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Entry-Exit Model for gas TSO

Kick off

21st October 2013

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Agenda

Conceptual approach – what we will do

Project approach – how we will work

PwC project team – who will participate

Project plan – how we will plan the work

Expected co-operation – how you will be involved

Next step

Conceptual approach

Why to implement Entry-Exit tariff system?

EC Regulation 715/2009 introduces new principles to gas TSOs

Regulation 715/2009 of the European parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks introduces following principles:

1. Gas should be **traded independently** of its location in the system, i.e. give network users the freedom to book entry and exit capacity independently
2. Ensure **optimal management** of the gas transmission network in the Community
3. Tariffs should be **cost-reflective**, non-discriminatory and provide efficient (scarcity) signals

As a result:

- Entry-exit tariff should replace tariffs calculated on the basis of contract paths
- Costs should correspond to those of an efficient and structurally comparable network operator and are transparent, whilst including an appropriate return on investments

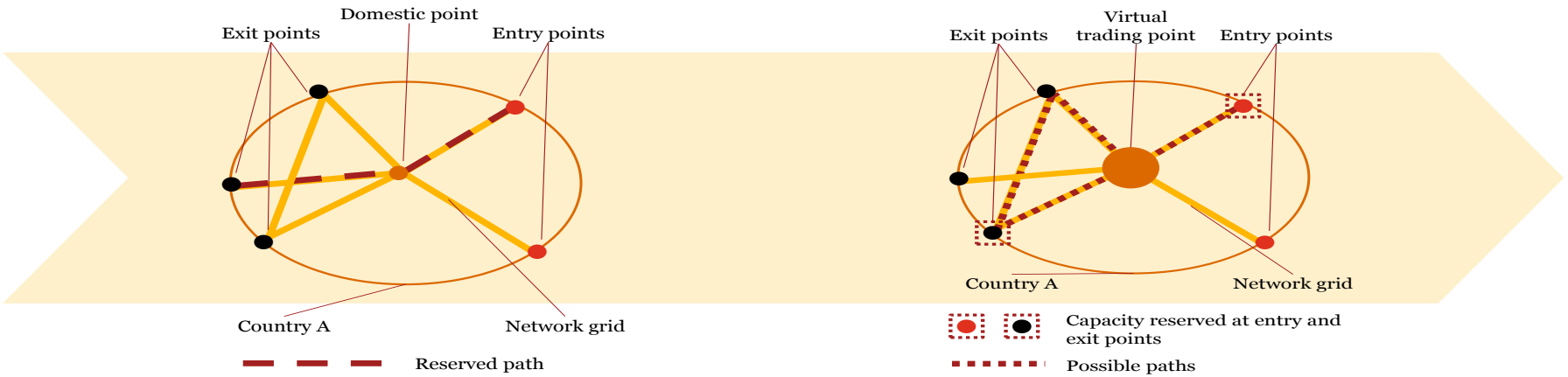
How Entry-Exit tariffs helps to achieve EC's objectives?

Promote competition and efficient gas trade

In Entry-Exit model, the input and off-take of gas is separated and the transport of the gas between these entry and exit points is not bound to the physical contracted path.

- It **promotes competition** since it decreases the entry barriers for new players on the market
- The separation of entry and exit points for capacity allocation results into **improved gas tradability** – gas is traded independently of its physical flow or location
- Entry-exit tariffs are **cost reflective** in the meshed and complex gas transit networks
- Entry-exit tariffs are capable of **accommodating the local characteristics** of different networks.

Entry-Exit tariff model overview



Current Point-to-Point model

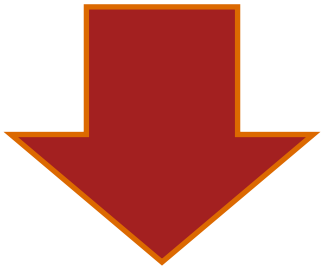
- Capacities are booked bound to a particular transportation path
- Costs for the gas transportation depend on the length of the transportation path

New Entry-Exit model

- Separation of the input and off-take of gas
- No defined contract path
- Virtual trading point – pur chase and sell gas without booking transportation capacity

Entry-exit model and cost reflectivity

Point-to-point system	Entry-exit system
Systems where only long pipelines with unidirectional flows exist.	**Complex and meshed networks**



In case physical flows deviate from contractual, distance based tariff system does not provide cost reflective charges and may be potentially discriminatory.

Focus of the project in wider context

The tariff setting process consist of **2 main steps**:

1. Setting the **total allowed revenues**
2. **Allocation** of the total allowed revenues to the users of the network

We will analyze the current tariff setting process, including the calculation of the revenue requirement, but our focus will be on the allocation of the revenues to user charges:

1. Total allowed revenues – possible approaches

Rate of return	Cost plus / Revenue cap	Benchmarking

Review

2. Allocation to user charges – possible approaches

Point-to-point	Postage stamp	Entry-Exit

Develop

3 main stages of the project

Methodology framework

- EEM application in EU and analysis of the Lithuanian system
- Analysis of the network and entry-exit ponts
- Analysis of current legislation and tariff model
- Establishment of the contact with key stakeholders

Model methodology

- Development of the methodological guidelines
- Identification of the entry-exit points, virtual balancing points and pipeline segments in the gas transit network
- Identification of the data requirements

Economic model

- Development of the EEM model
- Input data collection
- Data modelling
- Tariff calculation

Process of Entry-Exit model development

Analysis of the network topology

- Collection of the data on the network topology, points in the network, segments of the pipelines and the respective technical and cost data
- Analysis of the existing tariff methodology and gas sector regulation
- Analysis of the overall gas market in Lithuania

Development of Entry-Exit matrix

- Creation and costing of the gas pipeline segments, definition of the entry and exit points in the network and mapping the paths between entry and exit points
- Calculation of the unit marginal costs for each gas pipeline segment

Calculation of the Entry-Exit paths

- Calculation of the unit marginal costs to deliver the unit of gas from each entry point to each exit point considering the best available path in the network from the cost perspective

Calculation of the Entry-Exit tariffs

- Calculation of the tariffs for all entry and exit points such as to minimize the overall costs of the gas flow between each of the entry and exit points
- Application of the calculated entry and exit tariffs to the allowed revenue requirement

Normalization of the Entry-Exit tariffs

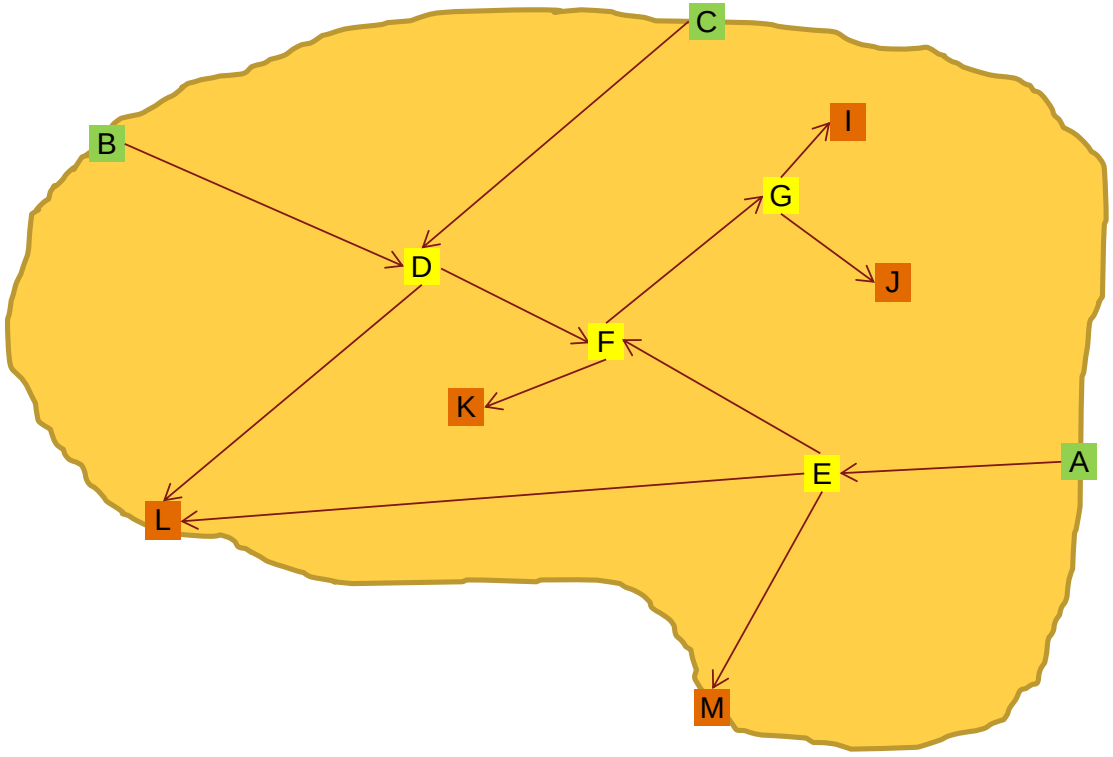
- Since the calculated entry and exit tariffs do not precisely recover the revenue requirement, the tariffs needs to be normalised to calculate the final tariffs that will recover all the allowed revenues

Step 1 – Network topology and input data

In the first step we need to understand the network and collect initial data on the topology, capacities and costs

Proposed approach:

- Develop the methodology
- Workshop with the TSO
- Draft the E/X model
- Prepare data request
- Collect and asses the data
- Apply the data to the model



- We need to collect the data on the pipeline segments and for all the segments we will need the technical parameters and costs (or allowed revenues)
- We will need to understand the points in the network (entry, exit, interconnections, gas storages, etc.

Step 2 – Entry-Exit cost matrix

In this step we will define the E/X matrix and calculate the marginal unit cost to deliver gas through each of the pipeline segments

Proposed approach:

- Define entry and exit points and pipeline segments
- Collect the required data (technical, economical)
- Calculate the unit costs of each segment

Pipeline segment	Length	Diameter	Capacity	CAPEX	Net asset value	Annual depreciation	Allowed profit	OPEX	TOTAL Cost
	km	*mm*	*mcm/day*	*mil. LTL*	*mil. LTL*	*mil. LTL*	*mil. LTL*	*mil. LTL*	*mil. LTL*
AE	80	900	50	150.00	120.00	3.75	7.80	7.50	19.05
CD	120	1,000	30	350.00	192.50	8.75	12.51	17.50	38.76
BD	100	750	20	250.00	12.50	6.25	0.81	12.50	19.56
DF	50	1,000	30	110.00	101.75	2.75	6.61	5.50	14.86

Pipeline segment	TOTAL Cost	Total gas flow	Gas flows: From A	From B	From C	Unit cost
	mil. LTL	*mcm/d*	*mcm/d*	*mcm/d*	*mcm/d*	*LTL/cm*
AE	19.05	50.00	50.00	-	-	0.38
CD	38.76	30.00	-	30.00	-	1.29
BD	19.56	20.00	-	-	20.00	0.98
DF	14.86	30.00	-	18.00	12.00	0.50

- We will work with the TSO to define the entry and exit points and the pipeline segment
- We will calculate total cost (revenue requirement) for each defined pipeline segment
- Based on the daily capacities of each pipeline segment we will calclate marginal unit costs for each segment

Step 3 – Calculation of all combination of entry-exit paths

Now we have to calculate the most efficient path between each exit and entry point from the cost perspective

	Unit costs		
	Entry points		
Exit points	A	B	C
	LTL/cm	LTL/cm	LTL/cm
I	2.46	2.47	2.78
J	2.10	2.11	2.42
K	1.72	1.73	2.05
L	2.27	2.09	2.40
M	2.76	4.93	5.25

EXAMPLE

- *The unit costs of the gas delivery between **entry point A** and **exit point I** is calculated as the sum of the unit costs of the pipeline segments that represent the most efficient path between these points*
- *In the case of the entry point A and exit point I, the most efficient path will consist of the **segments AE, EF, FG and GI***

Proposed approach:

- Statistical modelling of the most efficient paths

- For each combination of the entry and exit point we will calculate the unit costs to deliver the unit of gas through the pipeline between the defined points in the most cost effective manner
- The unit cost for gas delivery from 1 entry point to 1 exit point is calculated as the sum of the unit costs of the pipeline segments on the most efficient path

Step 4 – Calculation of Entry-Exit tariffs

The entry and exit tariffs need to be allocated in such a way as to minimize the overall costs

Proposed approach:

- Statistical modelling – minimizing the sum of the square
- Decision on allocation of portion of costs to entry points vs. exit points (fixed entry tariffs, 50:50 allocation)

$$\min \sum_{(l,k)} (ETI_l + XTI_k - PCI_{l,k})^2$$

We are minimizing the sum of the square of the above fomrulae, where:

- *ETI – entry points unit costs*
- *XTI – exit points unit costs*
- *PCI – the unit costs of delivering the gas between entry and exit point*

- Once the costs of all path have been determined, entry–exit charges are calculated by minimizing the sum of the squares of the differences between the paths costs and the sum of the corresponding entry and exit charges.
- Entry and exit charges so computed aim to be based on the cost of the fraction of the network used by each injection or exit flow, which takes into account the flows along all possible paths in the network.

Step 5 – Normalization of the tariffs

The indexes from the previous step have to be normalized to get the final tariffs that will fully recover the allowed revenues

Point	Tariff	Planned capacity demand	Recovered revenue	Revenue requirement	Normalized tariff	Recovered revenue
	LTL/cm	*mcm/d*	*mil. LTL*	*mil. LTL*		
Entry A	2.26	50	113		2.19	110
Entry B	2.67	20	53		2.58	52
Entry C	2.98	30	89		2.89	87
Exit I	2.57	10	26		2.49	25
Exit J	2.21	20	44		2.14	43
Exit K	1.83	20	37		1.78	36
Exit L	2.25	40	90		2.18	87
Exit M	4.31	10	43		4.18	42
TOTAL			**496**	**480**		**480**

Calculated preliminary tariffs recovers more revenue than total revenue requirement, therefore needs to be proportionally adjusted.

After this adjustment, by applying new normalized tariffs to planned demand, the total revenue requirement is fully recovered.

Proposed approach:

- Calculation of the planned revenue using the calculated tariffs and comparison to the total revenue requirement
- Subsequent adjustment of tariffs

- Once the preliminary tariffs are calculated we need to test, whether by applying these to the planned demand the revenue requirement will be fully recovered
- In practice, the resulting revenue from application of the preliminary tariffs will be lower or higher than the revenue requirement and therefore they need to be proportionally adjusted – “normalized”

Gas transmission network in Lithuania

Project approach

Project approach

Best practice and proven methodologies in designing EEM and tariff regulation

Technical knowledge about gas transit and transmission networks

Experts in the energy market regulation area

Large experience in managing similar projects

Good knowledge of local and EU gas markets

+

Detailed knowledge of the local gas transit and distribution market

Well established relationships with local market participants

Relevant comments on methodologies, cost models and final cost calculations

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Joint effort to fulfill project's goals and timeline

Transfer of knowledge to NCC's personnel

Strong project management and project governance

Project approach

Internal work PwC	• Legislation and regulation analysis • Framework assessment and methodology development • Model development • Data analysis and modelling
Workshops PwC, VKEKK, gas companies	• Presentation of the project • Presentation and consultation of approach and methodology • Data requirements and data collection • Evaluation of comments and issues
Technical consultancies PwC, Technical consultants	• Consultation with our technical experts on various topics that may arise
Support & training PwC, VKEKK	• Support and consultation to VKEKK regarding the applied principles in the methodology and modelling • Training to VKEKK's personnel
Public consultations PwC, VKEKK	• Support during public consultation process

Project team

PwC project team

Project leadership:
Audrius Cesiulis/Ivo Dolezal

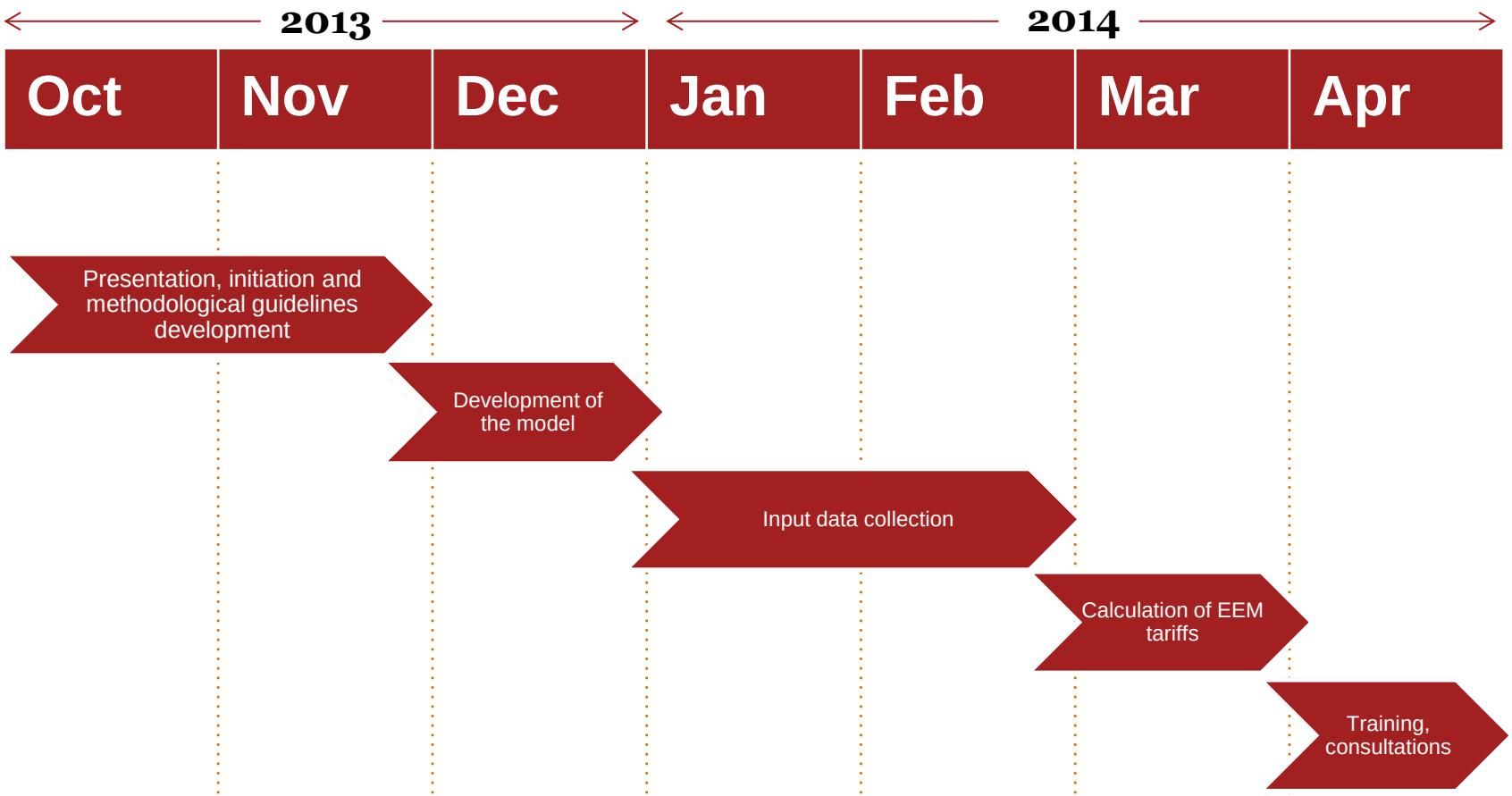
Technical expert:
Tomas Jenicek

Modelling expert:
Ondrej Seban

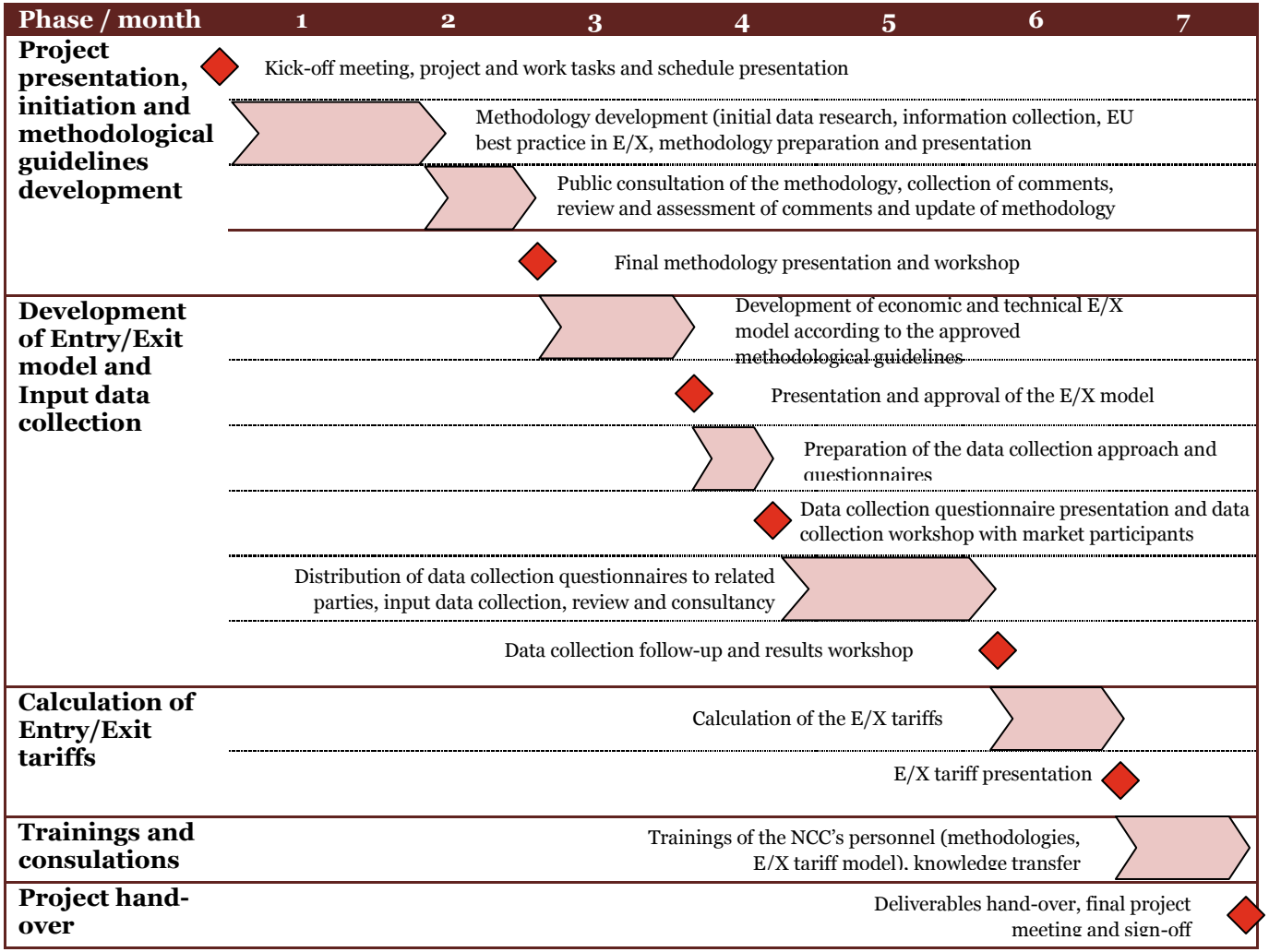
Project team:
Vytautas Ciapas and other Lithuanian consultants as required

Project plan

Project milestones



Project high level timeline



Expected co-operation

Expected co-operation

Data collection and information sharing

Will be specified at later stages

What data and information will be needed:

- Network topology (all interconnection points, gas pipeline segments)
- Capacity data (technical capacities, peak load capacities per gas pipeline segments)
- Other technical data (lengths of gas pipelines segments, diameters, etc.)
- Economic data (CAPEX, OPEX, depreciation, RAB, etc. per gas pipeline segment)
- Investment plans

Expected co-operation

Workshops, public consultations

What activities will be expected:

- Participation in workshops (methodology discussions, model discussions, data collection workshops)
- Participation in public consultations and follow-up discussions on the update of the methodology and the model

Next steps

Legislation and regulation analysis	• Now – mid November	
Presentation to key stakeholders (AmberGrid, Klaipedos Nafta and Lietuvos Dujos)	• 22.10.2013	
Initial data request	• TBD	
Methodology development	• End of November	
Model development	• December	
Data collection	• February	
Modelling tariffs	• March	
Final tariffs	• April	

Thank you for your attention!