Technics of financial assessment of infrastructure projects

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REKK
Main focuses of the corporate (TSO) level financial assessment

• Identify the investment costs of the project including the material and financial costs of investment;

• Model the effects of the new infrastructure on the operational costs and revenues of the TSO;

• Check the TSO’s general financial capabilities to finance the fixed asset investment;

• Measure the effects of the regulatory regime on the added value of the project.
Main elements of the assessment studies

Technical Report
- Definition of different grid routes
- Grid investment costs
- Effects on congestion charge
- Effects on transported electricity
- Effects on network losses

Corporate level CBA
- Changes in revenues of the TSOs
- Additional and avoided costs of operation
- Financing of the investments
- Effects of the capital structure
- Sensitivity analysis of major risk factors

Economy level CBA
- Effects on environment protection
- Effects on electricity market development
- Effects on generation requirements (avoided generation)
## Infrastructure project benefit categories of the ENTSO-E Guideline

<table>
<thead>
<tr>
<th>Benefit categories in ENTSO Guideline</th>
<th>Effects on TSO level</th>
<th>Consideration in the corporate level model</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B1. Improved security of supply</strong></td>
<td>Partial</td>
<td>Through decreasing O&amp;M costs</td>
<td>Newer infrastructure reduces the cost of maintenance</td>
</tr>
<tr>
<td><strong>B2. Socio-economic welfare (SEW)</strong></td>
<td>Partial</td>
<td>Effects of rent change calculated in corporate model. All other SEW impacts considered in economic model</td>
<td>Rent change impact depends on regulatory regime.</td>
</tr>
<tr>
<td><strong>B3. RES integration</strong></td>
<td>None</td>
<td>Considered in economic model</td>
<td>No direct impacts on TSO level.</td>
</tr>
<tr>
<td><strong>B4. Variation in losses</strong></td>
<td>Partial</td>
<td>Considered in economic model</td>
<td>Better system quality reduces the cost of network losses- depends on regulation.</td>
</tr>
<tr>
<td><strong>B5. Variation in CO2 emissions</strong></td>
<td>None</td>
<td>Considered in economic model</td>
<td>No direct impacts on corporate level</td>
</tr>
<tr>
<td><strong>B6. Technical resilience/system safety</strong></td>
<td>YES</td>
<td>Higher technical capabilities calculated in investment cost of fixed assets</td>
<td>Direct effects on TSO through cost of capital</td>
</tr>
<tr>
<td><strong>B7. Flexibility</strong></td>
<td>Partial</td>
<td>Higher technical capabilities calculated in investment cost of fixed assets</td>
<td>Direct effects on TSO through cost of capital</td>
</tr>
</tbody>
</table>
## Infrastructure project cost categories of the ENTSO-E Guideline

<table>
<thead>
<tr>
<th>Cost categories in the ENTSO-E Guideline</th>
<th>Consideration in the corporate (FA) model</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected cost for materials and assembly costs</td>
<td>Yes- cost of investment</td>
<td>Input from system study</td>
</tr>
<tr>
<td>Expected costs for temporary solutions which are necessary to realize a project</td>
<td>Yes- cost of investment</td>
<td>Input from system study</td>
</tr>
<tr>
<td>Expected environmental and consenting costs</td>
<td>Partial</td>
<td>Expropriation, compensation for forest cutting</td>
</tr>
<tr>
<td>Expected costs for devices that have to be replaced within the given period</td>
<td>None</td>
<td>Calculated depreciation would finance the required replacements</td>
</tr>
<tr>
<td>Dismantling costs at the end of life of the equipment</td>
<td>Limited</td>
<td>Conservative calculation of residual value partially considered.</td>
</tr>
<tr>
<td>Maintenance costs and costs of the technical life cycle</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Detailed structure of a financial assessment model

Assumptions
• Regulatory model
• Cost of operation
• Cost of financing
• Working capital

Calculation sheets
• Revenues & costs
• Debt service
• CAPEX & depreciation

Financial statements of version 1

Financial statements of version 2
• Profit and loss statement
• Balance sheet
• Cash flow

Financial statements of version “n”

Summary and Case Reports

Sensitivity analysis
ENTSO-E Guideline expressions on calculation method: “*All costs and benefits are discounted to the present, and expressed in the price base of that year.*”

Our model’s main methodological characteristics:

- based on a **discounted cash flow (DCF)** method;
- uses the **net present values (NPV)** of the project as a main indicator to demonstrate the key economic impacts;
- all figures are in **nominal terms**
- **Discount rates are in nominal terms.** The ENTSO-E Guideline declares: *the discount rate can be calculated as a real or a nominal rate. However, this choice must be consistent with the valuation of costs and benefits: real prices imply real rates, nominal prices imply nominal rate.*
Discounted cash flow method based on future free cash flows generated by the planned project.

NPV: difference of cash inflows and cash outflows.

\[
NPV = \sum_{t=1}^{n} \frac{FCFE_t}{(1 + r_{E_t})^t}
\]

where \( FCFE \) is the free cash flow to equity; \( r_{E_t} \) is the return expected by the shareholders in the \( t^{th} \) year.

The net present value can also be calculated on the basis of the free cash flow for the firm (FCFF), i.e. the balance on cash flows before external financing (borrowing); but then the weighted average cost of capital (WACC) needs to be applied.

\[
WACC = r_E \frac{E}{V} + r_D (1 - T_c) \frac{D}{V}
\]

where \( E \) is equity, \( D \) is the stock of liabilities subject to interest (loans), \( V \) is the aggregate value of equity and loans, and \( T_c \) is the corporate tax rate.
In the financial assessment we simulate the most probable impacts of the regulatory regime on the costs and income of the TSO. The simulation applies the general equation of the RoR framework as the following:

\[
RR_n = OE_n + D_n + T_n + (RAB \times RoR)_n
\]

where: \(RR_n\) means the required revenue of the project for period ‘n’; \(OE\) means the operating expenses; \(D\) means the depreciation expense; \(T\) means the tax expense; \(RAB\) means the regulated assets base and \(RoR\) means the rate of return.

We can calculate the project level required revenue on the following way:

1. “Pass-through cost elements”, including:
   • O&M costs
   • Cost effects of the rent differences comparing the current situation.
   • Other project related costs
   • Depreciation.
2. Corporate tax
3. WACC*RAB
Information from publicly available sources
1 - Calculation of return on equity

Enter the current risk premium for a mature equity market

Do you want to adjust the country default spread for the additional volatility of the equity market?
Yes

If yes, enter the multiplier to use on the default spread (See worksheet for volatility numbers for selected emerging markets)
1.39

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>B1</td>
<td>4.99%</td>
<td>12.95%</td>
<td>6.95%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Bosnia and Herzegovia</td>
<td>B3</td>
<td>7.21%</td>
<td>16.05%</td>
<td>10.05%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Baa2</td>
<td>2.11%</td>
<td>8.94%</td>
<td>2.94%</td>
<td>1.81%</td>
<td>8.52%</td>
<td>2.52%</td>
</tr>
<tr>
<td>Croatia</td>
<td>Ba1</td>
<td>2.77%</td>
<td>9.86%</td>
<td>3.86%</td>
<td>3.00%</td>
<td>10.18%</td>
<td>4.18%</td>
</tr>
<tr>
<td>Germany</td>
<td>Aaa</td>
<td>0.00%</td>
<td>6.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>6.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Greece</td>
<td>Caa3</td>
<td>11.08%</td>
<td>21.44%</td>
<td>15.44%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Hungary</td>
<td>Ba1</td>
<td>2.77%</td>
<td>9.86%</td>
<td>3.86%</td>
<td>1.76%</td>
<td>8.45%</td>
<td>2.45%</td>
</tr>
<tr>
<td>Macedonia</td>
<td>Ba3</td>
<td>3.99%</td>
<td>11.56%</td>
<td>5.56%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Montenegro</td>
<td>Ba3</td>
<td>3.99%</td>
<td>11.56%</td>
<td>5.56%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Romania</td>
<td>Baa3</td>
<td>2.44%</td>
<td>9.40%</td>
<td>3.40%</td>
<td>1.35%</td>
<td>7.88%</td>
<td>1.88%</td>
</tr>
<tr>
<td>Serbia</td>
<td>B1</td>
<td>4.99%</td>
<td>12.95%</td>
<td>6.95%</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

\[ r_E = r_f + \beta(r_m - r_f) \]

\( r_E \) return on equity, \( r_f \) risk free rate, \( r_m \) return on market
Information from publicly available sources 2 – betas and D/E ratios

Europe

<table>
<thead>
<tr>
<th>Industry Name</th>
<th>Number of firms</th>
<th>Beta</th>
<th>D/E Ratio</th>
<th>Tax rate</th>
<th>Unlevered beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal &amp; Related Energy</td>
<td>21</td>
<td>0,83</td>
<td>50,64%</td>
<td>7,07%</td>
<td>0,57</td>
</tr>
<tr>
<td>Green &amp; Renewable Energy</td>
<td>48</td>
<td>1,24</td>
<td>124,34%</td>
<td>12,79%</td>
<td>0,60</td>
</tr>
<tr>
<td>Oil/Gas (Integrated)</td>
<td>15</td>
<td>1,89</td>
<td>64,86%</td>
<td>20,56%</td>
<td>1,24</td>
</tr>
<tr>
<td>Oil/Gas (Production and Exploration)</td>
<td>133</td>
<td>2,02</td>
<td>179,05%</td>
<td>3,90%</td>
<td>0,74</td>
</tr>
<tr>
<td>Oil/Gas Distribution</td>
<td>34</td>
<td>1,72</td>
<td>106,31%</td>
<td>7,04%</td>
<td>0,87</td>
</tr>
<tr>
<td>Utility (General)</td>
<td>20</td>
<td>1,13</td>
<td>106,35%</td>
<td>23,58%</td>
<td>0,62</td>
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Emerging markets

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<th>D/E Ratio</th>
<th>Tax rate</th>
<th>Unlevered beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility (General)</td>
<td>12</td>
<td>0,83</td>
<td>226,13%</td>
<td>12,47%</td>
<td>0,28</td>
</tr>
</tbody>
</table>

~ 52% debt and 48% equity

~ 69% debt and 31% equity
### How to define the proper beta?

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**What is this data?** Beta, Unlevered beta and other risk measures Western Europe

**Home Page:** [http://www.damodaran.com](http://www.damodaran.com)

**Data website:** [http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html](http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html)

\[
B_U = \frac{B_L}{1 + (1 - T_C) \times (D/E)}
\]
Unlevered (asset) beta in European tariffs

Table 58 – Asset Beta in tariff calculation for 2015/2016 (based on equity beta, formula with taxes)

Gearing in tariff calculation

Table 45 - Gearing in tariff calculation for year 2015/2016
Source: NRA survey

Real cost of equity in regulation

Real cost of equity for year 2015/2016 (based on standarised equity beta formula without taxes, G=50%)

Table 63 – Real cost of equity for year 2015/2016 (based on standarised equity beta formula without taxes, G=50%)

Description of Electricity Dummy Project  
(BG-RO new OHL line)

The dummy project: a new 400kV OHL between Romania and Bulgaria  
Capacity: the new OHL increases the NTC by 1000 MW in both directions  
Commissioning year: 2020  
Investment costs:  
   BG: 10 m€ in 2018; 20 m€ in 2019, 20 m € in 2020  
   RO: 10 m€ in 2018; 20 m€ in 2019, 20 m € in 2020  
Operation cost: from 0.7% up to 2.2% based on investment value of the infrastructure
NPV on TSO level has a limited focus compared to economic assessment.

The Components of Net Present Value (NPV) calculation:

\[
\text{NPV} = \text{CS} + \text{PS} + \text{Rent} + \text{Value of losses} + \text{EENS} - \text{OPEX} - \text{Investment cost}
\]

- **CS**: Consumer surplus change in the countries of the area of analysis
- **PS**: Producer surplus change in the countries of the area of analysis
- **Rent**: Rent change in the countries of the area of analysis
- **Rent**: Rent change in the countries of the area of analysis
- **Value of losses**: Value of loss change in the countries of the area of analysis
- **EENS**: Value of Expected Energy Not Supplied change
- **OPEX**: Operation and Maintenance cost change due to the project
- **Investment cost**: verified investment cost
Reports and sensitivity analysis

Typical indicators required by the financial partners (banks)

- IRR
- DSCR (Net operating income / Total debt service)
- EBITDA/net interest
- Net debt/EBITDA

Sensitivity analysis

Potential impacts of several key parameters on the financial results of the TSO:

1) Overall financial cost environment
2) Cost overrun of investment
3) „Quality of regulation”
Teamwork with the demo model…
### Parameters and assumptions

#### Assumptions for "ROR & costs" regulation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost of equity</td>
<td>8.85%</td>
</tr>
<tr>
<td>Opening share of equity financing</td>
<td>20%</td>
</tr>
<tr>
<td>Corporate tax rate</td>
<td>9%</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

#### Investment

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost (EUR '000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Expropriation</td>
<td>3,000</td>
</tr>
<tr>
<td>Technical equipment</td>
<td>37,000</td>
</tr>
<tr>
<td>Other tangibles &amp; contingency</td>
<td>10,000</td>
</tr>
</tbody>
</table>

#### Costs of operation

- **O&M cost of a new network**: 0.70% of investment costs
- **O&M cost of an old network**: 2.20% of investment costs
- **Insurance cost**: 0.20% of net asset value

#### Cost of financing

- **Effective interest rate of long term investment debt**: 4.00%
- **Periods of repayment**: 12 years (plus 2 years grace period)
- **Short term interest rate - debts**: 3.5%
- **Short term interest rate - securities**: 1.5%

#### Working capital

- **Payment period for accounts receivable (days)**: 60
- **Payment period for accounts payable (days)**: 60
- **Cash and cash equivalents**: 5 days (% of O&M, other and financial costs)
Summary results

**Project NPV**
- FCFE: -2,792 EUR '000
- Residual value: 3,078 EUR '000
- Project NPV with residual value (EUR '000): 286 EUR '000
- IRR: 6.7%

**Financial indicators**

**External (loan) financing**
- Additional short-term loans
- Investment loan
Potential tariff impacts of the project

AVG: 0.0726 EUR/MWh in EUR(Year_1)