Network interconnectivity and capacity reservation behaviour: an investigation of the Belgian gas transmission network

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disclaimer: opinions are personal and do not bind CREG in any way
Outline

- 1-Rationale
- 2-Belgian natural gas transmission network
- 3-Upstream interconnection assessment
- 4-Downstream interconnection assessment
- 5-Mismatches at cross-border points
- 6-Conclusions
1-Rationale

To provide evidence and better understanding of the lack of cross-border integration of gas transmission networks.
Rationale

« Insufficient or unavailable cross-border capacity and different market designs hamper market integration. For gas, available capacity on cross-border import pipelines is limited. New entrants are unable to secure transit capacity on key routes and entry capacity into new markets. These access barriers are reinforced by ineffective congestion management mechanisms, which make it difficult to secure even small volumes of capacity on the secondary market. »

DG COMP Energy Sector Inquiry, 2007

« Shippers are concerned that there is insufficient capacity available within the networks in Belgium, and that insufficient new capacity is being built. This manifests itself in refusals by Fluxys of requests for new capacity and analysis of information on the Fluxys website shows that for a number of entry points there is no available capacity for a number of years into the future. »

LACK OF CROSS-BORDER INTEGRATION
NO ACCESS=NO MARKET=NO COMPETITION
FRUSTRATED CLIENTS, SHIPPERS, POLITICIANS,...
2-Belgian gas transmission network

Characteristics of the network and key data.
Belgian gas transmission network

- Highly interconnected network: 10 physical upstream cross-border entry points and 9 physical downstream cross-border exit points
- 1/3 of the capacity is booked for the Belgian market and 2/3 for border-to-border transit
- 8 adjacent network operators: 2 Dutch, 2 German, 1 Norwegian, 1 British, 1 French, 1 Lux.
- National market: 1 active shipper in 2002, 6 in 2007, 9 mid-2008 and probably 12 in 2009
- National gas consumption 17,12 bcm in 2007 (43,6% public distribution, 26,4% large industry; 30,0% power plants)
- Approx. 25 transit shippers: Zeebrugge HUB important platform
- Physical transit flows approx. 35 bcm: 73% for France, 18% for UK, 6 % for Germany, 3% for Luxemburg
3-Upstream interconnection assessment

Evidence on the technical capacity and firm capacity booking/selling at the upstream cross-border interconnections of the Belgian gas transmission network.
Upstream interconnection assessment

Adjacent upstream gas transmission networks

Technical exit capacity
$UTEX_i$

Booked firm exit capacity
$UBEX_i$

Upstream cross-border interconnection $i$ ($i=10$)

Technical entry capacity
$BTEN_i$

Booked firm entry capacity
$BBEN_i$

Technical capacity mismatch rate

Upstream capacity booking rate
$\varepsilon_i = \frac{UBEX_i}{UTEX_i}$

Belgian capacity booking rate
$\sigma_i = \frac{BBEN_i}{BTEN_i}$

Booking mismatch rate
$\rho_i = \frac{BTEN_i}{UTEX_i}$

$\mu_i = \frac{BBEN_i}{UBEX_i}$
# Upstream Interconnection Assessment

*in k.m³(n)/h firm, 1st May 2008*

<table>
<thead>
<tr>
<th></th>
<th>$UTEX_i$</th>
<th>$BTEN_i$</th>
<th>$\rho_i$</th>
<th>$UBEX_i$</th>
<th>$BBEN_i$</th>
<th>$\mu_i$</th>
<th>$BBEN_{i}^{nat}$</th>
<th>$BBEN_{i}^{transit}$</th>
<th>$\varepsilon_i$</th>
<th>$\sigma_i$</th>
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<td>1.700</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>11.024</td>
<td>15.585</td>
<td>1.41</td>
<td>10.443</td>
<td>14.567*</td>
<td>1.39</td>
<td>4.826</td>
<td>9.741</td>
<td>0.95</td>
<td>0.85</td>
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</table>
# Upstream Interconnection Assessment

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Evidence</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical capacity mismatch</td>
<td>$\frac{\sum_{i=1}^{l} BTEN_i}{\sum_{i=1}^{l} UTEX_i} = 1,41$</td>
<td>The technical entry capacity of the Belgian gas transmission network is 41% higher than the technical exit capacity of the upstream networks.</td>
</tr>
<tr>
<td>Upstream firm capacity overselling</td>
<td>no</td>
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<tr>
<td>Downstream firm capacity overselling</td>
<td>$\frac{BBEN_i=ZPT}{BTEN_i=ZPT} = 1,50$</td>
<td>There is one upstream cross-border interconnection point where on one side more firm capacity is sold than the network is able to transport. At ZPT, 50% more firm entry capacity is sold than technically available.</td>
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<tr>
<td>Upstream exit booking rate</td>
<td>$\frac{\sum_{i=1}^{l} UBEX_i}{\sum_{i=1}^{l} UTEX_i} = 0,95$</td>
<td>95% of the upstream exit capacity is booked (firm).</td>
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<tr>
<td>Downstream entry booking rate</td>
<td>$\frac{\sum_{i=1}^{l} BBEN_i}{\sum_{i=1}^{l} BTEN_i} = 0,85$</td>
<td>85% of the downstream entry capacity of the Belgian network is booked (firm).</td>
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<tr>
<td>Capacity overbooking</td>
<td>$\frac{\sum_{i=1}^{l} BBEN_i}{\sum_{i=1}^{l} UBEX_i} = 1,39$</td>
<td>39% of the booked firm entry capacity of the Belgian gas network is not firmly booked upstream.</td>
</tr>
</tbody>
</table>
4-Downstream interconnection assessment

Evidence on the technical capacity and firm capacity booking/selling at the downstream cross-border interconnections of the Belgian gas transmission network.
Downstream interconnection assessment

- **Belgian gas transmission networks**
  - Technical exit capacity: \( BTEX_j \)
  - Booked firm exit capacity: \( BBEX_j \)
  - Belgian capacity booking rate: \( \gamma_j = \frac{BBEX_j}{BTEX_j} \)

- **Adjacent downstream gas transmission networks**
  - Technical entry capacity: \( DTEN_j \)
  - Booked firm entry capacity: \( DBEN_j \)
  - Downstream capacity booking rate: \( \varphi_j = \frac{DBEN_j}{DTEN_j} \)

- Upstream cross-border interconnection \( j = 9 \)
  - Technical capacity mismatch rate: \( \theta_j = \frac{BTEX_j}{DTEN_j} \)
  - Booking mismatch rate: \( \tau_j = \frac{BBEX_j}{DBEN_j} \)
# Downstream Interconnection Assessment

in k.m³(n)/h firm, 1st May 2008

<table>
<thead>
<tr>
<th></th>
<th>BTEX&lt;sub&gt;j&lt;/sub&gt;</th>
<th>DTEN&lt;sub&gt;j&lt;/sub&gt;</th>
<th>θ&lt;sub&gt;j&lt;/sub&gt;</th>
<th>BBEX&lt;sub&gt;j&lt;/sub&gt;</th>
<th>DBEN&lt;sub&gt;j&lt;/sub&gt;</th>
<th>τ&lt;sub&gt;j&lt;/sub&gt;</th>
<th>Y&lt;sub&gt;j&lt;/sub&gt;</th>
<th>φ&lt;sub&gt;j&lt;/sub&gt;</th>
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<tbody>
<tr>
<td>IZT to UK</td>
<td>3.100</td>
<td>2.911</td>
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<td>2.911</td>
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<tr>
<td>ZZ1 to NL</td>
<td>585</td>
<td>210</td>
<td>2.79</td>
<td>640</td>
<td>210</td>
<td>3.05</td>
<td>1.09</td>
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<tr>
<td>ZZ2 to NL</td>
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<td>300</td>
<td>1.95</td>
<td>723</td>
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<td>2.41</td>
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<td>EYN1 to D</td>
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<td>BRAS to Lux</td>
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<td>PET to Lux</td>
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<td>BLAR L to F</td>
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<td>1.300</td>
<td>981</td>
<td>1.33</td>
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<tr>
<td>TOTAL</td>
<td>9.603</td>
<td>7.481</td>
<td>1.28</td>
<td>8.991*</td>
<td>7.193</td>
<td>1.25</td>
<td>0.92</td>
<td>0.96</td>
</tr>
</tbody>
</table>
# Downstream Interconnection Assessment

<table>
<thead>
<tr>
<th>Indicator</th>
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<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical capacity mismatch</td>
<td>[ \frac{\sum_{j=1}^{l} BTEX_j}{\sum_{j=1}^{l} DTEN_j} = 1,28 ]</td>
<td>The technical exit capacity of the Belgian gas transmission network is 28% higher than the technical entry capacity of the downstream networks.</td>
</tr>
<tr>
<td>Upstream firm capacity overselling</td>
<td>[ \frac{BBEX_{j=ZZ1}}{BTEX_{j=ZZ1}} = 1,09 ] [ \frac{BBEX_{j=ZZ2}}{BTEX_{j=ZZ2}} = 1,23 ]</td>
<td>There are two downstream cross-border interconnection points where on one side more firm capacity is sold than the network is able to transport. There is an overselling of 9.4% at ZZ1 and 23.6% at ZZ2.</td>
</tr>
<tr>
<td>Downstream firm capacity overselling</td>
<td>no</td>
<td></td>
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<tr>
<td>Upstream exit booking rate</td>
<td>[ \frac{\sum_{j=1}^{l} BBEX_j}{\sum_{j=1}^{l} BTEX_j} = 0,92 ]</td>
<td>92% of the exit capacity of the Belgian network is booked (firm).</td>
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<tr>
<td>Downstream entry booking rate</td>
<td>[ \frac{\sum_{j=1}^{l} DBEN_j}{\sum_{j=1}^{l} DTEN_j} = 0,96 ]</td>
<td>96% of the downstream entry capacity is booked (firm).</td>
</tr>
<tr>
<td>Capacity overbooking</td>
<td>[ \frac{\sum_{j=1}^{l} BBEX_j}{\sum_{j=1}^{l} DBEN_j} = 1,25 ]</td>
<td>25% of the booked firm exit capacity of the Belgian gas network is not firmly booked downstream.</td>
</tr>
</tbody>
</table>
5-Mismatches at cross-border points

What do we learn from the evidence provided by the assessment?

What is our understanding?
Adjacent upstream networks
Capacity: 11.024
Booking: 10.443

Capacity: 15.585
Booking: 14.567

Booking national: 4.826
Booking transit: 9.741

Belgian network
Capacity: 9.603
Booking: 8.991

Capacity: 7.481
Booking: 7.193

Adjacent downstream network

in k.m³(n)/h firm
gas H + L
1st May 2008

Status of network integration
Mismatch 1: technical capacity

- Important mismatches between technical capacities on both sides of cross-border interconnections.
- Generally, technical capacity on the Belgian side is higher than on the other side of the border.
- Network operators continue to develop their networks from a too isolated point of view.
- Consultation and cooperation between network operators could contribute towards a better network coupling.
- It becomes more and more difficult to exploit networks from a ‘stand-alone’ point of view because a.o. the lack of predictability of gas flows.
- See e.g. ERGEG’s Gas Regional initiatives.
Mismatch 2: contractual congestion

- Major cross-border entry and exit interconnections have high booking rates.
- There is a situation of contractual congestion at major interconnections.
- Shift to multi-shipper environment: removal of the supply portfolio management from one integrated utility to a number of individual companies.
- Growing divergence between contractual and physical network use.
- Routing and sourcing flexibility are new components of portfolio management: network use for arbitrage.
- Capacity needs are no longer merely derived from expected peak gas flows to guarantee security of supply.
- Capacity reservation for arbitrage is one of the factors that has given rise to the current situation of contractual congestion.
- Network management must react by making not used contractual capacity available again (need of ‘use-it-or-lose-it’ and anti-hoarding mechanisms).
Mismatch 3: overbooking

- Shippers book more firm capacity in Belgium than in upstream/downstream networks:
  - Booking firm capacity on several routes in Belgium (arbitrage between different markets);
  - Booking simultaneously capacity for the Belgian market and for transit;
  - Shippers without transmission capacity upstream book firm entry capacity in the prospect of possible gas deliveries/purchases at the border;
  - Shippers convert interruptible transmission contracts upstream into downstream firm transmission contracts.

- The phenomenon of overbooking is commercially understandable and as such not distortive.

- Overbooking is also rational for the network operator insofar as no more firm capacity is allocated than can be guaranteed.

- Lack of mechanisms to bring non-used capacity back to the market that makes overbooking distortive (contractual congestion).
Mismatch 4: overselling

- Belgian network operator sells more firm capacity than the network can guarantee (maximum flow in the adjacent network is capped).
- No ‘a priori’ objection for overselling (but guarantee all transmission contracts).
- As long as the technical entry capacity at an interconnection is greater than the technical upstream exit capacity, there can be no talk of congestion of entry capacity. As long as this inequality holds, firm entry capacity can be booked.
- Closer cooperation and agreements between neighbouring operators are advocated.
- Neighbouring network operators should share data on entry/exit capacities.
5-Conclusions

Network coupling supporting cross-border market access for shippers continue to be a major concern for those who strive for the ideal of a well-functioning internal EU gas market.
Conclusions

- The current congestion problem appears not so much to be a problem of physical transmission capacity, congestion points more to a management that is not leading to a full utilisation of the network’s capability.

- Technical capacity mismatches at cross-border interconnections shows the difficulties to coordinate operations and investments between adjacent network operators.

- Firm capacity overbooking show that shippers tend to use the gas transmission network from a commercial perspective which goes beyond the traditional security of supply purpose. This is a positive sign for the emergence of effective competition.

- Overselling of firm capacity is less straightforward and deserves further attention. Network operators seem to exploit the network more commercially.

- To solve contractual congestion and improve market access, the gap between contractual and physical use should be narrowed by e.g. bringing booked but non-used transmission capacity back to the market.
THANK YOU FOR YOUR ATTENTION

Network access is promised to those shippers who endure...