TYNDP17 identification of problems

Contribution to the 3rd PCI process

Preliminary Low Infra Level results

Webinar - 18 October 2016

ENTSOG System Development Team
1. The 3rd PCI process - overview
2. TYNDP 2017 - overview
3. The TYNDP Scenario framework
4. The TYNDP assessment frame
5. Identification of problems

Webinar – 18 October
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Priority corridors: gas

Southern gas corridor:
Infrastructure for the transmission of gas from the Caspian Basin, Central Asia, the Middle East and the Eastern Mediterranean Basin to the Union to enhance diversification of gas supply.

BEMIP gas:
Infrastructure to end the isolation of the three Baltic States and Finland and their dependency on a single supplier, to reinforce internal grid infrastructures accordingly, and to increase diversification and security of supplies in the Baltic Sea region.

North-South interconnections Western EU:
Infrastructure for North-South gas flows to further diversify routes of supply and for increasing short-term gas deliverability.

North-South interconnections CEE:
Infrastructure for regional connections between and in the Baltic Sea region, the Adriatic and Aegean Seas, the Eastern Mediterranean Sea and the Black Sea, and for enhancing diversification and security of gas supply.
Projects of **Common** Interest

- Issues of **Common** Interest
  - Cross-border relevance (cross-border impact)
  - Significant contribution to Market Integration, Interoperability and System Flexibility, Security of Supply, Competition or Sustainability
  - Not *any* gas asset (not upstream or distribution; storages connected to high-pressure pipelines; LNG/CNG reception)
### Indicative planning

<table>
<thead>
<tr>
<th>Event</th>
<th>16 Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross regional mtg all RG Gas (22 Sept)</td>
<td>⬇️</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
</tr>
<tr>
<td>Cross regional mtg all RG EL (21 Sept)</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
</tr>
<tr>
<td>Preparatory work (first two weeks of Oct)</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
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<tr>
<td>Documents on CIRCABC (by 18 Oct)</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
</tr>
<tr>
<td>RG mtgs - identification of needs (week of 24 Oct)</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
</tr>
<tr>
<td>Preparatory work (10/11 Nov)</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
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<tr>
<td>Documents on CIRCABC (by 17 Nov)</td>
<td>⬆️</td>
<td>⬆️</td>
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<tr>
<td>Cross regional mtg - all RG Gas (week of 21 Nov)</td>
<td>⬆️</td>
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<td>⬆️</td>
</tr>
<tr>
<td>Cross regional mtg - all RG EL (week of 21 Nov)</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
</tr>
<tr>
<td>Preliminary results needs identification of TYNDP-G</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
</tr>
<tr>
<td>Call for PCI candidates</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
<td>⬆️</td>
</tr>
</tbody>
</table>

### Cross-regional mtg G/E

**Objective:**
- Agreement on process
- Dividing assignments
- Draft list of problems

### Homework mtgs (NRA/Promoters/Stakeholders) – per corridor

**Objective:**
- Each sub-group coordinates its views on problems per Region

### RG mtgs

**Objective:**
- Views of stakeholders
- Consensus on list of problems in the Region
- Discussion on thresholds/parameters to frame a need

### Homework mtgs (NRA/Promoters); possibly MSs

**Objective:**
- Proposal on filtering the needs from the identified problems – per Region
- Consensus on list of needs per Region

### Cross-regional mtg G/E

**Objective:**
- Discussion on the infrastructure needs per region
- Consensus on list of needs per Region
Defining the *needs*

*Needs in terms of relevant criteria, such as of security of supply, market integration, system flexibility, interoperability, competition, or sustainability that are due to infrastructure shortcomings and that prevent the implementation of a given priority corridor or thematic area.*
Overview of the process

2016

ENTSOs (G/E)
- Prepare TYNDPs for gas and electricity

Project promoters
- Submit projects
- Criteria (Art4)/CBA methodology
- PS CBA (ENTSOs)

2017

NRAs (G/E)
- Check application of criteria
- Cross-border relevance

Regional Groups
- Evaluate projects [against needs]
- Rank
- Adopt regional lists

ACER (G/E)
- Opinion
- Cross-regional consistency (in CBA application)

European Commission
- Adopt Union-wide list of PCI (no ranking)

PCI identification process
1. The 3rd PCI process - overview
2. TYNDP 2017 - overview
3. The TYNDP Scenario framework
4. The TYNDP assessment frame
5. Identification of problems
Where are we in the TYNDP process?

- Strong cooperation with ACER and European Commission all along the process
- An intense interaction with Stakeholders
- Dialogue with ENTSO-E on TYNDP Scenarios
Application of the CBA Methodology in force (EC approval Feb-15)


ENTSOG has complemented the CBA Methodology on voluntary basis on some aspects
1. The 3rd PCI process - overview
2. TYNDP 2017 - overview
3. The TYNDP Scenario framework
4. The TYNDP assessment frame
5. Identification of problems

Webinar – 18 October
### 4 Demand Scenarios

<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter</th>
<th>Slow Progression</th>
<th>Blue Transition</th>
<th>Green Evolution</th>
<th>EU Green Revolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macroeconomic trends</td>
<td>EU on track to 2050 target?</td>
<td>Behind</td>
<td>On track</td>
<td>On track – National ambitions</td>
<td>On track / beyond – EU level ambitions</td>
</tr>
<tr>
<td></td>
<td>Economic conditions</td>
<td>Limited growth</td>
<td>Moderate growth</td>
<td>Strong growth</td>
<td>Strong growth</td>
</tr>
<tr>
<td></td>
<td>Green ambitions</td>
<td>Lowest</td>
<td>Moderate</td>
<td>High</td>
<td>Highest</td>
</tr>
<tr>
<td></td>
<td>CO2 price</td>
<td>Lowest</td>
<td>Moderate</td>
<td>Highest</td>
<td>Highest</td>
</tr>
<tr>
<td></td>
<td>Fuel prices</td>
<td>Highest</td>
<td>Moderate</td>
<td>Lowest</td>
<td>Lowest</td>
</tr>
<tr>
<td>Heating sector</td>
<td>Energy efficiency improvement</td>
<td>Slowest</td>
<td>Moderate</td>
<td>Fastest</td>
<td>Fastest</td>
</tr>
<tr>
<td></td>
<td>Competition with electricity</td>
<td>Limited gas displacement by elec. (new buildings)</td>
<td>Limited gas displacement by elec. (new buildings)</td>
<td>Gas displaced by electricity (district heating, heat pumps)</td>
<td>Gas displaced by electricity (district heating, heat pumps)</td>
</tr>
<tr>
<td></td>
<td>Electrification</td>
<td>Lowest</td>
<td>Moderate</td>
<td>High</td>
<td>Highest</td>
</tr>
<tr>
<td>Power sector</td>
<td>Renewables develop.</td>
<td>Lowest</td>
<td>Moderate</td>
<td>High</td>
<td>Highest</td>
</tr>
<tr>
<td></td>
<td>Gas vs Coal</td>
<td>Coal before Gas</td>
<td>Gas before Coal</td>
<td>Gas before Coal</td>
<td>Gas before Coal</td>
</tr>
<tr>
<td>Transport sector</td>
<td>Gas in transport</td>
<td>Lowest</td>
<td>Highest</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Elec. in transport</td>
<td>Lowest</td>
<td>Moderate</td>
<td>Highest</td>
<td>Highest</td>
</tr>
</tbody>
</table>

**Related ENTSO-E 2030 Visions**

- Vision 1
- Vision 3
- Vision 4
- Vision 4
Sectoral demand

**End-user demand**

**Stable to decreasing demand** depending on energy efficiency gains and electrification of the heating sector

**Gas for power demand**

**Stable to increasing demand** depending on role of gas in RES back-up and substituting coal-fired generation
**Overall demand**

*TYNDP assessment performed for the 3 on target scenarios*
Several paths to decarbonisation

Gas grid assessment for the different paths

CO2 emissions in 2030 – overall power demand and gas end-user demand
Country-level demand evolution

Slow Progression

Blue Transition

Green Evolution

EU Green Revolution

Total annual gas demand evolution – 2017 to 2035
Gas network designed for peak situation

Gas grid assessed both from an annual volume and high demand situation perspective

European gas and electricity demand – over the year and peak perspectives
1. The 3rd PCI process - overview
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The TYNDP 2017 assessment frame

4 infrastructure levels
Dynamic over time based on projects commissioning date

- FID projects
- Non-FID advanced projects
- 2nd PCI list non-FID projects
- Non-FID less advanced projects

Minimum development of infrastructure common to all scenarios

3 scenarios assessed

- Low infra level analysis:
  - EU Green Revolution
  - Blue Transition
  - Slow Progression

Focus of today presentation

Multi-criteria analysis
A multi-criteria analysis

Security of supply
- Risk of demand curtailment
- N-1

Competition
- EU-level supply needs
- Supply mixes
- Dependence to supply sources

Market Integration
- Import Route Div.
- Supply diversification and access to supply sources
- Prices effects under contrasted supply mixes
- Price spreads
- Bilateral indicator

High demand situation

Whole year

Not covered in the preliminary results
1. The 3rd PCI process - overview
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5. Identification of problems
Identification of problems

Objective: share the TYNDP identification of problems

- TYNDP assessment performed under an assumption of perfect market functioning
  - To avoid identifying needs where better market functioning would solve the issue
  - The assessment focuses on the infrastructure needs

The results allow to identify

- The most impacted countries
- The infrastructure limitations
- Identified issues may be mitigated by different types of gas infrastructure
- Additional results still pending, including on L to H-gas conversion issues

The focus is the identification of problems

- We will not talk about projects
Security of supply
Exposure to demand disruption (normal situation)

Blue Transition

<table>
<thead>
<tr>
<th>Year</th>
<th>BEMIP</th>
<th>NSI West</th>
<th>NSI East + South. Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-LOW</td>
<td>Remaining Flexibility: 20% - 50%</td>
<td>Share of curtailed demand: 50% - 100%</td>
<td>Disrupted rate: curtailed demand share under cooperative behaviour</td>
</tr>
<tr>
<td></td>
<td>0% - 20%</td>
<td>20% - 50%</td>
<td>Remaining Flexibility: additional share of demand the infrastructure would allow to cover (calculated non-simultaneously for each country)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0% - 20%</td>
<td></td>
</tr>
<tr>
<td>2030-LOW</td>
<td></td>
<td></td>
<td>Disruption: HR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GRev: HR less disrupted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low Rem Flex: HR, SI, RO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GRev: only RO</td>
</tr>
</tbody>
</table>

High demand situation (peak day)
Security of supply
Exposure to demand disruption - under route disruption cases

> Under route disruption cases, we are interested in the additional impact compared to the normal situation case

No significant additional impact for following route disruption cases:
> Langeled disruption
> Franpipe disruption
> Transmed disruption
> MEG disruption
> TANAP disruption

> No further exposure to demand curtailment
> Only very marginal remaining flexibility decrease
## Security of supply

### Exposure to demand disruption – under Belarus route disruption

**Blue Transition**

<table>
<thead>
<tr>
<th>Year</th>
<th>Remaining Flexibility</th>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>2020-LOW</td>
<td></td>
<td></td>
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<tr>
<td>2030-LOW</td>
<td></td>
<td></td>
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</tbody>
</table>

HR unchanged from normal situation

<table>
<thead>
<tr>
<th>Exposure to demand disruption under Belarus route disruption</th>
<th>BEMIP</th>
<th>NSI West</th>
<th>NSI East + South. Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disruption: PL</td>
<td>Rev: PL low Rem Flex</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Image of map showing demand disruption]
Security of supply

Exposure to demand disruption - under Ukraine route disruption

Blue Transition

<table>
<thead>
<tr>
<th>Remaining Flexibility</th>
<th>Share of curtailed demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% - 50%</td>
<td>50% - 100%</td>
</tr>
<tr>
<td>0% - 20%</td>
<td>20% - 50%</td>
</tr>
<tr>
<td></td>
<td>0% - 20%</td>
</tr>
</tbody>
</table>

HR unchanged from normal situation

<table>
<thead>
<tr>
<th></th>
<th>BEMIP</th>
<th>NSI West</th>
<th>NSI East + South. Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure to demand disruption under Ukraine route disruption</td>
<td></td>
<td></td>
<td>Disruption: BG, HR, HU, RO GRev: same</td>
</tr>
</tbody>
</table>
Decline of indigenous production leads to increased supply needs over time for 2 out of the 3 scenarios
The low infrastructure level enables a wide range of supply mixes.
Security of supply / Competition
EU supply mixes

Green Revolution

The low infrastructure level enables a wide range of supply mixes.
Security of supply / Competition
Dependence to supply sources

Dependence to a given supply source (CSSD) should be understood as the minimum share of this source necessary for a country to cover its demand on a yearly basis.

Dependence is presented under cooperative behaviour between countries:
- Countries will align their minimum source share (CSSD) if infrastructures allow for it.
- Non-alignement between countries indicate an infrastructure bottleneck.

High CSSD level can inform both on security of supply and competition:
- In the case of LNG, being a multi-source supply, security of supply is not at stake.

Results show no dependence to Norwegian*, Algerian, Libyan or Azeri gas:
- Neither at EU-level nor at country-level.

*In 2017: limited EU-level dependence on Norwegian gas due to restricted supply flexibilities for this time horizon, no infrastructure bottleneck.
Security of supply / Competition

Dependence to Russian supply

> At EU level, no infrastructure limitation preventing full access to the other supply sources*
> At country-level, some highly dependent countries indicating infrastructure bottleneck

*the EU-level dependency derive from the maximum supply potential from the other sources
Security of supply / Competition

Dependence to LNG supply*

> At EU level, no infrastructure limitation preventing full access to the other supply sources**

> At country-level, some highly dependent countries indicating infrastructure bottleneck

*LNG is a multi-source supply: results should be interpreted accordingly

<table>
<thead>
<tr>
<th>2017-LOW</th>
<th>2020-LOW</th>
<th>2030-LOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEMIP</td>
<td>NSI West</td>
<td>NSI East + South. Corridor</td>
</tr>
<tr>
<td>Dependence to LNG supply (25% - 50%)</td>
<td>ES, FR***, PT</td>
<td></td>
</tr>
</tbody>
</table>

**CSSD**
- 50% - 100%
- 25% - 50%
- 15% - 25%
- 5% - 15%
- 0%-5%

**the EU-level dependency derive from the maximum supply potential from the other sources

***The FR situation is remedied by 2020 thanks to the commissioning of a project
**Competition - Access to Supply Sources**

Access to Supply Sources is based on the SSPDi indicator

> SSPDi: capacity of a country to reflect a given source low price in its supply bill (SSPDi: supply bill share impacted)

> At EU-level, Libyan and Azeri volumes are too low to have any significant impact on prices

> Access to Supply Sources indicates the number of sources for which SSPDi exceeds a 20% threshold

**Blue Transition – Access to sources**

LNG is a multi-source supply: results should be interpreted accordingly
Competition - Access to Supply Sources

Indigenous production fades out as a diversification option

Blue Transition – Access to sources

LNG is a multi-source supply: results should be interpreted accordingly
Most of the countries accessing a limited number of supply sources also show high dependence to either Russian or LNG supply.
Price effects - LNG

LNG supply maximisation* (low LNG price) - Green Evolution

LEGEND

<table>
<thead>
<tr>
<th>price decrease compared to the balanced price configuration [EUR/MWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;2.00</td>
</tr>
<tr>
<td>&gt;1.00, &lt;2.00</td>
</tr>
<tr>
<td>&lt;1.00, &gt;0.50</td>
</tr>
<tr>
<td>&lt;0.50</td>
</tr>
<tr>
<td>ca. 0</td>
</tr>
</tbody>
</table>

LNG is a multi-source supply: results should be interpreted accordingly

*Price effects under supply maximisation configuration based on SSPDi
**Price effects under supply minimisation configuration based on CSSD**

LNG is a multi-source supply: results should be interpreted accordingly.

- No further information compared to CSSD to LNG supply.
Price effects – Russian gas

Russian supply maximisation* (low RU price) - Green Evolution

*Price effects under supply maximisation configuration based on SSPDi
Price effects – Russian gas

Russian supply minimisation** (high RU price) - Green Evolution

**Price effects under supply minimisation configuration based on CSSD**

LEGEND

| >2.00       | >1.00, <2.00 |
| <1.00, >0.50 | <0.50       |
| ca. 0       |

price increase compared to the balanced price configuration [EUR/MWh]

> No further information compared to CSSD to Russian supply
# Price effects – wrap-up

<table>
<thead>
<tr>
<th>Price effect: barriers to low price propagation</th>
<th>BEMIP</th>
<th>NSI West</th>
<th>NSI East + South. Corridor</th>
</tr>
</thead>
</table>
| LNG Maximisation (low LNG price)              | FI vs Baltic states  
PL vs Baltic states | FR vs ES  
East vs West | BG vs GR  
East vs West |
| Russian gas Maximisation (low RU price)       |       | ES, PT vs FR  
West vs East | West vs East |

These results should be interpreted taking due account of SSPDi results

<table>
<thead>
<tr>
<th>Barriers to high price mitigation</th>
<th>BEMIP</th>
<th>NSI West</th>
<th>NSI East + South. Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG Minimisation (high LNG price)</td>
<td></td>
<td>Same as CSSD to LNG supply</td>
<td></td>
</tr>
<tr>
<td>Russian gas Minimisation (high RU price)</td>
<td>Same as CSSD to RU supply</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

> At EU-level, Azeri volumes are too low to have any significant impact on prices
Market integration - Price spreads

- Handled through a simulation focusing on Russian supply price information
  - Input: EC quarterly report Q1-16 EBP2 information (European Border Price: Russia)
  - Price spreads measured to German border price

- Marginal prices simulated for 2017
Market integration - Price spreads

<table>
<thead>
<tr>
<th>Price spreads</th>
<th>BEMIP</th>
<th>NSI West</th>
<th>NSI East + South. Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE, FI, LV, LT, PL</td>
<td>EE, FI, LV, LT, PL</td>
<td>CZ, HR, HU, RO, SK</td>
<td></td>
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</tbody>
</table>
## Conclusions

<table>
<thead>
<tr>
<th></th>
<th>BEMIP</th>
<th>NSI West</th>
<th>NSI East + South. Corridor</th>
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</thead>
<tbody>
<tr>
<td>Exposure to demand disruption</td>
<td>PL</td>
<td></td>
<td>BG, HR, HU, RO</td>
</tr>
<tr>
<td>Increased supply needs due to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>decreasing indigenous production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependence or access to limited</td>
<td>EE*, FI, LV*, LT*, PL</td>
<td>ES*, PT*, FR in 2017</td>
<td>BG, GR*, RO</td>
</tr>
<tr>
<td>number of supply sources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(* including LNG)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Price effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Barriers to low price propagation</td>
<td>FI * Baltic states</td>
<td>FR vs ES</td>
<td>BG vs GR</td>
</tr>
<tr>
<td></td>
<td>PL * Baltic states</td>
<td>East vs West</td>
<td>East vs West</td>
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<tr>
<td></td>
<td></td>
<td>ES, PT vs FR</td>
<td>West vs East</td>
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<td></td>
<td></td>
<td>West vs East</td>
<td>West vs East</td>
</tr>
<tr>
<td>- Barriers to high price mitigation</td>
<td>Same as CSSD</td>
<td>Same as CSSD</td>
<td>Same as CSSD</td>
</tr>
<tr>
<td>Price spreads</td>
<td>EE, FI, LV, LT, PL</td>
<td></td>
<td>CZ, HR, HU, RO, SK</td>
</tr>
</tbody>
</table>

> The results allow to identify the **most impacted countries** and **infrastructure limitations**

> Identified issues may be mitigated by **different types of gas infrastructure**

> In addition to this

- **Gasification demand** has been reported for CY (NSI East) and MT (NSI West)
- Analysis of L to H-gas conversion issues is still pending
Next steps

**TYNDP results presentation in Regional Group meetings**

> Based on today Webinar, ENTSOG will prepare a presentation for each Regional Group focusing on the problems of the Region

> The presentation will be made available on CIRCABC ahead of the meetings

**Regional Group meetings (EC)**

> BEMIP: 26 October – 14:00 – 17:30
> NSI East: 7 November
> Souther Corridor: 7 November
> NSI West: 8 November

**Cross-regional group meeting (EC)**

> Date still to be announced by Commission
Thank You for Your Attention

ENTSOG -- European Network of Transmission System Operators for Gas
Avenue de Cortenbergh 100, B-1000 Brussels

EML:
WWW: www.entsog.eu