Good Practices in preparing ICT projects co-financed by EC

JASPERS Networking Platform
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Michael Schaller
Structure of the presentation

- I JASPERS Smart Development Division (SDD)
- II EC Cost Benefit Methodology – Background
- III Feasibility Study – analytical elements
- IV Cost Benefit analysis (financial and economic parts)
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Mainly engineers and economists but also environmental experts, in the following areas:

- Research, Development, Innovation,
- Information and Communication Technology (ICT),
- Health and Education, Urban Development
- Integrated or multi-sectoral projects (Smart Cities and others)

In the current programming period involvement in a number of major digital projects (Broadband, Data centers, e-Government, e-Education etc.):

- France (Bretagne, Martinique, La Reunion)
- Ireland
- Italy
- Greece
- Slovakia
- Croatia
- Albania
- Romania
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European Commission identified early the need for a structured approach for preparing and evaluating major projects eligible for ERDF (Structural Funds)

Notable was inconsistency in quality of project proposals and lack of evidence of long-term sustainability -> Risk of inefficient use of EU-funds

Result -> FS/CBA guidelines were gradually improved, especially during the last two Programming Periods (2007-2013 and 2014-2020)

A number of different sectors now covered in the EC guide (Rail, Road, Waste, Energy, R&D and Broadband):

Not a mandatory guideline, but strongly recommended to ensure the quality of projects and faster approval
JASPERS role in EC CBA (FS) Guideline

- JASPERS actively contributed to the development of the EC 2014-2020 guidelines, on the basis of its public sector experience.
- ICT projects in general could not be properly covered due to their diverse nature. JASPERS addressed this with a general template to be modified by Beneficiaries.
- The lack of methodology for broadband addressed through a working paper developed by JASPERS in 2013.
- Update of working paper in 2019* covers: lessons learnt from the use of previous model, new regulatory context, roll-out of last-mile, new economic studies. It also includes the financial analysis.
- A template approach, providing analytical baselines adaptable to specific project needs. Tested in projects - for instance Greece, France, Croatia and Albania.
- The model will feed to the planned 2021-2027 EC CBA Vademecum.

EC CBA (FS) – baseline elements

- For completeness and to cover all aspects following should be included:
  - **Socio-Economic link** – *compliance and contribution to society*
  - **Project Demand** – *current market situation vs. estimated uptake*
  - **Option analysis** – *examining best technical and operational alternatives*
  - **Technical analysis** – *choice of technology*
  - **Institutional arrangements** – *management structure, procurement, operation*
  - **Financial analysis** – *Project cost and funding needs (OPEX and CAPEX)*
  - **Economic analysis** – Economic drivers and results for society
  - **Risk analysis** – *project risk elements and mitigation factors*
  - **State Aid aspects and Environmental constraints**

- JASPERS use a seven steps approach to cover these elements in a Feasibility Study and Cost-Benefit analysis
7 steps of project preparation

1. Presentation of the socio-economic, institutional and political context

2. Definition of objectives

3. Project identification

4. Technical feasibility & Environmental sustainability

5. Financial analysis

6. Economic analysis

7. Risk assessment
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Here focus is on broadband – principles remain the same for ICT in general

The existing situation of ICT maturity in the country, compared with EU average

- Socio-economic factors (GDP, affordability)
- IT-literacy, use of digital services (including e-Government services)
- Political drivers (national broadband plans and digitalisation strategies)
- Connection with the EU objectives (incl. Digital Agenda, Gigabit-society)
- Market structure and competition (general overview)
- Market failure requiring public intervention
7 steps of project preparation

1. Presentation of the socio-economic, institutional and political context
2. Definition of objectives
3. Project identification
4. Technical feasibility & Environmental sustainability
5. Financial analysis
6. Economic analysis
7. Risk assessment
Objectives

- Objectives set based on potential market interest (confirmed in public consultation)
- … and in line with policy objectives:
  - compliance with the EU and national strategies and policy documents
  - Included in the Operational Programmes (priority axis, budget and indicators), applicable for EU member states
- Defined in relation to other initiatives (e-Government, Education, Research etc.)
- Clear quantification with a system of results indicators, including baseline and targets (coverage, penetration, services to provide)
7 steps of project preparation

1. Presentation of the socio-economic, institutional and political context

2. Definition of objectives

3. Project identification
   - Project activities
   - Body responsible for project implementation

4. Technical feasibility & Environmental sustainability

5. Financial analysis

6. Economic analysis

7. Risk assessment
Project identification

• What is the target for intervention (areas of digital divide)?
  • Rural vs. Urban
  • White vs. grey NGN areas
• Who (which user group(s)) is targeted by the project?
  • General public, Public institutions, Businesses
• Who manages and implements the project Institutional set-up (during, implementation, operation)?
• Who implements the project?
  • Where do actors intervene (type of services to provide)
  • Business model (Public/Private DBO, concession, bottom-up)
• How is the project organized?
  • Geographical split, Procurement lots, Technical considerations
7 steps of project preparation

1. Presentation of the socio-economic, institutional and political context

2. Definition of objectives

3. Project identification

4. Technical feasibility & Environmental sustainability
   - Demand analysis
   - Option analysis
   - Technical design, cost estimates and implementation schedule
   - Environmental considerations, including EIA and climate change

5. Financial analysis

6. Economic analysis

7. Risk assessment
Demand

• Verifies the need for the project and defines interest in the project results
• Start with current demand situation (numbers)
  • Coverage of different services (fixed, mobile, NGA)
  • Penetration/uptake (households, public institutions, companies)
  • Regional differences (urban vs rural)
• Main market players (wholesale and retail level) and their market shares
• Existing broadband offerings: capacity and price levels
• Followed by estimation of future demand estimation (penetration)
  • Public consultations, mapping, operator investment plans
  • Statistical evidence of broadband adoption in the country
  • New services and technologies that can trigger demand
  • Affordability and realistic pricing strategies
• Future demand estimations drives scope (budget and technologies)
Option analysis

• Selection of the best option through analysis of all realistic options at the (1) strategic and (2) technological level.

• Two-step approach recommended:

  1. Comparison of strategic project options. Normally based on MCA, using e.g. no-project scenario, business as usual, different institutional or business models, location etc.

  Leads to the best option and a list of feasible technological alternatives best suited to meet the identified objectives of the project.

  2. Comparison of the short-listed technological alternatives, preferably including quantitative methods (least cost (OPEX and CAPEX), ENPV).
Technical aspects

• Chosen technology option result from the option analysis (fiber dominates)

• Technology neutrality applies. All technologies meeting objectives should qualify.

• Indicative network map should be modelled and described, based on knowledge of existing infrastructure and identified gap (at the level of backhaul, access and last mile).

• CAPEX should be estimated
  • Based on quantified analysis of equipment/civil works needs
  • Comparison with recently procured projects in the same sector/country (benchmarking), e.g. cost per home passed.

• OPEX should be estimated
  • Benchmarking exercises, in particular for staff and asset maintenance requirements

• Reinvestment cost should be estimated
  • Periodic asset replacement need (normally active equipment)
Implementation aspects

• Realistic?
• Important with timely ex-ante activities:
  • Clear roles and responsibilities (Beneficiary, MA, regulator..)
  • Mapping, public consultations, operator interest
  • State aid and Environmental clearance
  • Establish strong and well defined PIU and management structure
  • Procurement preparation
• When relevant; state aid approval will take time. EC approval will take time. Procurement will take time
• Well defined penalties clauses necessary in case of delays are important
• Well defined and realistic roll-out plan needed. Delays will occur (technical, permits etc.). Allow for unexpected delays.
• Strong contract management team to avoid implementation delays
• Delays often due to political interference, or unclear institutional set-up and governance. Technology standard and rarely cause for delays
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# 7 steps of project preparation

1. **Presentation of the socio-economic, institutional and political context**
2. **Definition of objectives**
3. **Project identification**
4. **Technical feasibility & Environmental sustainability**
5. **Financial analysis**
   - Assess project’s profitability
   - Verify financial sustainability
   - Outline the cashflows which underpin the calculation of socio-economic costs and benefits.
6. **Economic analysis**
7. **Risk assessment**
Financial analysis: key questions

- Objectives of the financial analysis for EU co-financed projects:
  - Check if the project is in need of public co-financing – what is the funding gap?
  - Demonstrate the project’s sustainability during implementation and operating phases – will the project be financially sustainable?
  - Verify the project return(s) after the EU grant – is the EU grant not excessive? Will the project be attractive to the commercial operators?
Financial analysis: the model

- Facilitates the analysis in relation to the three “questions”
- Addresses possible ownership and operating models
- Does not foresee to carry out detailed calculations of project cashflows
- Input sheet where all the relevant information on project costs and revenues can be provided
- Emphasis is put on the results of demand estimations in terms of households and businesses covered by the project and connected (take-up rate)

### Business model switch

<table>
<thead>
<tr>
<th>Owner</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>Private</td>
</tr>
</tbody>
</table>

### Model flags - DO NOT CHANGE

<table>
<thead>
<tr>
<th>Owner</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>Public</td>
</tr>
<tr>
<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td>Private</td>
<td>Public</td>
</tr>
<tr>
<td>Private</td>
<td>Private</td>
</tr>
</tbody>
</table>

### COVERAGE AND TAKE-UP

**Cumulative broadband take-up in intervention project - Households**
- From Nothing/Basic/Fast to Superfast broadband (greater than 30Mbit/s)
- From Nothing/Basic/Fast to Ultrafast (greater than 100Mbit/s)
- From Superfast broadband to Ultrafast

**Cumulative broadband take-up in intervention project - Business employees**
- From Nothing/Basic/Fast to Superfast broadband (greater than 30Mbit/s)
- From Nothing/Basic/Fast to Ultrafast (greater than 100Mbit/s)
- From Superfast broadband to Ultrafast

**Cumulative no. of households covered by intervention project**
- From Nothing/Basic/Fast to Superfast broadband (greater than 30Mbit/s)
- From Nothing/Basic/Fast to Ultrafast (greater than 100Mbit/s)
- From Superfast broadband to Ultrafast

**Total number of households addressed by this project**

**% of households covered in the intervention area**

**Cumulative no. of business employees covered by intervention project**
- From Nothing/Basic/Fast to Superfast broadband (greater than 30Mbit/s)
- From Nothing/Basic/Fast to Ultrafast (greater than 100Mbit/s)
- From Superfast broadband to Ultrafast
Financial analysis: is the project in need of co-financing with an (EU) grant?

**CONSOLIDATED (OPERATOR + OWNER) (All national sources)**

Cashflow projections (constant 2019 prices)

<table>
<thead>
<tr>
<th>Project expenditures and revenues</th>
<th>Unit</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital expenditure</td>
<td>EUR</td>
<td>7,700,000</td>
<td>25,300,000</td>
<td>30,900,000</td>
<td>18,000,000</td>
</tr>
<tr>
<td>Operational expenditure</td>
<td>EUR</td>
<td>0</td>
<td>694,375</td>
<td>3,185,417</td>
<td>6,475,000</td>
</tr>
<tr>
<td>Revenue</td>
<td>EUR</td>
<td>0</td>
<td>2,016,000</td>
<td>4,262,400</td>
<td>8,640,000</td>
</tr>
<tr>
<td>Residual value</td>
<td>EUR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Replacement costs</td>
<td>EUR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Net project cashflow without project</strong></td>
<td>EUR</td>
<td>-7,700,000</td>
<td>-23,978,375</td>
<td>-29,823,017</td>
<td>-15,835,000</td>
</tr>
</tbody>
</table>

| FNPV(C)                           | EUR  | -6,564,803 |
| FRR(C)                            | %    | 3.0%      |

- Financial return on investment (FNPV(C)) : to determine if there is need for public support
- FDR of 4.0% => verify that FRR(C) < 4%

*Note: data is for illustrative purpose, not project specific*
## Financial analysis: Sustainability

### Financial sustainability

<table>
<thead>
<tr>
<th>Sources of financing</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERDF grant</td>
<td>EUR 2,310,000</td>
<td>7,590,000</td>
<td>9,270,000</td>
<td>5,400,000</td>
<td>0</td>
</tr>
<tr>
<td>EIB loan</td>
<td>EUR 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other public contribution</td>
<td>EUR 4,290,000</td>
<td>13,310,000</td>
<td>16,130,000</td>
<td>9,300,000</td>
<td>0</td>
</tr>
<tr>
<td>Private</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private equity</td>
<td>EUR 770,000</td>
<td>2,530,000</td>
<td>3,090,000</td>
<td>1,800,000</td>
<td>0</td>
</tr>
<tr>
<td>Private loan</td>
<td>EUR 1,870,000</td>
<td>6,930,000</td>
<td>8,590,000</td>
<td>5,100,000</td>
<td>0</td>
</tr>
<tr>
<td>Total revenues</td>
<td>EUR 0</td>
<td>2,016,000</td>
<td>4,262,400</td>
<td>8,640,000</td>
<td>11,160,000</td>
</tr>
<tr>
<td>Total inflows</td>
<td>EUR 9,240,000</td>
<td>32,376,000</td>
<td>41,342,400</td>
<td>30,240,000</td>
<td>11,160,000</td>
</tr>
<tr>
<td>Initial investment</td>
<td>EUR 9,240,000</td>
<td>30,360,000</td>
<td>37,080,000</td>
<td>21,600,000</td>
<td>0</td>
</tr>
<tr>
<td>Replacement costs</td>
<td>EUR 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Loan repayment (including interest)</td>
<td>EUR 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total operating costs</td>
<td>EUR 0</td>
<td>694,375</td>
<td>3,185,417</td>
<td>6,475,000</td>
<td>8,917,500</td>
</tr>
<tr>
<td>Total outflows</td>
<td>EUR 9,240,000</td>
<td>31,054,375</td>
<td>40,265,417</td>
<td>28,075,000</td>
<td>8,917,500</td>
</tr>
<tr>
<td>Net cash flow</td>
<td>EUR 0</td>
<td>1,321,625</td>
<td>1,076,983</td>
<td>2,165,000</td>
<td>2,242,500</td>
</tr>
<tr>
<td>Cumulated net case flow</td>
<td>EUR 0</td>
<td>1,321,625</td>
<td>2,398,608</td>
<td>4,563,608</td>
<td>6,806,108</td>
</tr>
</tbody>
</table>

### Need to demonstrate:

- Financial sustainability of the operation
- How the sources of financing (internal and external) will match disbursements

*Note: data is for illustrative purpose, not project specific*
Financial analysis: Return on investment after the EU grant

<table>
<thead>
<tr>
<th>Cashflow projections (constant 2019 prices)</th>
<th>Unit</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
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<td>Project expenditures and revenues</td>
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<td>Revenue</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
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<td>-29,823,017</td>
<td>-15,835,000</td>
<td>2,242,500</td>
</tr>
<tr>
<td>Interest payments</td>
<td>EUR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>632,531</td>
</tr>
<tr>
<td>Principal repayments</td>
<td>EUR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,405,625</td>
</tr>
<tr>
<td>Loan fees</td>
<td>EUR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Public contribution</td>
<td>EUR</td>
<td>4,290,000</td>
<td>13,310,000</td>
<td>16,130,000</td>
<td>9,300,000</td>
<td>0</td>
</tr>
<tr>
<td>Private contribution</td>
<td>EUR</td>
<td>770,000</td>
<td>2,530,000</td>
<td>3,090,000</td>
<td>1,800,000</td>
<td>0</td>
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<tr>
<td>Net project cashflow considering financial</td>
<td>EUR</td>
<td>-5,060,000</td>
<td>-14,518,375</td>
<td>-18,143,017</td>
<td>-8,935,000</td>
<td>204,344</td>
</tr>
</tbody>
</table>

FNPV(K) | EUR | 3,695,841 |
FRR(K)  | %   | 4.8%      |

- Financial return on capital (consolidated) – FNPV(K) – to check the level of return “after” the EU grant; consolidated analysis
- Possibility to estimate
  - Operator’s financial profitability - FRR(Kp) - not mandatory if private partner is chosen in a fair, transparent and open competitive procedure assuring the best value for money and if claw-back mechanism is in place to avoid overcompensation
  - Public owner return on investment - FRR(Kg) often not meaningful (subject to budgetary balance)

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7 steps of project preparation

1. Presentation of the socio-economic, institutional and political context
2. Definition of objectives
3. Project identification
4. Technical feasibility & Environmental sustainability
5. Financial analysis
6. Economic analysis
   - Economic benefits
   - Economic profitability
7. Risk assessment
Economic analysis: scope of the model

• The model is linked to infrastructure investments (improving connectivity)

• Projects linked to connectivity to schools, eGovernment or eHealth services require sector- and project-specific analysis

• The model is a “living document” with recommendations

• Flexibility to use alternative types of benefits or modify parameters (the methodology and assumptions used need to be explained; and in line with the EU regulations/guide)

• Simplicity

<table>
<thead>
<tr>
<th>Quantitative</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumers</td>
<td>e-education</td>
</tr>
<tr>
<td>Business</td>
<td>Environment:</td>
</tr>
<tr>
<td></td>
<td>e-health</td>
</tr>
<tr>
<td></td>
<td>e-government</td>
</tr>
<tr>
<td></td>
<td>Social inclusion</td>
</tr>
<tr>
<td></td>
<td>Farming</td>
</tr>
</tbody>
</table>
Economic analysis: What is the project potential to affect the society and economy?

- Research literature: positive impact of high-speed networks is generally recognized, it is equally noted that the exact impact remains difficult to measure.

- The model assumes that the impact of the project will depend on the difference in speeds between the existing broadband provision and those resulting from the investment in the project area.

- Two economic benefits quantified for consumers and businesses.

<table>
<thead>
<tr>
<th>Socio-economic benefit parameters</th>
<th>Unit</th>
<th>Year 1</th>
<th>Year 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household consumer benefit from Nothing/Basic/Fast to Superfast broadband (monthly)</td>
<td>EUR</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Household consumer benefit from Nothing/Basic/Fast to Ultrafast broadband (monthly)</td>
<td>EUR</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Household consumer benefit from Superfast to Ultrafast broadband (monthly)</td>
<td>EUR</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>GVA rise per employee due to Nothing/Basic/Fast to Superfast broadband</td>
<td>%</td>
<td>0.30%</td>
<td>3.00%</td>
</tr>
<tr>
<td>GVA rise per employee due to Nothing/Basic/Fast to Ultrafast broadband</td>
<td>%</td>
<td>0.40%</td>
<td>4.00%</td>
</tr>
<tr>
<td>GVA rise per employee from Superfast to Ultrafast broadband</td>
<td>%</td>
<td>0.10%</td>
<td>1.00%</td>
</tr>
</tbody>
</table>
Economic analysis: ENPV and ERR calculations

Social Discount Rate benchmark for 2014 – 2020 in real terms
• 5 % for Cohesion countries,
• 3 % for non-Cohesion countries
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5. Financial analysis
6. Economic analysis
7. Risk assessment
   - Sensitivity analysis
   - Qualitative risk analysis
   - Probabilistic risk analysis
Sensitivity analysis

- Variables are changed one at a time to assess the impact on NPV:
  - Identify critical variables (NPV elasticity > 1) and to calculate “switching values” (% change in variable to make NPV switch sign)

- Scenario analysis: simultaneous changes in different variables

### E.3.2 Sensitivity analysis - variables tested

<table>
<thead>
<tr>
<th>Variable tested</th>
<th>Financial net present value (FNPV/K) variation</th>
<th>Financial net present value (FNPV/C) variation</th>
<th>Economic rate of return (ERR) variation</th>
<th>Economic net present value (ENPV) variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Capital expenditure with 1% increase</td>
<td>-1.3%</td>
<td>-11.2%</td>
<td>-0.1%</td>
<td>-0.6%</td>
</tr>
<tr>
<td>2 Capital expenditure with 1% decrease</td>
<td>1.3%</td>
<td>11.2%</td>
<td>0.1%</td>
<td>0.6%</td>
</tr>
<tr>
<td>3 Operational expenditure with 1% increase</td>
<td>-39.7%</td>
<td>-22.3%</td>
<td>-0.1%</td>
<td>-1.3%</td>
</tr>
<tr>
<td>4 Operational expenditure with 1% decrease</td>
<td>39.7%</td>
<td>22.3%</td>
<td>0.1%</td>
<td>1.3%</td>
</tr>
<tr>
<td>5 Revenues with 1% change</td>
<td>59.8%</td>
<td>33.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Revenues with -1% change</td>
<td>-59.8%</td>
<td>-33.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Benefits with 1% change</td>
<td>-0.2%</td>
<td>3.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Benefits with -1% change</td>
<td></td>
<td>-0.2%</td>
<td>3.0%</td>
<td></td>
</tr>
<tr>
<td>9 Business employee benefits with 1% increase</td>
<td>0.2%</td>
<td>2.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Business employee benefits with 1% decrease</td>
<td>-0.2%</td>
<td>-2.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Household consumer surplus with 1% increase</td>
<td>0.1%</td>
<td>0.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Household consumer surplus with 1% decrease</td>
<td></td>
<td>-0.1%</td>
<td>-0.7%</td>
<td></td>
</tr>
</tbody>
</table>

### E.3.2 Sensitivity analysis - switching values for critical variables *

<table>
<thead>
<tr>
<th>Critical variable</th>
<th>Switching value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Benefits</td>
<td>Maximum change before ENPV turns zero (%)</td>
</tr>
<tr>
<td>2 Capital expenditure</td>
<td>Maximum change before ENPV turns zero (%)</td>
</tr>
<tr>
<td>3 Operational expenditure</td>
<td>Maximum change before ENPV turns zero (%)</td>
</tr>
<tr>
<td>4 Capital expenditure</td>
<td>Maximum change before FNPV/K turns zero (%)</td>
</tr>
<tr>
<td>5 Operational expenditure</td>
<td>Maximum change before FNPV/K turns zero (%)</td>
</tr>
<tr>
<td>6 Revenues</td>
<td>Maximum change before FNPV/K turns zero (%)</td>
</tr>
</tbody>
</table>

* - Critical variables are those for which a change of 1% in value results in a change of at least 1% in FNPV/K or ENPV

Calculate Switching Values
Risk analysis and Risk Matrix

Qualitative risk analysis:

Evaluation scale:
Probability: A. Very Unlikely; B. Unlikely; C. About as likely as not; D. Likely; E. Very likely
Severity: I. No effect; II. Minor; III. Moderate; IV. Critical; V. Catastrophic
Risk level: Low; Moderate; High; Unacceptable
Quantitative risk analysis

- A probabilistic risk analysis for cases with significant residual risks

**Assumptions - Triangular Probability Distributions**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Investment</th>
<th>O&amp;M</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base-case (Present Value)</td>
<td>mEUR</td>
<td>86.7</td>
<td>164.7</td>
</tr>
<tr>
<td>Minimum</td>
<td>%</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>Most Likely (Mode)</td>
<td>%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Maximum</td>
<td>%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Number of iterations</td>
<td>#</td>
<td>10,000</td>
<td></td>
</tr>
</tbody>
</table>

**Results of Monte Carlo Simulation - ENPV**

<table>
<thead>
<tr>
<th>Summary</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (Expected ENPV)</td>
<td>mEUR</td>
</tr>
<tr>
<td>Median</td>
<td>mEUR</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>mEUR</td>
</tr>
<tr>
<td>Minimum</td>
<td>mEUR</td>
</tr>
<tr>
<td>Maximum</td>
<td>mEUR</td>
</tr>
<tr>
<td>Prob. (ENPV&gt;0)</td>
<td>%</td>
</tr>
</tbody>
</table>

**ENPV probability distribution**

**ENPV cumulative probability distribution**
Thank you

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More Information

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