TYNDP 2017 - identification of problems

Contribution to the 3\textsuperscript{rd} PCI process

\textit{Preliminary results}

NSI East and SGC Regional Groups – 7 November 2016

ENTSOG System Development Team
Infrastructure gap under TYNDP 2017

1. TYNDP 2017 - overview
2. The TYNDP Scenario framework
3. The TYNDP assessment frame
4. Identification of problems
Infrastructure gap under TYNDP 2017

1. TYNDP 2017 - overview
2. The TYNDP Scenario framework
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4. 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

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<thead>
<tr>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<td>Oct</td>
<td>Nov</td>
<td>Dec</td>
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</table>

- ACER Opinion TYNDP 2015
- Stakeholder engagement
- ENTSO-E data: installed capacities & generation
- Demand
- Projects
- Demand and project: data publication
- Preliminary Low Infra Level results
- Release
- Submission to ACER
- Public consultation

**TYNDP identifies problems and needs**
Infrastructure gap under TYNDP 2017

1. TYNDP 2017 - overview
2. The TYNDP Scenario framework
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4. Identification of problems
### 4 Demand Scenarios

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<th>Slow Progress</th>
<th>Blue Transition</th>
<th>Green Evolution</th>
<th>EU Green Revolution</th>
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<tr>
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<td>Macroeconomic trends</td>
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<td>EU on track to 2050 target?</td>
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<td>On track</td>
<td>On track – National ambitions</td>
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<td>Economic conditions</td>
<td>Limited growth</td>
<td>Moderate growth</td>
<td>Strong growth</td>
<td>Strong growth</td>
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<td>Green ambitions</td>
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<td>Moderate</td>
<td>High</td>
<td>Highest</td>
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<td>CO2 price</td>
<td>Lowest</td>
<td>Moderate</td>
<td>Highest</td>
<td>Highest</td>
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<td>Fuel prices</td>
<td>Highest</td>
<td>Moderate</td>
<td>Lowest</td>
<td>Lowest</td>
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<td>Heating sector</td>
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<tr>
<td>Energy efficiency</td>
<td>Slowest</td>
<td>Moderate</td>
<td>Fastest</td>
<td>Fastest</td>
</tr>
<tr>
<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>
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<tr>
<td>Electrification</td>
<td>Lowest</td>
<td>Moderate</td>
<td>High</td>
<td>Highest</td>
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<td>Power sector</td>
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<tr>
<td>Renewables develop.</td>
<td>Lowest</td>
<td>Moderate</td>
<td>High</td>
<td>Highest</td>
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<tr>
<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>
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<td>Transport sector</td>
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<tr>
<td>Gas in transport</td>
<td>Lowest</td>
<td>Highest</td>
<td>Moderate</td>
<td>Moderate</td>
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<tr>
<td>Elec. in transport</td>
<td>Lowest</td>
<td>Moderate</td>
<td>Highest</td>
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</tbody>
</table>

**Related ENTSO-E 2030 Visions:**

- Vision 1
- Vision 3
- Vision 4
- Vision 4
Sectoral gas 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

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End-user demand consist of the following demand: residential & commercial, industrial and transport
Overall gas demand

TYNDP assessment performed for the 3 on target scenarios
Energy Efficiency

> 27% (resp. 30%) targets set against the 2007 PRIMES baseline for 2030 (total primary energy).
  
In reference to the 2005 level, it corresponds to 20% gains (resp. 23%)

> Standard usages of gas already allow to achieve the EE target

> Gas displacing other fuels, such as for power generation, further increases the gains

When looking at targets’ achievement in the gas and power sectors it should be kept in mind that targets are set globally across all sectors.
Several paths to achieving the EU targets

**CO2 emissions**

> The on-target scenarios achieve the target of 40% CO2 reduction compared to 1990

![CO2 Emissions - 2030](image)

**Renewables**

> TYNDP 2017 scenarios for power generation are based on ENTSO-E TYNDP 2016 Visions which comply with the EU RES-E target

> TYNDP 2017 scenarios incorporate biomethane, a renewable gas source

**CO2 emissions in 2030 – overall power demand and gas end-user demand**

When looking at targets’ achievement in the gas and power sectors it should be kept in mind that targets are set globally across all sectors
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
Infrastructure gap under TYNDP 2017

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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

3 scenarios assessed

- Low
- Advanced
- 2nd PCI list
- High

Multi-criteria analysis

Low infra level analysis:
Focus of today presentation
A multi-criteria analysis

Security of supply

High demand situation
- Risk of demand curtailment
- N-1

Whole year
- EU-level supply needs
- Supply mixes
- Dependence to supply sources

Competition

Import Route Div.
- Supply diversification and access to supply sources

Market Integration

- Prices effects under contrasted supply mixes
- Price spreads

Bilateral indicator

Not covered in the preliminary results
Infrastructure gap under TYNDP 2017

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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.
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
Decline of indigenous production leads to increased supply needs over time for 2 out of the 3 scenarios
EU supply mixes
Retained supply potentials

Minimum Supply Potentials

Maximum Supply Potentials

NP  Russia  Norway  Algeria  Libya  Azerbaijan  LNG
The low infrastructure level enables a wide range of supply mixes. Azeri supply and local additional indigenous production enter the supply mix over time.
EU supply mixes

Green Revolution

The low infrastructure level enables a wide range of supply mixes. Azeri supply and local additional indigenous production enter the supply mix over time.
Security of supply
Exposure to demand disruption

*Disrupted rate and Remaining Flexibility*

> The **disrupted rate** indicates the share of a country’s demand that cannot be covered. It is calculated under **cooperative behaviour** between countries

  - Countries will align their disruption rate if infrastructures allows for it
  - Non-alignement between countries indicate an **infrastructure bottleneck**

> When a country does not face disruption, the **remaining flexibility** indicates the additional share of demand that the infrastructure would allow to cover. It is calculated non-simultaneously for each country.

*Cases investigated*

> Normal situation

> Specific route disruption cases: in this case we are interested in the **additional impact compared to the normal situation case**

> Cases leading to demand disruption are presented
Security of supply
Exposure to demand disruption (normal situation)

The Region is generally able to cover its demand even under peak situation. Croatia is exposed to demand disruption in 2030.

**Blue Transition**

<table>
<thead>
<tr>
<th>Remaining Flexibility</th>
<th>Share of curtailed demand</th>
<th>NSI East + South. Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% - 50%</td>
<td>50% - 100%</td>
<td>Exposure to demand disruption under normal situation</td>
</tr>
<tr>
<td>0% - 20%</td>
<td>20% - 50%</td>
<td>Disruption: HR</td>
</tr>
<tr>
<td></td>
<td>0% - 20%</td>
<td>Green Rev: HR less disrupted</td>
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<tr>
<td></td>
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<td>Low Rem Flex: PL, SI, RO</td>
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<tr>
<td></td>
<td></td>
<td>Green Rev: only RO</td>
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Security of supply
Exposure to demand disruption – under Belarus route disruption

Blue Transition

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</tr>
<tr>
<td></td>
<td>0% - 20%</td>
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</table>

NSI East + South. Corridor

| Exposure to demand disruption under Belarus route disruption | Disruption: PL in 2030 Green Rev: PL low Rem Flex |

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

Blue Transition

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<tr>
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<td>0% - 20%</td>
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</table>

HR unchanged from normal situation

Improvement of the situation after 2017 is linked to the foreseen commissioning of projects in the region by 2020

Disruption: BG, HR, HU, RO, GR in 2017
Green Rev: same
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 EU-level and no country-level dependence to Norwegian*, Algerian, Libyan or Azeri supply
- EU-level but no country-level dependence in the NSI East and Southern Corridor Regions to LNG supply

*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

Whole year

Blue Transition

NSI East + South. Corridor

| Dependence to Russian supply above 25% | BG, RO, PL GE and GRev.: same but PL below 25% |

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

Results for the other scenarios are provided in Annex

CSSD

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

 Improvement of the situation after 2017 is linked to the foreseen commissioning of projects in the region by 2020;

RO face infrastructure limitations in exporting its indigenous production
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)
- Access to Supply Sources indicates the number of sources for which SSPDi exceeds a 20% threshold

Blue Transition – Access to sources

NSI East + Southern Corridor Regions focus

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

*At EU-level, Libyan and Azeri volumes are too low to have any significant impact on prices
Competition - Access to Supply Sources

Blue Transition – Access to sources

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

Improvement of the situation after 2017 is linked to the foreseen commissioning of projects in the region by 2020.
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

**NSI East + Southern Corridor Regions focus**

Access to less than 3 supply sources (* including LNG)*

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>BG, GR*, RO</td>
</tr>
<tr>
<td>Barriers from GR to BG, RO</td>
</tr>
<tr>
<td>to neighbours, West to East</td>
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</tbody>
</table>

> Countries accessing a limited number of supply sources also show high dependence to Russian gas
Price effects – LNG supply

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

Legend: price decrease compared to the balanced supply configuration (EUR/MWh)

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

<table>
<thead>
<tr>
<th>Price effect: barriers to low price propagation</th>
<th>NSI East + South. Corridor</th>
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<tr>
<td>LNG Maximisation (low LNG price)</td>
<td>BG vs GR</td>
</tr>
<tr>
<td></td>
<td>East vs West</td>
</tr>
</tbody>
</table>

*Price effects under supply maximisation configuration based on SSPDi – Consider SSPDi when interpreting
Price effects – Russian supply

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

Legend: price decrease compared to the balanced supply configuration (EUR/MWh)

Barriers to low price propagation

<table>
<thead>
<tr>
<th>Russian Max. (low RU price)</th>
<th>NSI East + Southern Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>East to West barrier: Eastern part can benefit from a decrease, then CZ and SK AT, DE and SI are less sensitive.</td>
<td></td>
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</tbody>
</table>

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

Legend: price increase compared to the balanced supply configuration (EUR/MWh)

Barriers to high price mitigation

<table>
<thead>
<tr>
<th>Russian Min. (high RU price)</th>
<th>NSI East + Southern Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countries are equally impacted except for RO due to its NP. ***In 2017, BG more impacted (higher price) than neighbours.</td>
<td></td>
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</table>

*Price effects under supply maximisation configuration based on SSPDi – Consider SSPDi when interpreting
**Price effects under supply minimisation configuration based on CSSD
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

*EBP2 not available for PL (use of LT) and FI (use of LT, LV, EE)
Market integration - Price spreads

Results in Romania in 2020 related to increased national production
## Conclusions – NSI East

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<th>NSI East</th>
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<td>Isolation</td>
<td>CY</td>
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<tr>
<td>Exposure to demand disruption</td>
<td>HR&lt;br&gt;PL (2030 – Blue Transition) in case Belarus route disruption&lt;br&gt;BG, GR (2017), HU, RO in case of Ukraine route disruption</td>
</tr>
<tr>
<td>Increased supply needs calling for diversified supply</td>
<td>EU wide</td>
</tr>
<tr>
<td>Dependence or access to limited number of supply sources (*) including LNG</td>
<td>BG, GR*, RO&lt;br&gt;Barriers from GR to BG, RO to neighbours, West to East</td>
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<tr>
<td>Price effects</td>
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<tr>
<td>- Barriers to LNG low price propagation</td>
<td>BG vs GR&lt;br&gt;East vs West</td>
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<tr>
<td>- Barriers to RU low price propagation</td>
<td>West vs East barrier: AT, DE, SI vs East; CZ, SK vs East</td>
</tr>
<tr>
<td>- Barriers to RU high price mitigation</td>
<td>BG vs neighbours; neighbours vs RO</td>
</tr>
<tr>
<td>Price spreads</td>
<td>BG, CZ, HR, HU, PL, 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
## Conclusions – Southern Gas Corridor

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<th>Southern Corridor</th>
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<td>Relevant for NSI East</td>
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<td><strong>Exposure to demand disruption</strong></td>
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<td><strong>Dependence or access to limited number of supply sources (including LNG)</strong></td>
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> The results allow to identify the **most impacted countries** and **infrastructure limitations**

> Identified issues may be mitigated by **different types of gas infrastructure**
Thank You for Your Attention

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Infrastructure gap under TYNDP 2017

Annex
Demand – NSI East and SGC focus

CY gasification demand cannot be covered under the Low infra level as necessary infrastructures are missing
Overall demand evolution – country-level

Slow Progression

Blue Transition

Green Evolution

EU Green Revolution

Total annual gas demand evolution – 2017 to 2035
Sectoral demand evolution – country-level

Evolution of annual end-user gas demand in the period 2017-2035

- Blue Transition
- Green Evolution
- EU Green Revolution

Evolution of annual gas demand for power generation in the period 2017-2035.
Dependence to Russian gas
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

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

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<tr>
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<tr>
<td>Dependence to LNG supply (25% - 50%)</td>
<td>No dependency</td>
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</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