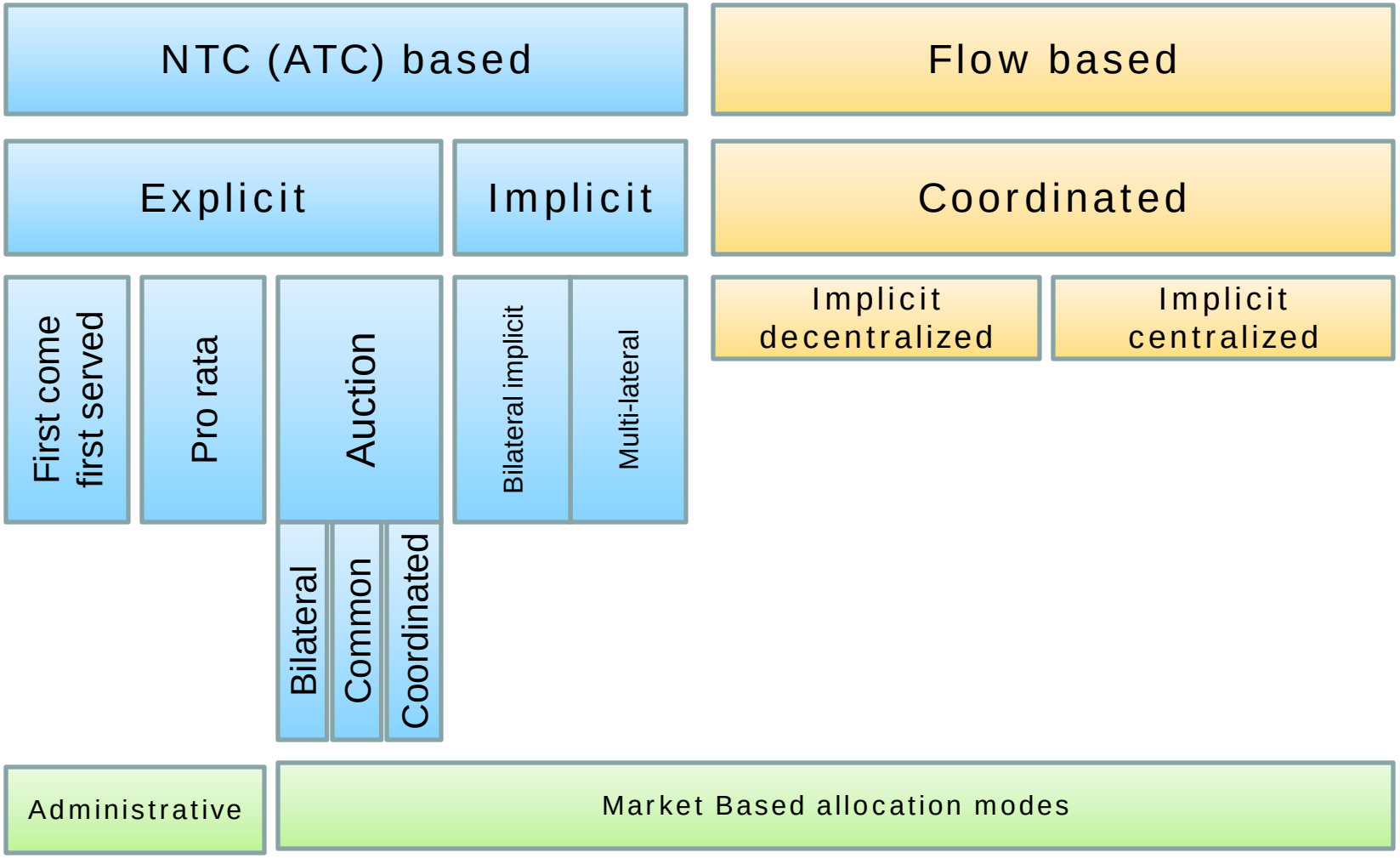
- In shorter time periods, updated NTCs are usually higher than longer-period NTCs.
- If a recalculated NTC is smaller, some allocated capacity must be curtailed.
- Curtailment causes losses that must be compensated and should be avoided. Determining and fairly allocating these losses is difficult.
- In meshed systems, loop flows complicate congestion relief.



# *Capacity allocation methods*

- Capacity allocation should be transparent and non-discriminatory.
- Allocation methods have four dimensions:
  - Basis of calculation: **NTC or flow-based**
  - Separation versus integration of cross-border capacity and energy markets: **explicit versus implicit methods**
  - Logic of allocation: **administrative versus market based**
  - Level of harmonization of TSOs: **bilateral, common, coordinated**

# *Capacity allocation methods*

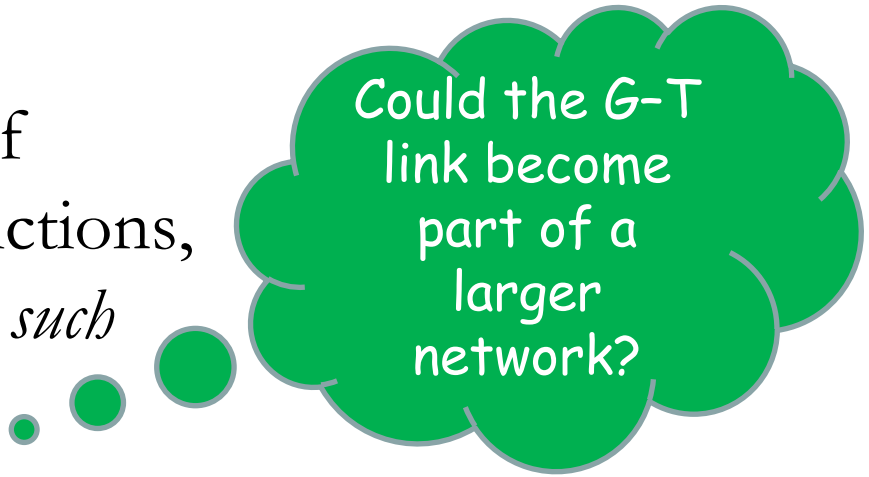


# NTC based capacity allocation modes

- The TSO must consider power flows at other borders.
- Uncertainties cause NTC to set lower capacity levels.
- As a result, actual physical flows often surpass the allocated capacity by a large margin.

# Flow-based allocation (FBA)

- In contrast, FBA uses actual distribution of power flows in the adjacent areas.
- FBA better approximates the capacity that can be allocated safely.
- It allows more relaxation of cross-border capacity restrictions, *especially in a meshed network such as of continental Europe.*




- But it requires complex computation and agreed modeling methods by all involved TSOs.

# Explicit allocation methods

- Transmission capacity and energy markets are separated.
- The two markets are settled sequentially.
  - First the capacities are determined
  - Then the energy flows.
- Market participants hence bear the risk that the two volumes do not match.
- Sequential clearance of transmission capacity and energy markets invites dominant generators to exercise market power.

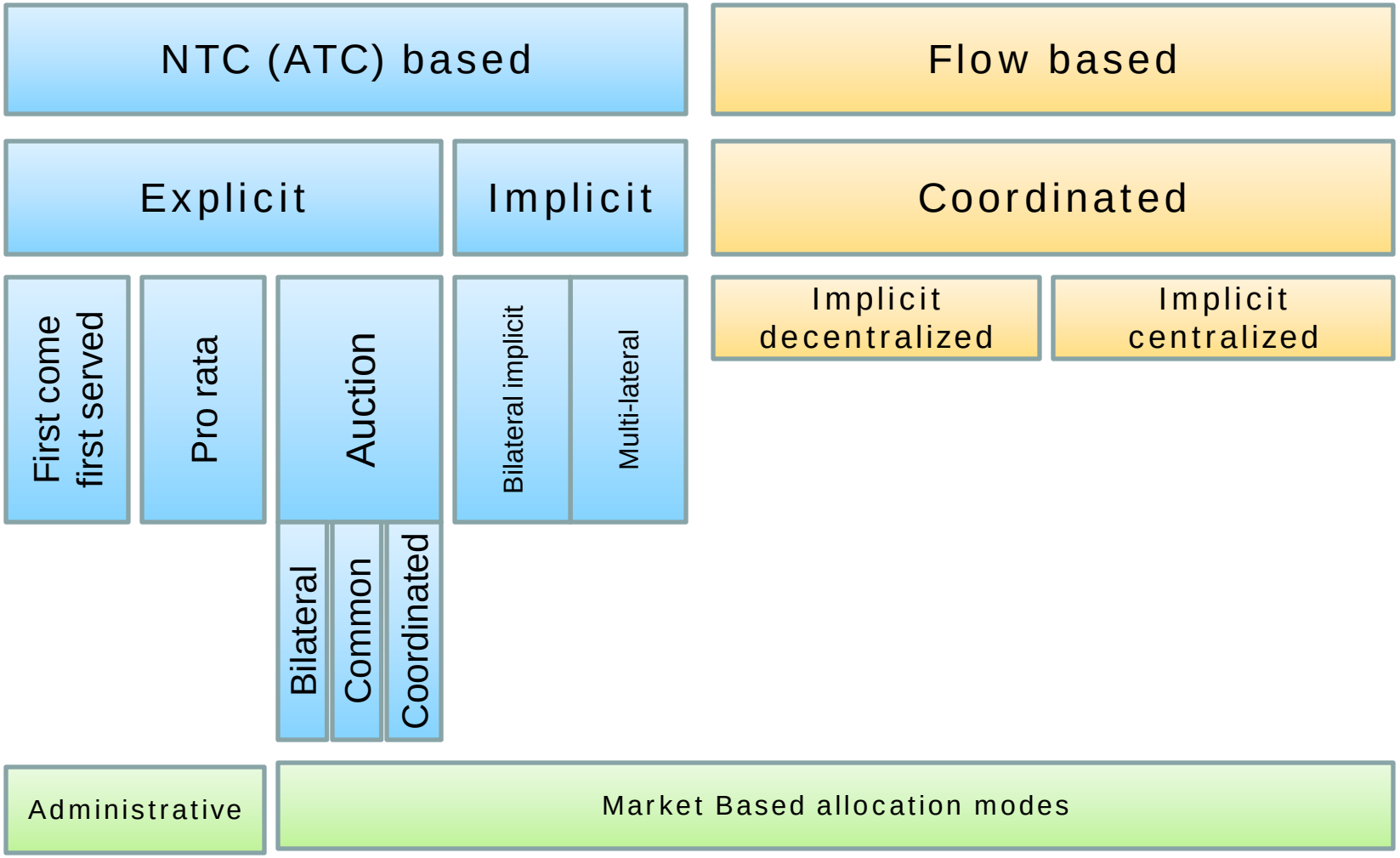
And so --

- Allocated transmission rights limit trading options .
- Unused capacities create loss (if not received for free).

# Implicit Methods - Auctions

- Capacity rights are internalized in the settlement procedure of the electricity markets.
  - They are not allocated to individual participants.
- EU and ACER urge implicit NTC or flow-based methods.
- Implicit methods are more compatible with the future single internal electricity market of Europe.
- But many European TSOs still use explicit NTC allocation methods

# *Capacity allocation methods*



# Capacity Allocations Generally Apply a "Use-it-or-lose-it" Rule

- The TSO can reallocate excess rights for shorter time periods.
- Excess rights are known only when the energy market gate closes.
- More frequent allocations use the infrastructure more efficiently.
- *An alternative: Secondary markets, using a "use-it-or-sell-it" rule, improves efficiency of final allocations.*

# TSO Independence

- Regulators should reduce the TSO's incentive to increase its own revenues by decreasing ATC.
- Under EU rules, revenues from the allocation of cross-border capacities should be used only for the following purposes:
  - Guaranteeing the actual availability of the allocated capacity
  - Network investment to maintain or expand cross-border capacity
  - Reduction of network tariffs

# Administrative capacity allocation methods

The two main versions of *administrative allocation* are the "first come, first served" and the pro rata allocation.

- In "first come, first served," capacity rights are assigned without cost according to the temporal order of capacity requests until all capacity is assigned.
  - Administrative allocation is not efficient.
- Pro rata allocation accepts all requests all by equal percentages.
  - This method invites gaming behavior by bidders.

# Explicit Auctions – Bilateral

- The two TSOs independently determine the NTCs (for both directions) and the smaller will be allocated.
  - In some cases the two TSOs involved split the available capacity and allocate their own share (split auction),
  - In other cases one of the TSOs or an independent office is mandated to allocate the capacity on behalf of both tsos (common auction).
- In all cases the TSOs simultaneously define NTC for each common border.
  - But power flows may be affected by flows across other borders. Thus TSOs tend to define over-restrictive NTCs.

# Explicit Auctions - Common

- Find

# Explicit Auctions – Coordinated

- TSOs set the NTC jointly and recognize the interaction of NTC settings at various borders.
- Traders can acquire a single allocation for a cross-border transaction.
- A joint cross-border capacity allocation office is a major step towards electricity market integration.
  - In Central and East Europe, a Central Allocation Office or Coordinated Auction Office (CAO) was established in November 2010 as a joint company of eight TSOs to perform long term and day-ahead calculation and allocation of cross-border capacity.
  - The CAO's harmonized allocation rules reduce transaction costs and enhance wholesale competition.

# Advantages of Market Based Allocations

- Provide revenue for the TSO
- Provide investment location signals for the TSO
- Provide incentives for the TSO to maximize NTC within security limits
- Allocations are based on willingness to pay and more closely reflect the economic value of the capacity.
- Revenue sharing agreements should be reviewed and approved by the relevant regulators.

# Explicit Auctions – Summary

- Explicit auction is market based and the most widely used allocation mode.
- It can be executed on a bilateral basis or in a coordinated form.
- A single country can employ different types of explicit auctions at its various borders.
- When capacity auctions are used for the allocation of cross-border capacities, the price of the capacity is determined by the auction's outcome.
  - The demand for capacity is determined by the bids of market participants.
  - Bids indicate the required capacity and the price the bidder is willing to pay for it. The TSO can order the bids into descending order and allocate the capacity for those who are willing to pay the most for it until the available capacity is fully allocated. In this case the price of a MW of cross border capacity will be equal to the last bidder's offer price who still received capacity at the auction.
- The auction price of a MW of cross-border capacity for a given hour will roughly reflect the wholesale price difference of a MWh of electricity between the two countries.

# Capacity Allocations

- Georgia 
  - Current Situation
  - Goals
- Turkey 
  - Current Situation
  - Goals

# Market Integration and Regional Regulatory Cooperation

- Electricity market integration requires more than efficient and harmonized rules for cross border electricity trading.
- It also requires the integration of electricity market transactions of the interconnected electricity markets.

# Market Coupling

- *Market Coupling (MC)* is an implicit auctioning method to efficiently allocate cross-border transmission capacities.
- The system operator makes unreserved capacities available for market coupling. Power exchanges balance supply and demand in each country by considering the prices quoted on the exchanges of neighbouring price zones.
- Cross-border energy transactions do not have to be supplemented with separate transmission capacity rights allocations.
- When TSOs or regulators consider coupling two interconnected day-ahead markets currently divided by a national border, they should first make sure that their national day-ahead energy markets have an organized electricity market or power exchange.
  - Many rules and procedures of both markets must be harmonized beforehand, like types of traded products, bid closing times, and other operational procedures.

# Discussion of Market Coupling

- Successful integration of interregional markets requires that national monopolies be unbundled.
- Successful market coupling presumes energy markets operated by organized power exchanges and cross-border transmission capacity markets operated by TSOs.
- European models recognize sovereignty interests and may be politically more realistic models than US models.

# Advantage of Market Coupling Over Explicit Methods

- Market Coupling increases trade on existing interconnection lines, and maximizes the combined welfare of the participating countries.
- If day-ahead markets work as auctions, the two neighboring day-ahead markets can be cleared jointly. Supply and demand bids are available from the other zone as long as transmission capacity is available.
  - Market participants sell and buy energy in their home markets.
  - Inter-zonal arbitrage opportunities are exploited routinely by the market coupling mechanism.
  - Cross-border capacity is allocated to transactions with the highest value, and the price of capacity is equal to the energy price difference between the two zones.
  - Capacity is allocated implicitly , without a separate transmission capacity auction.
- In the longer term, by creating transparent markets and clear price signals, market coupling leads to optimal planning for transmission system development.

# Alternative Ways to Accomplish Market Coupling

- Market coupling can be accomplished with different capacity calculation methods.
  - One option calculates unreserved transmission capacities NTC or ATC.
  - The other option uses flow-based capacity allocation (FBA), estimated by simultaneous load-flow calculations that forecast actual physical network flows.
  - A market can change from an NTC method to an FBA method.

# Advantages and disadvantages

- An NTC method restricts cross-border trade, and makes less efficient use of the existing transmission network.
  - Especially in a meshed network, bilateral NTCs must be determined low enough for the grid to withstand a "worst case" congestion scenario.
  - NTC allocation recognizes network loop-flows poorly.
- FBA methods handle loop flows better and reduce unintended effects on third parties. With FBA, security assessment and capacity allocation are integrated, using actual market conditions instead of worst case scenarios.
  - The complexity of an FBA exercise may keep market coupling off the agenda for too long.
- Having no market coupling at all is the worst option.
  - Although NTC market coupling is less powerful than an FBA system, NTC market coupling offers positive benefits.

# Regional Regulatory Cooperation

- Enhancing cross border trading and market integration is a demanding regulatory task. It requires political support, focused technical work, and the support of other major stakeholders (most prominently the affected TSOs).
- A starting point is to assess the participants' present cross-border trading regimes and then draft a regulatory guideline for harmonized cross-border access and trading rules.
- Cross-border capacity markets are easier to establish than local electricity markets.

# Market Monitoring

- In the European model, the amount of cross-border trading is limited by the Available Transmission Capacity of transmission facilities.
- Available Transmission Capacity is determined by Transmission System Operators.
- Accurate and commercially neutral calculations are necessary to maintain reliability of the systems and at the same time allow maximum trading.

# Market Monitoring Methods and Goals

- Market monitoring describes ways regulators can observe and verify the accuracy and neutrality of thse calculations.
- US electricity markets usually contract market monitoring to specialized third-party firms.
- In Europe, in-house monitoring by the regulator is a more common approach.

- The goals of market monitoring of cross-border electricity trading are to:
  - Ensure competitive and efficient trading.
  - Provide improved transparency in the electricity markets.
  - Give confidence in the markets.
  - Achieve the benefits of competition for the benefit of consumers and producers of electricity.
- Monitoring of electricity markets looks for:
  - Flaws in the cross-border trading rules, or within the rules of the linked markets, that create inefficiencies or gaming opportunities.
  - Improvements to market efficiency.
  - Market power abuses and manipulation.