



ECOM+ Results 2005: TSO A

SENSITIVITY REPORT

Per Agrell
Peter Bogetoft

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Summary

This is a report on the ECOM+ (Efficiency of Construction, Operations and Maintenance, improved) model that puts a spotlight at a subset of the transmission tasks. The mathematical structure is simple in its derivation of a standardized unit cost measure and a relative efficiency measure. However, the report also provides details on econometric approaches to elicit more information from submitted data and to enrich the performance assessment. The model takes into account inflation, exchange rates, investment horizons, assets lives, asset groupings and country specific factors for each asset group. In this run, the method has been enhanced with methodologically sound partial measures that control for investment profile and scale, based on linear programming, as well as dynamic measures to study the changes over time of both the efficiency frontier and the individual TSOs.

The ECOM+ model is applied to the transmission operators in Austria, Denmark, the Netherlands, Norway and Portugal. The study comprises operating expenditure from 2000 to 2003 in addition to the investment and assets since 1965.

The final report identified TSO A as one of two TSOs in a group with considerably higher total costs, a result that was validated using absolute and relative benchmarks for total costs and using partial non-parametric measures.

This study investigates the sensitivity of the obtained results with respect to administrative costs, commercial revenues, regulators parameters for interest rate and asset life length, alternative investment stream indexations and age corrections.

The sensitivity analyses with respect to various parameters show robust average results higher than European average costs.

An indexation using purchasing power indicates an average absolute cost higher than European average cost, but it also implies lower efficiency score compared to sample best practice. The truncation of the investment stream before 2000 considerably changes the results, since it uncouples the investment stream from the operating costs for its assets in use. The hypotheses behind these two simulations are invalid and the results are purely numeric illustrations without any other interpretation.

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Sumicsid AB
Tunbyn 502
S-85590 SUNDSVALL, SWEDEN
www.sumicsid.com

1. Organization

Project team

- 1.01 Project leader from SUMICSID AB was Senior Associate Per Agrell, prof.dr. The project team consisted also of senior associate Peter Bogetoft, prof.dr, consultants Daniele Benintendi and Mathias Lorenz, from SUMICSID and chief engineer Jacques Deuse, ph.d. from Tractebel Engineering.
- 1.02 The ECOM+ model is applied to the transmission operators in Austria, Denmark, the Netherlands, Norway and Portugal.

Objectives

- 1.03 The ECOM+ 2004 project aimed at determining an economically and technically solid performance indicator for TSO maintenance and construction costs, controlling for individual operating conditions.
- 1.04 The report for TSO A focuses at
- 1) *Standard sensitivity analyses*
 - 2) *Suggestions with regard to commercial revenues*
 - 3) *Cautiousness of results.*
 - 4) *Robustness of results, in particular with respect to costs.*
 - 5) *Frontier shift in the sample*
- 1.05 The sensitivity analysis for TSO A focuses at
- 1) *Purchasing power indexation of CAPEX*
 - 2) *Dte parameters in the calculations*
 - 3) *Exclusion of revenue corrections in OPEX*
 - 4) *Effects of cost shocks for peers*
 - 5) *Relationship between age and OPEX*
 - 6) *Effects of truncation at 2000*

Document status

- 1.06 This report is the sensitivity report for TSO A on the second round of the ECOM+ project on international benchmarking of transmission system operators in 2004/2005. This report is OPEN.

2. Summary of results

Method

- 2.01 ECOM+ is essentially a unit cost measure based on a standardized cost measure, both for operating and capital costs, divided by a normalized grid proxy constructed from a large number of asset items in 8 categories.
- 2.02 The Unit Cost measure (UC) gives an absolute benchmark with respect to average European grid maintenance and construction costs in 2003. The validity of this information is assured by the technical validation team, using actual data from international tenders and cost studies. The ECOM+ method is open for the inclusion of specific correction factors for asset items or categories, given that a country-specific exogenous, significant and durable cost driver has been documented. In the current study, no such factors were identified in spite of extensive reviews of submitted documentation. However, the interactions did lead to the introduction of new refined asset classes for e.g. alpine and mountainous lines as well as revisions of the cost norms valid for all TSOs.

$$\begin{aligned}
 UC &= \frac{\text{ActualCosts}}{\text{SizeOfGrid}} \\
 &= \frac{\text{OPEX} + \text{CAPEX}}{\text{SizeOfGridOPEX} + \text{SizeOfGridCAPEX}} \\
 \text{Total UnitCost} \quad UC_{ff}(w, v) &= \frac{\text{OPEX} \quad C_{ff} + \sum_{s=t_0}^t \varphi_s I_{fs} \alpha(r, T_f)}{\underbrace{\sum_a N_{fa} w_{fa}}_{\text{OPEX Grid Size}} + \underbrace{\sum_{s=t_0}^t \sum_a \varphi_s n_{fas} v_{fa} \alpha(r, T_g)}_{\text{CAPEX Grid Size}}} \\
 &\quad \underbrace{\hspace{10em}}_{\text{OpEx UnitCost}} \quad \underbrace{\hspace{10em}}_{\text{CapEx UnitCost}}
 \end{aligned}$$

- 2.03 The Efficiency measure E is defined as

$$E = \frac{\text{Min UC}}{UC}$$

Partial measures

- 2.04 In addition to the unit cost results, the ECOM+ study validates the obtained results using constrained partial measures of the non-parametric type (DEA). The model is calculates result contingent on both year of operation, scale of grid and operating cost level to control for any possible objections. However, given the strict constraints and low number of observations, the very cautious results only serve as lower bounds to the efficiency and are not further developed in this report.

Standard sensitivity analyses

- 2.05 The standard sensitivity analyses in the final report investigate the impact of changes in interest rate, asset life times and evaluation horizon (forgiveness factor) on the unit cost results. The result show unanimously that the results are robust to the given parameters.
- 2.06 For the TSO A, specific analyses are already made in the final report on OPEX and CAPEX for lines, the dominating asset group.

Suggestions with regard to commercial revenues

- 2.07 Revenues generated by the operations and maintenance staff are included in the operating costs (cf art 4.05 in Operating Cost Definition 2.1). Operational telecommunication, including incomes and costs from rental of telecommunication capacity on high voltage towers, installation, depreciation and operating costs of optic cables, is entirely excluded from the benchmarked operating cost (art 4.17 in Operating Cost Definition 2.1). The impact of deleting revenue corrections is negligible on the TSO A unit cost and efficiency results. For continued evaluations, we suggest that there still is correction for revenues related to the use of O&M staff by external clients, audited if necessary with respect to its relative impact.

Cautiousness of results

- 2.08 The unit cost measure is an indicator of overall transmission operating costs that is firmly based in a standardized asset data base. Given the improved level of detail and technical definition of the items (118 classes used in the current run), in combination with crossvalidating studies, the results for CAPEX have high significance level. The OPEX results are also reliable at an aggregate level, but can be less useful at detailed level due to the non-unique allocation of joint costs. The detected inefficiency of TSO A is derived and dominated by the CAPEX components, for which the uncertainty is the lowest.

Robustness of results, in particular with respect to costs.

- 2.09 Sensitivity analyses in the final report showed that current organizational diversity does not allow for the intended standardization of administrative costs. TSO without own administrative resources can in the current system freely allocate direct costs onto the TSO activities, in particular system operations, grid planning and market facilitation. First, as the weight system for OPEX includes normal administrative costs, this is likely to contribute to the cautiousness of the results. Second, for TSO A the overall level of administrative cost is not substantially lower than for its "reporting" peers, which suggests stable or slightly worse results when including it with any reasonable

allocation key. Besides administrative costs and overhead, the remaining problems with the operating cost reporting concerns activation policies and exceptional costs. In absence of any harmonized European rules for activation of TSO assets, some discrepancies are likely to remain. However, the impact is limited to relative efficiency since the absolute unit cost measure is unaffected by these accounting differences.

Frontier shift in the sample

2.10 Removed.

3. Specific Sensitivity Analyses

3.01 The sensitivity analysis focuses at

- 1) *Effects of cost shocks for peers*
- 2) *Purchasing power indexation of CAPEX*
- 3) *Exclusion of revenue corrections in OPEX*
- 4) *Regulators parameters in the calculations*
- 5) *Relationship between age and OPEX*
- 6) *Effects of truncation at 2000*

Effects of cost shocks for peers

3.02 The impact of variable cost increases between 0% - 25% of operating cost, including and excluding administrative costs, for the peers is examined.

Purchasing power indexation of CAPEX

3.03 The comparison of long series of past capital investments in European countries with initially different currencies, inflation rates, taxations and procurement practices is a true methodological challenge. In the current method, both in the 2002 and 2004 runs, the most favorable indexation series using CPI and annual conversion to NOK has been used. An alternative specification can be based on *purchase power index (PPI)* to reflect national cost differences.

Exclusion of revenue corrections in OPEX

3.04 The effects of eliminating the deduction for revenues related to external work performed by O&M staff in the operating cost is examined.

Regulator's parameters in the calculations

3.05 The standard parameters (WACC and asset life times) are somewhat different from the Regulators and TSO A parameters. A series of runs were made excluding and including administrative costs for the specific parameters furnished by the regulator and TSO A.

Effects of truncation at 2000

3.06 By virtue of regulatory ruling, the investments of TSO A up until the year 2000 have allegedly been judged efficient. The forgiveness factor φ in the model has been adjusted to 0 for all year up until 2000 and to 1 for all following years to investigate the impact of later investments.

Relationship between asset age and OPEX

- 3.07 A naïve comparison of the operating costs for the TSOs in the ECOM+ study may give the impression that operating cost follows a declining curve with asset age. This intriguing finding is entirely caused by the TSO B performance, being absolutely lowest in operating cost per grid unit and also operator of a relatively old network. However, the paradox is easily explained by the confusing of *efficient* and *average* operating costs. TSO B has demonstrably been undertaking significant and innovative reductions in operating cost that have no particular correlation to the asset age, simply their operating efficiency. Thus, a counter-intuitive correction for asset age would largely equate a correction for operating efficiency, a highly unwanted result. As the working hypothesis¹ for most regulators would be a constant or possible increasing operating cost by age, it makes no sense to test for the opposite without some detailed control for operating efficiency.

Summary

- 3.08 A full comparison of the runs is given in Table 3-1 and illustrated in Figure 3-1 and Figure 3-2 below. The truncated runs are unsatisfactory, as the operating cost cannot be disaggregated in the same way and thus contaminates the results for some other TSOs. The PPI adjusted runs are methodologically dubious as the index is applied to both operating cost and capital costs, knowing that most investments are made in competitive markets using USD or EUR.

¹ The hypothesis of increasing operating costs by age is explicitly supported by regulatory rulings in Ireland (CER Response to comments received regarding the Transmission Price Review Proposals, CER/01/135, 02/10/2001), and implicitly by OFGEM in Transmission price control review, Second consultation, 16/12/2005, and also confirmed by industry, as in e.g. SP Transmission & Distribution, Response to Ofgem Consultation Paper: Transmission price control review, 09/09/2005.

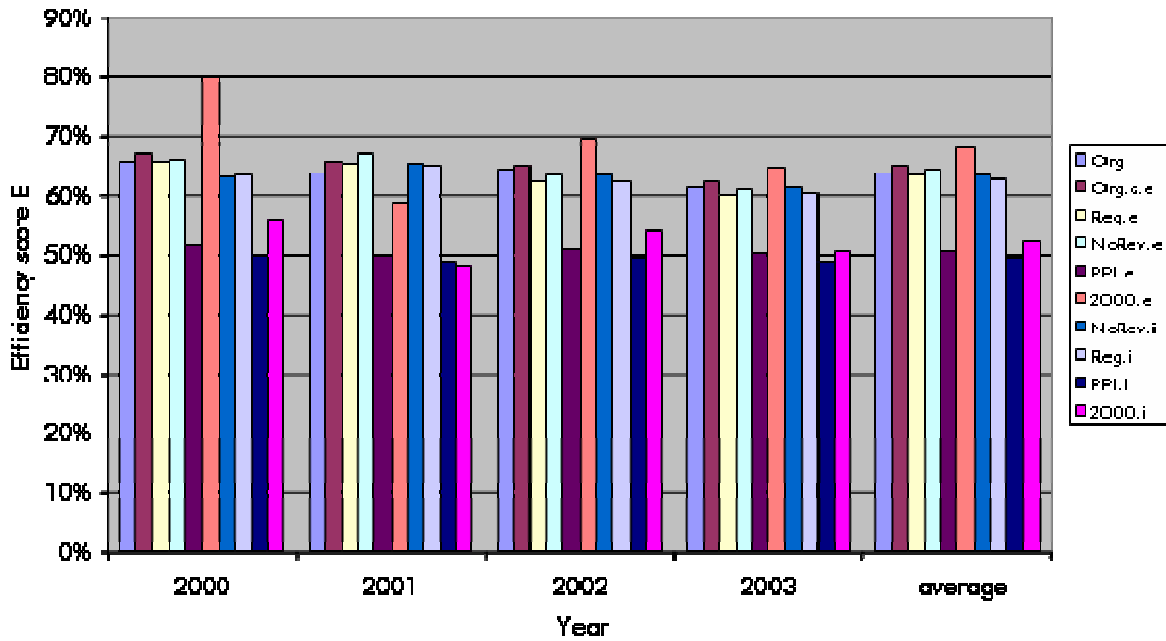


Figure 3-1 Summary of efficiency scores E for the sensitivity analyses Cf. Table 3-1.

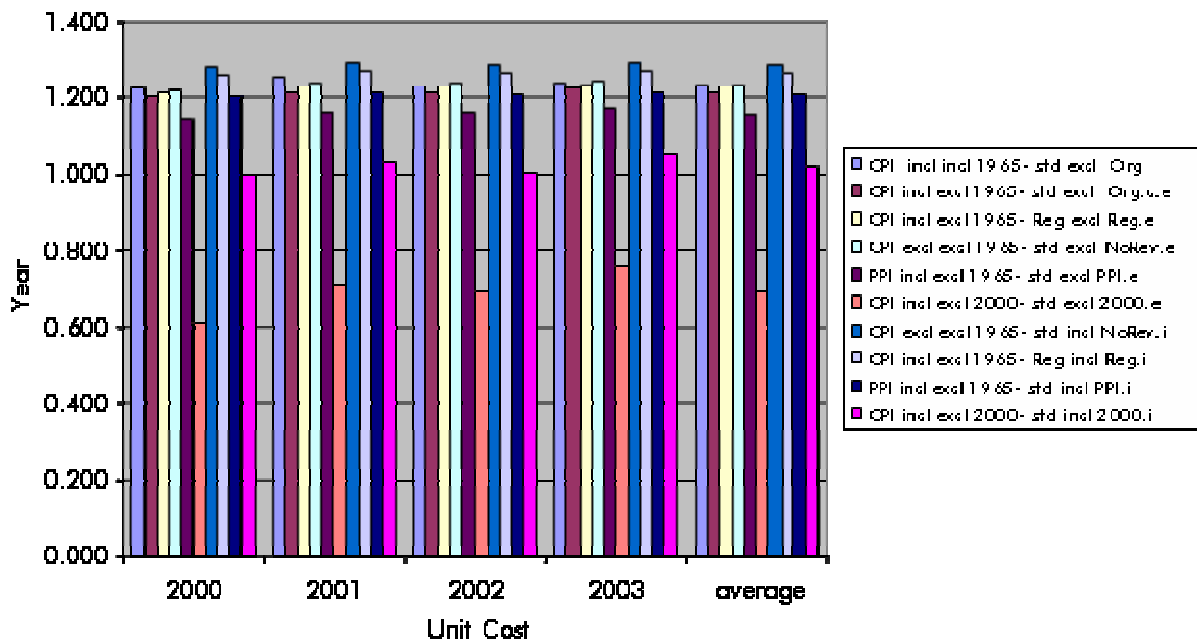


Figure 3-2 Summary of unit costs UC for the sensitivity analyses. Cf. Table 3-1.



Table 3-1 Summary of TSO A results from specific runs.

UC	Parameters									
	CPI	CPI	CPI	CPI	PPI	CPI	CPI	CPI	PPI	CPI
Indexation	incl.	incl.	incl.	excl	incl.	incl.	excl	incl.	incl.	incl.
Rev from O&M	incl.	excl	excl	excl	excl	excl	excl	excl	excl	excl
Tower painting	1965-	1965-	1965-	1965-	1965-	2000-	1965-	1965-	1965-	2000-
Investments included	std	std	Reg	std	std	std	std	Reg	std	std
Interest rate, life times	excl	excl	excl	excl	excl	excl	incl.	incl.	incl.	incl.
Administration costs	Unit Cost									
UC	2000	2001	2002	2003	average	2000	2001	2002	2003	average
	1.224	1.256	1.231	1.240	1.238	1.144	1.161	1.159	1.169	1.158
	1.201	1.216	1.214	1.221	1.213	0.613	0.712	0.696	0.760	0.695
	1.216	1.231	1.229	1.236	1.228	1.280	1.292	1.287	1.294	1.288
	1.263	1.269	1.267	1.272	1.268	1.205	1.211	1.208	1.216	1.210
	1.205	1.211	1.208	1.216	1.210	1.001	1.032	1.005	1.054	1.023
E	Efficiency score									
	2000	2001	2002	2003	average	2000	2001	2002	2003	average
	66%	64%	64%	61%	64%	52%	50%	51%	50%	51%
	67%	66%	65%	62%	65%	80%	59%	69%	65%	68%
	66%	66%	62%	60%	63%	63%	66%	63%	60%	63%
	66%	65%	63%	61%	64%	63%	65%	62%	60%	63%
	50%	49%	50%	49%	49%	56%	48%	54%	51%	52%