ENTSO-E Cost-Benefit Analysis Methodology for Electricity Projects

Steve Van Campenhout
Member Drafting Team Planning Standards

ENTSO-E Stakeholders' Workshop
Regional Group North Sea
31 March 2014, Brussels

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Reliable Sustainable Connected

European Power System

Objectives – EU Policy

Ensuring the development of a single European grid in line with **20-20-20 targets**

Guaranteeing **security of supply**

Completing the **internal energy market**

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Regulatory Framework

Regulation 347/2013 (guidelines for trans-European energy infrastructure) mandates ENTSO-E to:

- ✓ Deliver a methodology for a **harmonised energy system-wide cost-benefit analysis at Union level** for projects of common interest, including on network and market modelling
- ✓ Make ENTSO-E **TYNDP sole basis** for selection of electricity Projects of Common Interest (PCI)
- ✓ Deliver a consistent and interlinked **electricity and gas market and network models**, jointly with ENTSO-G, including both electricity and gas transmission infrastructures covering the energy infrastructure priority corridors **(Dec 2016)**

Objectives of system wide CBA methodology

Transparency on all TYNDP projects

- ✓ Harmonized EU energy system-wide CBA
- ✓ Demonstrate overall costs and benefits from a **Pan-European system perspective**

Support Selection Projects Common Interest (PCIs)

- ✓ PCI Selection process will take into account ENTSO-E CBA results in TYNDP

Cross border cost allocation

- ✓ CBA results as one of possible input for Cross Border Cost Allocation (CBCA)

Tool to assess all Pan-EU grid development projects

CBA = tool to assess all projects

TYNDP projects

CBA = possible input to decision - making process

Candidate PCIs

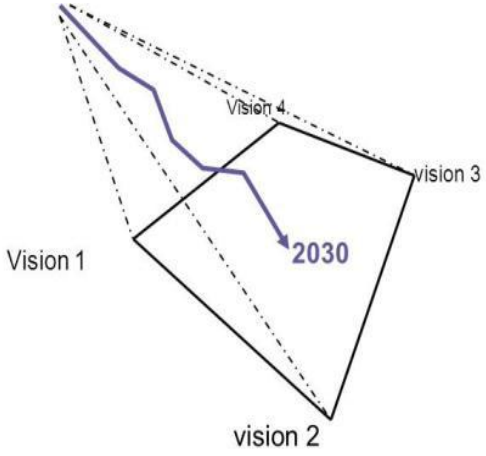
CBCA: Upon request

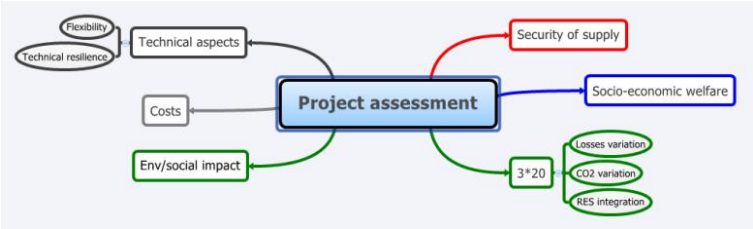
General approach to Cost Benefit Analysis

What "could develop", not what "will happen"

Market studies (economic optimization) & network studies (grid capability)

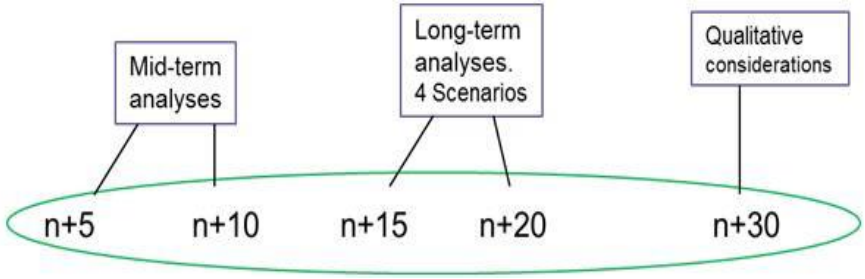
Scenarios building: 4 visions in 2030 → **Project Identification ➔Reference Network** → **Multi-criteria assessment of costs & benefits for each individual project**



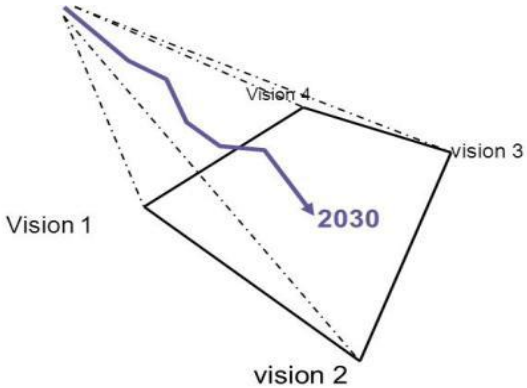


How to address uncertainties: scenarios & time horizons

Time horizons



Scenarios



TYNDP 2014:
4 Scenarios for one time horizon (2030)

TYNDP 2016:
At least two time horizons
- Mid term (n+5-10)
- Long term (n+15-20)

CBA quality depends mainly on quality of input assumptions !

Some definitions…

Investment ➔ Project (Cluster)

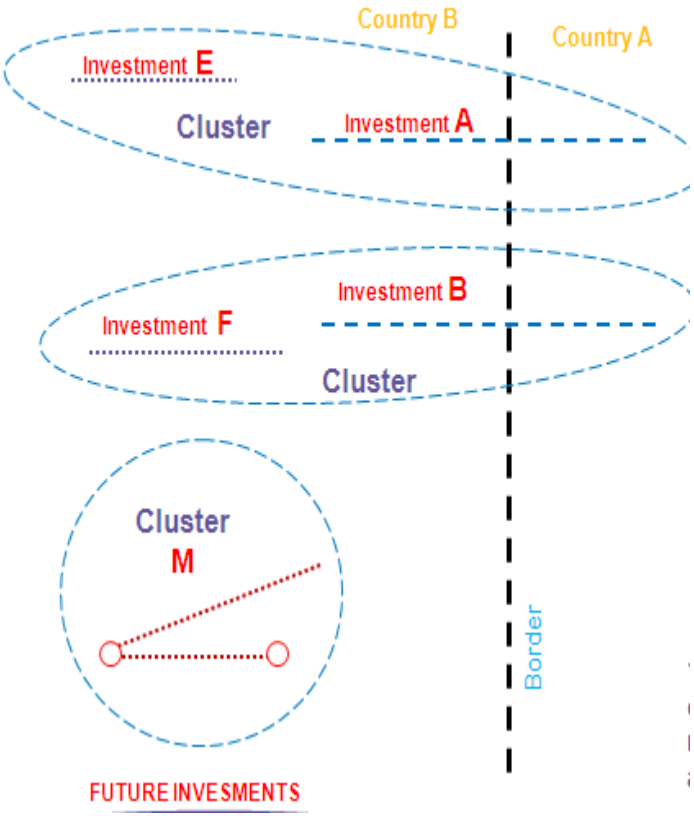
- ✓ Investment: single asset (line, transformer); 2 or more completely dependent assets (line + transformer)
- ✓ Project: investment or **set of investments = cluster** to realized in total to achieve a desired effect

What is Grid Transfer Capability (GTC)?

- ✓ Ability grid to transport electricity across a **boundary (internal / cross-border)**
- ✓ Directional and expressed in **MW**

Clustering Rules

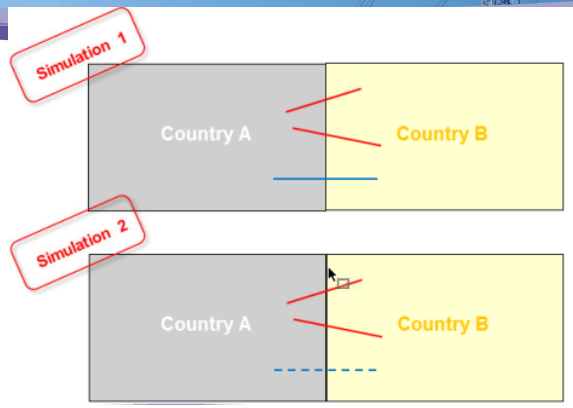
- ✓ Same goal, same area/corridor, complementary
- ✓ Influence at least **20% on total GTC increase**
- ✓ Commissioning dates less than **5 years** apart



Project Assessment Methodology

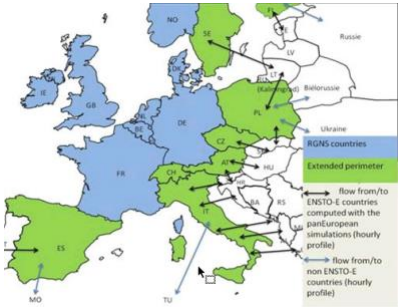
TOOT – Take Out One at a Time:

- ✓ Project assessment in most plausible future
- ✓ Conservative approach
- ✓ Reference network: «all-projects-in» considering needs on each border



Geographical scope:

- ✓ Pan-European database
- ✓ Simulation ENTSO-E Region + neighbours



Maybe some needs for adaptations:

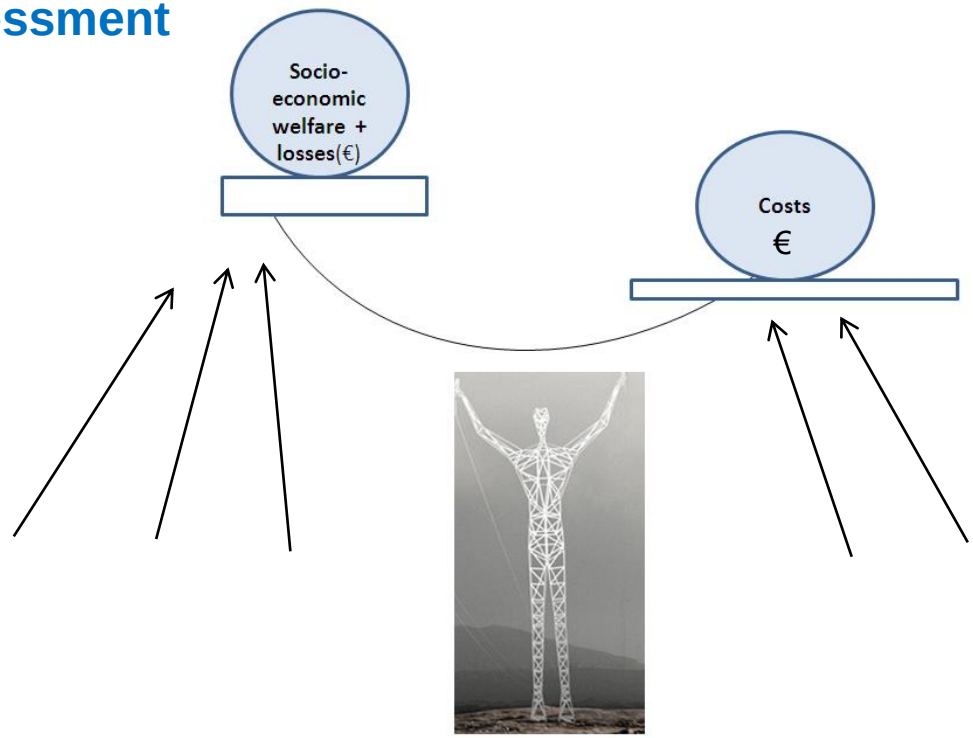
- ✓ In case of non-mature projects
- ✓ According to scenarios

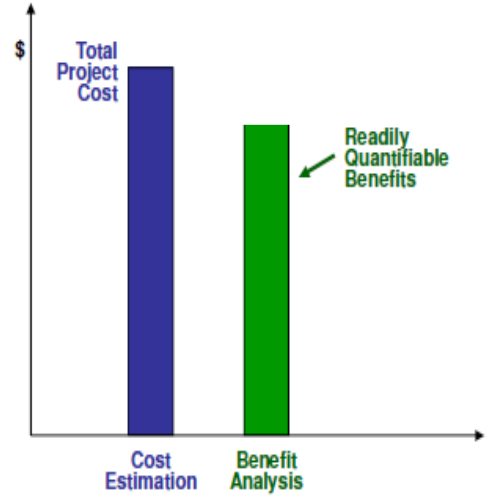
Golden Rule: equal treatment TSOs and third Party Projects

Get the balance right: combined cost-benefit and multi-criteria framework

Project Assessment

Balancing exercise



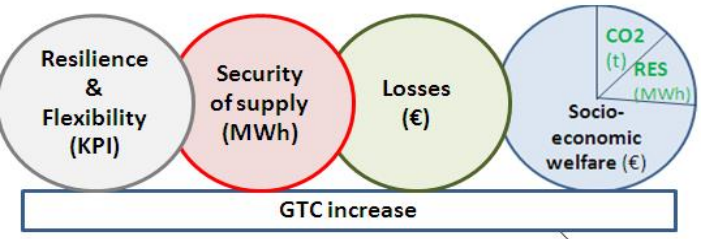


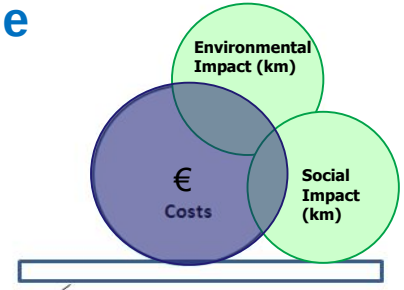
+ Multi-criteria

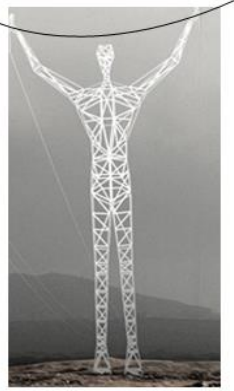
How to ensure that benefits outweigh costs ?

Costs and benefits are not compared directly but instead are given as information

Monetized where objectively possible

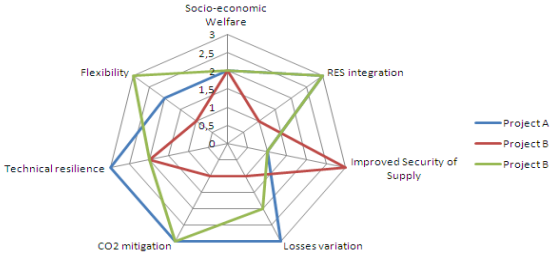






Results Presentation

Criteria	Grid Transfer Capability Increase	Socio-economic Welfare	RES integration	Improved Security of Supply	Losses variation	CO2 mitigation	Technical resilience	Flexibility	Social and environmental Impact	Project costs
	MW	M€/year	MWh/year	MWh/year	M€	Mt				M€
Project A	1000	90-150	500-550			0,5-0,6	+++	++		650-700
Project B	500	30-50		3000	20-30		++			25
Project C	800	225-30	3000-3500		10-20	1-1,5	++	+++		150



Best&most complete information for stakeholders and decision-makers

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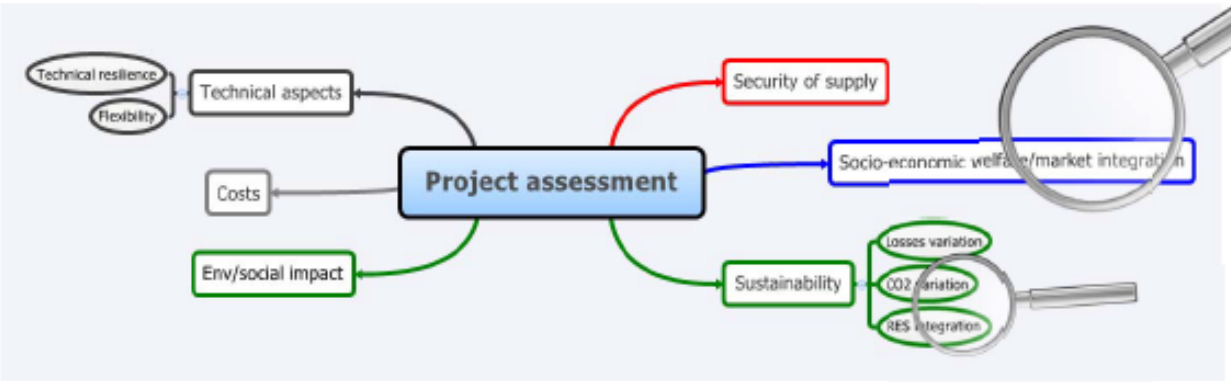
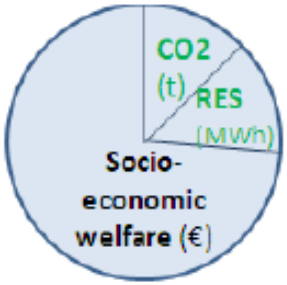
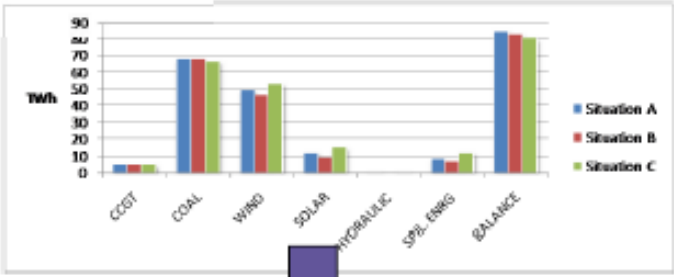
Socio-economic welfare with internalized CO2 and RES



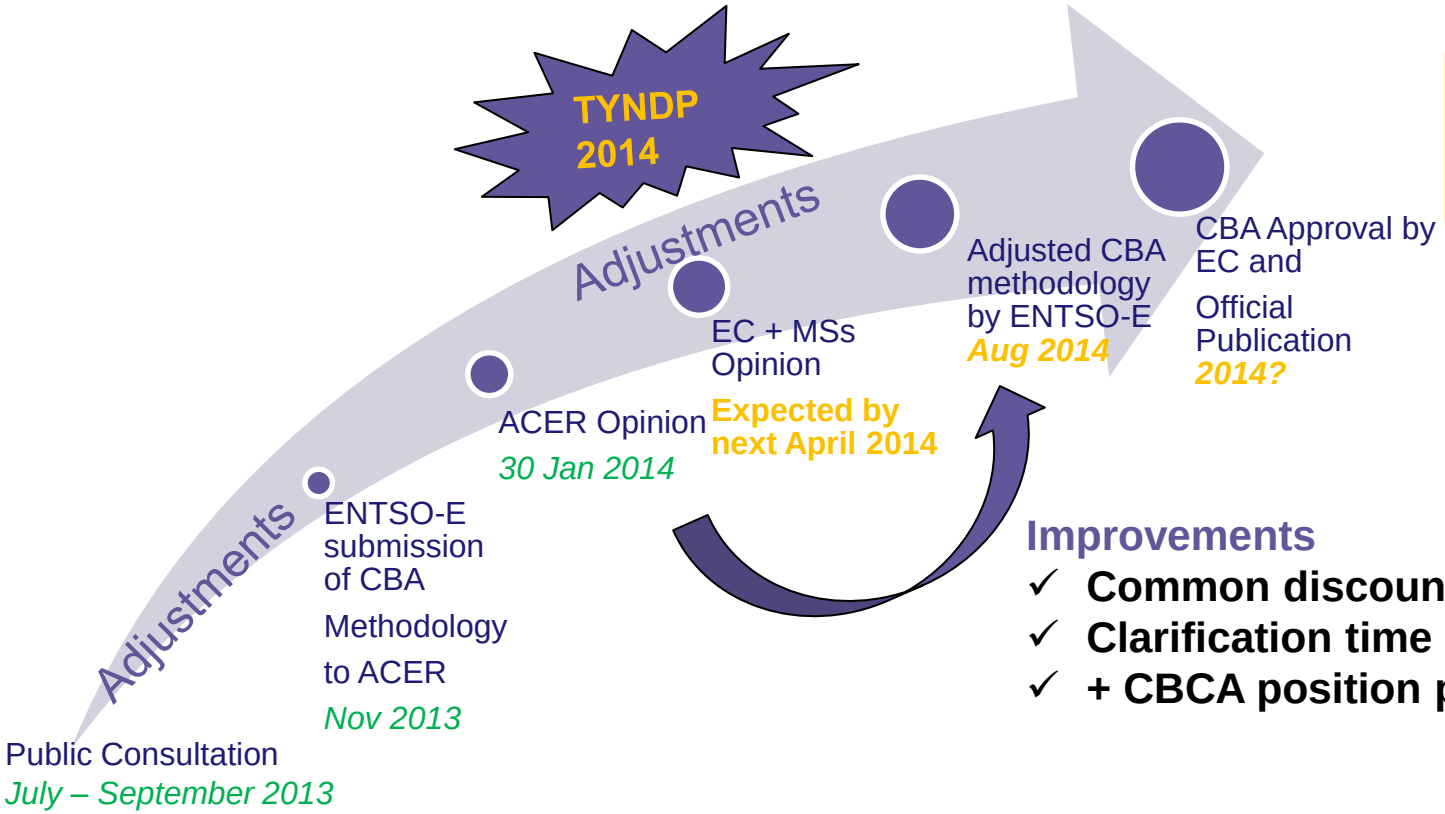


Transmission allows optimisation of generation portfolios - in order to reduce generation costs, reduce CO2 emissions and facilitate evacuation of RES.



Where are we in the process? Finalization CBA 1.0

- ✓ A continuous dialogue with stakeholders
- ✓ ENTSO-E submitted its CBA Methodology to Member States, the Commission and ACER for their relevant opinion on 15 November 2013

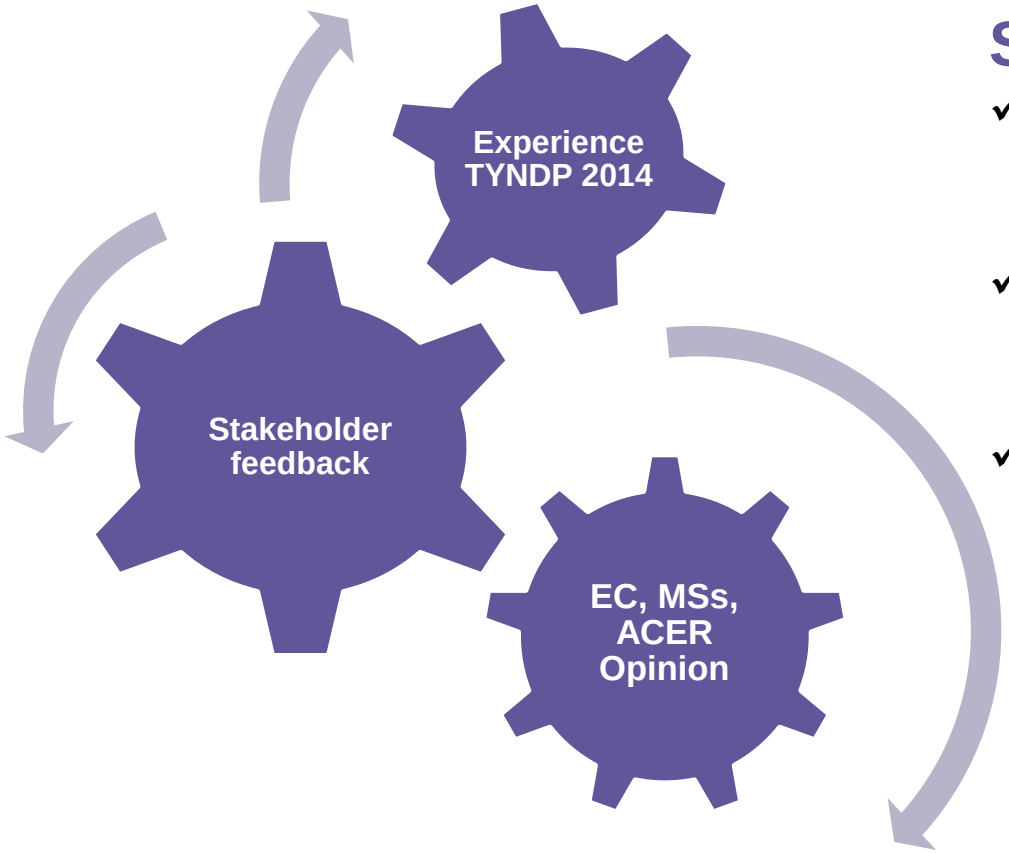


TYNDP 2016

Improvements

- ✓ **Common discounting methodology**
- ✓ **Clarification time horizons**
- ✓ **+ CBCA position paper**

Let's continue to improve



Some examples…

- ✓ Fine-tune the security-of-supply indicator
- ✓ Implement a detailed CBA part for Storage projects
- ✓ Capture beneftis from ancillary services & avoided generation costs

Conclusion

ENTSO-E CBA Methodology:

- ✓ Delivers a **harmonized** energy system-wide cost-benefit analysis at Union level for PCIs and other TYNDP projects, as required by regulation
- ✓ Is based upon an objective **combined cost-benefit and multi-criteria** framework, established from framework guidelines & stakeholder input
- ✓ Is applied via **market & network** analysis on each TYNDP project in a **Pan-European system perspective,** guaranteeing a fair and **equal treatment of TSO and 3rd parties**
- ✓ Creates **transparency** to stakeholders and decision-makers
- ✓ Will undergo **further improvements**….not to reach academical perfection but to further increase transparency whilst **keeping practicality in applying it!**

Back-up

Benefit Indicators

B1. Security of supply is the ability of a power system to provide an adequate and secure supply of electricity in normal conditions.

B2. Social and economic benefit on electricity markets is characterised by the ability of a power system to reduce congestions and thus provide an adequate grid transfer capability.

B3. RES integration. Support to RES integration is defined as the ability of the system to allow the connection of new RES plants and unlock existing "green" generation, while minimising curtailments.

B4. Variation of losses (energy efficiency) is the ability to minimise thermal losses in the power system.

B5. CO2 emissions is a result of B2 and B3 (unlock of carbon-free generation), as well as B4.

B6. Technical resilience/system safety is the ability of the system to withstand increasingly extreme system conditions (exceptional contingencies).

B7. Flexibility is the ability of the proposed reinforcement to serve in different possible future development paths or scenarios.

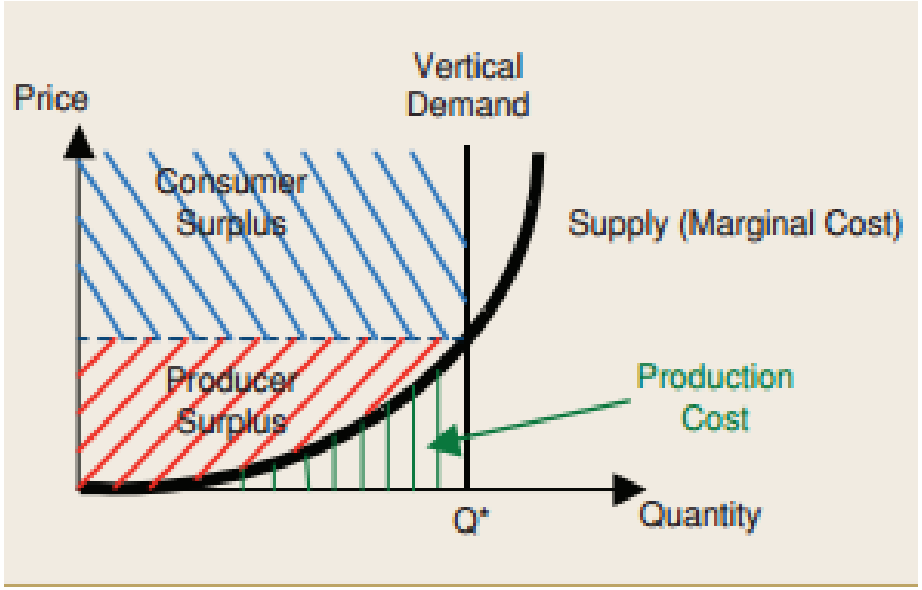
Thresholds : benefit indicators

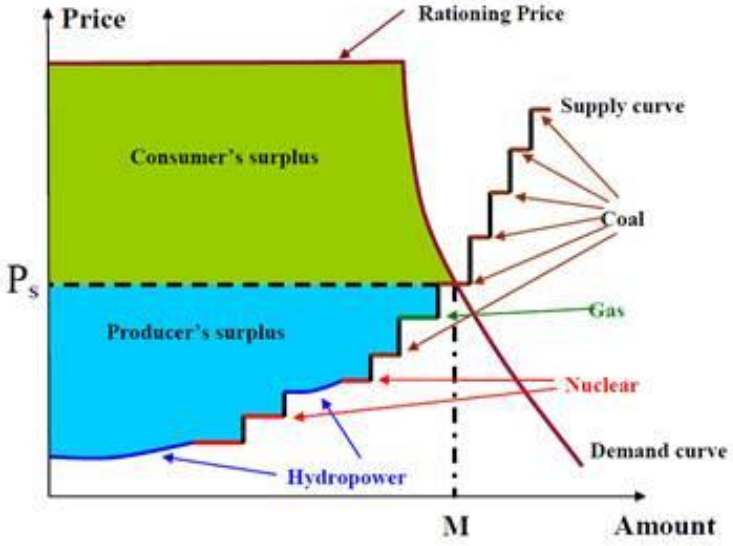
- Socio economic benefit

Light green : the project has an annual benefit < € 30 million

Green: the project has an annual benefit between€ 30 and € 100 million

Dark green: the project has an annual benefit > or = to € 100 million





Thresholds : benefit indicators

- Socio economic benefit

Light green : the project has an annual benefit < € 30 million

Green: the project has an annual benefit between€ 30 and € 100 million

Dark green: the project has an annual benefit > or = to € 100 million

- RES integration

White: the project has a neutral effect on the capability of integrating RES, i.e. allows less than 100 MW of direct RES connection or increases RES generation by less than 50 GWh

Light green: the project allows direct connection of RES production between 100 and 500 MW or permits an increase in RES generation between 50 GWh and 300 GWh

Dark green: the project allows direct connection of RES production greater than 500 MW or increases RES generation by more than 300 GWh

- Security of Supply

Light green: the project has no measurable impact on security of supply;

Green: the project increases the security of supply for an area of annual energy demand greater than 3 TWh by more than 0.001% of annual consumption[41];

Dark green: the project increases the security of supply for an area of annual energy demand greater than 3 TWh by more than 0.01% of annual consumption[42].

Thresholds : benefit indicators

- CO2 variations

Indicative colours are assigned as follows:

White: the project has no positive effect on CO2 emissions

Green: the total of projects reduces CO2 emissions by < 500 kt/year

Dark green: the total of projects reduces CO2 emissions by > 500 kt/year

- Variations in losses

Red: the project contributes to increase the volume of losses on the grid

White: the project may help decreasing losses in some situations and increasing them in others

Light green: the project the project contributes to decrease the volume of losses on the grid

- Technical resilience/system safety
- Robustness/flexibility

Indicative colours are assigned as follows:

White: the score of KPI's is 0

Green: the score of KPI's is < or = 3+

Dark green: the score of KPI's is > 3 +

Thresholds : impact indicators

- Investment costs

Light green: Higher than 1000 M€

Green: Between 300 M€ and 1000 M€

Dark green: lower than 300 M€

- Environmental and social impact

Light green: desk-top studies indicate that sensibility is low (no protected or dense urban area is affected, the visual impact is perceived as low).

Amber: desk-top studies indicate that sensibility is medium (protected or urban area may be affected in a limited way, visual impact is perceived as moderate).

Red: desk-top studies indicate that sensibility is high (visual impact is high, protected or urban area may be affected).