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ΔΙΑΚΗΡΥΞΗ ΔΑΠΜ-41623

«ΕΚΠΟΝΗΣΗ ΜΕΛΕΤΗΣ ΚΟΣΤΟΥΣ ΟΦΕΛΟΥΣ ΚΑΙ ΕΚΤΙΜΗΣΗ ΟΙΚΟΝΟΜΙΚΗΣ ΒΙΩΣΙΜΟΤΗΤΑΣ ΤΟΥ ΕΡΓΟΥ ΚΟΙΝΟΥ ΕΝΔΙΑΦΕΡΟΝΤΟΣ 3.7.1 MARITSA EAST 1 (BG)- N.SANTA (EL)»

ΤΕΥΧΟΣ 8

ΤΕΧΝΙΚΟ ΜΕΡΟΣ

Terms of Reference

Technical Description

For the assignment:

"Detailed cost benefit analysis and financial viability evaluation of the PCI 3.7.1 Maritsa East 1 (BG)- N.Santa (EL)"

1. Introduction

The second interconnection between Greece and Bulgaria concerns the construction of the new 400kV AC line Nea Santa (EL)-Maritsa East 1 (BG). The project is included in the list of Projects of Common Interest (PCIs).

IPTO S.A (the operator of the Hellenic Transmission System) and ESO-EAD (the operator of the Bulgarian Transmission System) have decided to collaborate for the preparation of a detailed cost benefit analysis (CBA), pursuant to the Regulation (EU) 347/2013 and the relevant methodology developed by ENTSO-E as well as a detailed business plan for the evaluation of the financial viability of the project. This activity is financially supported by the Connecting Europe Facility (CEF) mechanism, under an agreement signed between IPTO S.A and INEA. Taking also into account that the activity concerns the entire PCI, a close collaboration with ESO-EAD is foreseen in the agreement.

The aim of this document is to describe the technical specifications for the tendering of the cost benefit analysis and the business plan of the PCI. These two documents are prepared and submitted to the regulatory authorities in the energy sector of the Republic of Greece and the Republic of Bulgaria in line with the provisions of Article 12, paragraph 3 of Regulation (EU) 347/2013 on guidelines for trans-European energy infrastructure. In this regard, the documents must fully meet the requirements of Regulation (EU) 347/2013. Furthermore, the documents need also to comply with *Recommendation 5/2015[1] of 18.12.2015 by the European Agency for the Cooperation of Energy Regulators (ACER) on good practices for treatment of investment requests including cross-border cost allocation (CBCA) requests for electricity and gas projects of common interest (PCI)*, also in system connectivity the documents need to comply with *ACER Recommendation 03/2014[2] on Incentives for Projects of Common Interest and on a Common Methodology for Risk Evaluation*.

In addition, the cost benefit analysis and the business plan documents need to take into account and comply with:

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[1]
http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Recommendations/ACER%20Recommendation%2005-2015.pdf
[2]
http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Recommendations/ACER%20Recommendation%2003-2014.pdf

a) The CBA methodology developed by ENTSO-E (final version approved by the European Commission, 5 Feb 2015) (ENTSO-E CBA methodology)[3]

b) The Guide to Cost Benefit Analysis of Investment projects[4], Economic appraisal tool for Cohesion Policy 2014-2020" (issued by EC, Directorate General for Regional and Urban policy) for "major projects"

2. Project Specific CBA

The CBA for the 2nd interconnection between Greece and Bulgaria shall be based on the ENTSO-E CBA methodology. The contractor shall conduct the necessary market and network calculations, using:

- Analytic data from the market studies performed by the CSE RG of ENTSO-E in the framework of TYNDP 2016 for Bulgaria and Greece.
- Detailed data that shall be provided by IPTO and ESO-EAD for their national systems.
- Any other available sources.

The CBA shall be based on the scenarios adopted in the latest ENTSO-E's TYNDP (TYNDP 2016). These scenarios include the Expected Progress (EP) scenario for the year 2020 and the four Visions for the year 2030.

Analytic data include: hourly time series of RES production, hourly demand time series, hourly time series of marginal prices, hourly time series of generation per fuel type, hourly time series of power flows in the interconnections of the Greek and Bulgarian power systems and annual production costs per fuel type for the two countries.

For the analysis of the benefits, the Take Out One at the Time (TOOT) methodology shall be used, in order to be compatible with the approach adopted in ENTSO-E TYNDP for the assessment of midterm projects. According to this methodology, it is assumed that all projects included in ENTSO-E TYNDP with a commissioning date up to the target year have been realized and the project under assessment is then excluded from the forecasted network structure in order to evaluate changes in the load flow and other indicators. The TOOT method provides an estimation of benefits of each project as if it were the last to be commissioned. In fact, the TOOT method evaluates the new development investment/project into the whole forecasting network. Analytic data mentioned above shall be provided for the cases with and without the project.

A crucial parameter in the CBA analysis of a transmission project is the contribution of the project to the Grid Transfer Capability (GTC) that reflects the capability of the grid to transport electricity across a boundary. The value of this parameter (ΔGTC), calculated in the context of the ENTSO-E TYNDP 2016, shall be adopted for the project CBA.

Expected outcome of these studies shall include:

- Monetization of the following indicators:
    - Socio-economic welfare (SEW) (European market study)
    - Variation in losses (network studies)
- Analysis of the national net impacts for the affected countries
- Sensitivity analysis

[3] www.entsoe.eu/Documents/SDC%20documents/TYNDP/ENTSO-E%20cost%20benefit%20analysis%20approved%20by%20the%20European%20Commission%20on%204%20February%202015.pdf

[4] http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

Costs and benefits of the project will be disaggregated for the two hosting countries (Bulgaria and Greece). In addition, cost and benefits shall be discounted to the present, according to ENTSO-E CBA methodology as also specified in paragraph 3 of this document.

For the carrying out of market calculations, the total surplus approach shall be used, in order to be able to disaggregate SEW values per country and further per stakeholder (variation of producer surplus, variation of consumer surplus and variation of congestion rents).

The project, according to the analysis performed in the framework of ENTSO-E TYNDPs 2014 and 2016, is expected, to only influence the border between Bulgaria and Greece. As such, calculation of congestion rents shall be carried out only for this border and an allocation different from 50%-50% shall be adopted, in order to compute national benefits. Adopted allocation shall be commonly agreed between IPTO S.A and ESO-EAD.

Monetization of variation in losses (€/MWh), shall be commonly agreed and provided to the contractor from IPTO S.A and ESO-EAD.

Network-study simulation tools should be able to identify the network elements (lines and transformers), where variations of losses take place with and without the project under analysis. Such capability will allow providing disaggregated values for losses benefits.

For the network studies, a selection of points in time (snapshots) shall be performed, based on an aggregated duration curve of the Bulgarian and Greek power systems hourly demand. The hours of the year for which these points are representative shall be obtained by calculating the distance to each of the selected snapshots for each individual hour (8760) of the modeled year. The hour is then assigned to the snapshot to which it has the closest distance to.

The contractor will construct network snapshots for each selected point, using the output of market studies of ENTSO-E in order to define the engagement of each generator unit. Also the production of renewables as well as the demand in each load bus will be defined according to the annual time series used for the market studies calculations of ENTSO-E. Calculation of the values of variation of losses will be performed using the characteristic hours of each snapshot. For the construction of the network snapshots, reference network models of the Greek and the Bulgarian power systems shall be provided in PSS/E format by IPTO and ESO-EAD respectively.

The CBA calculations shall identify the national net impacts for Bulgaria and Greece.

Calculation of national net impacts for each country should consist of three steps:
   a) the analysis of costs
   b) the analysis of benefits
   c) the analysis of other cross-border monetary flows

All concerning costs needed for the study are described in paragraph 3 of this document and shall be provided by IPTO S.A and ESO-EAD, according to their best estimates.

Cross border monetary flows may include the following:
- Expected congestion rents (already counted in the SEW benefit)
- Expected revenues (payments) of Inter-TSO Compensation (ITC) mechanism (Positive or negative)
- Expected income (payments) for other charges (Positive or negative)
- Awarded non-national grants (Positive)

National monetary transfers (e.g. payments of taxes and national grants) should not be considered, as well as potential grants.

Sensitivity analysis

Besides the presentation of the benefit results per country for the various ENTSO-E's TYNDP 2016 scenarios, the CBA should also include sensitivity analysis on key assumptions and critical parameters used. Critical parameters are those whose variations, positive or negative, have the greatest impact on the project's economic performance. In comparison to scenario analysis, which studies the impact of combinations of values taken by the critical parameters, sensitivity analysis is carried out by varying one parameter at a time and determining the effect of that variation on the national net impacts.

In this respect, sensitivity studies shall be carried out with respect to parameters including the commissioning date, discount rate and value of losses (euro/MWh).

An uncertainty range (-x%; + y%) with respect to the expected costs and benefits in each country should be presented. A narrative description of reasons underlying the possible variations has to accompany the uncertainty range.

3. Business Plan

A Business Plan (BP) for the project will be carried out. The main aim of the BP is the evaluation of the financial viability of the project, including the chosen financing solution. This will comprise mainly a financial and economic analysis, the treatment of risk, organizational issues and implementation procedures.

The Business Plan should be in line with the **"Guide to Cost-Benefit Analysis of Investment projects".** The **Financial Analysis** is carried out in order to:

- assess the consolidated project profitability
- assess the project profitability for the project owner (IPTO & ESO- EAD)
- verify the project financial sustainability.

It is carried out in accordance with the Discounted Cash Flow (DCF) method and in compliance with the Commission Delegated regulation 480/2014.
The inputs for the financial analysis include:
- operating revenues from the provision of services (charges paid by the users, ITC revenues, etc.)
- sources of financing
- subsidies and other financial gains

The outputs relate to the following:
- Development costs (e.g. studies, rights of way, environmental planning) and project management costs
- Material and assembly cost, including installation and commissioning
- Other construction costs, including temporary solutions, waste management and environmental costs
- Operating costs (incl. ITC costs)
- Maintenance costs
- Replacement cost

- Reimbursement of loans and interest payment
- Taxes on capital/income and other direct taxes

The **project profitability** is measured by the following key indicators[5]:

- Financial Net Present Value **FNPV (C)** and Financial Rate of Return **FRR (C)** on investment (before EU grant)
- Financial Net Present Value **FNPV (K)** and Financial Rate of Return **FRR (K)** on national capital (after EU grant)

An economic analysis should be carried out to appraise the project's contribution to social welfare. Monetized benefits derived from ENTSO-E CBA methodology and following Regulation 347/2013, will be taken into account for the economic analysis.

Once all project costs and benefits have been quantified and valued in money terms, it is possible to measure the economic performance of the project by calculating the following indicators (Annex II):

- **Economic Net Present Value (ENPV):** is the difference between the discounted total social benefits and costs
- **Economic Rate of Return (ERR):** the rate that produces a zero value for the ENPV.
- **B/C ratio**: the ratio between discounted economic benefits and costs.

The **financial sustainability** of the project will also be verified. The project is considered as financially sustainable when the risk of running out of cash in the future, both during the investment and the operational stages is negligible.
The difference between inflows and outflows will show the deficit or surplus that will be accumulated each year of the analysis. Sustainability occurs if the generated cumulative cash flow is positive for all the years considered.

It is important to ensure that the project does not risk suffering from a shortage of capital. Proof of disposal of sufficient resources to cover future costs should be provided in the sustainability analysis.
 A **funding plan** is required including an outline of the proposed gearing, sources of capital, long term equity capital, debt capital and financial assistance (i.e. subsidies). The funding plan will significantly determine the financial sustainability of the project. The funding plan includes a description of the chosen financing solution (including tariffs) and information on awarded, applied for and expected grants and loans, also differentiating on national, European and other sources, as well as on the estimated financing costs (indicating an estimation of the part of financing costs to be incurred until commissioning of the project). Furthermore, a description of the respective applicable national methodologies for tariff calculation and of the project's impact on network tariffs should be provided in sufficient detail.

Analysis of the project inflows and outflows shall cover a time horizon of 25 years, starting from the commissioning date. Calculated values shall be discounted to the current year. Taking into account that the latest ENTSO-E TYNDP 2016 covers two time horizons (2020 and 2030) and the

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[5] see Annex I

commissioning year of the project is 2021, benefits for the years between 2021 and 2030 shall be calculated through a linear interpolation of the 2020 and 2030 benefits. These calculations shall be carried out for all the Visions examined for the 2030 horizon. For the years after 2030, calculated benefits for 2030 shall be maintained. In addition, a real discount rate of 4% for the 25 year life-cycle of the project shall be adopted and a residual value of zero.

More detailed financial projections for at least 5 years starting from the commissioning date, including the profit and loss account, the balance sheet and cash flow statement will also be provided.

The Business plan will also include an **organizational structure** and an **implementation plan**. Details on the promoters' experience and expertise and financial substance and contribution to the project are especially important to financial institutions.

The implementation plan should contain specific objectives and reasonably detailed checklist of the various steps that are going to happen.

Also a **strategy for dealing with risk** will be provided. This will be based on the Risk Assessment described below.

Risk assessment

The recommended steps for assessing the project risks are:

- *sensitivity analysis*

It enables the identification of the critical variables of the project. Such variables are those whose variations have the greatest impact on a project's financial and economic performance. The sensitivity analysis is carried out by varying one variable at a time and determining the effect of that change on the FNPV and ENPV. As critical variables could be chosen those for which a variation of +/-1% of the value adopted in the base case gives rise to a variation of more than 1% in the value of the FNPV and ENPV.

- *qualitative analysis* (incl. risk matrix)
  Shall include the following elements:
  - ➢ a list of adverse events to which the project is exposed
  - ➢ a risk matrix for each adverse event
  - ➢ an interpretation of the risk matrix including the assessment of acceptable levels of risk
  - ➢ a description of mitigation and/or prevention measures.
- *Probabilistic risk analysis*
- *Risk prevention and mitigation* (incl. Risk Management)

4. **Deliverables**
   - *Project-specific Cost Benefit Analysis (CBA)*
     - ➢ Information on input data and assumptions;
     - ➢ Details underlying cost estimations;
     - ➢ Details underlying benefit determination;

- ➢ Details underlying estimations of other cross-border monetary flows;
- ➢ Detailed calculations in spreadsheet format (for calculation of national net impacts);
- ➢ Summary of results (disaggregated by country): benefit for each benefit category, cost for each cost category, other cross-border monetary flows, national net impact identifying the Member State as beneficiary or cost bearer
- ➢ Sensitivity analysis.

- • *Business Plan (includes mainly Financial and Economic Analysis and Risk Assessment)*
  - ➢ *Financial Analysis,* incl. Financial Sustainability, Funding Plan and detailed financial statements (P&L, Balance Sheet, Cash Flow)

  - ➢ *Risk Assessment (*sensitivity analysis, qualitative analysis, probabilistic risk analysis, risk prevention and mitigation)

  - ➢ **Organizational structure**

  - ➢ **Implementation plan.**

- • *Proposal for cross border cost allocation pursuant to the ACER's recommendation 5/2015 of 18.12.2015*

5. Time schedule

The deadline for the completion of the project and the submission of deliverables is three months from the date of signing of the respective contract.

ANNEX I: CALCULATION OF FINANCIAL PERFORMANCE INDICATORS

Financial Net Present Value (FNPV)

This indicator represents the discounted economic cash-flow of the project. It shall be calculated according to the following formula:

$$FNPV = \sum_{t=f}^{c+T} \frac{R_t - C_t}{(1+i)^{(t-n)}}$$

Where:
- **c** is the first full year of operation
- R_t: is the revenue from the operation in year t (in the revenues of year t+T the residual value of the project is included)
- **Ct** is the sum of CAPEX and OPEX on the year *t*
- **n** is the year of analysis
- **i** is the Financial Discount Rate (FDR) of the project
- **f** is the first year of revenue or cost

If FNPV is positive the project generates a net profit. The FNPV reflects the financial viability of a project in absolute values and it is considered the main
financial performance indicator.

Financial Internal Rate of Return (FIRR)

This indicator represents the financial viability of the project being its ability to generate revenues higher than its investment and operational costs. The indicator is defined as the discount rate that produces a zero FNPV.

Therefore a project is considered financially desirable if the FIRR exceeds its Financial Discount Rate.

The Financial Benefit/Cost ratio (FB/C)
This indicator is the ratio between the discounted benefits and the discounted costs.

$$FB/C = \frac{\displaystyle\sum_{t=f}^{c+T} \frac{R_t}{(1+i)^{t-n}}}{\displaystyle\sum_{t=f}^{c+T} \frac{C_t}{(1+i)^{t-n}}}$$

Where:
- **c** is the first full year of operation
- R_t: is the revenue from the operation in year t (in the revenues of year t+T the residual value of the project is included)
- **Ct** is the sum of CAPEX and OPEX on the year *t*

- ■ *n* is the year of analysis

- ■ *i* is the Financial Discount Rate (FDR) of the project

- ■ *ƒ* is the first year of revenue or cost

If FB/C exceeds 1, the project is considered as financially efficient as the revenues outweigh the costs on the time horizon.

These performance indicators should be seen as complementary to FNPV.

ANNEX II: CALCULATION OF ECONOMIC PERFORMANCE INDICATORS

Economic Net Present Value (ENPV)

This indicator represents the discounted economic cash-flow of the project. It shall be calculated according to the following formula:

$$ENPV = \sum_{t=f}^{c+T} \frac{R_t - C_t}{(1+i)^{(t-n)}}$$

Where:
- *c* is the first full year of operation
- **Rt** is the social benefit induced by the project on year *t*. The benefit on year c+T also includes the Residual Value of the project.) The benefit refers mainly to Socio-Economic Welfare, SEW, which is the benefit indicator B2. Moreover, other monetized benefits, such as benefits from variation of losses (benefit indicator B4), should be taken into account.
- **Ct** is the sum of CAPEX and OPEX on the year *t*
- *n* is the year of analysis
- *i* is the Economic Discount Rate of the project
- *f* is the first year of induced social welfare ($\Delta SWEU$) or cost

If ENPV is positive the project generates a net benefit. The ENPV reflects the performance of a project in absolute values and it is considered the main performance indicator.

Economic Internal Rate of Return (EIRR)
This indicator represents the economic viability of the project being its ability to generate social welfare higher than its investment and operational costs. The indicator is defined as the discount rate that produces a zero ENPV.

Therefore a project is considered economically desirable if the EIRR exceeds its Social Discount Rate.

The Economic Benefit/Cost ratio (EB/C)
This indicator is the ratio between the discounted benefits and the discounted costs.

$$EB/C = \frac{\displaystyle\sum_{t=f}^{c+T} \frac{R_t}{(1+i)^{t-n}}}{\displaystyle\sum_{t=f}^{c+T} \frac{C_t}{(1+i)^{t-n}}}$$

Where:
- *c* is the first full year of operation
- **Rt** is the social benefit induced by the project on year *t*. The benefit on year c+T also includes the Residual Value of the project.) The benefit refers mainly to Socio-Economic Welfare, SEW, which is the benefit indicator B2. Moreover, other monetized benefits, such as benefits from variation of losses (benefit indicator B4), should be taken into account.
- **Ct** is the sum of CAPEX and OPEX on the year *t*

- **_n_** is the year of analysis

- **_i_** is the Economic Discount Rate of the project

- **_f_** is the first year of induced benefit or cost

If EB/C exceeds 1, the project is considered as economically efficient as the benefits outweigh the costs on the time horizon.

These performance indicators should be seen as complementary to ENPV and as a way to assess/compare projects of different sizes (different level of costs and benefits).