



ECOM+2

– logic and components

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First ECOM+2 Workshop

Bruxelles, November 27, 2004



Outline

Charter perspective

- Focus of the ECOM+ model

Logic

- From partial to aggregate evaluations

Data

- The necessary TSO inputs

Results

- Examples

Extensions

- Improvements and uses

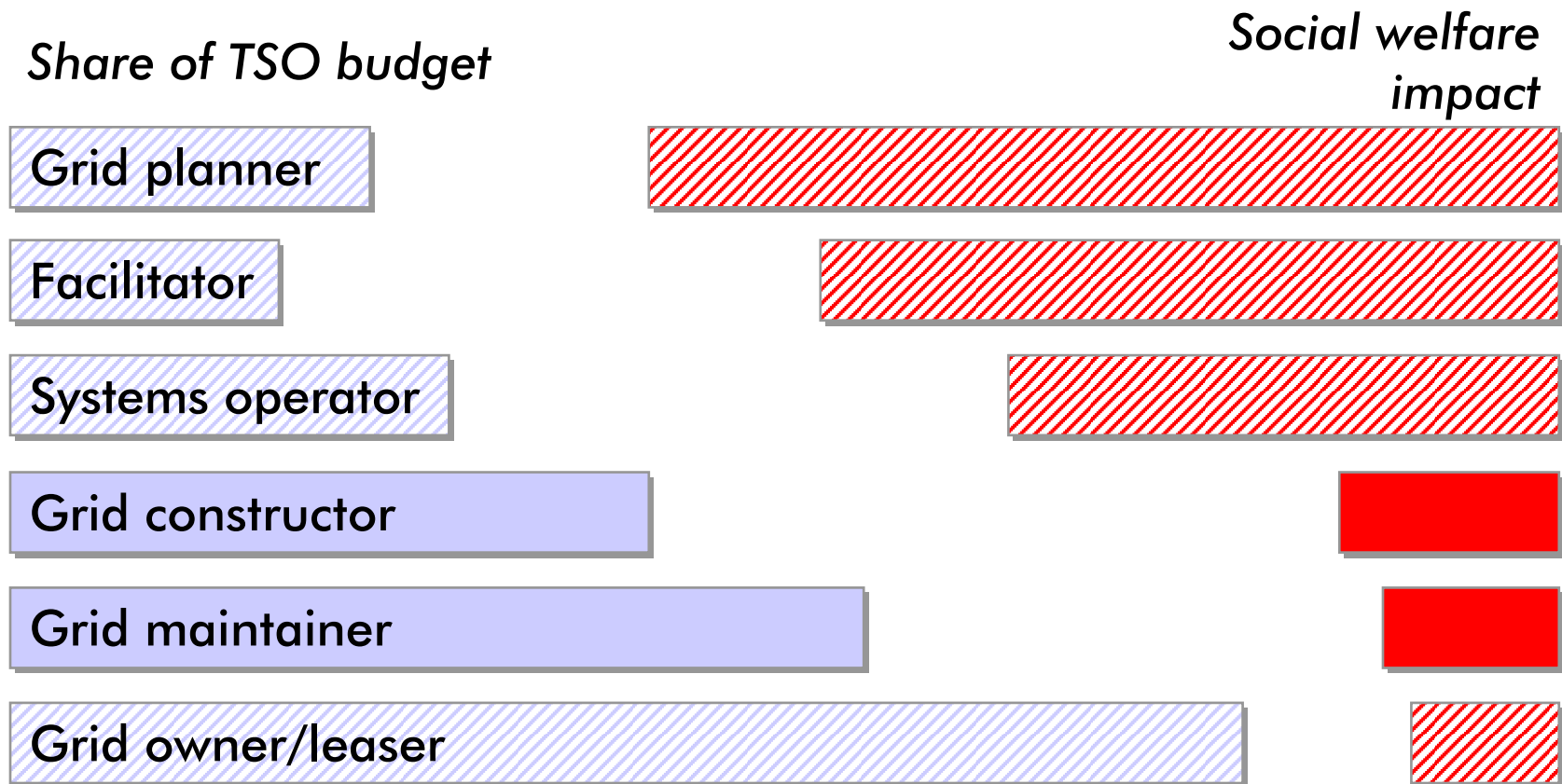
Conclusions



Charter perspective

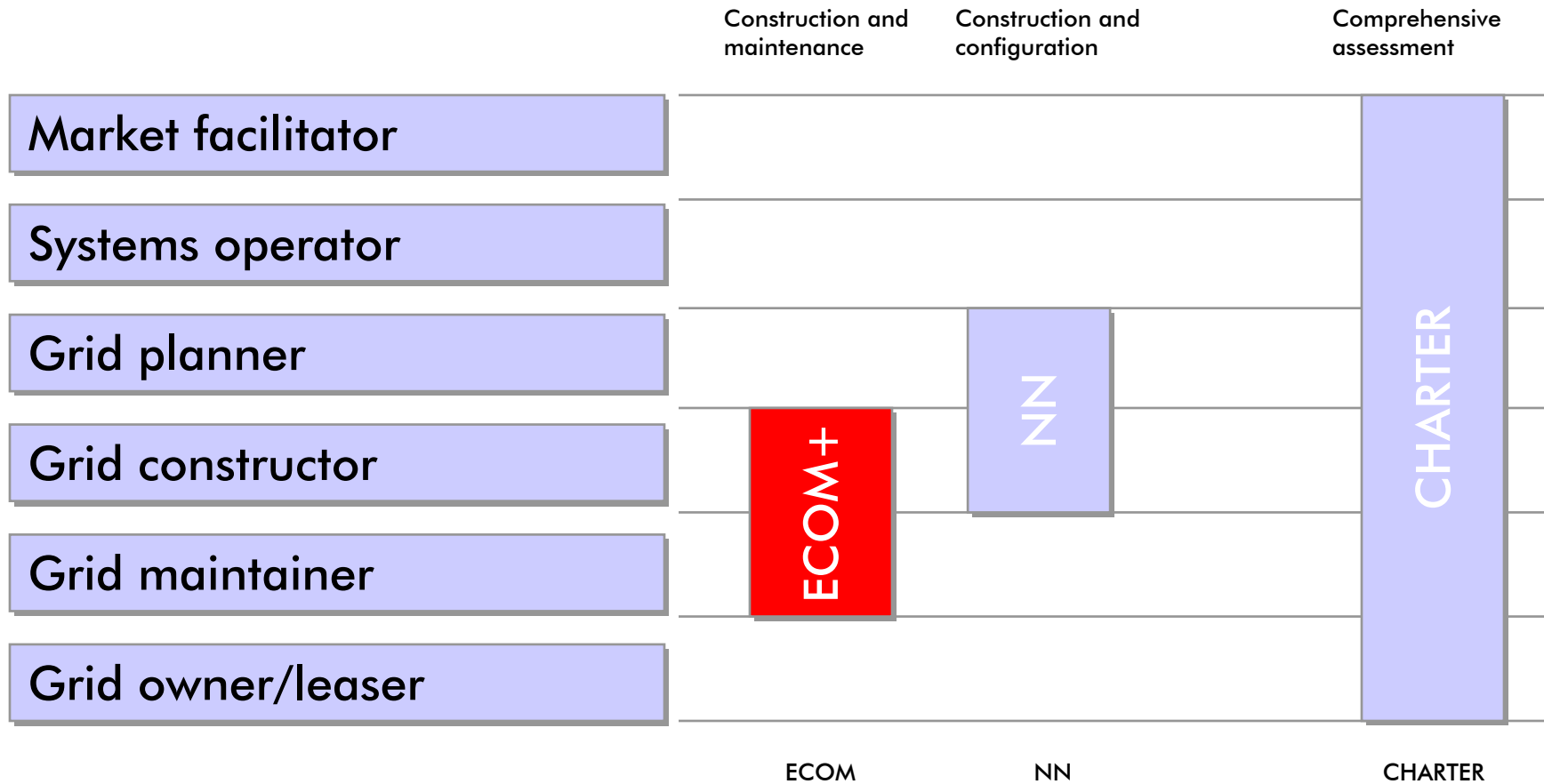


Budget and Impact





TSO benchmarking





Functions and Synergies

Grid Construction

- Physical construction of grid and installation of network assets.

Grid Operations and maintenance

- Preventive and reactive service of assets, staffing of facilities, replacement of degraded or faulty assets etc

Synergies

- Substitution between construction and maintenance is accounted for.
- Other synergies ignored –e.g. between planning and construction.



Effectiveness - Efficiency

Effectiveness

- Doing the right things

Efficiency

- Doing things right

ECOM +

- Doing some things right
- Avoid unnecessary costs in investment and maintenance
- Ignore several synergies / interactions with other costs and benefits



The ECOM+ Rationale

CEER promotes continuous infrastructure *expansion* and stable *quality provision* as key principles (Ten principles of Transmission Regulation, 2003)

ECOM+

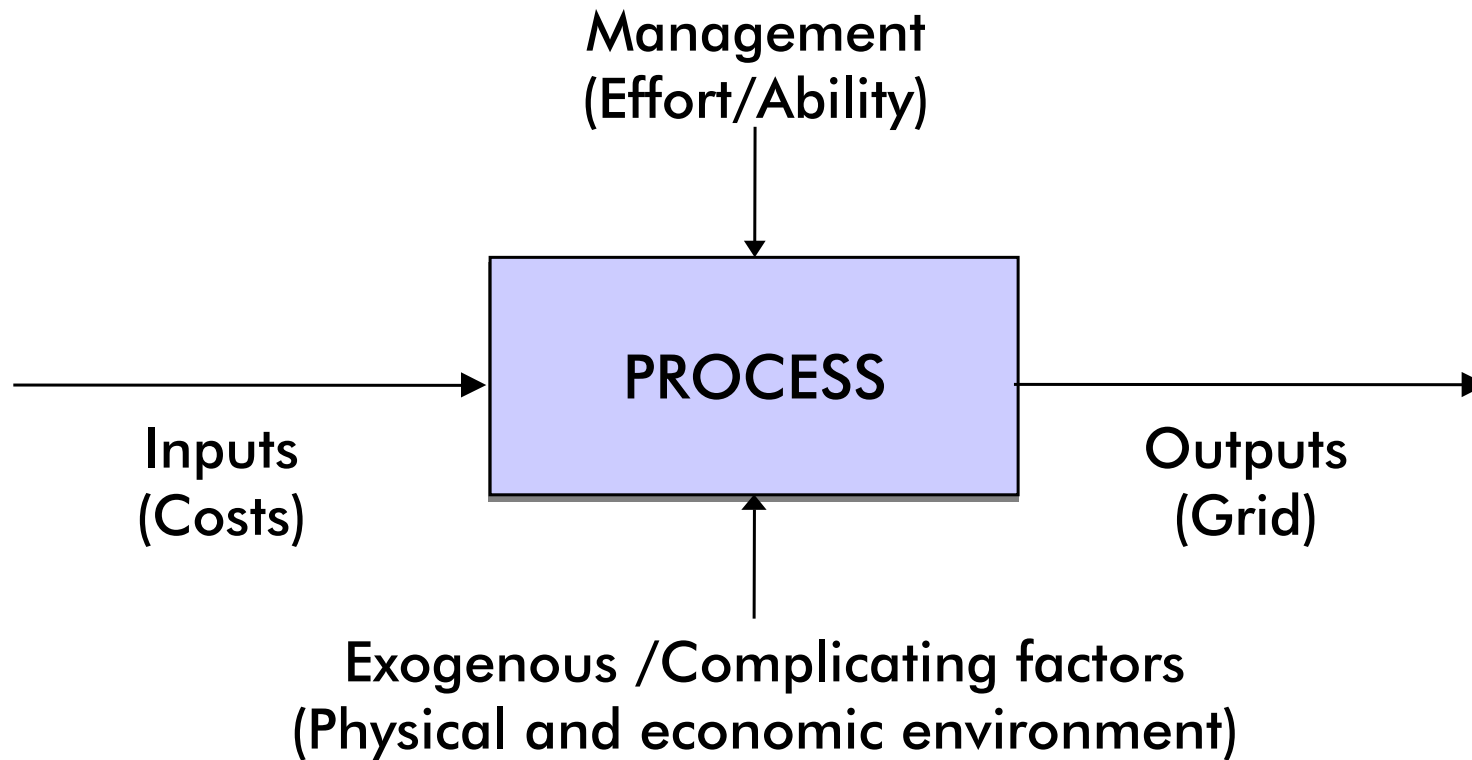
- Fully reimburses **all investments**
- Uses **no utilization metrics**
- Promotes quality by **not penalizing scale**



Logic

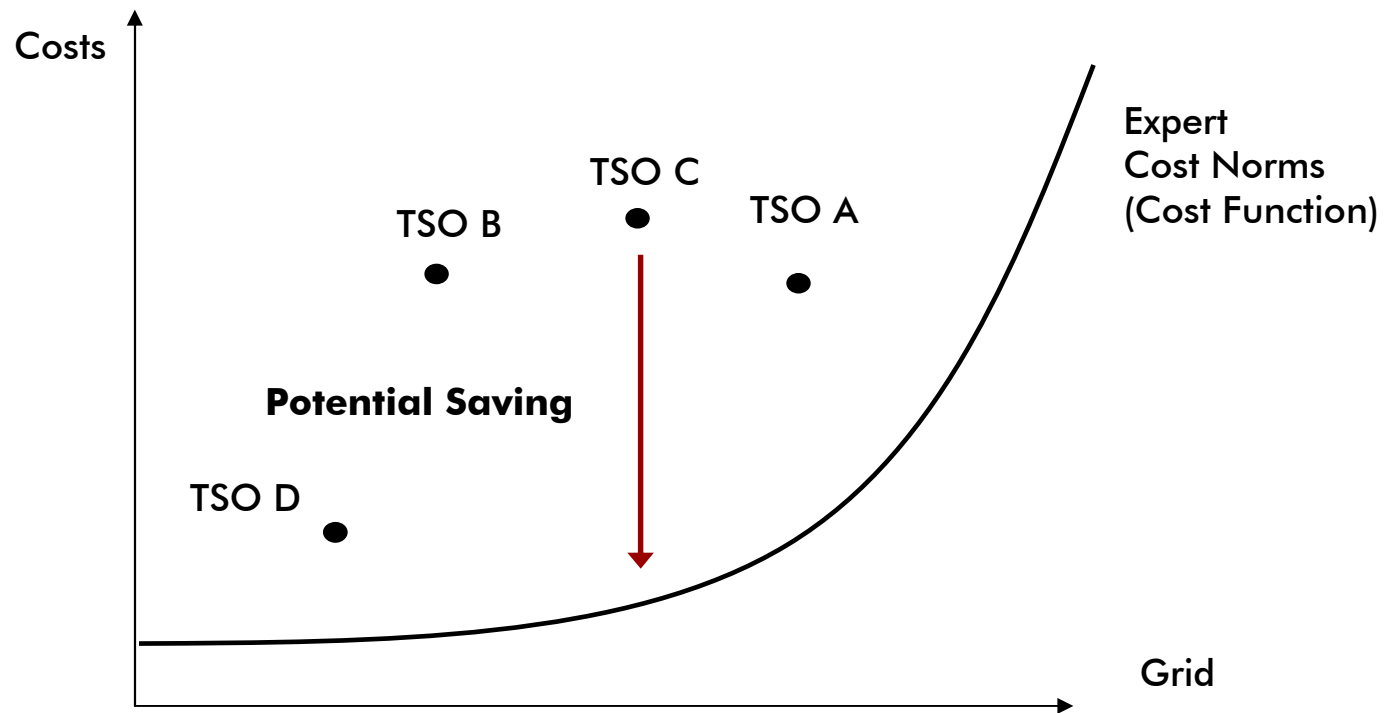


Benchmarking System Model





Ideal Evaluations





Real Evaluations

Real evaluations complicated by

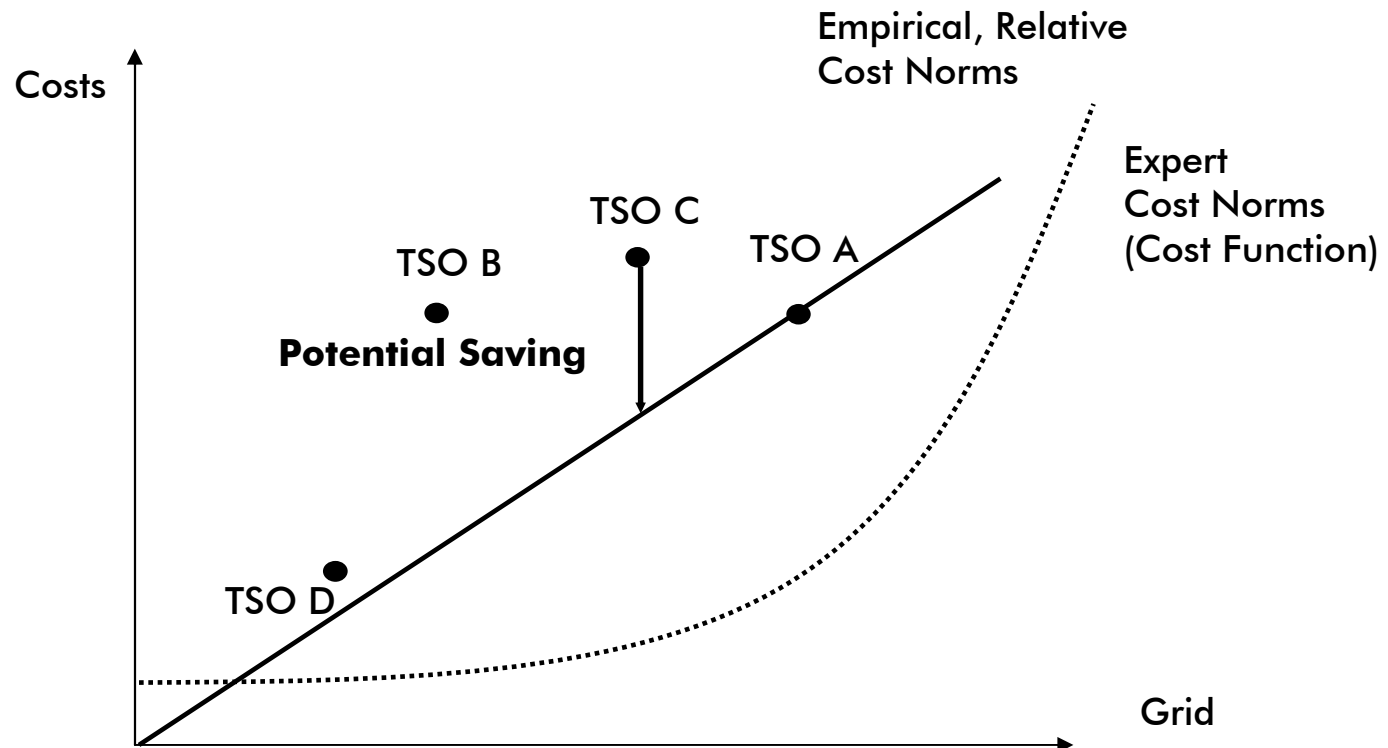
- Unknown true underlying cost function
- Multiple inputs (=cost types) and outputs (=grid elements)
- Different environments

Solutions

- Empirical cost norms /relative performance eval.
- Aggregations
- Corrections plus local negotiations



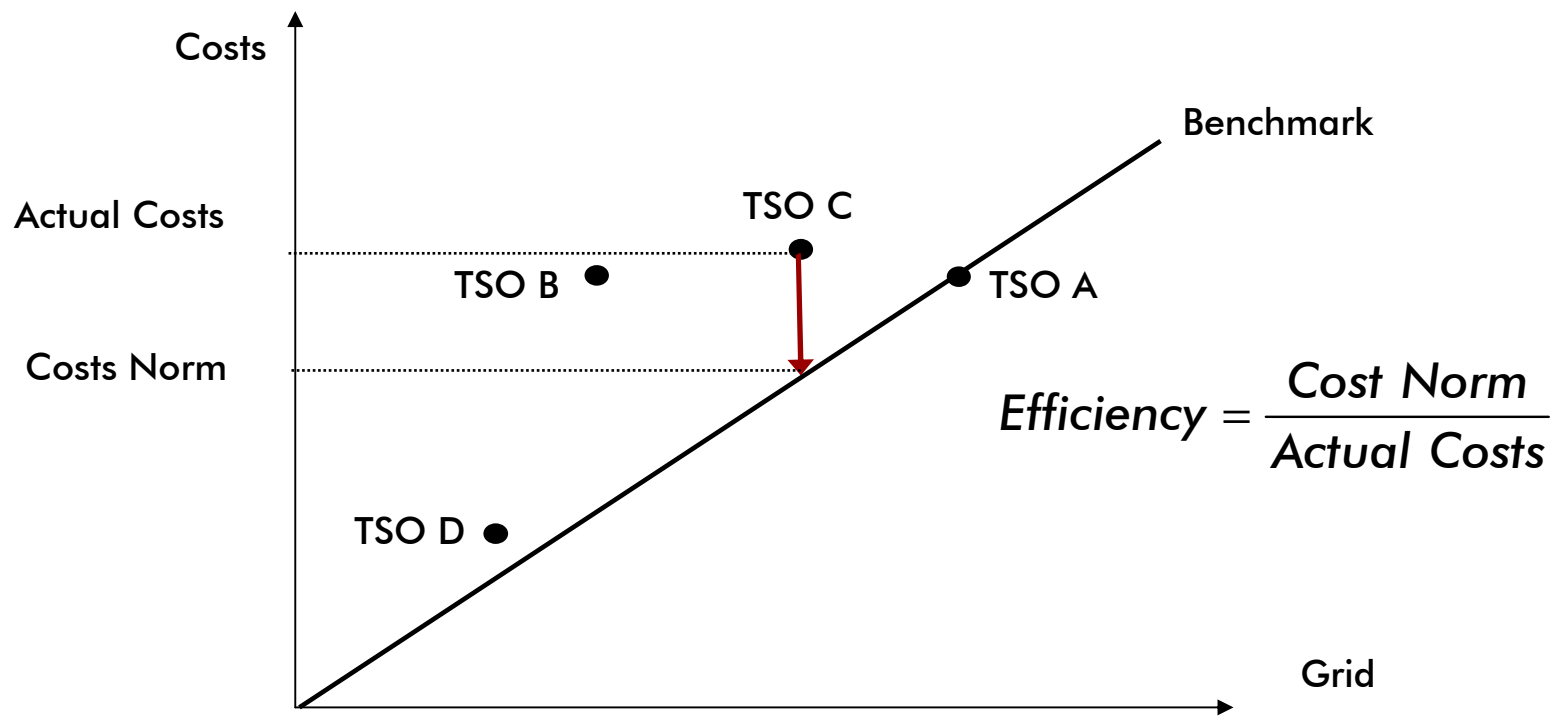
Relative Norms



ECOM+ presumes no gains from scale – can be relaxed



Efficiency



Efficiency = 0.7 suggests: potentially save 30% of present costs



ECOM+ Measures

Unit costs is cost per grid unit

$$UC = \text{cost} / \text{grid size}$$

Benchmark is company with lowest unit costs

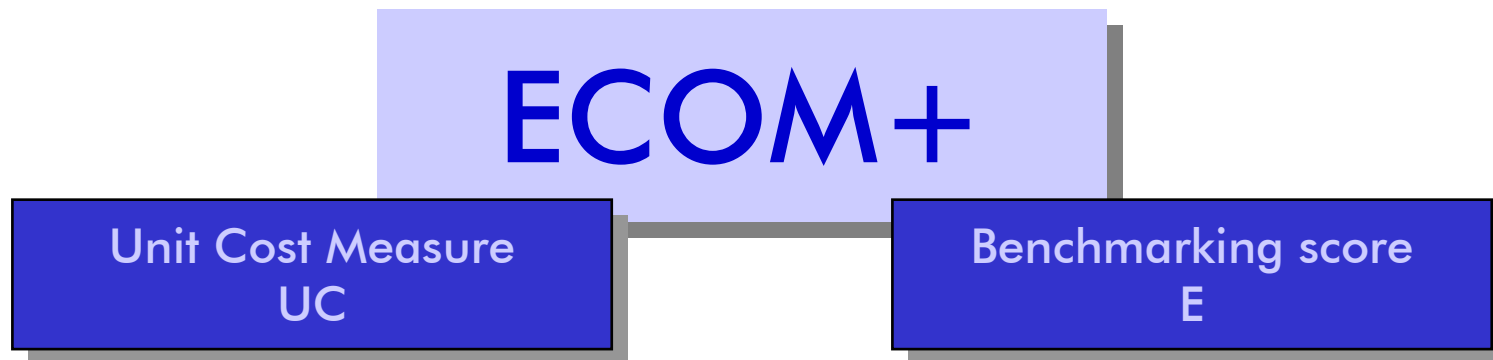
$$\text{Benchmark} = \min \{ \text{unit costs} \}$$

Efficiency is

$$E = \text{benchmark} / \text{unit cost}$$



ECOM+ is a dual method



How well are we
doing in compared to a norm?

How well are we
doing relative to the others?



Multiplicity

Inputs (costs)

- O & M costs
- Investment costs
- Timing: 1965,1966,...2002

Outputs (grid)

- Lines and cables
- Circuit ends
- Transformers
- Reactors
- Compensating equipment
- Age and maintenance conditions

Ways ahead

- Partial measures, aggregation, and ignorance



Partial Measures

Partial measures

- O&M costs / km lines
- Labor hours / km 150-220kV land cables
- Capital costs / transformer
- Etc etc

Drawback of partial measures

- Cost allocations will often be arbitrary
- Measures may point in many different directions – OK in process benchmarking, not in comprehensive assessment
- Regulators should not micro-manage the TSO

ECOM ++ has some partial measures

- Caution is needed – cf. this afternoon.



Input (Cost) Aggregations

Capital (investment) costs

- Cover interest payment and depreciation
- Depreciation pattern standardized with common interest rate and yearly cost over expected lifetime (30-40 years)

O & M costs

- are periodized as reported

Capital and O&M costs can be added

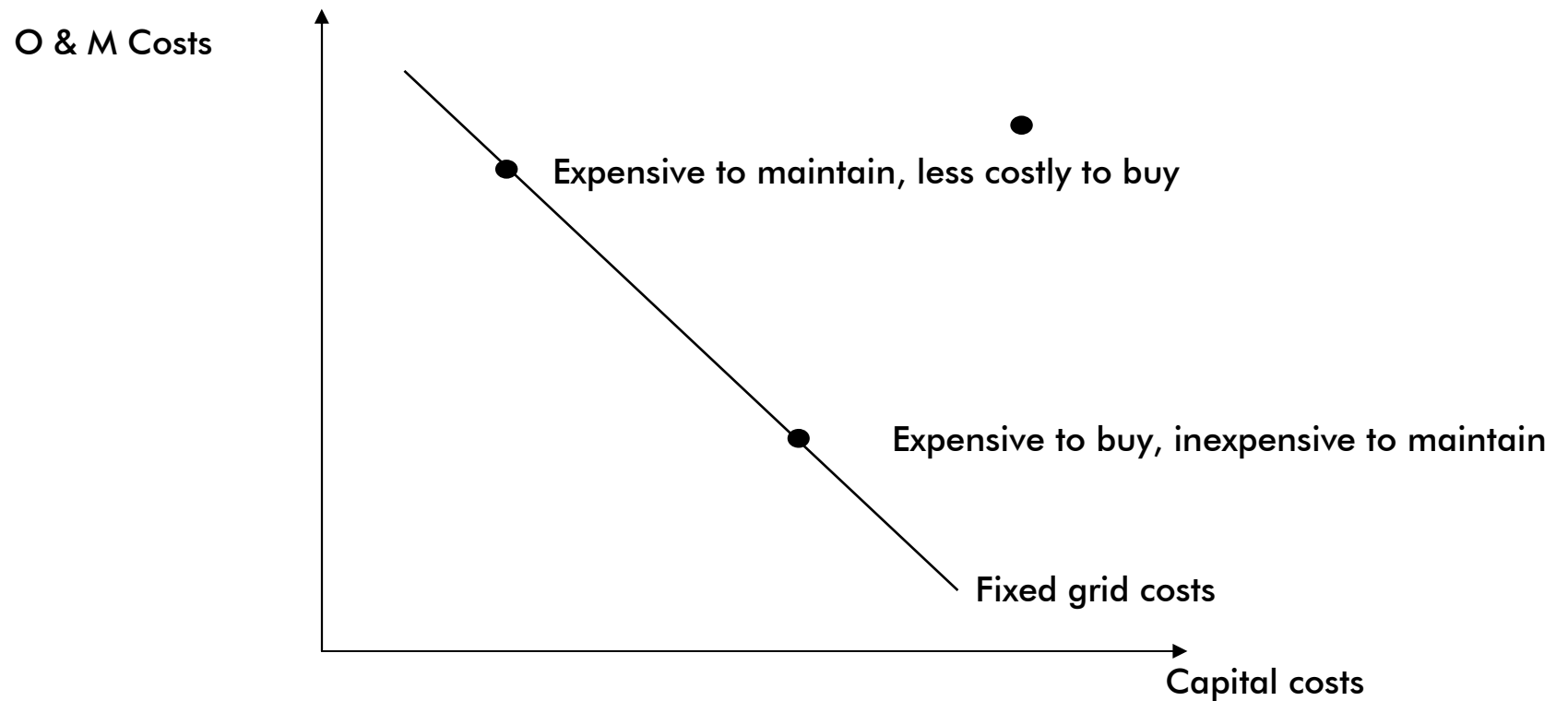
- to reflect substitution possibilities

Capital and O&M costs can be evaluated separately

- to provide decomposition



Cost Substitution



O & M and capital costs added to capture substitution



Output (Net) Aggregations

Net size (capital cost driver)

- the existing net-parts (lines and cables, circuit ends, transformers, reactors, compensating equipment) are aggregated using (relative) weights
- Two set of weights used

Capital cost weights

- Proportional to investment costs (equipment+installation)

O & M weights

- Proportional to the cost of O&M

ECOM+ weights

- From technical reports, country reporting etc
- Common in all countries
- Adjusted by country specific asset group weightings



Country Specifics

Country specifics have a

- exogenous
- durable
- sizeable

impact on benchmarked cost (wire company).

Primarily

- Mountain Lines (via weights)
- Hilly areas
- Dense area
- Painting



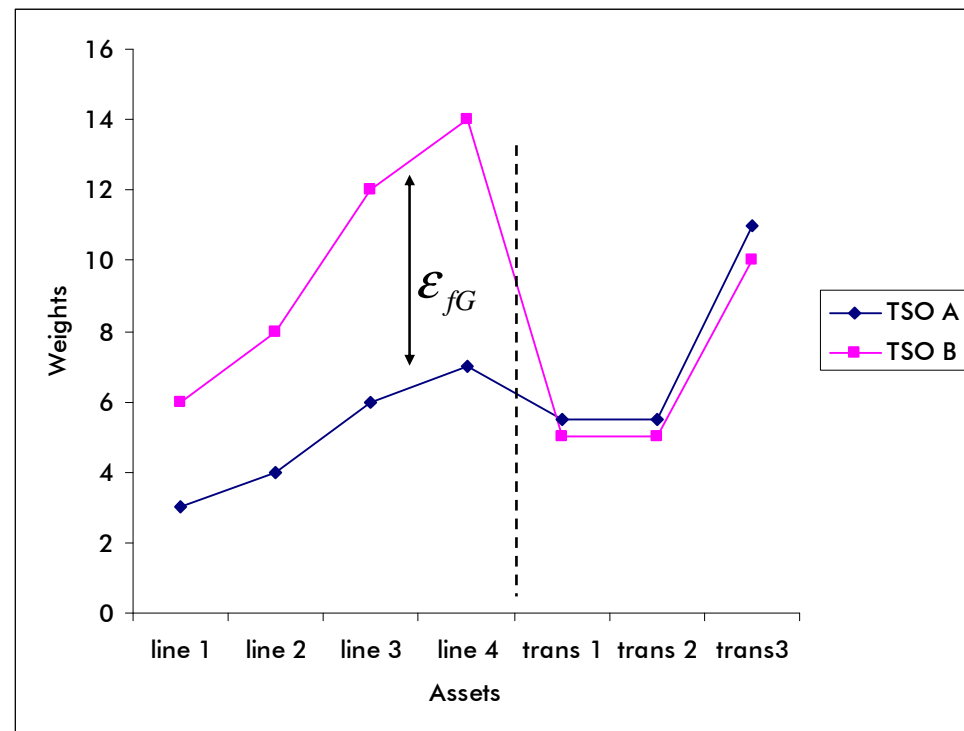
Multiplicative regularity

CapEx

$$V_{fa} = V_a \lambda_{fg}$$

OpEx

$$W_{fa} = W_a \mu_{fg}$$





Country Specifics in ECOM+

Table 5.9 Groups and assets used in ECOM+.

Group g	Comment	Asset no
1	Lines	1 – 9
2	AC cables (sea and land)	10 – 25, 42 – 57
3	DC cables (sea and land)	26 – 41, 58 – 73
4	Transformers	90 – 101
5	Stations and components	102 – 110

Table 6.2 Country specific CAPEX weights ECOM+.

Asset group g	TSO F	TSO E	TSO G	TSO D
1	1.00	1.00	1.20	1.25
2	1.00	1.00	1.00	1.00
3	0.50	0.50	0.50	0.50
4	1.00	1.00	1.00	1.00
5	1.00	0.50	1.00	1.00



Other parameters

Structure

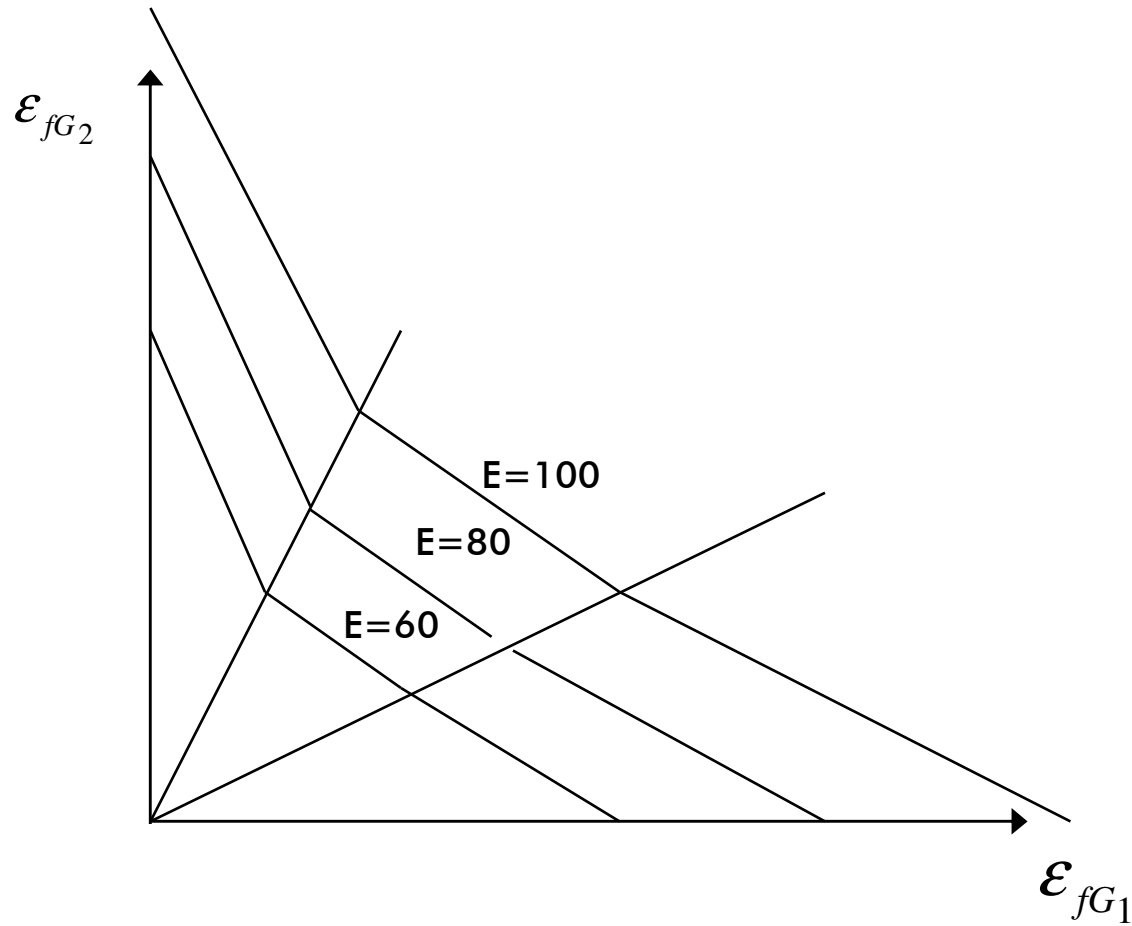
- Asset grouping

Parameters

- Currency and inflation correction
- Lifelength equalization
- Forgiveness
- Real interest rate



Sensitivity analysis





ECOM+ Structure

	Benchmarked OPEX		Normalized CAPEX
UnitCost	$C_{ff} + \sum_{s=t_0}^t \varphi_s I_{fs} \alpha(r, T_f)$		
$UC_{ff}(w, v) =$	$\sum_a N_{fa} w_{fa} + \sum_{s=t_0}^t \sum_a \varphi_s n_{fas} v_{fa} \alpha(r, T_g)$		
	Standard OPEX		Standard CAPEX



Data from TSOs



Input and Output Elements

O & M costs

- 2000-2002
- Total plus disaggregated to enhance consistency

Construction cost

- Yearly
- Total or componentwise

Assets register

- Approx 110 asset types
- Installation time

Consistency

- Cost drivers and cost elements must correspond
- E.g. if HVDC equipment in assets base, corresponding costs are needed



Accounting Principles

Guidelines on included costs elements

- Purchase of goods
- Employers contributions
- Outsourced services
- Losses on accounts receivables
- Overhead costs
- R&D costs

and how to handle

- Construction interest, investment duty, telecommunication, ground rent, property tax, pension costs, insurance



Other data

Suggestive

- OpEx weights
- CapEx weights
- Country specifics
- Special events



Results



Results UC

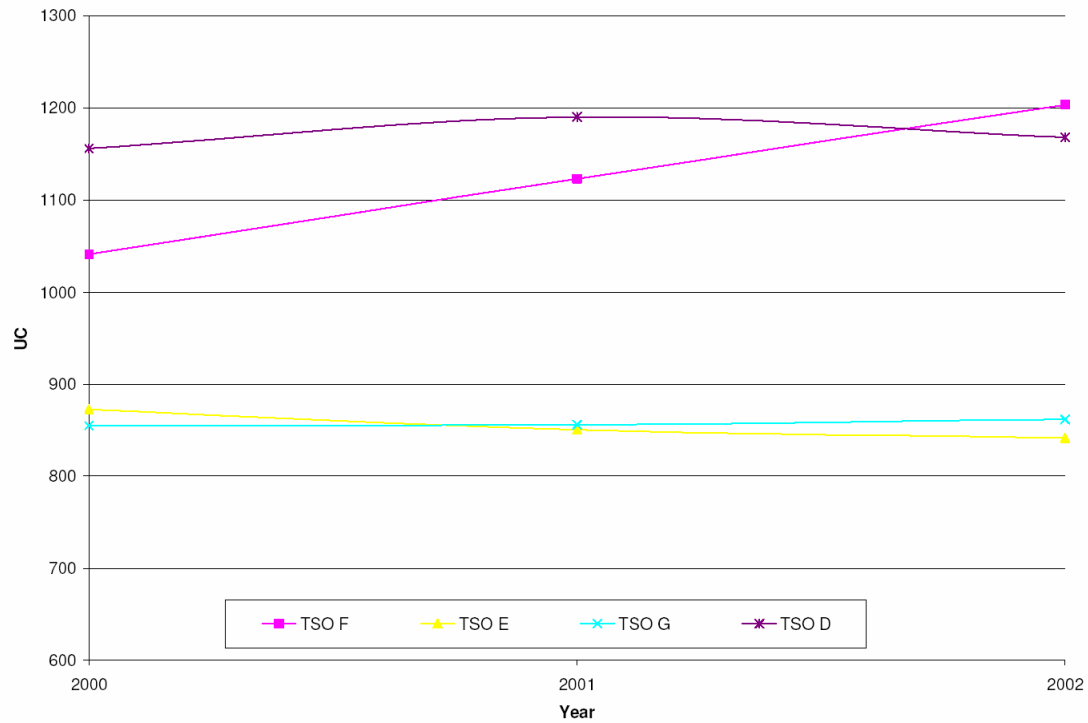


Figure 7.1 Results in Unit Cost 2000 - 2002.



Results E

Table 7.2 Efficiency results 2000-2002.

	TSO F	TSO E	TSO G	TSO D
2000	82%	98%	100%	74%
2001	76%	100%	99%	71%
2002	70%	100%	98%	72%



SA TSO E

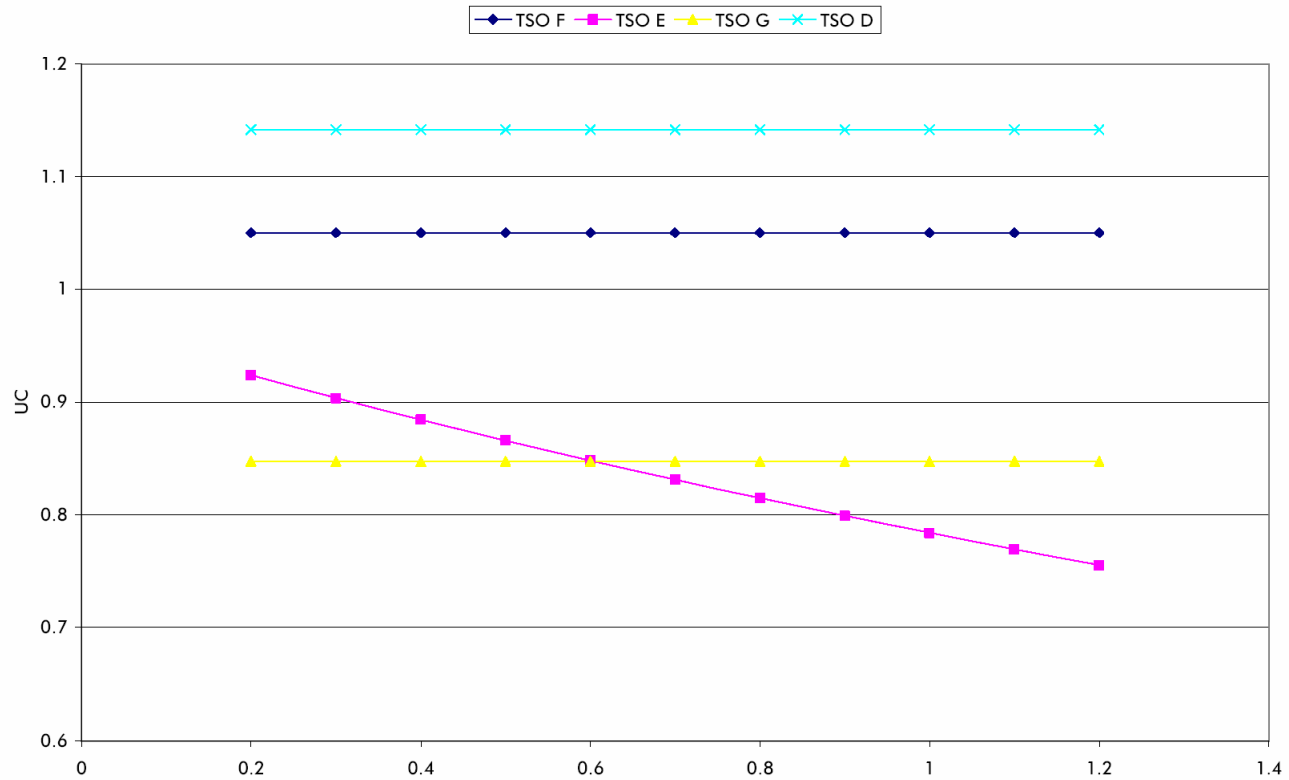


Figure 7.5 UC as a function of $\lambda_{TSO E}$ (specific asset).



SA Lifelength of lines

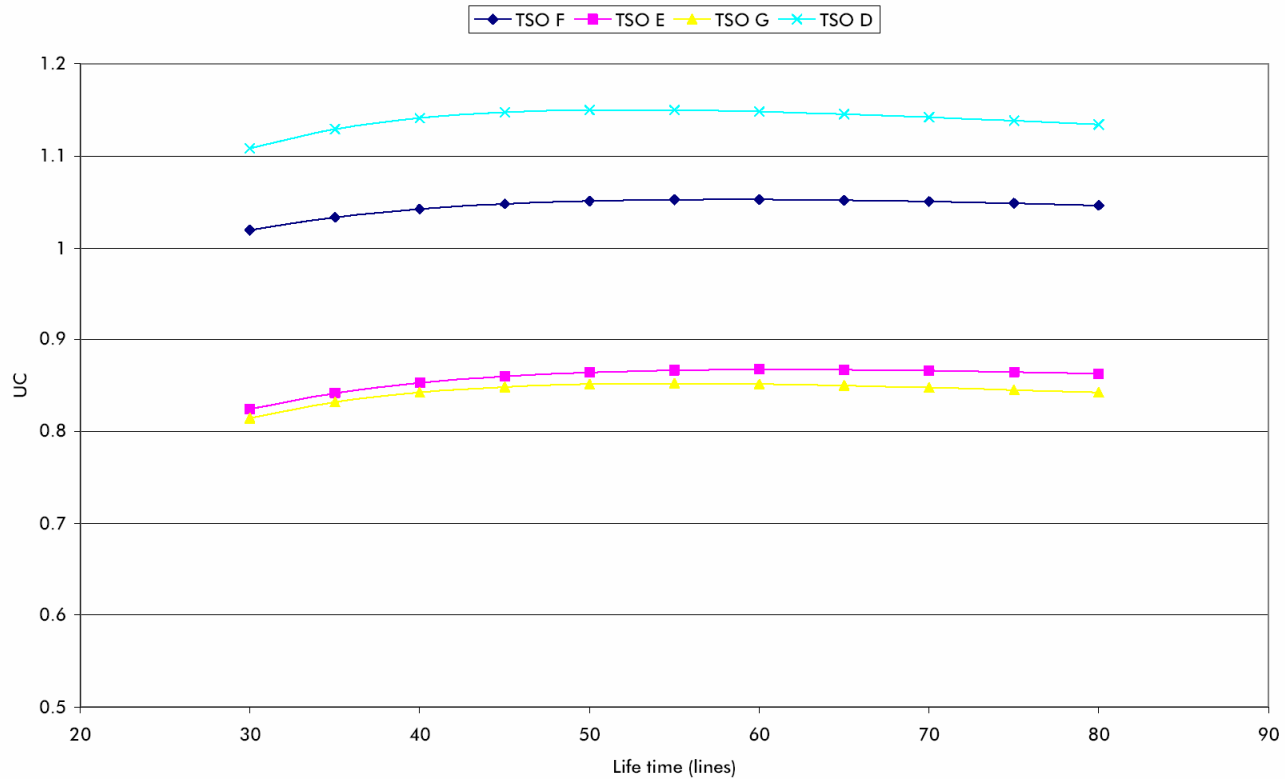


Figure 8.4 UC as a function of life time (lines).



Extensions



Uses

Learning

- Regulators learned about TSOs
- TSOs learned about themselves and others

Regulation

- ECOM+ used to guide regulatory decisions
- Combined with regulatory discretion and negotiation

Other uses

- Indication of managerial competencies (and hereby revenue generation capability)
- Allocation of costs among TSOs and users



Next Steps

ECOM + gives useful experience and background
BUT still room for improvements: ECOM+2

Increased reliability

- More data points
- More work on price index, weights, and country specifics
- More site visits
- More usage of technical assessments and tech-econ audits
- **Better asset and accounting guidelines**

Increased relevance

- **More decompositions to identify sources of efficiency**
- **More dynamics to see improvements and reduce reliance on distant past**



Future steps

TSO Activity	TSO Costs	Efficiency Indices	Scores
<i>Future (Long term ideal)</i>	Long run transmission costs	$\frac{\text{C \& B Matching Costs}}{\text{LR Transmission Costs}}$	92/92 = 1.00
<i>Market Facilitation</i>	Cost and Benefit matching costs	$\frac{\text{Bid Matching Costs}}{\text{C \& B Matching Costs}}$	80/92 = 0.87
<i>Systems Operation</i>	Bid matching costs	$\frac{\text{Capacity Costs}}{\text{Bid Matching Costs}}$	76/80 = 0.95
<i>Planning</i>	Capacity Costs	$\frac{\text{Corridor Costs}}{\text{Capacity Costs}}$	80/76 = 1.05
	Corridor Costs	$\frac{\text{Equipment Costs}}{\text{Corridor Costs}}$	83/80 = 1.04
<i>Construction and Maintenance</i>	Equipment costs	$\frac{\text{Financial Costs}}{\text{Equipment Costs}}$	101/83 = 1.22
<i>Financing</i>	Financial costs	$\frac{\text{Actual Costs}}{\text{Financial costs}}$	110/101 = 1.09
<i>Present</i>	Act.Constr. & Maint. Costs	$\text{PRODUCT} = \frac{\text{Actual Costs}}{\text{LR Transmission Costs}}$	$\text{PRODUCT} = 110/92 = 1.19$



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