Principles of Entry-Exit Tariff Setting Project Commissioned by E-Control

Presentation of the Interim Report

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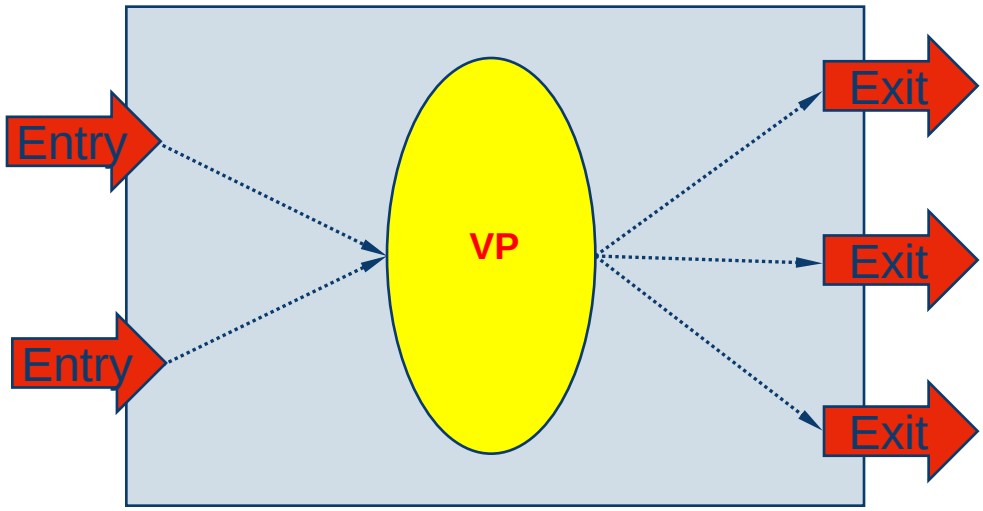
Experience you can trust.

Agenda

- Conceptual properties of the entry-exit model
- Country studies
- Capacity management
- Interim results

Basic Set-up of Entry-Exit Model

Input and exit can be independently contracted and combined (decoupled) – no linked contract paths between individual points; capacities are freely assignable.



E/E-models often use a virtual trading point (**VP**), where gas can be traded independently of entry and exit capacity.

Exit points can be dealt with individually or combined into zones.

Capacity Products

Design of product portfolio is a starting point for the tariff setting.

- Short (daily, monthly) and long-term capacities (annual and multi annual)
- Firm and interruptible capacities
- Eventually non-freely assignable capacities
- Backhaul capacities
  - Against physical flow direction, interruptible
- Shorthaul capacities
  - In some cases short distance transport may lead to prohibitively high tariffs in the E/E systems
- **Standard product**: firm, freely assignable, annual capacity

Tariff Principles as set by 3rd Package

Fundamental principles are included in Directive 2009/73/EC and Regulation (EC) No 715/2009.

- Tariffs for network users shall be set separately for every entry and exit point:
  - Economically efficient
  - Cost reflective
  - Transparent
- Cost allocation mechanisms and tariff setting methodology are approved by the national regulatory authorities
- By September 3, 2011 the Member States shall ensure that network charges shall not be calculated on the basis of contract paths (i.e. transition to entry-exit model)

Design of Transmission Tariffs

Several criteria can be used to design the tariff structure.

- Capacity and commodity charges
  - Separate commodity charge for fuel gas?
- Time-of-use differentiation
  - Application of seasonality factors (tariffs may vary in different seasons)
  - Dependency on contract duration (potentially higher tariffs for short contracts and lower tariffs for longer contracts)
- Locational differentiation
  - Uniform, zonal or nodal pricing

Derivation of Entry-Exit Tariffs

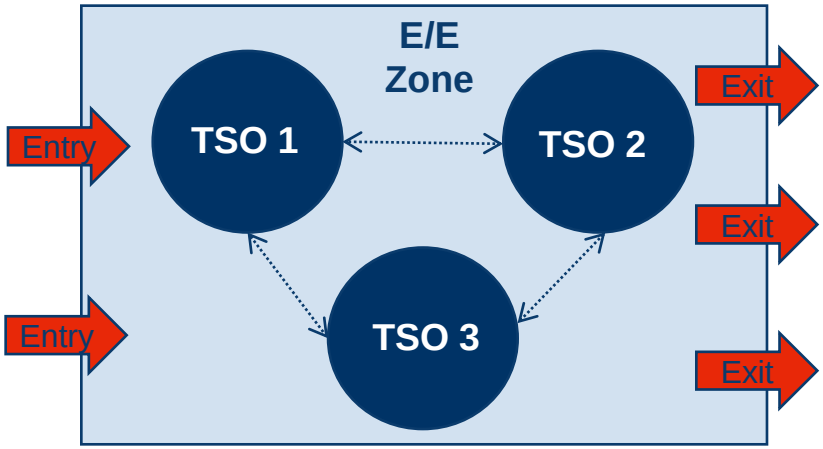
In addition to the fundamental tariff principles, further restrictions and requirements may be considered.

- Avoiding significant regional differences
- Avoiding distortive impact on the competitive environment in sectors like gas production and gas storage
  - Uniform tariffs or limited regional differentiation at production and storage sites
- Minimizing the impact of the new tariff system on shippers
- Ensuring high transparency
- Keeping control on the complexity and transaction costs

Entry-Exit Zones and Pricing

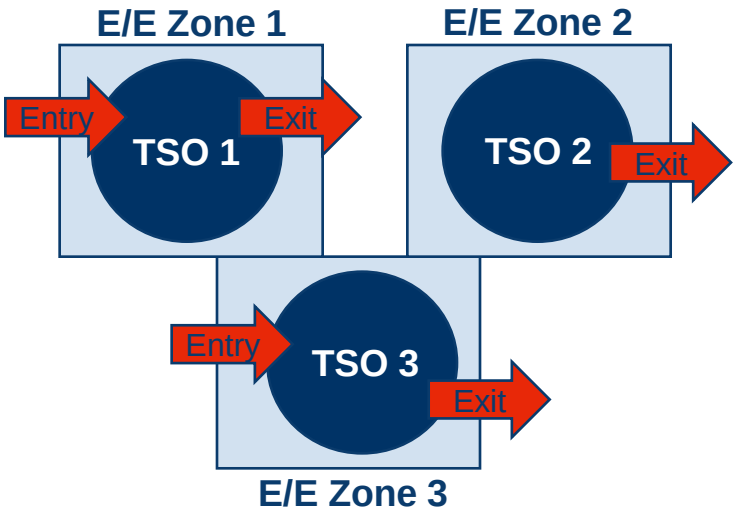
In general, network costs can be allocated following two approaches: integrated for the whole market area or separately for each network.

Integrated E/E Zone



- E/E tariffs not related to network boundaries/ownership
- Integrated cost allocation / tariff setting for the whole market area results in adequate price signals
- Depending on the capacity allocation mechanism, a reconciliation mechanism may be required

Separated E/E Zones

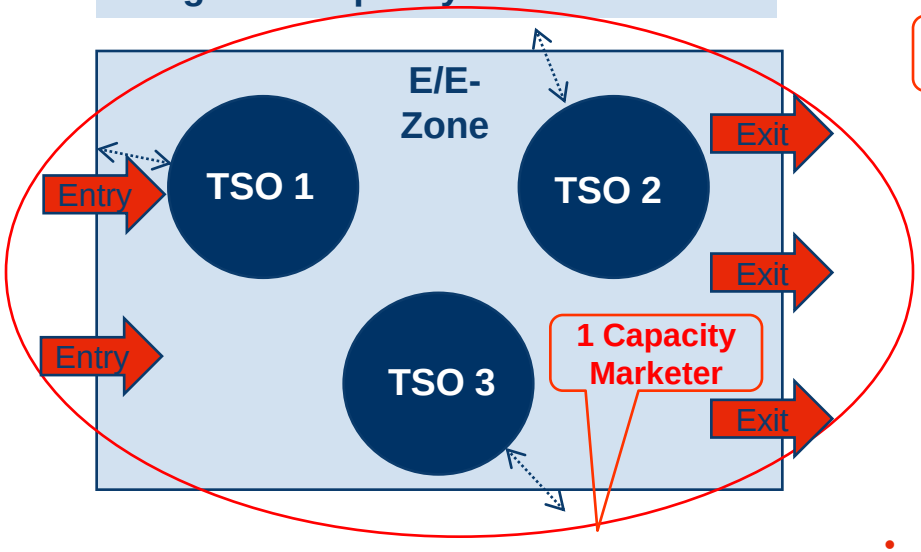


- E/E tariffs reflect network boundaries/ ownership
- Cost allocation / tariff setting separately for each network results in fragmented price signals
- No reconciliation mechanism required

Revenue Reconciliation

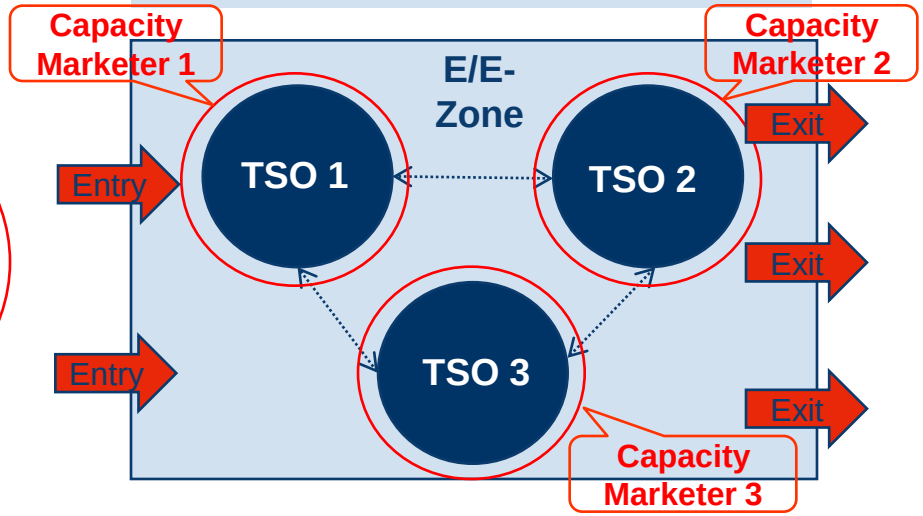
Depending on the capacity allocation mechanism, the reconciliation happens either automatically or needs to be conducted separately.

Integrated Capacity Allocation



- Integrated capacity allocation by one responsible party for the whole market area
- Revenues collected by a capacity marketer
- Revenue distribution (revenue adjustments due to quantity variations) through the capacity marketer
- Requires TSOs' acceptance

Separate Capacity Allocation

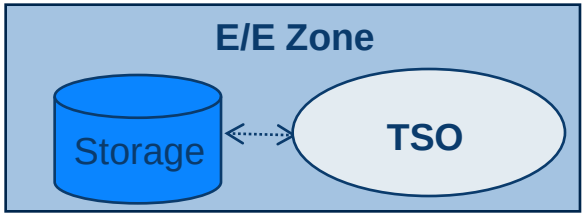


- Separate capacity allocation by TSOs
- Revenues collected by TSOs (acting as capacity marketers for their areas)
- Reconciliation through an explicit inter-TSO compensation
- Revenue adjustments due to quantity variations integrated into the reconciliation mechanism
- Higher complexity due to the inter-TSO compensation

Network Charges at Storage Sites

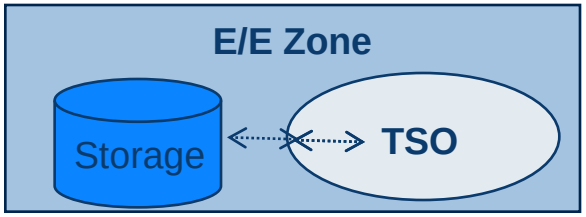
Network charges at storage sites can cover different portions of the network costs.

Shallow Pricing



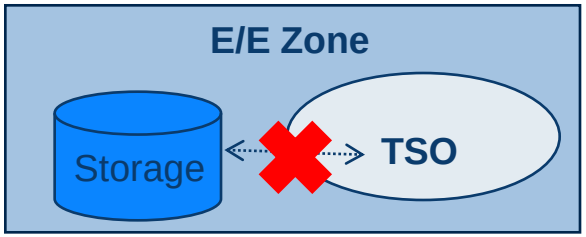
- Directly attributable costs (without network enhancement)
- Simple and transparent
- Costs for network reinforcement distributed over E/E points

Deep Pricing



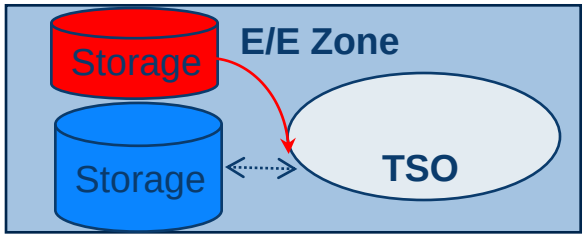
- Directly attributable costs (including network reinforcement)
- More complex and less transparent
- Follows causality principle

Full Socialization



- No cost allocation
- Costs distributed over E/E points
- Deviation from causality principle

Netback Approch



- Considers competitiveness
- Requires knowledge and discretionary assumption on comparable facilities
- Decoupled from costs, deviation from causality principle

Agenda

- Conceptual properties of the entry-exit model
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Country Analysis - Overview

	BE	DE	FR	IT	SR	CZ	Result
Entry-Exit	1	1	1	1	1	1	6
Significant transit volumes	1	1	0	0	1	1	4
Transit fully integrated	0	1	1	1	1	0,5	4,5
One market area	1	0	0	1	1	1	4
VHP	0	1	1	1	0	1	4
Capacity fee	1	1	1	1	1	1	6
Commodity fee	1	0	0	1	0	1	3
Gas-in-Kind	0	0	0	1	1	0	2
Bundled capacity products	1	1	1	0	0	1	4
Interruptible capacities	1	1	1	1	1	1	6
Discount for interruptible capacities	1	1	1	1	1	1	6
Non-freely allocable capacities	1	1	0	0	0	0	2
Mark-up for short-term capacities	1	0	1	1	1	1	5
Seasonality factor cross-border points	0	0	0	0	0	0	0
Seasonality factor domestic exit	1	0	1	0	0	0	2
Storage points treated separately	1	0	1	0,5	0	1	3,5
Locational differentiation cross-border points	0,5	0,5	1	1	1	1	5
Locational differentiation domestic exit	0	0,5	0	1	0		1,5

1=Yes; 0=No; 0,5=partly

Germany: Only selected TSOs

Belgium: Table shows existing system, new tariff system will be implemented as of October 2012

Tariff Setting Method

Within the EU, a tendency to harmonize regulatory approaches and tariff setting methods can be observed.

- In most cases, allowed revenues/tariffs are calculated based on revenue-cap regulation
  - Slovak Republic: tariffs are based on initial benchmark with comparable EU Member States
  - Italy: cost-based regulation for CAPEX, price-cap regulation for OPEX
- The E/E model is principally applied
  - Most countries have a virtual trading point
- In some cases, short-term adjustments are possible and/or have already been planned
  - New tariff system in Belgium as of October 2012

Tariff Setting Method

Taking a closer look, differences in E/E systems are also caused by structural differences between countries.

- In some cases special conditions apply to transit flows, for instance limiting the free assignability of capacities
  - A distinction should be made between generally applied limitations (Belgium) and the use of optional capacity products (Germany)
- Tendency towards reduction in the number of market areas
  - Market and network areas do not always match
- First trials with bundled capacity products in short-term markets
- First examples of using auctions for primary capacity allocation
  - Germany (in general), France (in some cases)

Tariff Structure

Commodity charges, locational differentiation at domestic exit and seasonality factors for transit are NOT commonly applied.

- In general, transport is charged based on capacity fees, in several cases complementary application of commodity fees, sometimes additional gas-in-kind component
- At cross-border points, locationally differentiated tariffs are typically used
- Domestic exit typically without locational differentiation
  - Exception: Italy and some German TSOs
- Short-term and multi-annual capacities
  - Seasonality factors for domestic exit
  - No seasonality factors at cross-border points
  - Mark-ups for short-term capacities commonly applied

Tariff Structure

In most countries tariff arrangements and tariff structures are fairly similar.

- In some cases separate treatment of production and storage sites
  - Tendency towards lower tariffs at these points
- Interruptible capacity typically offered at significant discount
  - 10% to 50% is common, also depends on risk of interruption
- Backhaul capacities are not offered in all countries
  - Significant discount
- Single cases: non-freely assignable capacities
  - e.g. Germany, discount between 0% and 50%, depends on the individual TSO

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Determination of Available Capacity

The capacities that can be made available to the market are calculated using a simulation model and a set of demand/supply scenarios.

Input: Scenario for different temperatures

- Predicted demand for different consumer groups:
  - Households (f (T))
  - Industry
  - Power generation, import/export)
- Assumptions on:
  - Gas production levels
  - Usage of cross border capacity
  - Usage of storage capacity

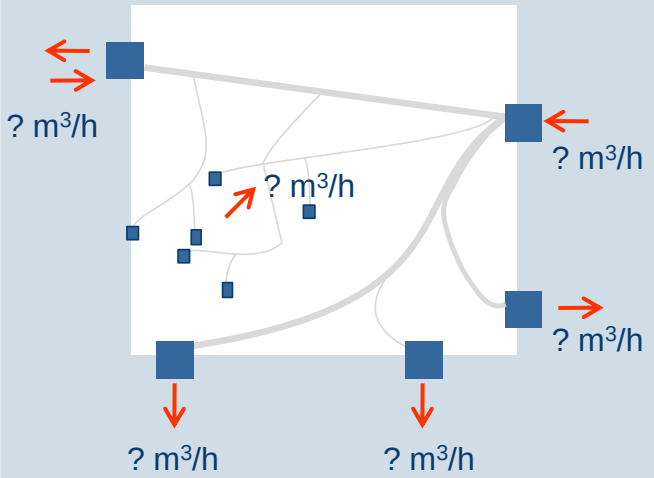
Constraints: technical limitations of the network

- Maximum technical capacity of an entry/exit point
- Demand = supply (scenarios should be balanced)
- Minimum and maximum pressures
- Installed compression power

Output: can the network accomodate the N/X flows?

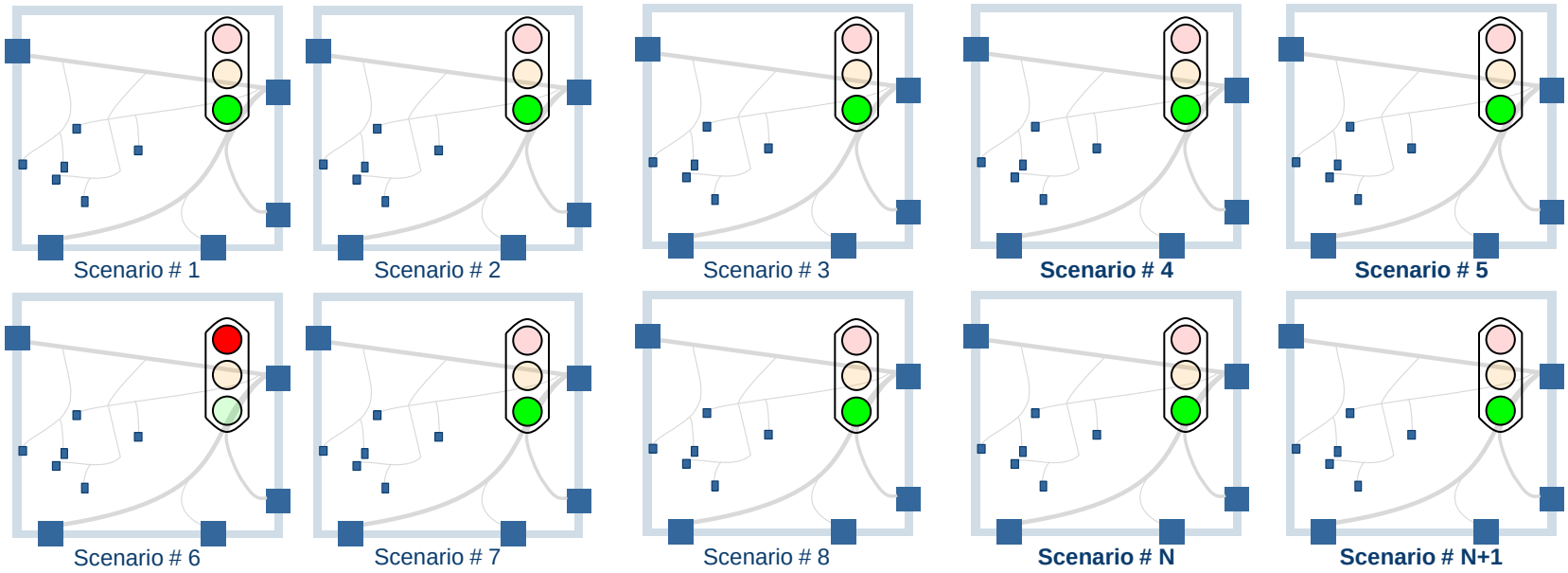
- Simulation status: fail / success
- Utilization of pipeline sections / compression power

SIMULATION MODEL



Scenarios

Scenarios represent possible shipper behaviour. Network simulations are run to test if the scenarios can be accomodated by the network.



- The maximum bookable capacity that can be made available to the market at an N/X point is the capacity that the network can accommodate in *all* scenarios.
- Technical capacity ≥ maximum bookable capacity ≥ sum of booked capacity

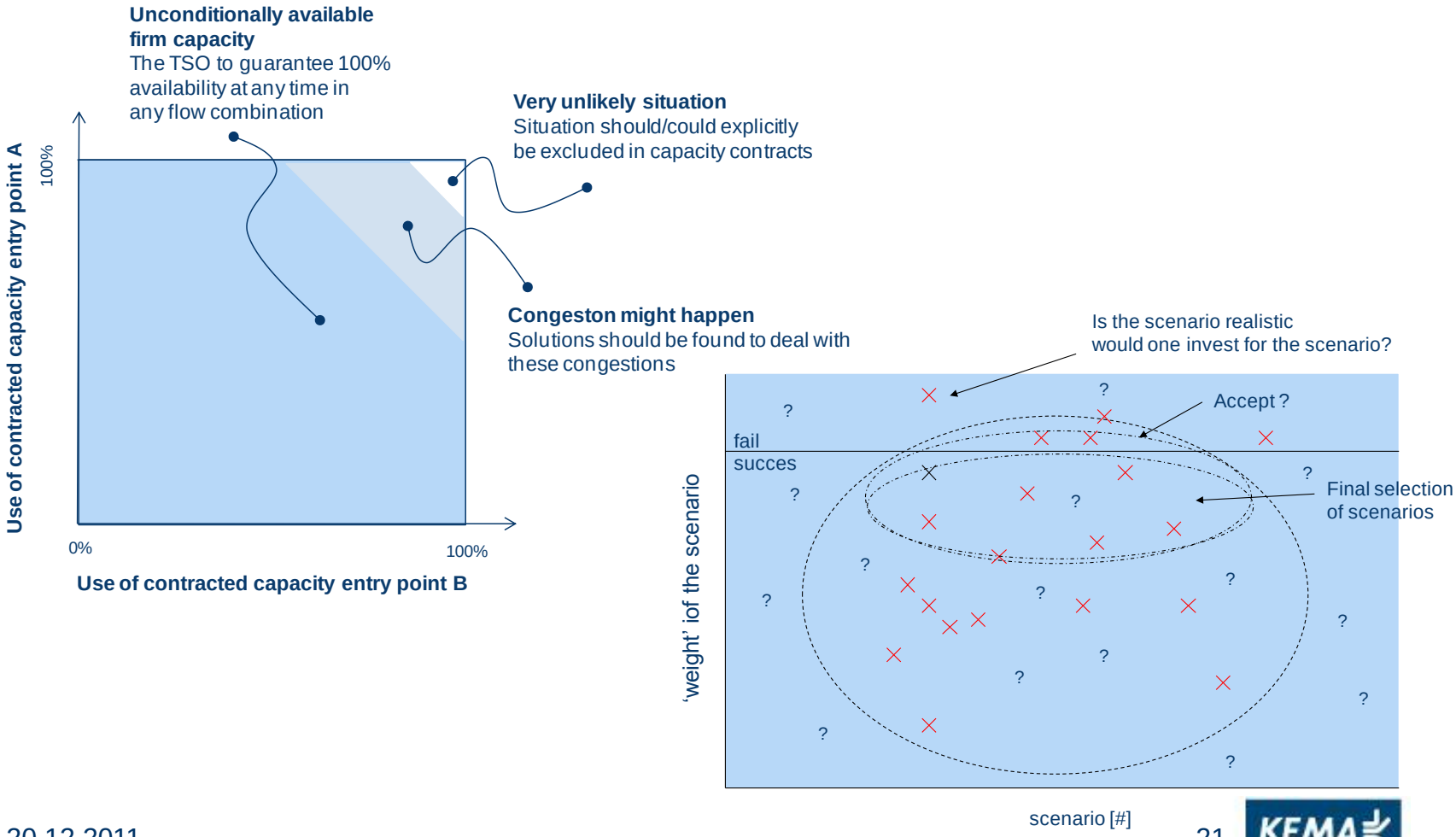
Analysis of the Scenario Runs

Within their booked capacity at entry and exit points, shippers should be able to use the capacities at any level and in all combinations.

- Key question is: can shippers always **freely use** the entry/exit capacity they have booked?
- The scenarios should represent ‘all’ possible shippers’ behavior. In principal **all** possible entry/exit **combinations** have to be considered
- The degrees of freedom and the corresponding number of combinations are however extremely large!
- It should be made explicit which theoretical **combinations** of entry/exit flows are explicitly **not accounted for** in the assumptions

Selection of Demand/Supply Scenarios

Drafting the set of scenarios is all about striking the balance between free allocability and efficient use of the capacity in the network.



Capacity Calculation

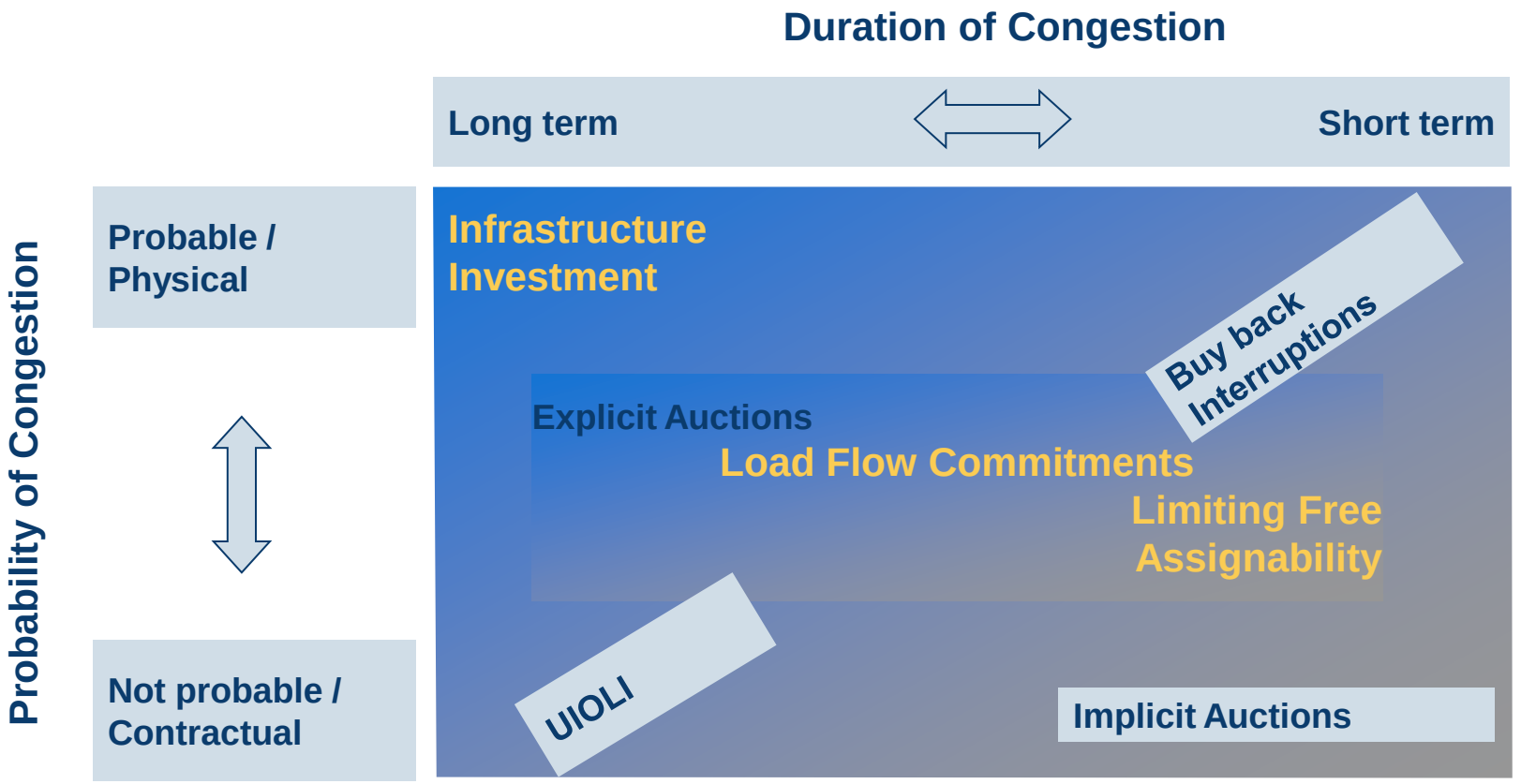
The available capacity is the difference between the calculated capacity and the capacity already booked at the E/E points.

- Free (for selling) capacities:
  - Positive difference between base capacity and the sum of all booked non-interruptible capacity at certain time point *t*
  - Available capacities are calculated on an annual basis, however checks should be made regularly during the year. Depending on existing capacity booking this may lead to an updated optimization of available capacities.
  - Free capacities are in the range of the technical capabilities of the system, but may be increased via redistribution of non-nominated capacity (UIOLI)
  - Amount strongly depends on the capacity products offered, the methods for capacity allocation and congestion management

- A network is fully loaded if there is no free capacity available. It is possible to offer additional capacity based on interruptible contracts.

Congestion Management

Measures to mitigate congestions are taken in relation to whether congestion is expected (*ex-ante)* or has already occurred (*ex post).*



Load Flow Commitments

Load flow commitments constitute a binding call option on a specific nomination. They increase the available network capacities.

- Load flow commitments may be used in cases of potential congestion
  - At internal network connection and storage points as well as at cross-border points
  - Locational specification required, although it decreases the number of potential providers
  - Costs are highly dependent on the procurement mechanism
- Tenders for load flow commitments exhibit several essential features:
  - Small lot sizes and short contract durations are required in order to enable market parties with smaller portfolios to also participate
  - Remuneration should be on commodity basis only
  - Number of suppliers is potentially small, this may result in a negative impact on procurement costs

Non-Freely Assignable Capacities

Non-freely assignable capacities refer to capacity booking; the network capacity increase is limited, i.e. flows cannot be ensured.

- Limiting free assignability increases available capacity only to certain extent
  - Knowledge of demand profile is required
  - Reference to entry-point Baumgarten seems most likely
- Dynamically or simply limited assignability may reduce the uncertainties of the TSO, however:
  - Capacity auctioning becomes more difficult, and the complexity of capacity allocation and pricing increases
  - Nominations are not binding
  - The supply of flexibility sources for balancing purposes may decrease
  - May hamper gas trading at the virtual point

Capacity Allocation Mechanisms

Several allocation mechanisms exist, only auctions are market-based.

Capacity allocation mechanisms have to …

- Provide appropriate economic signals for optimal usage of technical capacity
- Reduce hurdles for investments in new infrastructure and cross-border gas trading
- Be compatible with market mechanisms, including spot markets and trading hubs, and
- Be compatible with network access regulations in EU Member States

Capacity allocation mechanism

Non-market based

- **First come, first served**
- **Pro rata**
- **Lottery**
- **Open Season**
- **Use-it-or-lose-it (UIOLI)**

Market based

- **Auctions**

Auctions

Auctions result in an efficient capacity allocation by revealing the network users' willingness to pay.

Auction revenues should be used in line with the regulatory requirements with respect to the allowed revenue and the needs of new infrastructure investments.

Capacity auctions …

- Should provide robust and sustainable signals on costs of congestion mitigation
- Allow for reliable usage of booked capacities for appropriate contract durations and with sufficient lead times, and
- Have to provide efficient allocation of available capacities to a large number of network users

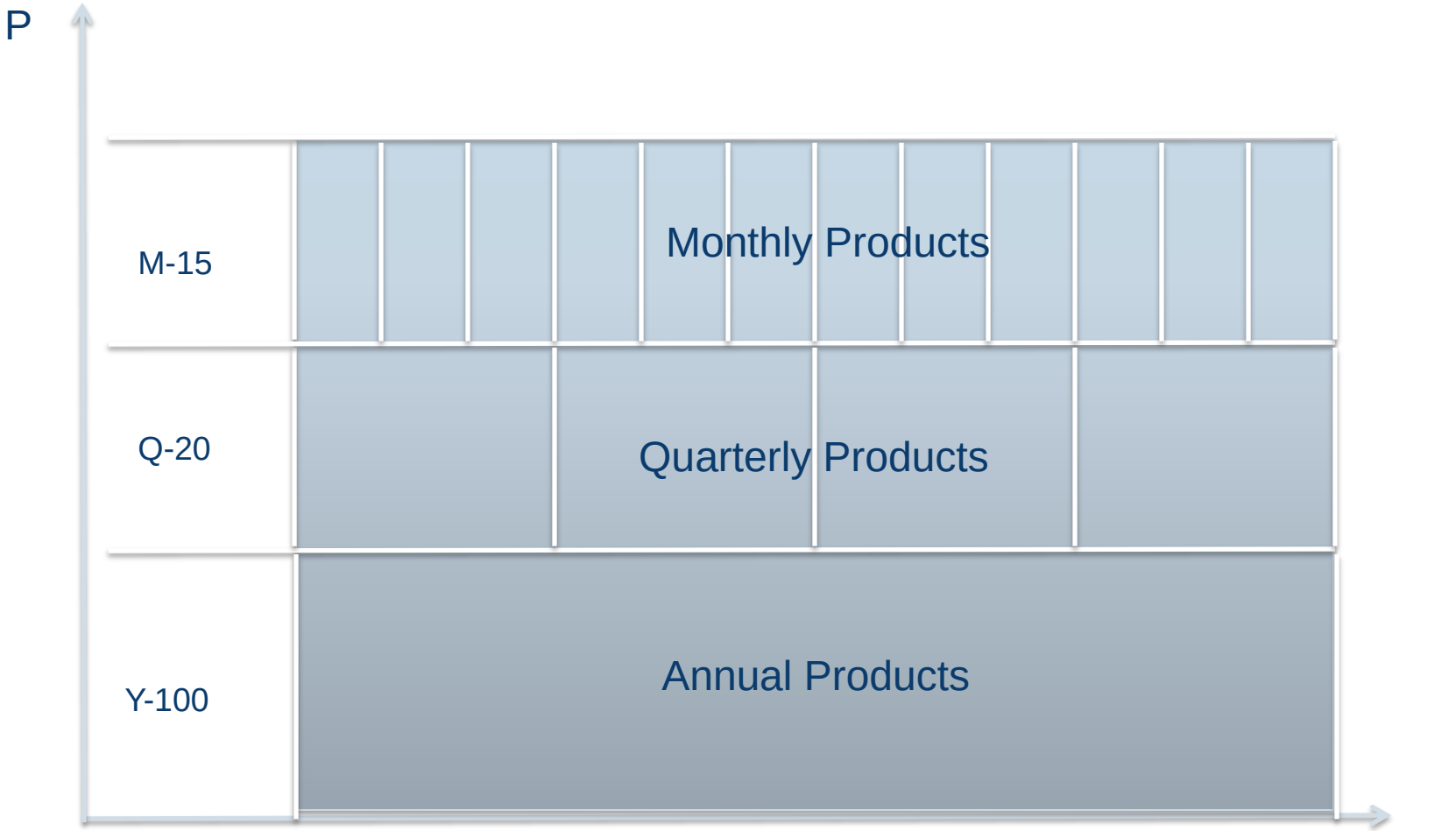
Auctions Applied on Capacity Markets

The auction design should ensure efficient price discovery and market clearing.

- Explicit price-volume auctions: Bidders submit capacity bids at a pre-determined starting price. The price is increased until the total demand of all bidders equals or is below the offered capacity.
- Bundled capacities: All capacity providers at a connection point between two market areas bring their capacities together into a single integrated auction.
- Multiple rounds with increasing prices: Allow for efficient price discovery as bidders' own assumptions can be reconsidered. Smaller price steps support the market clearing process.
- Open bid curve: The aggregated supply curve and the marginal price is visible to all bidders. Based on this information they can adjust their bids.
- Limiting the volume per bidder: In auctions for selling only a small part of the total capacity, this increases the number of players.

Auction Products

The auction products should be compatible with the traded commodity products and allocated in line with the duration of the trade products.



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Interim Results

The tariff system currently applied in Austria needs to be amended.

- The future tariff system is determined by the legal requirements set out in European and Austrian legislation, the specific country conditions and the developments in other EU Member States, in particular the neighboring countries
- KEMA's recommendations are based on the existing legal framework, European experience, own considerations and discussions with E-Control and the Austrian TSOs
- Only **Market Area East** is considered
- The **interim results** presented in the next slides reflect the accomplishments at this stage

Interim Results

Transit flows have to be adequately taken into account in the design of the new tariff system.

- An **integrated, decoupled entry-exit tariff** system without contract path dependency is required
- **Single Market Area East** encompassing the TSO network areas
  - Entry and exit capacities are required when entering or leaving the market area
- The market area has a **virtual trading point** freely accessible from any location in the market area

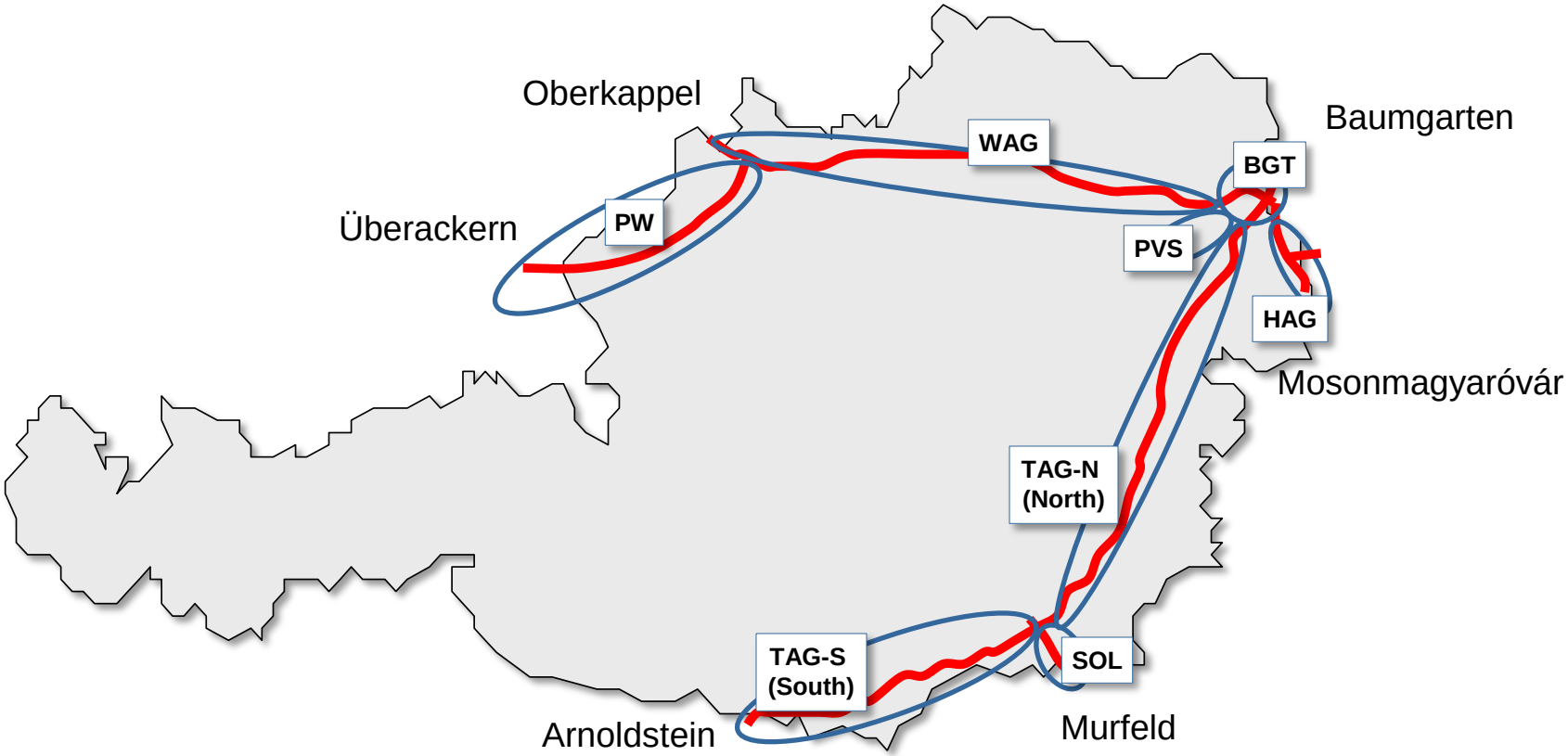
Interim Results

The entry-exit tariff system should be balanced, efficient and well suited to foster competition and trade.

- A **uniform entry tariff** at **cross-border** points
- **Locationally differentiated exit tariffs** at **cross-border** points
- **Uniform exit tariff** for **domestic exit** (one national exit zone)
- Separate consideration of **storage** and **production** sites
- **Capacity charge**
- **Commodity charge** to cover compressor fuel costs based on actually transported volume and a reference price

Interim Results

The Austrian gas transit network has been segmented to enhance the cost-reflectivity in the tariff derivation.



Note: These segments are not market areas, but merely a segmentation of the network to facilitate the allocation of costs to different network points.

Interim Results

The entry-exit tariffs should be calculated using the total allowed revenues of the TSOs, thus resulting in an integrated tariff model.

- Basis for the calculation is the **sum of the individually allowed revenues** of the TSOs
- **No** separate **calculation for the individual TSOs**
- **No tariffs at network connection points** between TSOs within the market area
- Calculation results in an **integrated tariff system** for the whole market area
- Depending on the applied capacity allocation mechanism an **inter-TSO compensation mechanism** may be required

Interim Results

The tariff system must enable the TSO to cover the allowed revenues.

Calculation of entry-exit tariffs includes the following steps:

1. Calculation of the **allowed revenue** (costs) of the TSO

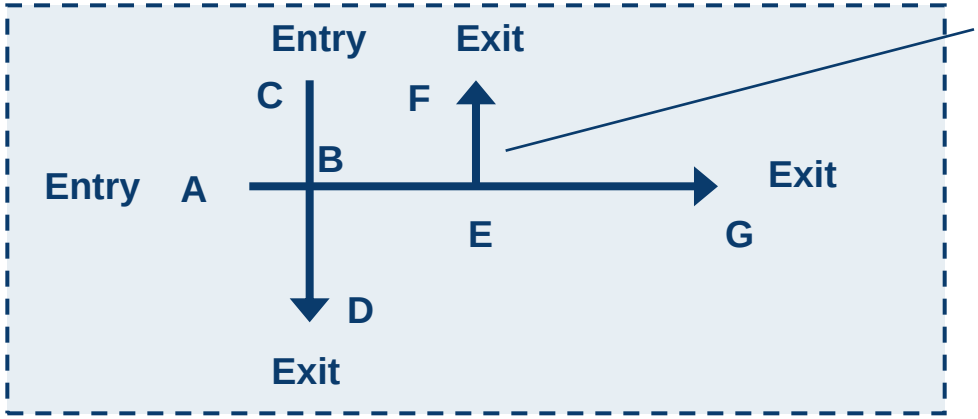
2. **Allocation** of the corresponding cost
   - first, **to pipelines sections**, and then
   - to **chargeable quantities** (booked capacities) at the entry and exit points

3. **Fine-tuning** of resulting tariff structure to ensure sustainability, successful transition, competitiveness and affordability

Interim Results

Simplified numeric example: The replacement value is used as key to allocate the allowed revenue to pipeline sections.

Stylized network:



Each pipeline section has its own replacement value

Pipeline section	Length [km]	Diameter [inch]	Replac. value [mil. €]
AB	50	36	76,25
CB	100	36	152,50
BD	125	30	153,75
BE	200	30	246,00
Etc…	Etc…	Etc…	Etc…

➔

Value in percentage of total [%]
10%
20%
20%
32%
Etc…

➔

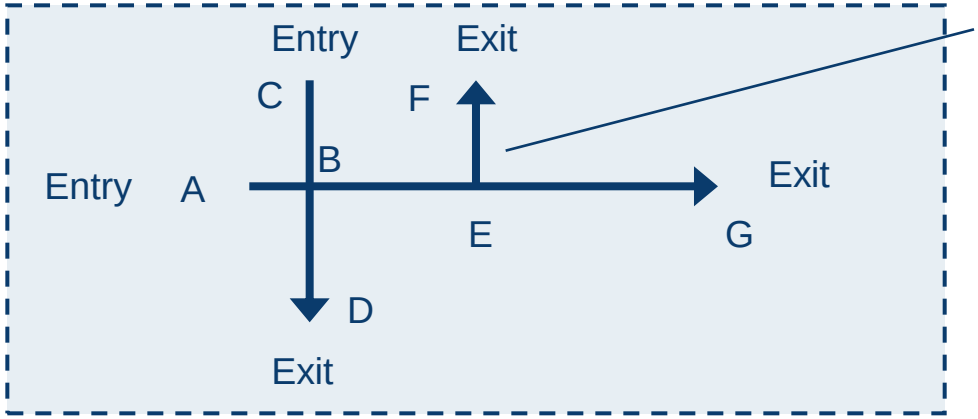
Allowed Revenue* to be recovered by section [M€]
5
10
10
16
Etc…

* Assumed that allowed revenue is set at €50M

Interim Results

Example of deriving the unit costs for each pipeline section.

Stylized network:



Each pipeline section has its own unit cost

Pipeline section	Allowed Revenue* to be recovered by section [M€]		Contr. Cap. [Nm³/h]		Unit cost [€/(Nm³/h)]
AB	5	÷	50 000 000	=	0,100
CB	10		75 000 000		0,133
BD	10		65 000 000		0,154
BE	16		60 000 000		0,267
Etc…	Etc…		…		…

* Assumed that allowed revenue is set at €50M

Interim Results

Tariffs from one network point to another (entry tariff + exit tariff) should equal (as much as possible) the unit costs of this route.

Unit cost matrix:

	Exit BD	Exit EF	Exit EG
Entry AB	$UC_{AB}+UC_{BD}$	$UC_{AB}+UC_{BE}+UC_{EF}$	$UC_{AB}+UC_{BE}+UC_{EG}$
Entry CB	$UC_{CB}+UC_{BD}$	$UC_{CB}+UC_{BE}+UC_{EF}$	$UC_{CB}+UC_{BE}+UC_{EG}$

Tariffs:

	Exit BD	Exit EF	Exit EG
Entry AB	$Tariff_{AB}+Tariff_{BD}$	$Tariff_{AB}+Tariff_{EF}$	$Tariff_{AB}+Tariff_{EG}$
Entry CB	$Tariff_{CB}+Tariff_{BD}$	$Tariff_{CB}+Tariff_{EF}$	$Tariff_{CB}+Tariff_{EG}$

Interim Results

Deriving the tariffs is a mathematical optimization problem.

- Values for sum of the entry and exit tariffs need to be the same as the corresponding values of the unit cost matrix
- This can be achieved by applying an Ordinary Least Squares method which results in the following **minimization task**:
  - $min \sum_{ij} (C_{ij} - (TN_i + TX_j))^2$
- This minimization problem can be solved by using a numerical solver
- Indicative **calculations lead to 'initial' tariffs**, these tariffs subsequently may be adjusted in order to **take into account additional constraints and requirements**

Interim Results

The tariff structure should include capacity products of different durations; the different values of these products should be appropriately considered.

- **Short-term** (< one year) and **multi-/annual** capacity products
  - At least annual, quarterly, monthly and daily products
  - Specific shares of technical capacity should be reserved for short-term products
- Tariffs for short-term capacities
  - The sum of **seasonality factors** over one year should not exceed 100%, if their application is considered
  - A **small mark-up** to reflect higher administrative burden **may be adequate**

Interim Results

The auctions at the major entry-exit points should be aligned with the capacity allocation in the adjacent market areas/networks.

- Use of **explicit price-volume auctions with multiple rounds** where physical network constraints hold
- Auctions at the cross-border points connected to the **German network** should be **aligned with the product structure and auction calendar** of the existing **Trac-x primary**
- This product structure and auction calendar could then also serve as a template for other cross-border points
- The regulated network charges set the maximum levels for the **auction starting prices** (reserve prices)

Interim Results

Congestion management should consider congestions known *ex ante* and *ex post* of capacity allocation.

- Load flow commitments increase certainty of the network use
  - Regulation should encourage efficient and economic procurement mechanisms
  - Procurement through balancing platform (FG) should be considered
- Non-freely assignable capacities may be used if they i**ncrease the available firm capacities**
  - Has to be proven by the TSOs
- Application of **UIOLI on a daily basis**
  - In case of contractual congestion, capacities become available at short-notice
  - Discourages strategic hoarding of long-term capacities
  - Limiting renomination rights after capacity has been reallocated improves certainty for the TSOs

Interim Results

In line with the major principles of the entry-exit model, capacities have to be generally offered as firm and freely assignable.

- **Standard** type of **capacity** is **firm** and **freely assignable**
- In order to improve network use, **interruptible capacities are offered** where and when firm capacities are not available
  - Price discount reflects the risk of interruptions
- **Non-freely assignable** capacities are offered at an **adequate discount** price
- Interruptible **backhaul capacities** are offered where a reversal of physical flows is not possible

Interim Results

The design of the entry-exit model should avoid distortions in the competitive environment for natural gas storage and production.

- It is suggested to apply **uniform charges at storage and production** sites to support a neutral impact on the competitive position of the providers in these areas
- Network capacities at **storage sites**
  - Explicit capacity booking only for exit, booking by storage operator
  - Storage operator integrates network charges into storage charges
  - Uniform exit fee at all storage sites on transmission level
  - Network charges based on directly attributable network costs
- Network capacities at **production sites**
  - Gas producers book only entry capacity
  - Uniform entry fee at all production sites

Interim Results

The implementation of the new model should be based on a smooth transition.

- **Impact** of the new tariff system on **TSOs and shippers**
- **Impact** of the new tariff system on **network charges**
- **Affordability and reasonableness**
- Mechanisms to **mitigate the price changes**
  - Rules for recovery of the allowed revenues from entry and exit charges
  - Capping the spread between entry and exit charges
  - Limiting the price changes in comparison with the current network charges

Many Thanks!

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