TYNDP 2017 - identification of problems

Contribution to the 3rd PCI process

Preliminary results

NSI West Regional Group – 8 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

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2. The TYNDP Scenario framework
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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

<table>
<thead>
<tr>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<td>Oct</td>
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ENTSO-E Scenario Report

Concept elaboration
incl. scenario and assumption building

Data collection and check

Assessment and editing

TYNDP identifies problems and needs
Infrastructure gap under TYNDP 2017

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

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<th>Blue Transition</th>
<th>Green Evolution</th>
<th>EU Green Revolution</th>
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<td>Vision 3</td>
<td>Vision 4</td>
<td>Vision 4</td>
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<tr>
<td>Category</td>
<td>Parameter</td>
<td>Slow Progress</td>
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<td>Macroeconomic trends</td>
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<td>Behind</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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<tr>
<td>Green ambitions</td>
<td>Lowest</td>
<td>Moderate</td>
<td>High</td>
<td>Highest</td>
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<tr>
<td>CO2 price</td>
<td>Lowest</td>
<td>Moderate</td>
<td>Highest</td>
<td>Highest</td>
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<td>Fuel prices</td>
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<td>Lowest</td>
<td>Lowest</td>
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<tr>
<td>Heating sector</td>
<td>Efficiency improvement</td>
<td>Slowest</td>
<td>Moderate</td>
<td>Fastest</td>
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<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>
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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>
<td>Renewables develop.</td>
<td>Lowest</td>
<td>Moderate</td>
<td>High</td>
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<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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<tr>
<td>Transport sector</td>
<td>Gas in transport</td>
<td>Lowest</td>
<td>Highest</td>
<td>Moderate</td>
</tr>
<tr>
<td>Elec. in transport</td>
<td>Lowest</td>
<td>Moderate</td>
<td>Highest</td>
<td>Highest</td>
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</tbody>
</table>
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

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
Several paths to achieving the EU targets

**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](chart)

**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**

The gas grid is to be assessed for the different paths

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

3 scenarios assessed

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

Security of supply

- Risk of demand curtailment
- N-1

High demand situation

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

Whole year

Competition

- Import Route Div.

Market Integration

- Supply diversification and access to supply sources
- 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
Infrastructure gap under TYNDP 2017

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4. Identification of problems – NSI West Region
   4.1. Supply Adequacy
   4.2. Assessment of problems
Decline of indigenous production leads to increased supply needs over time for 2 out of the 3 scenarios.
EU supply mixes
Retained supply potentials
The low infrastructure level enables a wide range of supply mixes.
The low infrastructure level enables a wide range of supply mixes.
Supply Adequacy in North-West Europe: the challenge of L-gas conversion

*The decline of the European gas production is a general concern and it makes new imports necessary*

*The case of L-gas is even more significant given*

- the fact that L and H gas are not substitutable
- the limited number of L-gas fields and the predominance of Groningen

*Therefore L-gas market conversion is currently the biggest infrastructure challenge in the North-West Europe gas market*

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*The L-gas topic is not part of the TYNDP main assessment. It is handled through a dedicated approach, based on data collected as part of the TYNDP data collection.*
European L-gas market

### Netherlands
- **Production**: 240 TWh
- **L-gas Consumption**: 270 TWh
- **Share of total consumption**: 60%
- **Number of customers**: 6.8 M

### Germany
- **Production**: 73 TWh
- **L-gas Consumption**: 230 TWh
- **Share of total consumption**: 30%
- **Number of customers**: 4.9 M

### Belgium
- **Production**: 0 TWh
- **L-gas Consumption**: 50 TWh
- **Share of total consumption**: 30%
- **Number of customers**: 1.6 M

### France
- **Production**: 0 TWh
- **L-gas Consumption**: 44 TWh
- **Share of total consumption**: 10%
- **Number of customers**: 1.3 M

- **1 TSO, 7 DSO**
- **5 TSO, 161 DSO**

**Rounded figures**

- ~14.5 millions of customer
- ~600 TWh / year
Decline of L-gas production: Groningen

Remaining reserves of 650-700 Gm3 (beginning of 2016)
Export contracts end between 2020 and 2030
Decline of L-gas production: Germany

Producer forecast has become more conservative over the years
Starting from 2020, part of the local gas demand in Belgium, France and Germany may not be covered by L-gas exports from the Netherlands, unless converted to H-gas.
The challenge of L-gas conversion
A specific assessment of needs

2025 - with conversion

2025 - without conversion

A specific CBA assessment is foreseen to be carried out for the L-gas sub-zones in Belgium, France and Germany as part of GRIP NW

The following CBA indicators are foreseen to be assessed:
- Remaining Flexibility
- Disrupted Demand
- USSD/CSSD
- N-1

The methodology and the data set will be consistent with the data set used for the ESW CBA of the TYNDP 2017
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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 NSI West Region is able to cover its demand even under peak situation

Blue Transition

<table>
<thead>
<tr>
<th>Remainning Flexibility</th>
<th>Share of curtailed demand</th>
<th>NSI West</th>
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</thead>
<tbody>
<tr>
<td>20% - 50%</td>
<td>50% - 100%</td>
<td>Low Rem Flex: DK</td>
</tr>
<tr>
<td>0% - 20%</td>
<td>20% - 50%</td>
<td></td>
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<tr>
<td></td>
<td>0% - 20%</td>
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</tbody>
</table>
Security of supply
Exposure to demand disruption - Route disruption cases

The following route disruption cases have been assessed

- Ukraine route disruption
- Belarus route disruption
- Langeled disruption
- Franpipe disruption
- Transmed disruption
- MEG disruption
- TANAP disruption

None of these cases have any significant impact on the NSI West Region

- No exposure to demand curtailment
- Only very marginal remaining flexibility decrease
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:**
- *neither EU-level nor country-level dependence to Norwegian*, Algerian, Libyan or Azeri supply
- *EU-level but no country-level dependence in the NSI West Region to Russian 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 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

<table>
<thead>
<tr>
<th>CSSD</th>
<th>50% - 100%</th>
<th>25% - 50%</th>
<th>15% - 25%</th>
<th>5% - 15%</th>
<th>0%-5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependence to LNG supply (25% - 50%)</td>
<td>BEMIP</td>
<td>NSI West</td>
<td>NSI East + South. Corridor</td>
<td></td>
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<tr>
<td><strong>the EU-level dependency derive from the maximum supply potential from the other sources</strong></td>
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<tr>
<td><strong>The FR situation is remedied by 2020 thanks to the commissioning of a project</strong></td>
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</table>
**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)
- **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

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

*Indigenous production fades out as a diversification option*

**Blue Transition – Access to sources**

Indigenous production fades out as a diversification option. LNG is a multi-source supply: results should be interpreted accordingly. The NSI West countries accessing a limited number of supply sources also show high dependence to LNG supply.

**NSI West Region focus**

- Access to less than 3 supply sources (*including LNG*):
  - ES*, PT*

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

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

LNG supply minimisation* (high LNG price) - Green Evolution

<table>
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<tr>
<th>Price effect: barriers to low price propagation</th>
<th>NSI West</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG Maximisation (low LNG price)</td>
<td>FR, BE, UK, IE benefits less than ES and PT; Eastern countries benefit less than Western ones</td>
</tr>
</tbody>
</table>

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

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

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

Barriers to high price mitigation

<table>
<thead>
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<tr>
<td>LNG Minimisation (high LNG price)</td>
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</table>

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

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

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

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

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

**Barriers to low price propagation**

<table>
<thead>
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<td>Russian gas Max. (low RU price)</td>
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**Barriers to high price mitigation**

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*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

Assessment shows no spreads in the NSI West Region neither in 2017, nor later

*EBP2 not available for PL (use of LT) and FI (use of LT, LV, EE)
Conclusions

<table>
<thead>
<tr>
<th>Problems</th>
<th>NSI West</th>
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<tr>
<td>Isolation</td>
<td>MT</td>
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<tr>
<td>Decline of indigenous production increasing supply needs.</td>
<td>Potential impact on all countries</td>
</tr>
<tr>
<td>In particular decline of L-gas production making it necessary to adapt</td>
<td>L-gas market countries</td>
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<tr>
<td>L-gas market to H-gas.</td>
<td></td>
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<tr>
<td>Dependence or access to limited number of supply sources</td>
<td>ES*, PT*, FR in 2017</td>
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<tr>
<td>(* including LNG)</td>
<td></td>
</tr>
<tr>
<td>Price effects</td>
<td></td>
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<tr>
<td>- Barriers to low LNG price propagation</td>
<td>FR, BE, UK, IE benefits less than ES and PT;</td>
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<tr>
<td></td>
<td>Eastern countries benefit less than Western ones</td>
</tr>
<tr>
<td>- Barriers to high LNG price mitigation</td>
<td>ES and PT less able to mitigate than other countries</td>
</tr>
<tr>
<td>- Barriers to high RU price mitigation</td>
<td>ES and PT benefit less than other NSI West countries</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**
Thank You for Your Attention

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Infrastructure gap under TYNDP 2017

Annex
MT gasification demand cannot be covered under the Low infra level as necessary infrastructures are missing.
Demand evolution

Evolution of annual final 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.

Blue Transition  Green Evolution  EU Green Revolution

> -50 %  0%  > 50 %
Country-level demand evolution

Slow Progression

Blue Transition

Green Evolution

EU Green Revolution

Total annual gas demand evolution – 2017 to 2035
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, no infrastructure bottleneck identified within the NSI West Region

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

Results for the other scenarios are provided in Annex
Dependence to Russian gas
Dependence to LNG

CSSD LNG 2020

CSSD LNG 2030

LOW