Regulatory asset base (RAB) for network tariff setting
Agenda

- Establishment of RAB
- Valuation of RAB
- Depreciation
- Cost of capital
- Ownership vs lease of assets
Establishment of RAB
Pricing is a two step procedure

1. Regulator determines revenue requirements for the regulated company

2. Regulator chooses a tariff structure which allows the company to obtain enough revenues to cover its cost and earn a reasonable return

   *Alternatively*

   Regulator revises a tariff structure proposed by the company
Typical formula of revenue requirement (RR) is the following:

$$RR = O + D + T + r*B$$

*where*

- $RR$ = Revenue Requirement
- $O$ = Operating Expenses
- $D$ = Depreciation
- $T$ = Taxes
- $r$ = allowed rate of return
- $B$ = rate base (or regulatory asset base – RAB)
RAB usually refers to the measure of the net value of a company’s regulated assets used in price regulation.

RAB drives two of the fundamental building blocks that make up the company’s revenue requirements:

- the return on capital (i.e. the return on the RAB) and
- the depreciation allowance

RAB is a key determinant of prices that may be charged for regulated services in the future.
RAB initial value

- RAB is compilation and summation of the assets used in providing the regulated service
  - generally only includes those assets funded with investor money
  - regulators do not generally recognise intangible assets such as goodwill
  - RAB should include the assets used for the provision of the regulated services only
  - excludes customer contributed assets
- RAB is the investment base upon which the provider is permitted to earn a reasonable return
Fair value of RAB

- provision of certainty for investors
- provision of incentives for investors
- fairness - including:
  - sharing benefits between investors and customers
  - continuity of initial price level for social reasons
- provision of correct price signals for consumption, investment etc.
- interpretation of the regulatory ‘contract’ - in what state are assets expected to be kept?
RAB calculation

Opening value + Prudent capital expenditures - Asset disposals or retirements - Regul. accumulated depreciation = Net asset balance
The regulatory asset base for the year $t$ is calculated according to the following formula:

$$CB = OB + Inv - D - AD - DC + DWC$$

where:

- $OB$ - opening value of regulatory assets for year $t$ of the regulatory period;
- $Inv$ - investment (capital expenditures) for year $t$ of the regulatory period;
- $D$ - depreciation for year $t$ of regulatory period;
- $AD$ - assets disposal for year $t$ of regulatory period;
- $DC$ - annual change over year $t$ in the value of assets funded by capital contributions;
- $DWC$ - annual change over year $t$ in working capital;
- $CB$ - closing value of regulatory assets for year $t$ of the regulatory period.
The closing value of the RAB for year $t$ of regulatory period might be expressed by the following formula:

$$CB = CFA - CCC - CWC$$

where:

$$CFA = OFA + Inv - D - AD$$

$CB$ - closing value of regulatory assets for year $t$ of regulatory period;

$CFA$ - closing value of fixed assets for year $t$ of regulatory period;

$CCC$ - closing value of capital contribution;

$CWC$ - closing value of working capital
Capital contributions comprise of:

- grants obtained from international institutions and/or the government and
- direct payments by the user of a specific service for an asset, e.g. connection payments

The assets financed by the capital contributions should be excluded from the RAB

Therefore, it is necessary to disclose the values of capital contributions (for existing assets and for new investments) in order to ensure transparency of the process.
Regulators should require that:

- The net asset value of capital contributions and the relevant accumulated depreciation should be shown separately on the balance sheet for each energy activity;
- Capital contributions should be split into those associated with grants, connection contributions and other capital contributions;
- Where exact splits cannot be identified the regulated companies should provide estimates as well as an explanation of the methodology adopted and why it is considered appropriate.
To the extent that the time at which a particular cost is incurred is not matched with its recovery (via tariff revenues), then capital is required to cover the time lag – working capital.

An investment in working capital is a necessary part of conducting a regulated business.

In addition, there is also place for a return on the working capital similar to the requirement for a return on capital assets.
There are different approaches for working capital treatment in the regulatory price control.

In general, regulators want to give companies an incentive to manage working capital well.

The USA regulatory practices use cash cycle method called lead-lag approach.

Some Eastern European (Bulgaria, Romania) regulators allow working capital allowance set equal to 1/8 of the revenue requirements.
Most of the regulators think that new capital expenditure should be introduced in the RAB on the basis of actual costs incurred up to the point at which the assets become operational.

Some regulators include construction work in progress in the RAB when construction is to be completed within a relatively short period of time, e.g. in one year.

There is also the question of prudent investment when considering whether the full cost of new investment should be added to the RAB.
New investments

Different type of investments

- extension investments: all investments needed for meeting the change of load and generation patterns in the future
- replacement investments: all investments related to replacement of aged (technically or economically) equipment
- exceptional investments: investment resulting from e.g. new legal obligations.

Some investments could be both for network extension and for replacement reasons (e.g. replacement of an old transformer with a new one but more powerful)
Information asymmetry – company always knows better than the Regulator

The regulator will not accurately know the appropriate amount of capital expenditure required by the regulated service providers

In this case there may be incentives for the regulated entity to inflate the reported capital expenditure relative to the true cost

Investments may be examined from two perspectives: ex-ante and ex-post
Ex-post assessment of investments

- Ex-post assessment may be undertaken to supplement the ex-ante investment reviews.
- Regulators aim to identify differences between the capital expenditures allowed in the ex-ante review and the actual investments undertaken by the regulated company.
- Regulatory ex-post checks can also be undertaken without any previous ex-ante approval of the investments.
- In this case, the companies are confronted with the uncertainty of whether the undertaken investments will be recognised by the regulator ex-post.
Regulator needs to consider whether the company’s assets are sufficient to carry the regulated activity.

On the other hand, if a regulated company has excessive number of assets the regulator may decide not to include these assets into the RAB.

Although the assets are being “used” the question is whether they are actually “useful”.
Asset valuation options

- **Book valuation**
  - Historic cost
  - Indexed historic value

- **Market valuation**
  - Current cost
  - Modern equivalent asset

- **Economic valuation**
  - Current
  - Re-valued initial
  - Net present value
Historic cost

- The historic cost methodology values assets at their original purchase price
- It has several advantages:
  - it is administratively efficient and can be easily audited because the data should be available from financial statements;
  - it is relatively inexpensive since it does not require experts to determine costs;
  - and it is objective because it relies on actual data rather than judgements
Historic costs may understate asset prices in times of high inflation and overstate asset prices in times of technological change.

This method may lead to unstable prices (e.g., prices may rise when new, more expensive assets replace existing assets).

Data may be inadequate (especially for assets that have been acquired a long time ago) and returns may also be inadequate to support the funding of new investments.
This is the procedure for adjusting the value of the asset base for the effect of inflation.

Indexation should measure movements in the current replacement cost of the assets.

Consumer price index or industrial price index?

A set of industry-based indices would be more accurate but too complex.
Replacement cost

- Calculates the cost of replacing an asset with another asset (not necessarily the same) that will provide the same services and capacity as the existing asset.
- The assets are valued based on what it would cost to replace them today.
- Replacement costs reflect the price that a firm with a certain service requirement would pay for existing assets in preference to replicating the assets.
## Replacement cost advantages and disadvantages

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ provide an incentive for efficient investment decisions as it allows the regulator to reduce the value of the assets once it becomes aware that a more efficient low cost alternative asset is available</td>
<td>➢ replacement cost valuations entail a degree of estimation and judgment</td>
</tr>
<tr>
<td>➢ this reduces the risk of economically inefficient duplication of infrastructure</td>
<td>➢ the information is more expensive to collect than historic cost data because it may require expert advice</td>
</tr>
</tbody>
</table>
Fair market value

- Sum of the prices that would be obtained from selling each of the assets in a competitive market
- What a third party would pay in an arm’s length transaction
- Difficult if no active market, especially for large, specialised items
Net present value

- Sum of the discounted cash flows associated with each asset
- Predict the cash flows expected to be generated, then discount it back to present values using appropriate risk-adjusted discount rate
- Discount rate is often a key determinant of the result
In many CEE countries assets of the energy companies were not properly valued, historic cost was very low.

Indexations were not sufficient and many countries introduced the replacement cost principle for re-evaluation.

E.g. in Romania asset value of the distribution companies after the re-evaluation increased from 3 to 7 times.

But it was impossible to put it into the revenue requirement.
Lessons from the CEE countries

Privatisation of the distribution utilities in Bulgaria, Romania and Macedonia has shown that

- necessary to increase the asset value before the privatisation as it was usually kept too low
- could be too painful to switch to the replacement value of assets
- therefore it is important to agree on the re-valuation of assets before the privatisation and on their further regulatory treatment
- Romania agreed on the market value
Depreciation
The normal usage of assets involves a reduction in their ability to provide a service.

This “consumption” of the asset’s value should be reflected in the operating costs and capital value of the company.

When determining a depreciation charge there are similar objectives to those for the RAB.

Is also a desire for equity - consumers should pay a fair cost for the assets that they are consuming.

However, since assets often have a longer life than the consumers there may be a strong inter-generational equity question.
Options to consider include:

- current cost depreciation;
- historic cost depreciation;
- depreciation of the initial RAB plus separate depreciation of new investment; and
- an infrastructure renewals charge

Each option effectively impacts on the allocation of depreciation charges between existing and future assets since it alters the level of assets that are presumed to be kept in perpetuity.
Yearly value of depreciation depends on company’s depreciation policy

Straight line (linear), non-linear, normal, extraordinary, time proportionate, performance related types of depreciation are available

Accounting, taxation and regulatory depreciation requirements usually deviate from each other

All assets should be depreciated with the exception of land and construction work in progress
### Example: useful life times for calculation depreciation

<table>
<thead>
<tr>
<th>Asset group</th>
<th>Life time of a new asset (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High voltage lines</td>
<td>35</td>
</tr>
<tr>
<td>Medium voltage lines</td>
<td>30</td>
</tr>
<tr>
<td>Low voltage lines</td>
<td>25</td>
</tr>
<tr>
<td>Transformers</td>
<td>25-30</td>
</tr>
<tr>
<td>Buildings</td>
<td>50</td>
</tr>
<tr>
<td>Vehicles</td>
<td>8</td>
</tr>
</tbody>
</table>
Rate of return
The forecast level of profit (rate of return) that a company should be able to earn depends on:

- the value of the company (the RAB) and
- the forecast rate of return (weighted average cost of capital)

Is needed whether using incentive-based or rate of return type regulation
Rate of return (r) is the expected yield from the company (industry), taking into account the costs of financing the business (cost of capital).

The cost of capital is usually measured as the Weighted Average Cost of Capital (WACC).

The r sets the return that can be earned on:
- existing assets and
- net investment

This is a mixture of debt and equity.
Weighted average cost of capital

\[ WACC = r_e \frac{E}{E + D} + r_d (1 + t) \frac{D}{E + D} \]

where

- \( r_e \) = required rate of return on equity
- \( r_d \) = rate of return on debt
- \( E \) = equity
- \( D \) = debt
- \( t \) = corporate tax rate
Before tax

\[
\text{WACC} = (8.92\% \times 0.55) + (6.4\% \times 0.45) = 7.79\% 
\]
WACC of some European TSOs

%
This is the cost of borrowing funds for the company from the debt markets.

- Could be estimated by considering the Eurobond markets.
- May not be available to most of the companies, but is the key market for determining the cost of funds.
- The cost of debt is defined as a risk-free rate plus a company premium.
- Reality check is to consider the actual cost of borrowing and determine financial indicators.
The cost of equity \( (r_e) \) is usually determined with the Capital Asset Pricing Model (CAPM)

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

where

- \( r_e \) = required rate of return on equity
- \( r_f \) = risk free rate of return (e.g. treasury bills)
- \( \beta \) = Beta, the relative volatility of the specific stock to the market
- \( r_m \) = market risk
Beta is a measure of the relative riskiness of the company, with respect to unavoidable risk.

- So, beta is a scalar applied to the equity risk premium.
- The value used in the calculation is the equity beta.

This measures:
- underlying business risk (referred to as the asset beta); and
- financial risk (arising from the debt-equity structure).

- So, although two companies have the same business risk, if they have different gearing levels then the equity beta will be different.
The country risk calculation

- Political risk factors
  - existence of special taxes, restriction on fund transfers, protection of local firms, etc.
  - bureaucracy
  - corruption
- Financial risk factors
  - interest rate
  - inflation
  - exchange rate
  - economy growth
- To every factor corresponding rating and weight are assumed
Market risk premium for electricity DSOs in some EU countries (2008)
After tax

\[ r_e = 4.6 + 0.43 \times 5.9 = 7.14\% \]

Before tax

\[ r_e = 7.14/(1-0.2) = 8.92\% \]
Ownership vs lease of the assets
Companies often choose to lease long-term assets rather than buy them for a variety of reasons:

- the tax benefits are greater to the lessor than the lessees
- leases offer more flexibility in terms of adjusting to changes in technology and capacity needs and so on
## Ownership of the assets

### Advantages

- Outright asset ownership
- Assets can be modified at any stage to suit changing business requirements
- Asset can be replaced or disposed of at any time

### Disadvantages

- Major capital outlay up-front
- Entity incurs maintenance and repairs costs which typically increase as assets age
- Entity incurs costs for the replacement or disposal of assets at the end of their useful lives
### Lease of the assets

**Advantages**

- Cash-flow effective method for gaining access to assets as no major capital outlay up-front
- Assets may be replaced more frequently, allowing the entity access to latest technology for no additional cost
- Possible access to knowledge, purchasing power and discounts offered by the lessor

**Disadvantages**

- Assets may not be able to be modified and replaced to suit changing business requirements without lessor approval and attracting fees
- Potential capital outlay at the end of the lease term if purchasing the asset at the end of the lease
The decision to either lease an asset or purchase it requires an analysis of the financial implications of the decision also.

Financial parameters, such as the interest rate as well as the implied opportunity cost of using the entity's own cash resources, may have a significant impact on the lease versus purchase decision.
Two examples

\[
\begin{align*}
2 & + 2 \\
& = 4
\end{align*}
\]
### RAB calculation in some EE countries

<table>
<thead>
<tr>
<th>Country</th>
<th>CWIP included</th>
<th>CC included</th>
<th>Assets value</th>
<th>Revaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>no</td>
<td>yes</td>
<td>historic</td>
<td>yes</td>
</tr>
<tr>
<td>Croatia</td>
<td>yes</td>
<td>no</td>
<td>historic</td>
<td>no</td>
</tr>
<tr>
<td>Estonia</td>
<td>no</td>
<td>no</td>
<td>historic</td>
<td>yes</td>
</tr>
<tr>
<td>Hungary</td>
<td>no</td>
<td>no</td>
<td>replacement</td>
<td>yes</td>
</tr>
<tr>
<td>Lithuania</td>
<td>no</td>
<td>no</td>
<td>replacement</td>
<td>yes</td>
</tr>
<tr>
<td>Serbia</td>
<td>yes</td>
<td>no</td>
<td>historic</td>
<td>yes</td>
</tr>
<tr>
<td>Slovakia</td>
<td>yes</td>
<td>no</td>
<td>replacement</td>
<td>yes</td>
</tr>
</tbody>
</table>
## Development of price regulation in Hungary

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Market model</td>
<td>Single buyer</td>
<td>Single buyer/hybrid</td>
<td>Hybrid/Competitive</td>
<td>Competitive</td>
</tr>
<tr>
<td>Pricing model</td>
<td>Cost plus and price cap</td>
<td>Cost plus and price cap</td>
<td>Cost plus and price cap</td>
<td>Cost plus and price cap</td>
</tr>
<tr>
<td>Rate base</td>
<td>Equity</td>
<td>Book value</td>
<td>Replacement value</td>
<td>Replacement value</td>
</tr>
<tr>
<td>Rate of return</td>
<td>8%</td>
<td>9,8%</td>
<td>7,1%</td>
<td>7,8%</td>
</tr>
</tbody>
</table>
## Development of price regulation in Hungary

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Calculation of r</td>
<td>Internat. benchmark</td>
<td>Risk free + premium</td>
<td>WACC</td>
<td>WACC</td>
</tr>
<tr>
<td>Depreciation</td>
<td>Law on Taxation</td>
<td>Law on Taxation</td>
<td>Useful lifetime</td>
<td>Useful lifetime</td>
</tr>
<tr>
<td>Inflation k</td>
<td>IPI*k</td>
<td>CPI*k</td>
<td>CPI-k</td>
<td>CPI-k</td>
</tr>
<tr>
<td></td>
<td>0,85-0.95</td>
<td>0,7-0,9</td>
<td>1,8-2,2</td>
<td>0,7-2,3</td>
</tr>
<tr>
<td>Network losses</td>
<td>12%</td>
<td>10,8%</td>
<td>8,7%</td>
<td>8,3%</td>
</tr>
</tbody>
</table>