

A methodology for TSO to TSO payments based on cost flows

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Context

- Contribution to the search for a long-term CBT mechanism
- Study promoters
 - CREG (Belgium)
 - Swiss Federal Office of Energy
- Study team
 - Dr. H. Glavitsch, Prof. Dr. G. Anderson (ETHZ)
 - CREG

Methodology description:

Basic principles

■ **Cost-reflective**

- ❑ tariff must be based on the true costs generated by the usage of the network
- ❑ domestic flows, imports, exports and transits have to support their share of the costs in function of their use of the network
- ❑ avoid cross-subsidisation between domestic & foreign users

■ **Non-discriminatory**

- ❑ same tarification mechanism for domestic and foreign users

■ **Non-transaction based**

- ❑ no reference is made to individual transaction

Design principle: evolutionary method in function of data availability

- Beginning of the study: summer 2000
- At that time:
 - Available data: only hourly measurements of cross-border flows & annual values for generation and consumption
 - No detailed topological & flow data of the UCTE network available
 - Consequence: the « supernode concept »
- For 2003: detailed data available?

Consequence of limited data: the « supernode concept »

- Each country is represented by one compact node called « super node » (= simplified internal network)
- All the lines between two countries are represented by one arc

Objectives of the methodology

- Determine TSO to TSO payments
- Basic principle
 - Compensate TSOs for CBT costs they support
 - Charge TSOs for CBT costs they generate
- Pragmatic approach based on CEER and ETSO works

Methodology description: major steps

- First step: calculation of the costs borne by a supernode for each hour
- Second step: hourly allocation of these costs on the supernodes in function of their responsibility
- Third step: adaptation of domestic tariffs

First step: Costs borne by a supernode

- Average unitary cost of a supernode:

$$p = \frac{\textit{Total HN costs}}{\textit{Max}(G, L) + \textit{Tr}}$$

Where:

- Total HN Costs = Total annual costs of HN including investment amortization, O&M, losses and profit
- G = Generation; L = Load; Tr = Transits

First step: internal model of a supernode

Features:

Costs associated with imports, exports and transits are forwarded through the graph; transits only can be considered

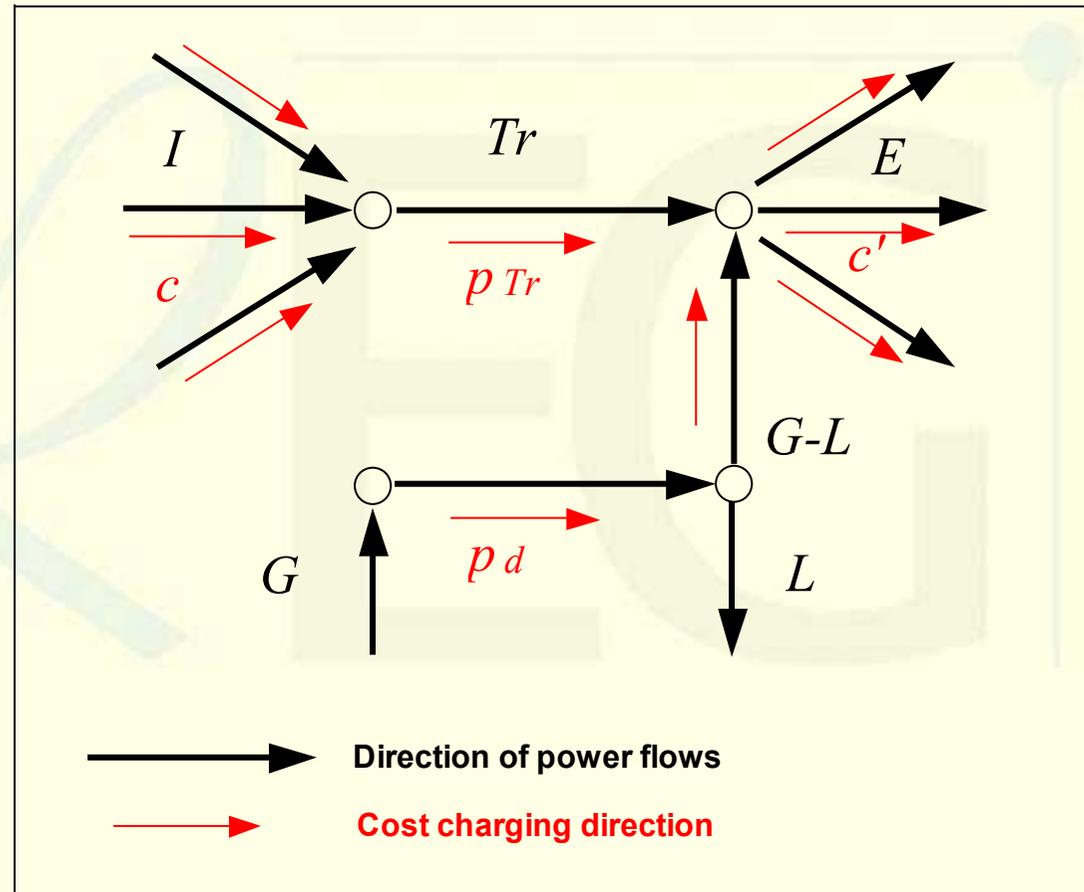
Two charging directions:

- towards load and exports,
- towards generation and imports

Example:

- $G > L$
- charging towards load and exports

Flow of costs



First step: transit definition example

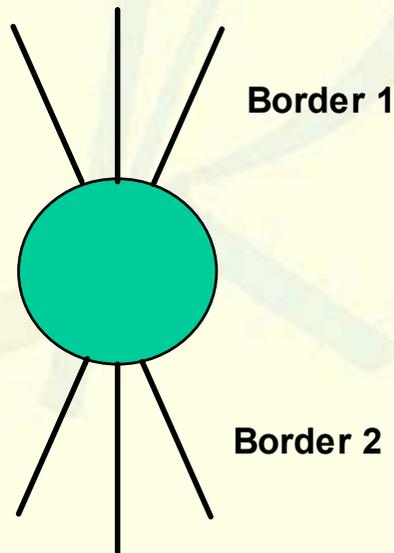
$$Tr = \sum_{t=1}^{8760} \text{Min}\left(\sum_{borders} \text{Net ExFlo}(t), \sum_{borders} \text{Net ImFlo}(t)\right)$$

Applied on each border

Data example:

Imports = 50
Exports = 75

Imports = 100
Exports = 40



Study method:

Border 1: Net Exports = 75-50=25

Border 2: Net Imports = 100-40=60

Transit = Min (Exp, Imp) = 25

ETSO method:

Exports = 75+40=115

Imports = 50+100=150

Transit = Min (Exp, Imp) = 115

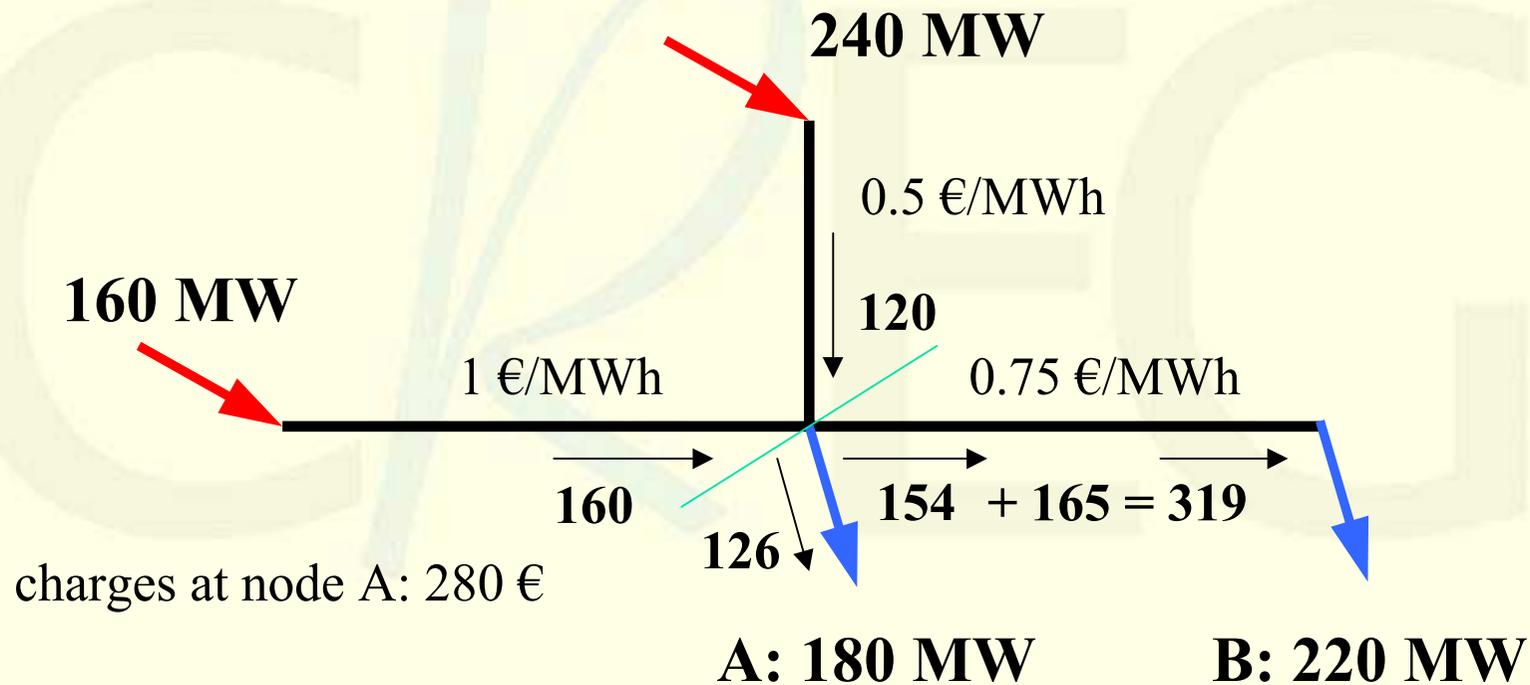
Second step:

Cost allocation mechanism

- Costs generated by cross-border flows in a supernode are forwarded through the graph if the flows are not to the benefit of local users
- Two « cost charging » directions are considered:
 - Towards load & export
 - Towards generation & import
- If the charging direction is towards load
 - Part of the compensation associated with import is charged on domestic load
 - Remaining part is transferred to export at true costs

Algorithm: network charges

Charging towards load



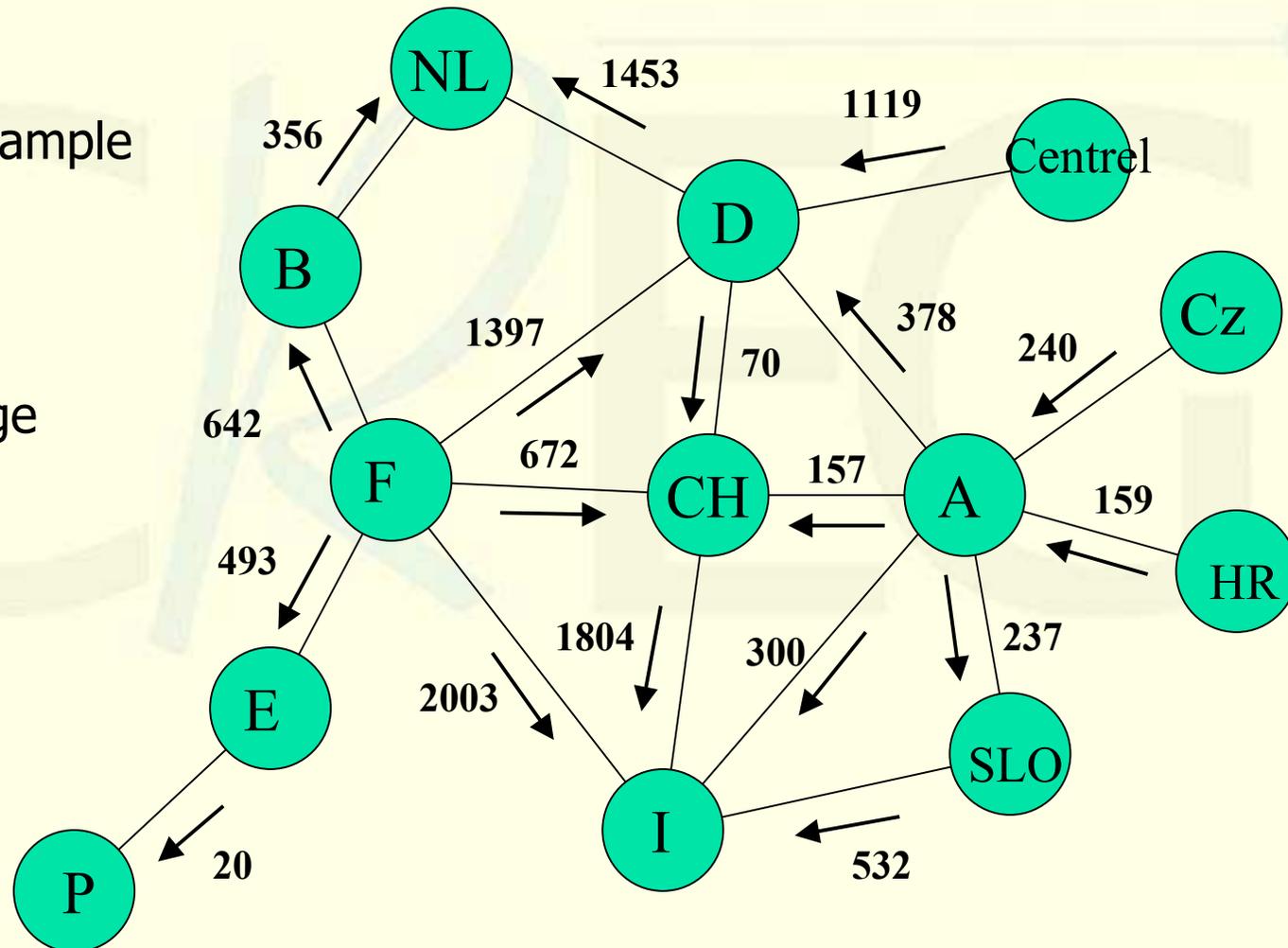
consumer A: $280 \cdot 180 / 400 = 126 \text{ €}$ consumer B: $154 + 165 = 319 \text{ €}$

Third step: domestic tariff adaptation

- Application of the net result of TSO to TSO compensations to domestic tariffs

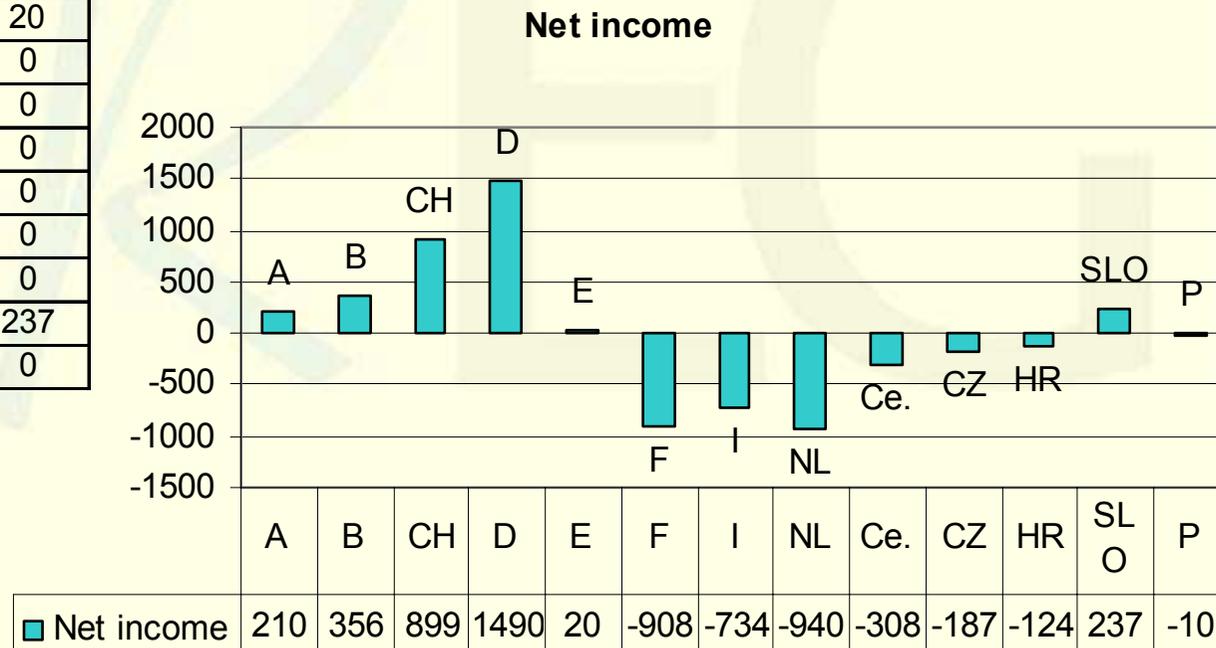
Application of the methodology: limited data set

- One hour example
- 50 % on G
- 50 % on L
- Same postage stamp in each country



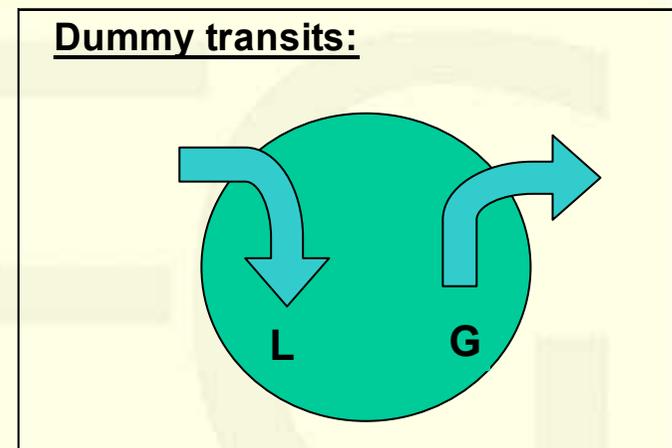
Application of the methodology: limited data set

	Generation (MW)	Load (MW)	Transit (MW)
A	5867	5194	399
B	8515	8801	356
CH	6898	5993	899
D	51939	53310	1523
E	18020	18493	20
F	50960	45753	0
I	26480	31119	0
NL	4287	6096	0
Ce.	10119	9000	0
CZ	6240	6000	0
HR	6159	6000	0
SLO	2909	2614	237
P	3621	3641	0
Total	202014	202014	

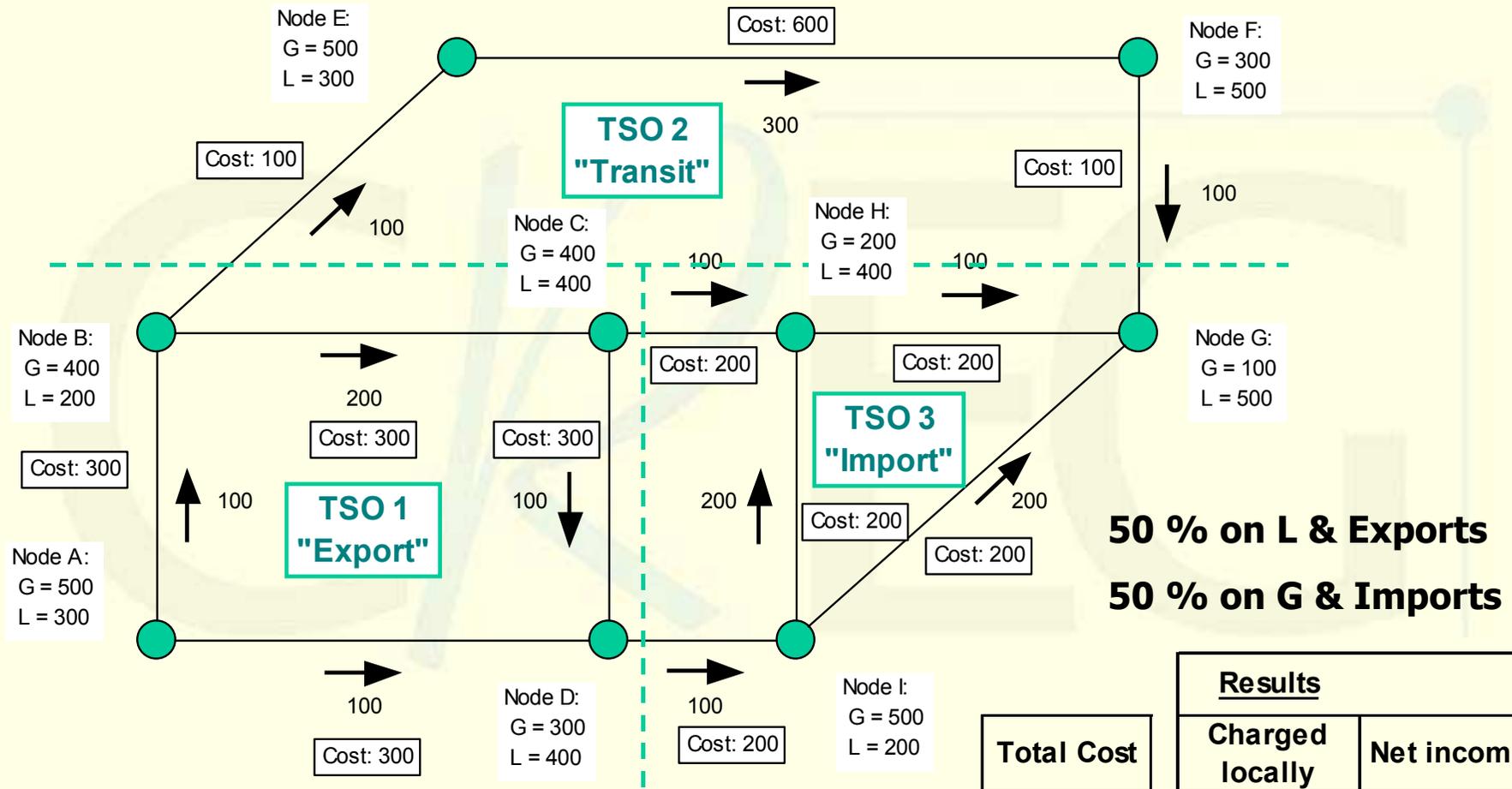


Application of the methodology: detailed data

- Detailed topological and flow data
- Overcomes the limitations of using limited data: dummy transits and HN network definition
- Fine analysis of the use of the horizontal network made by transits
- Application of the costing mechanism embedded in a supernode to each line/node of the HN
- For each line&node, the difference between outgoing and incoming costs is a measure of the use of the « internal » network made by transits



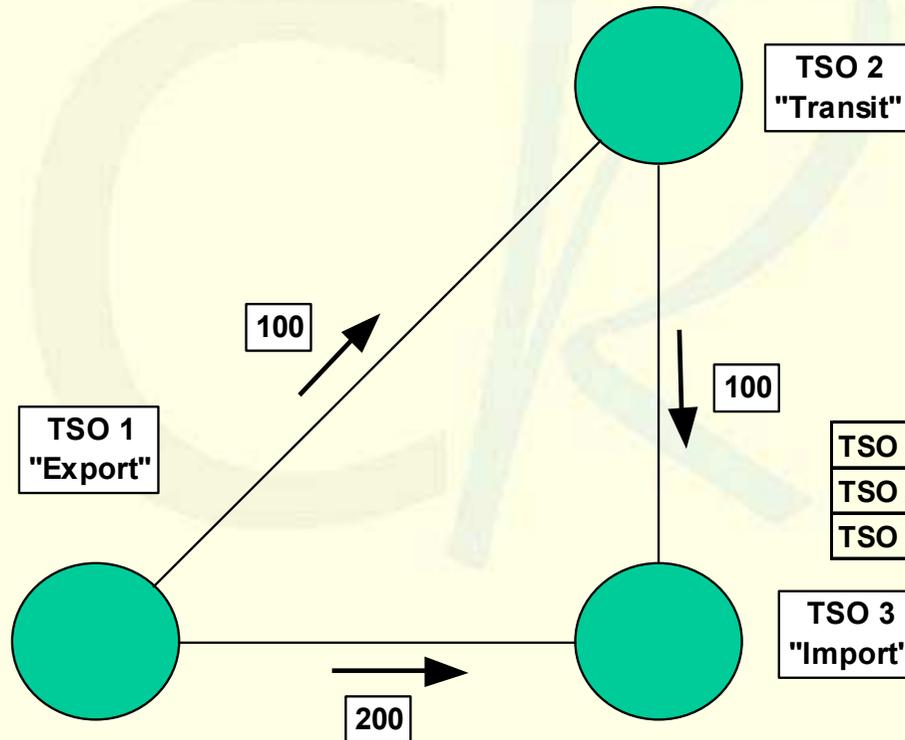
Application of the methodology: detailed data example



Detailed internal representation of each country/TSO

Application of the methodology: comparative example with limited data

Same annual costs, transits and total load/generation per TSO



TSO 1
TSO 2
TSO 3

Total cost

1200
800
1000

Results	
Local charge	Net income

1268	-68
711	89
1021	-21

Conclusions

- TSO to TSO payments determined on basis of network use
- Quality of tracing cost responsibility
- Flexibility in charging G and/or L
- Calculation method applicable with aggregated or detailed data
- Creation of fund not necessary
- Prototype computer software available