TYNDP Outputs

The TYNDP assessment

ENTSOG System Development Area

Image Courtesy of Thyssengas

TYNDP is a multi-criteria assessment

The TYNDP assessment frame is defined by the CBA methodology

It is a multi criteria assessment

> Aiming at assessing the situation along the **criteria defined by Reg. 347**

> Aiming at assessing the projects along a wide range of potential benefits
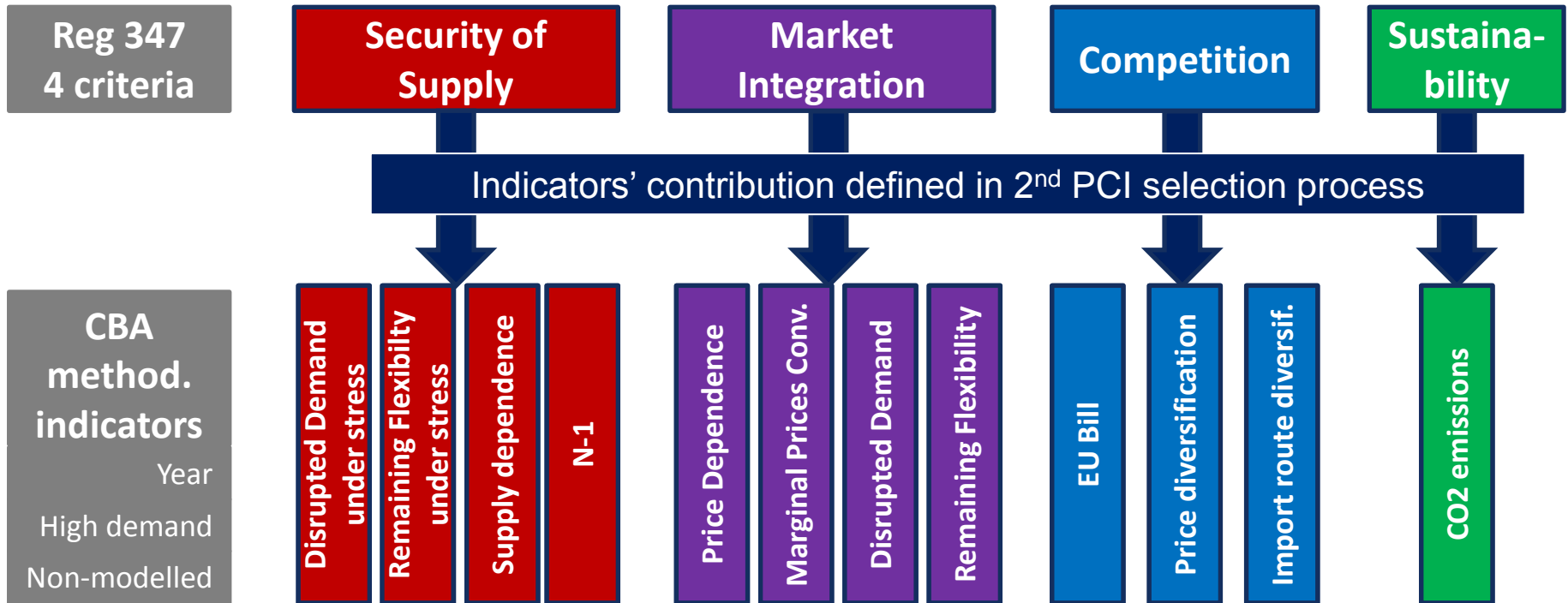
Within this multi-criteria assessment

> Some parts are modelled, other are not

> Some parts looks at quantitative indicators that are not monetised

> Some parts looks at quantitative indicators that could be monetised using a fixed value

> Some parts looks at indicators that are monetised as part of the simulation
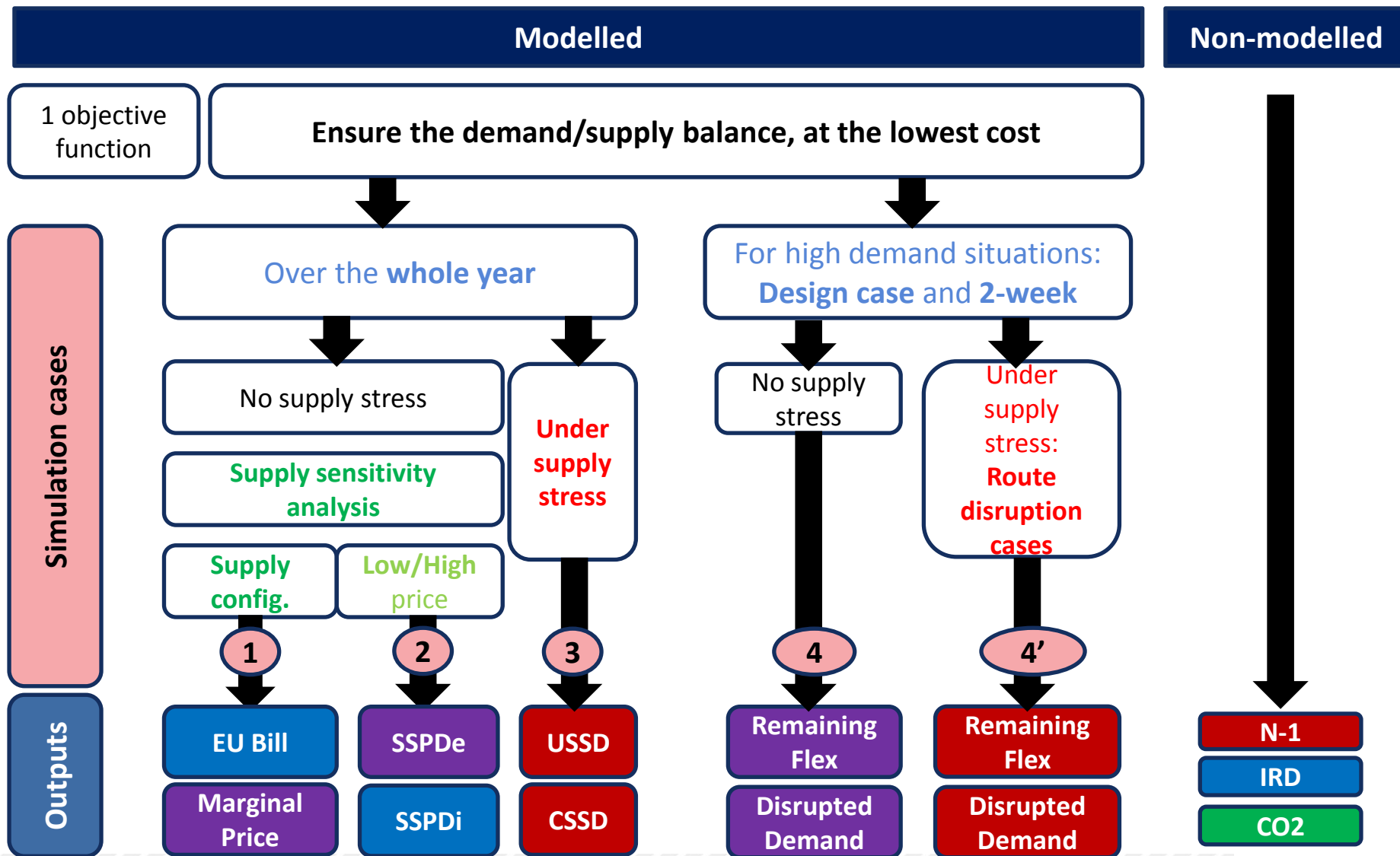
All parts are as relevant and none should be disregarded.

TYNDP is a multi-criteria assessment

A multi-criteria assessment

| Reg 347 4 criteria | Security of Supply | Market Integration | Competition | Sustaina-bility |

Indicators' contribution defined in 2nd PCI selection process

CBA method. indicators

Year

High demand

Non-modelled

Security of Supply				Market Integration				Competition			Sustainability
Disrupted Demand under stress	Remaining Flexibility under stress	Supply dependence	N-1	Price Dependence	Marginal Prices Conv.	Disrupted Demand	Remaining Flexibility	EU Bill	Price diversification	Import route diversif.	CO_2 emissions

TYNDP is a multi-criteria assessment

Modelled	Non-modelled

1 objective function

Ensure the demand/supply balance, at the lowest cost

Simulation cases

Over the **whole year**

For high demand situations: **Design case** and **2-week**

No supply stress

Under supply stress

No supply stress

Under supply stress: **Route disruption cases**

Supply sensitivity analysis

Supply config.

Low/High price

1

2

3

4

4'

Outputs

EU Bill	SSPDe	USSD	Remaining Flex	Remaining Flex	N-1
Marginal Price	SSPDi	CSSD	Disrupted Demand	Disrupted Demand	IRD
					CO2

TYNDP assessment

The assessment is performed

> For the different Infrastructure Levels (possible developments of the gas system)

> Over the whole time horizon

> For the retained Demand Scenarios

Infrastructure Levels

Demand Scenarios	Low Infrastructure Level	Mature Infrastructure Level	High Infrastructure Level	PCI Infrastructure Level
Green Revolution	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035
Blue Transition	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035
Slow Progression	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035	2017, 2020, 2025, 2030, 2035

← **Time Snapshots**

Demand Scenarios may not all be assessed in the TYNDP. Decision will be taken at a later stage.

Non-modelled indicators
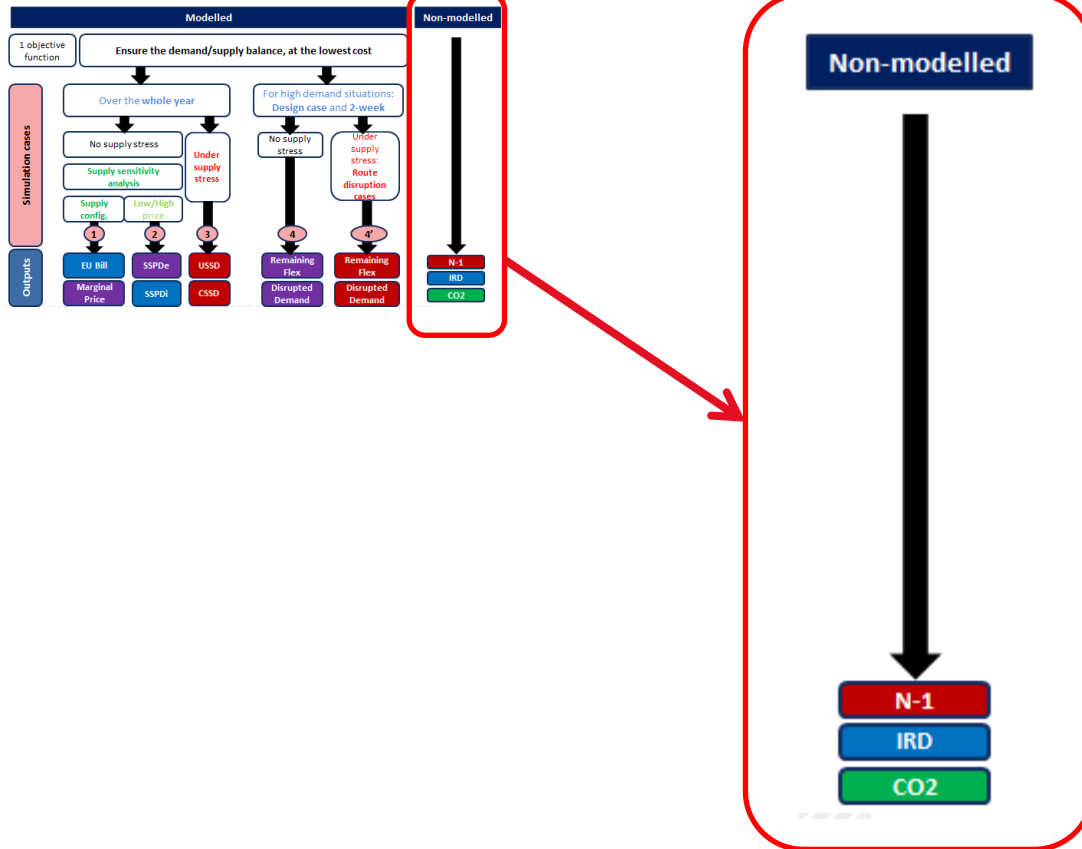
Non-modelled indicators

SoS

N-1 for ESW-CBA (N-1)

> Question addressed: **are entry capacities sufficient to cover design case demand in case of unavailability of the single largest infrastructure?**

- Capacity-based (not flow-based)
- Application of lesser-of-rule
- Per demand scenario
- Per Infrastructure level
- Per year

$$N - 1 = \frac{IP + NP + UGS + LNG - I_m}{Dmax} * 100$$

2020 Low

TYNDP 2015

N-1 for ESW-CBA

🟧	N-1 < 90%
🟨	90% < N-1 < 100%
🟩	100% < N-1 < 120%
🟦	N-1 > 120%

Non-modelled indicators

Import Route Diversification (IRD)

> Measures the **diversification of paths that gas can flow through** to reach a country (or balancing zone), based on the entry capacity split between entry points

- HHI-type indicator
- Capacity-based (not flow-based)
- Per Infrastructure level

> The lower , the better the diversification

2020 Low

TYNDP 2015

Import Route Diversification (IRD)

■ Low route diversification: > 6150

↓

■ High route diversification: < 3580

$IRD =$

$$\sum_l^{Xborder}\left(\sum_k^{IP}\% \, IP_k \, Xborder_l\right)^2 + \sum_j^{Source}\sum_i^{IP}\left(\% \, IP_i \, from \, source_j\right)^2 + \sum_m(\% \, LNG \, terminal_m)^2$$
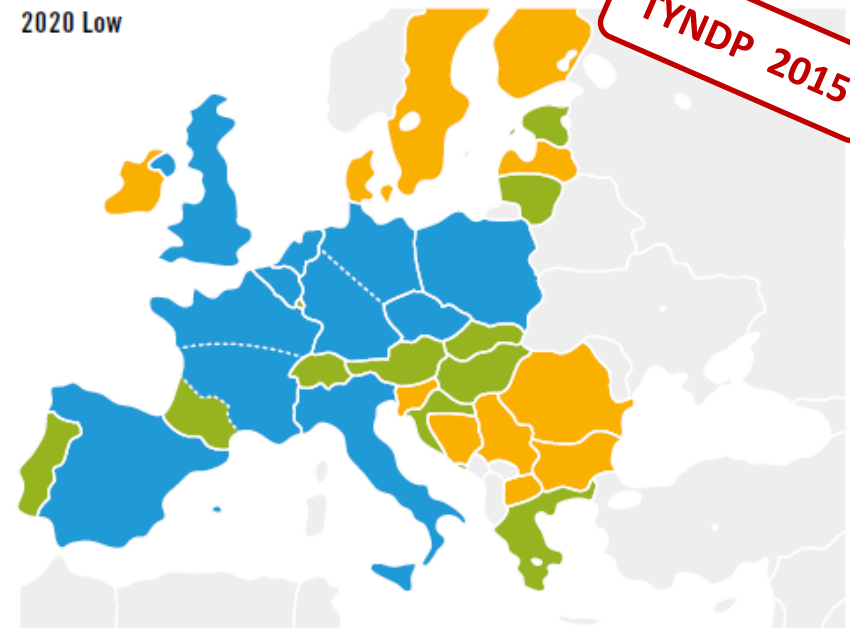
Non-modelled indicators

Sustainability

CO2 emissions

> CO2 emissions deriving from gas demand and coal demand for power generation

> Calculation based on the power methodology module: generation mix' thermal gap splitt between gas and coal

High demand indicators
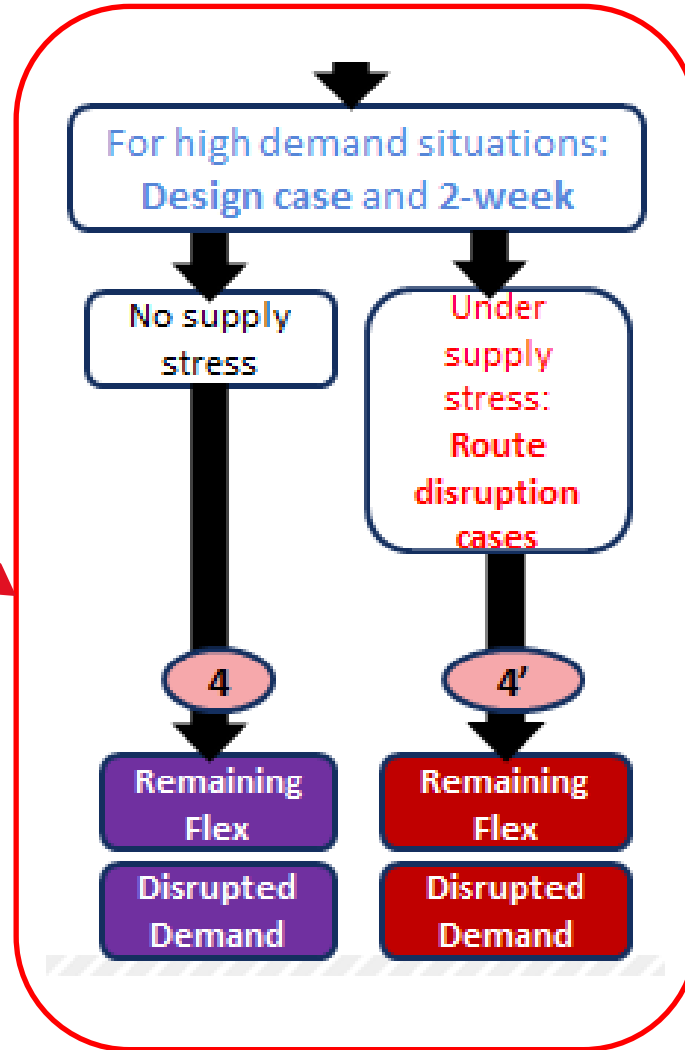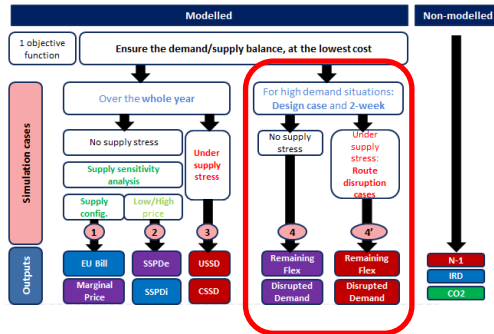
High demand indicators
Disrupted rate and Remaining Flexibility

Disrupted Demand (DD)

> Question addressed: **are countries (or BZ) facing demand curtailment under high demand situations?** If yes, which share of their demand is curtailed?

- Both Disrupted Demand Rate and Disrupted Demand Quantity are calculated

Remaining Flexibility (RF)

> Question addressed: **how much additional demand is a country (or BZ) able to cope with?** Expressed as share of the country's actual demand.

- Calculated for each country one by one

High demand indicators
Disrupted rate and Remaining Flexibility

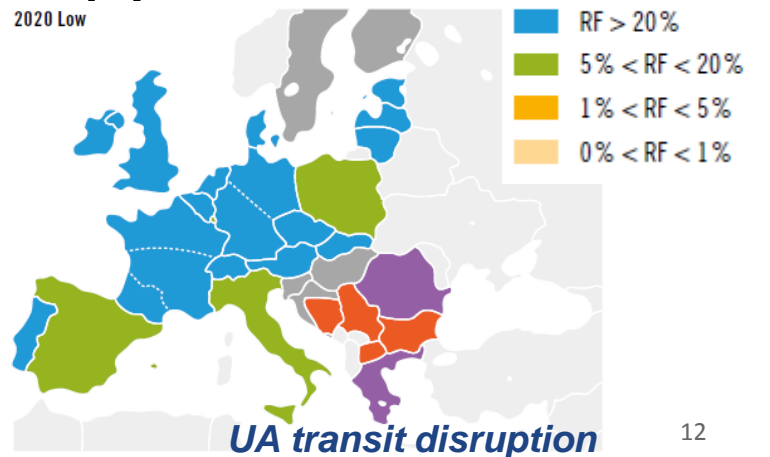**Market integ.**

DD and RF under normal situation
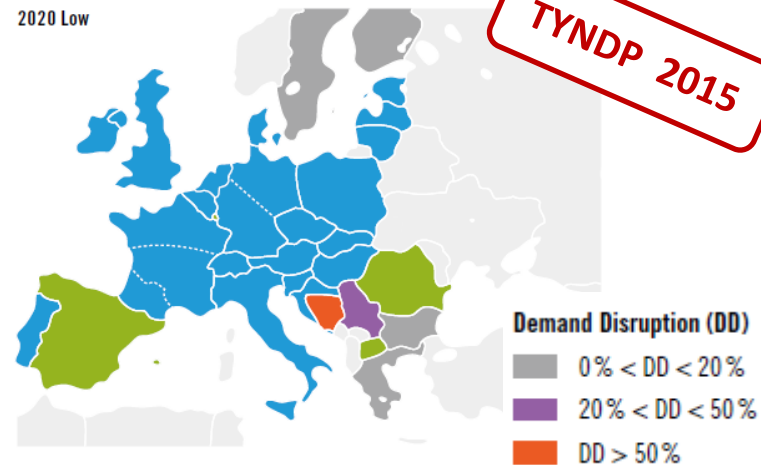
SoS

DD and RF under route disruption situations (8)

> RU transit through **Ukrainian** or **Belarus**

> NO: **Langeled** or **Franpipe** disruption

> DZ: **Transmed** or **MEG** disruption

> LY: **Green Stream**

> AZ : **TANAP**

TYNDP 2015

2020 Low

Demand Disruption (DD)
- 0 % < DD < 20 %
- 20 % < DD < 50 %
- DD > 50 %

Remaining Flexibility (RF)
- RF > 20 %
- 5 % < RF < 20 %
- 1 % < RF < 5 %
- 0 % < RF < 1 %

2020 Low

UA transit disruption

12

High demand indicators
Disrupted rate and Remaining Flexibility

Modelling assumptions

> Demand: design case and 2-week high (per demand scenario)

> Supplies

- up to 110% (of daily average yearly maximum)
- Disruption is the "last resort supply"

> Infrastructures

- Storages: deliverability depends on inventory

- LNG terminals
  - Design case: send-out up to 100% of send-out capacity
  - 2-week case: use of tanks on 1st week, possible additional cargoes on 2nd week
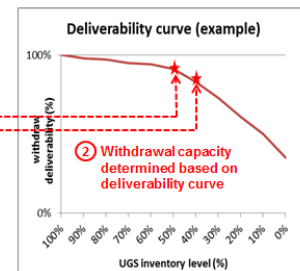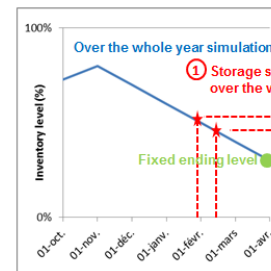
High demand indicators
Disrupted rate and Remaining Flexibility
Proposal for the valuation of lost load – Background

> Request from institutions for further monetization, including in ACER Opinion

> TYNDP 2015 approach in the modelling
  o Mathematical value of 105.000 EUR/GWh to be the most expensice "source"
  o This did not represent any monetary value

Proposal for the valuation of lost load

(Total EU28 GDP/Gross Inland Consumption) x Demand not satisfied as *a result from the modelling*

> **Pros**

- Simple
- Transparent
- Understandable
- Data is readily available and is easy to project for the future
- Provides a max. Estimate
- EIB uses similar approach, methodologically they have approved this proposal

> **Cons**

- Real GDP loss would be different (less/more) ?
- Specificities of a given disruption case and the economic agents' reaction to that are not considered

EU 28	2010	2011	2012	2013
Gross Inland Energy Consumption - GIEC (kTOE)	1.766.132	1.698.070	1.686.081	1.666.318
GDP (mEUR) *current prices*	12.371.536	12.711.207	12.959.736	13.068.601
CoD - GIEC (EUR/GWh)	602.311	643.652	660.903	674.359

Proposal for the valuation of lost load
FAQs

> **Data source**
  - **Gross Inland Consumption:** Eurostat/IEA assumptions for the future;
  - **GDP:** – IEA/ECB/World Bank assumptions for the future

> **Why not different values for each country are proposed?**
  - Possible improvements in future publications are possible
  - Use of a common Social Discount Rate in PS-CBA

> **Why not to use only the gas consumption or the gas share of the energy consumption?**
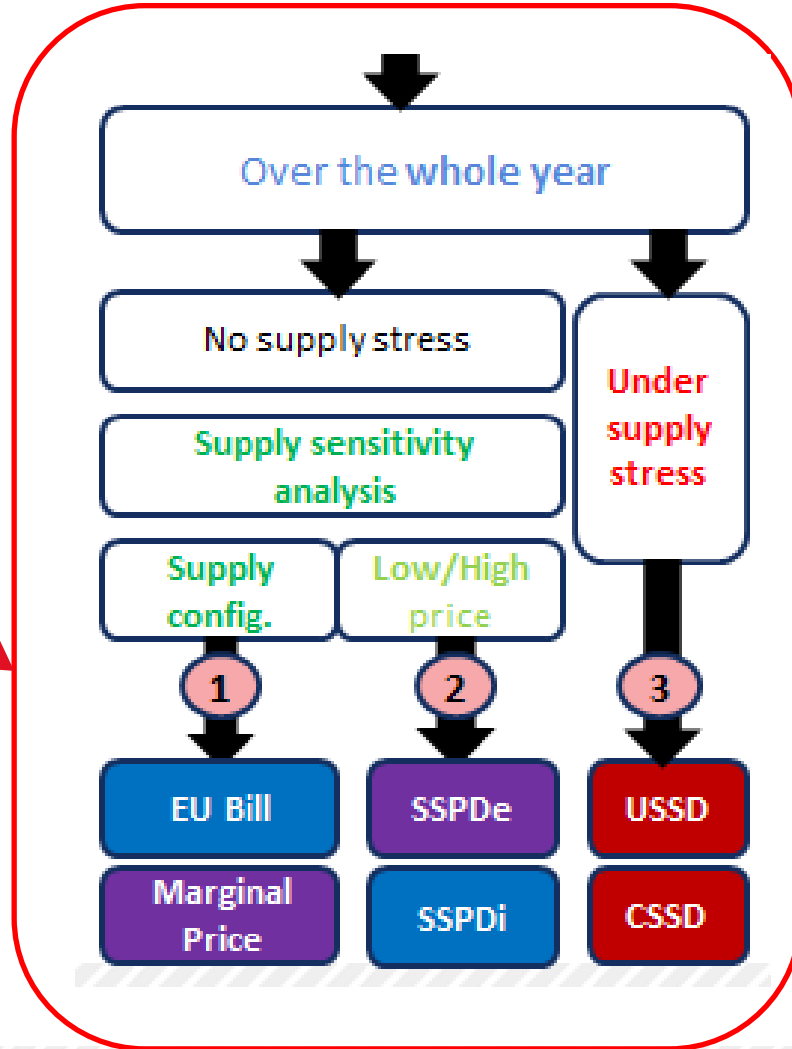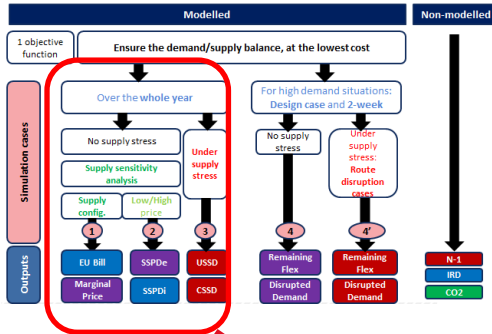 - In case we assume that the contribution of each energy source in the energy mix to the GDP is the same, the result is the same
  - We do not have data to assume differently

> **Theoretically a more complex approach could be created**
  - Practically the data, resources and time necessary for such an excercise makes it non-feasible

Over the whole year indicators

Over the whole year indicators
EU supply bill and Marginal Prices (reminder SJWS#2)

Competition

EU supply bill

> to answer the questions: do projects improve the EU supply bill?

Market integ.

Marginal prices (at country level)

> to answer the question: do projects improve the marginal **price convergence between countries**?

> Marginal prices can be used to compute the **consumer bill** at country level
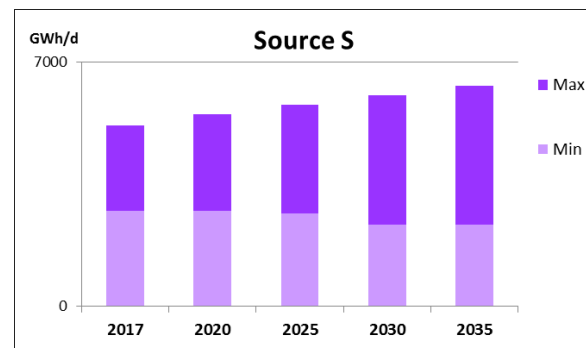
Monetised (simulation-based) part of the assessment

> Calculated as part of the same simulation

Over the whole year indicators
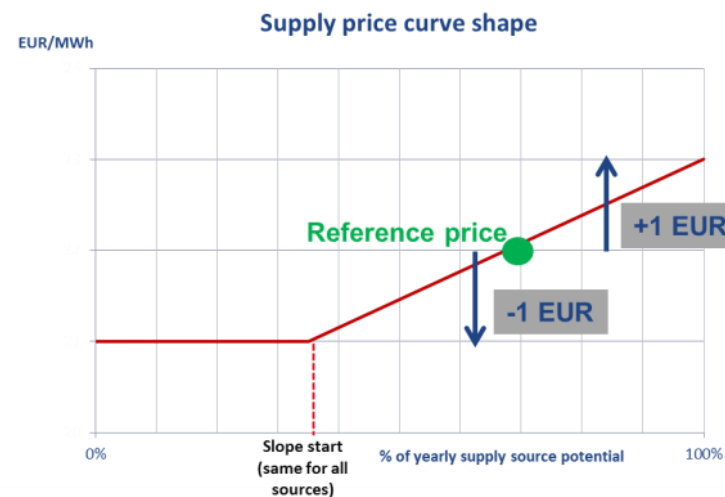## EU supply bill and Marginal Prices (reminder SJWS#2)

> Supplies modelled using

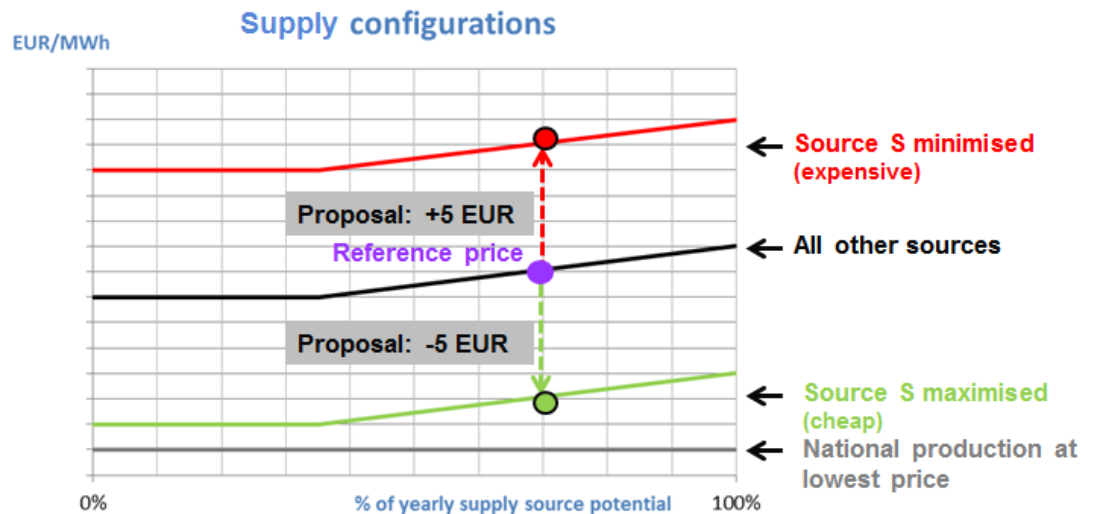- [Min – Max] supply range per source

- **a reference supply price**

- **supply price curves**

Over the whole year indicators
EU supply bill and Marginal Prices (reminder SJWS#2)

> Integrated Market simulations cases: a **sensitivity analysis** on **contrasted supply mixes**
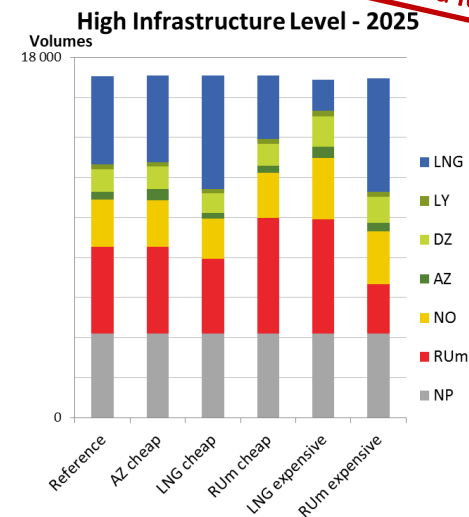
  ▪ Using **supply configurations**

> Market integration assumption: same **price per source** regardless of the import point

> Supply configurations intend at representing **short-lasting situations** (not over 20 years)

> **Supply mixes do not depend on price spread assumptions**

> **Monetised results directly depend on price spread assumptions**: **standardised results** based on standardised price spread assumptions (not a forecast)

Over the whole year indicators
EU supply bill and Marginal Prices (reminder SJWS#2)

TYNDP 2017 will focus on 6 "integrated market" supply configurations

- Neutral (balanced use of sources)
- LNG maximisation
- LNG minimisation
- RU maximisation
- RU minimisation
- AZ maximisation

> cover **high use of each individual source**

TYNDP 2015 (Supply potentials will be updated for TYNDP 2017!)

High Infrastructure Level - 2025

Volumes
18 000

Legend: LNG, LY, DZ, AZ, NO, RUm, NP

Reference, AZ cheap, LNG cheap, RUm cheap, LNG expensive, RUm expensive

ENTSOG has developed an additional "non-perfect market" config.

> Dealt with in a specific presentation

Competition

Supply price diversification (SSPDi)

> measures the ability of each country to take advantage of a cheap source in its gas bill

- **Share of the country gas bill** impacted when **source S is cheap**
- Nota: such ability doesn't always mean physical access of the country to the source

> Simulation cases: each sources cheaper one by one (flat price curve)

2020 Low

Number of import sources including at least 20% SSPDi reaction
- 1
- 2
- 3
- 4

TYNDP 2015
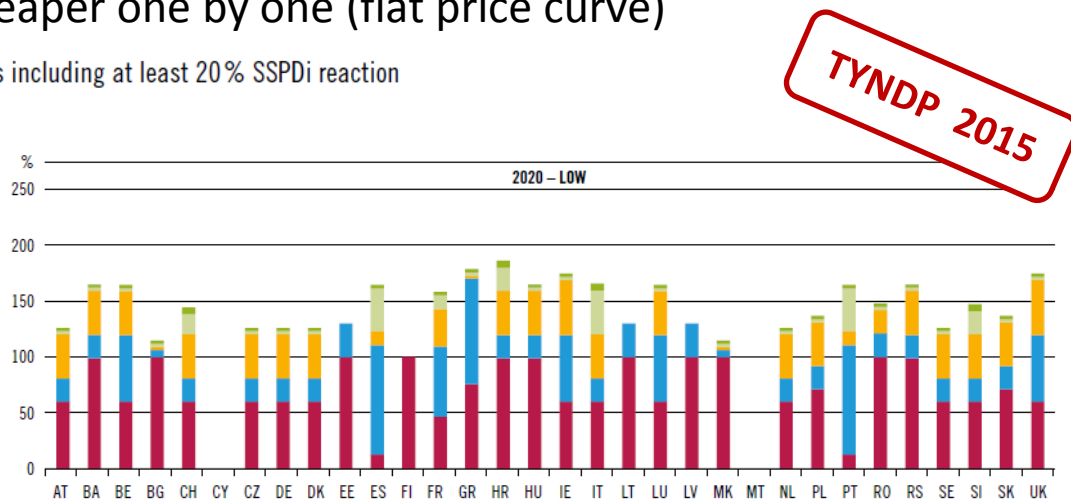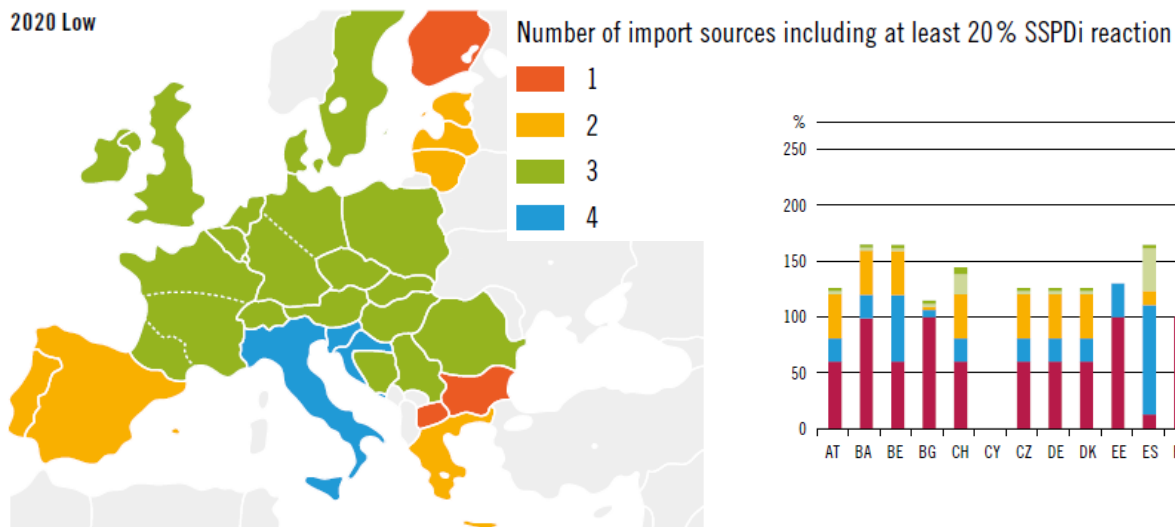
The assumption of well-functioning markets across Europe may give a picture more positive than currently perceived.

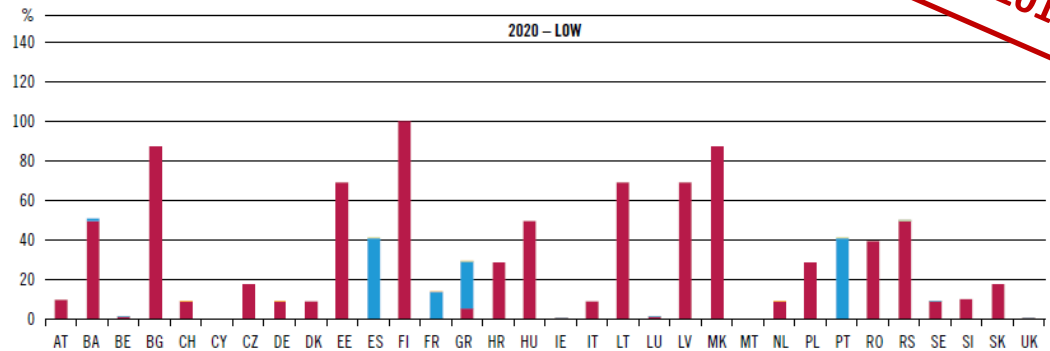# Over the whole year indicators

Supply price dependence (SSPDe)

> measures the dependence of each country gas bill to a given source

- **Share of the country gas bill** impacted when **source S is expensive**

> Simulation cases: each sources more expensive one by one (flat price curve)

TYNDP 2015

Over the whole year indicators

SoS

Cooperative / uncooperative supply source dependence (CSSD / USSD)

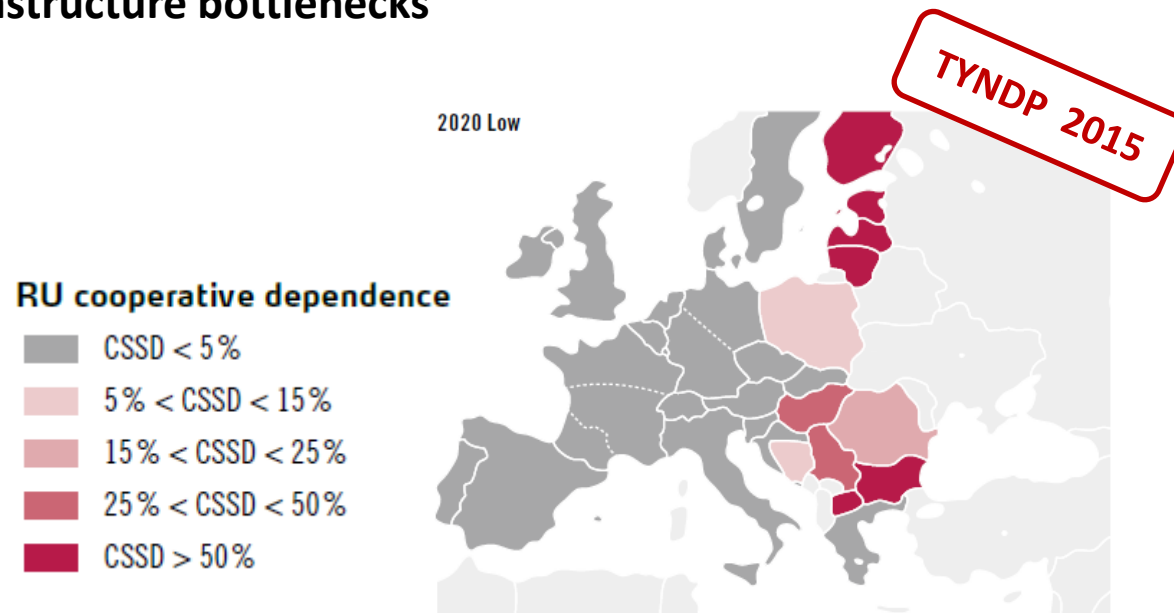> Measures **dependence** to each source at country level as the **minimum share of the source in the country yearly supply mix**
  - It is **not intended** at representing a **disruption** of the source

> Modelling
  - Source S volume set to 0
  - Other sources: [Min; Max] range unchanged
  - Disruption is the "last resort supply"
  - Share of curtailed demand per country = min share of source

Over the whole year indicators

Cooperative / uncooperative supply source dependence (CSSD / USSD)

> **Cooperative approach**: dependence balanced between countries
>   - Allows identification of **infrastructure bottlenecks**

2020 Low

RU cooperative dependence

- CSSD < 5 %
- 5 % < CSSD < 15 %
- 15 % < CSSD < 25 %
- 25 % < CSSD < 50 %
- CSSD > 50 %

TYNDP 2015

> Uncooperative approach: countries will individualy avoid dependence if possible
>   - Allows identification of **most depending countries**

Over the whole year indicators

Cooperative / uncooperative supply source dependence (CSSD / USSD)

> Simulation cases: each source one by one

> Presentation will be simplified in TYNDP 2017, based on modelling results
  - For **sources showing dependence**: EU map at country granularity
  - For **sources showing no dependence**, for any country, already under Low Infra Level
    - Absence of dependence will be shown at EU level for Low Infra Level
    - Indicator not shown for other Infra Level
    - Indicator not computed in PS-CBA

Conclusion

1 objective function

Ensure the demand/supply balance, at the lowest cost

Simulation cases

Over the **whole year**

For high demand situations:
Design case and **2-week cold spell**

No supply stress

Supply price sensitivity analysis

Under supply stress: **Supply disruption**

No supply stress

Under supply stress: **Route disruption cases**

Price conf.

Low/High price

1   2   3   4   4'

Outputs

EU Bill	SSPDe	USSD	Remaining Flex	Remaining Flex
Marginal Price	SSPDi	CSSD	Disrupted Demand	Disrupted Demand

Non-modelled indicators

Monetised part (simulation-based)

Non-monetised part

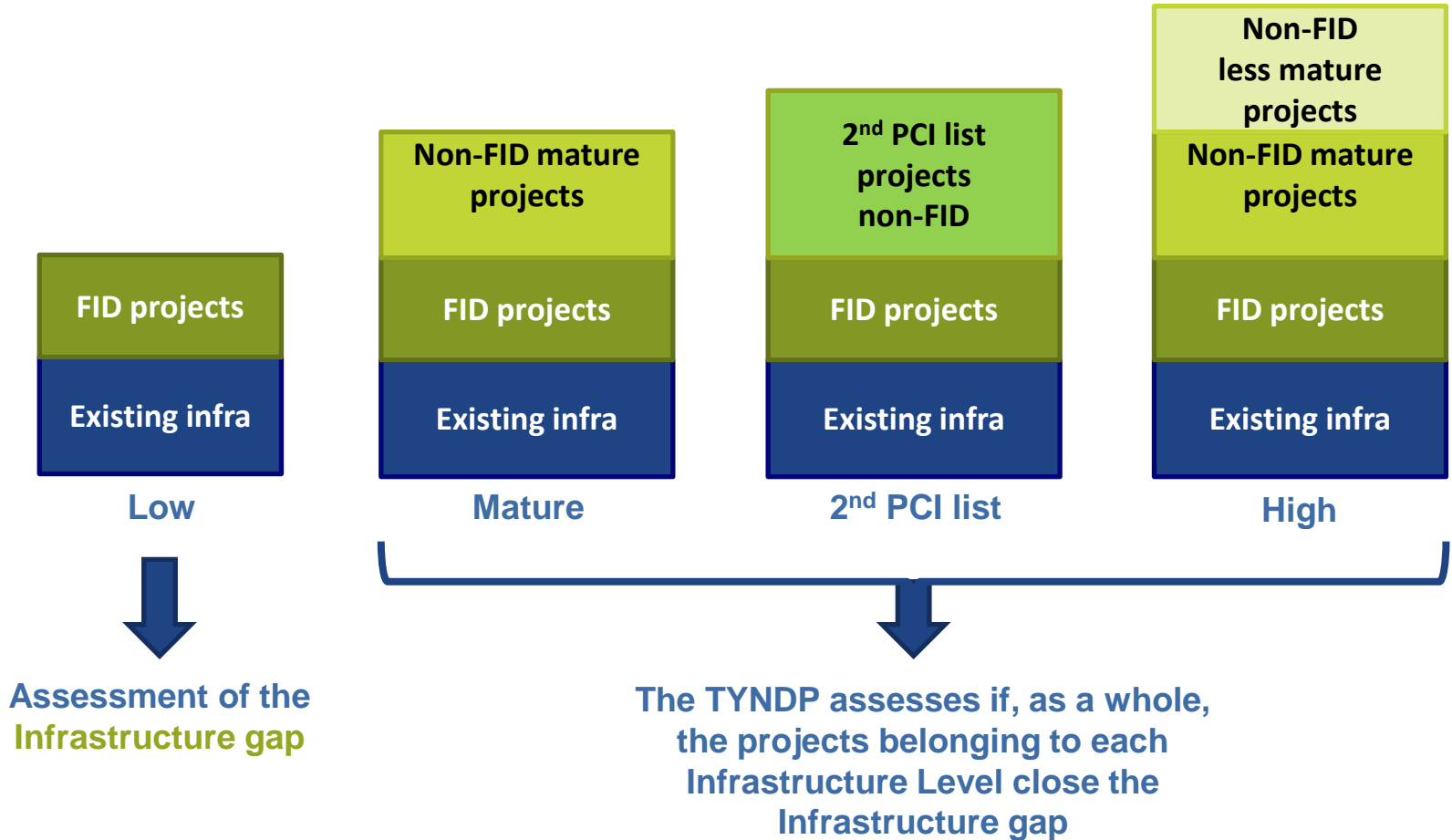**Part possibly monetised (fixed value)**

TYNDP is a multi-criteria assessment: all criteria are as relevant

TYNDP assessment

The assessment is performed for the different Infrastructure Levels

			Non-FID less mature projects
	Non-FID mature projects	2nd PCI list projects non-FID	Non-FID mature projects
FID projects	FID projects	FID projects	FID projects
Existing infra	Existing infra	Existing infra	Existing infra
Low	**Mature**	**2nd PCI list**	**High**

Assessment of the Infrastructure gap

The TYNDP assesses if, as a whole, the projects belonging to each Infrastructure Level close the Infrastructure gap
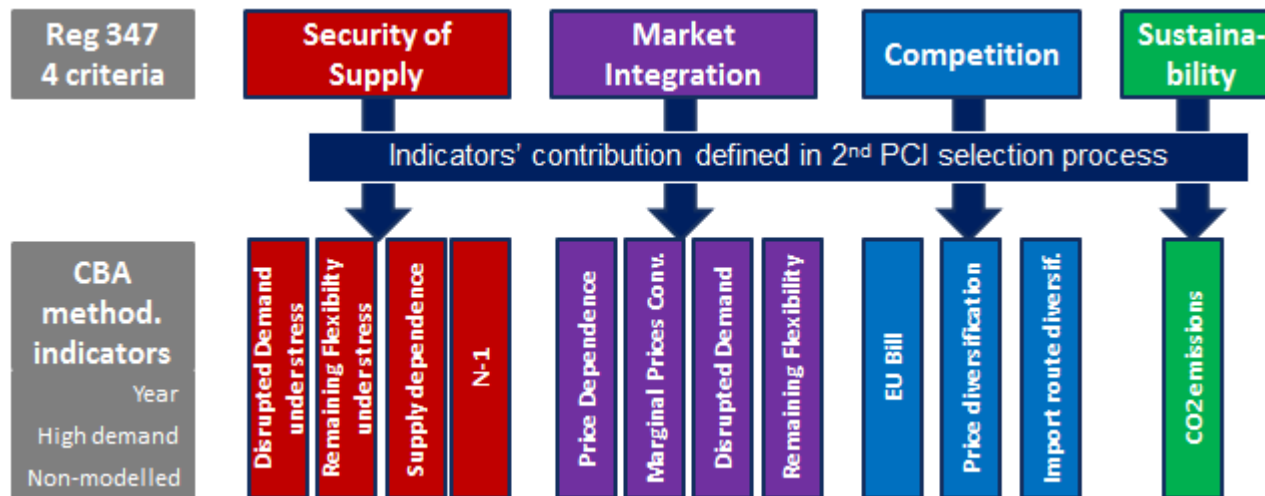
TYNDP assessment: the infrastructure gap

The assessment under the Low Infrastructure Level provides the infrastructure gap

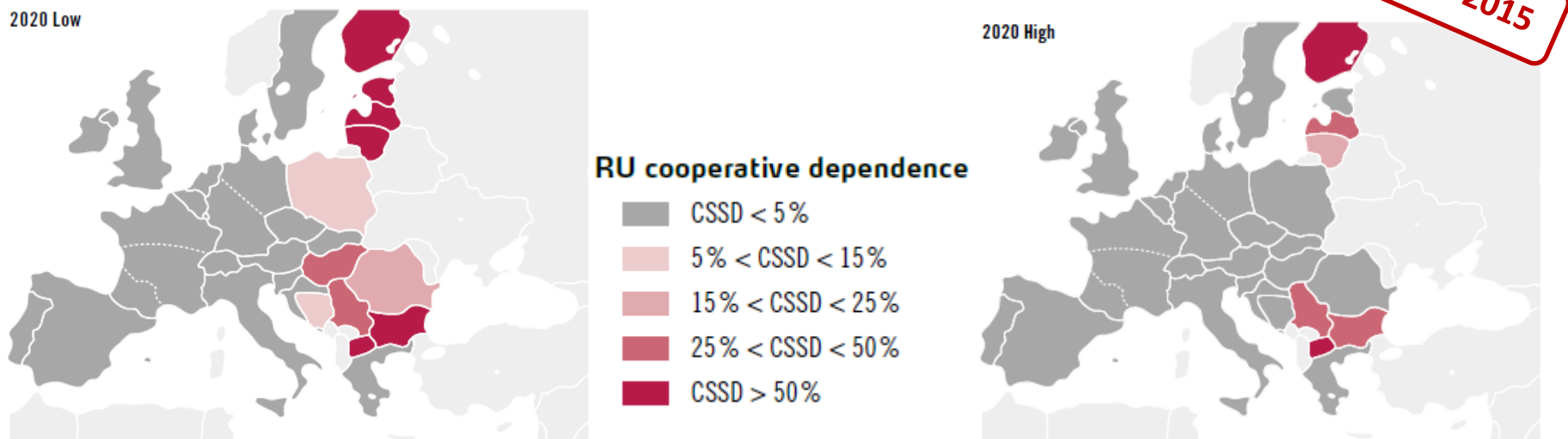*The TYNDP report will be re-structured with a chapter dedicated to the infrastructure gap*

> The chapter will be structured along the criteria from Regulation 347

> For a given criterium, it will provide the results for the different contributing indicators

TYNDP assessment: do projects close the gap?

entsog

The assessment under the other Infrastructure Levels shows if projects, as a whole, allow to close the infrastructure gap

> e.g. supply source dependence

TYNDP 2015

2020 Low

2020 High

RU cooperative dependence

- CSSD < 5 %
- 5 % < CSSD < 15 %
- 15 % < CSSD < 25 %
- 25 % < CSSD < 50 %
- CSSD > 50 %

Thank You for Your Attention

Céline Heidrecheid
Business Area Manager, System Development

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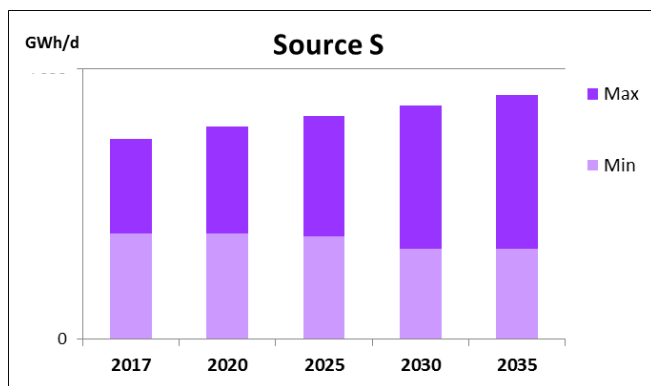Avenue de Cortenbergh 100, B-1000 Brussels

EML: Adam.balogh@entsog.eu, Celine.heidrecheid@entsog.eu
WWW: www.entsog.eu

Reminder on supplies

Supplies

> 6 sources considered

> [Min – Max] supply range per source

> Each source is connected to the relevant import points

- Existing
- Or related to projects submitted to the TYNDP (depending on the considered Infrastructure Level)

Imports points in TYNDP 2015