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Interreg Europe



European Union
European Regional
Development Fund

Financial Indications for Dutch e-Bus Investments and Operations

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TWG 4 Procurement & Tendering

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Agenda



Topics

- The essence of a TCO
- An example (based on a study by CROW)
- A remark about financial arrangements
- Retrospects and Prospects

The Actual Market Conditions:

- ❖ Dutch transport operators (concession holders) receive a reimbursement per hour of bus service, in addition to the passenger revenues. The profit margins may be small
- ❖ It is difficult to predict whether and when the passenger volumes will reach their **pre-COVID** levels again and how the business case will be in the near future. ➡ More uncertainty about the future and a higher level of risk that accompany investments
- ❖ Replacement of diesel by more expensive e-buses

Assessing Investments



Total Cost of Ownership (TCO)

- ❖ Is a method used to contribute to a more rigorous underpinning of investment decision making
- ❖ Is a way of assessing all the cost induced over an entire lifespan of an asset.

TCO – The Sum of the Parts



The Iceberg Principle Calculating Total Cost of Ownership

PURCHASE PRICE
25%

PRODUCT PRICE

HIDDEN COSTS
75%

TRAINING &
EDUCATION

LABOR
COSTS

INSTALLATION
COST

USER
PREFERENCE

UNPLANNED
DOWNTIME

RISK
MANAGEMENT
& SAFETY

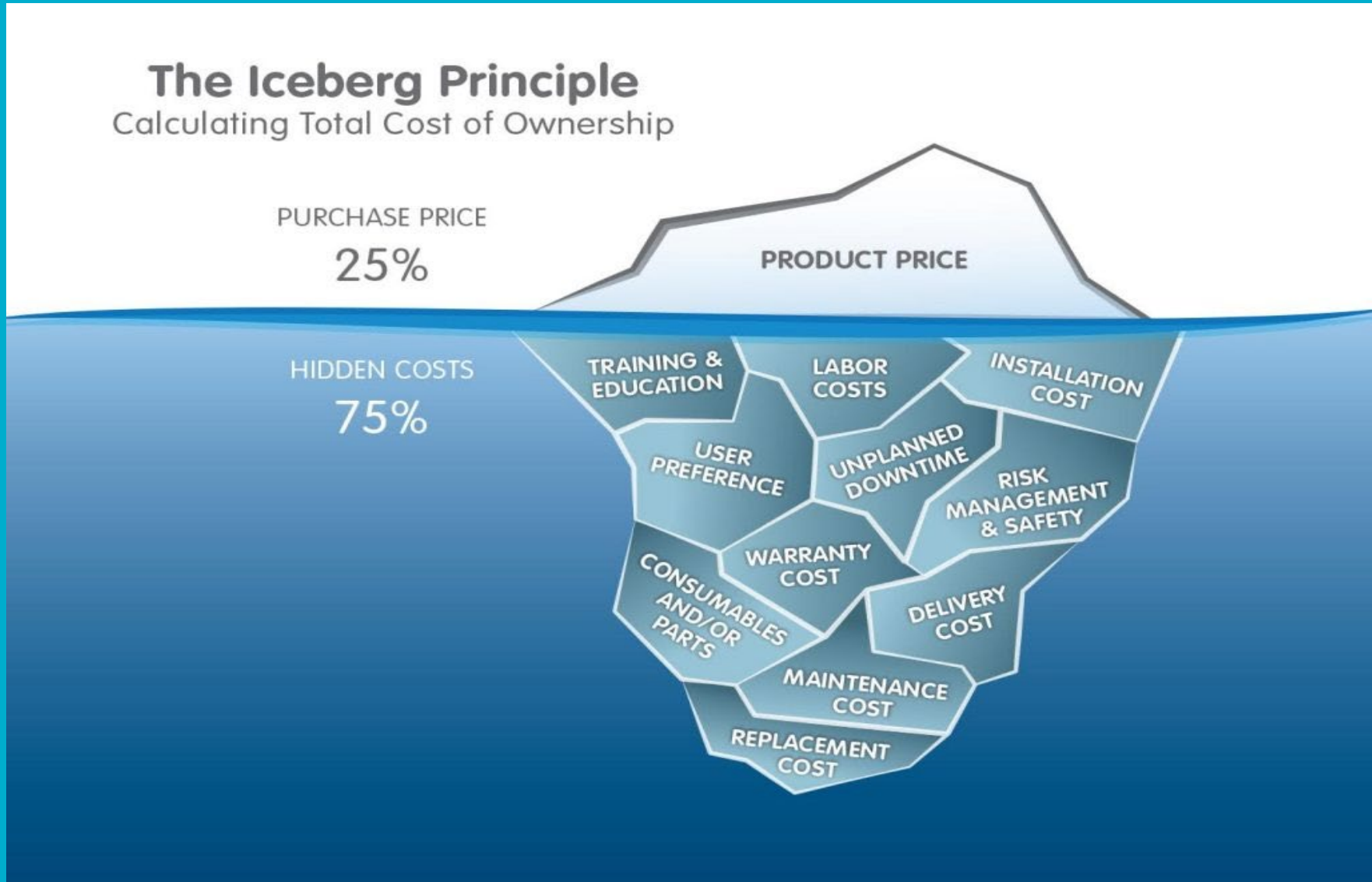
CONSUMABLES
AND/OR
PARTS

WARRANTY
COST

DELIVERY
COST

MAINTENANCE
COST

REPLACEMENT
COST



TCO – The Cost Drivers



Various types of cost can be distinguished.
2 categories:

- ❖ Direct cost (directly related to the object)
- ❖ Indirect cost (related to two or more specific cost objectives)



TCO – an Example



Total Cost of Ownership Model



- R&D
- Tooling
- Equipment
- Evaluation
- Bid and Award
- Supplier Certification

- Working Capital
- Internal Support
- Quality
- Incoming Inspection
- Interest Expense
- Prototyping
- Order Processing
- Accounts Receivable
- Engineering Builds
- Process Validation
- T&E
- Licensing
- Vendor Tracking
- Storage and Distribution
- Inventory Management

- Purchase Price
- Shipping
- Packaging
- Duties
- Tariffs
- Taxes
- Supplier Profit

- Installation
- Labor and Benefits
- Training
- Operating
- Supplies and Consumables
- Performance
- Maintenance
- Labor
- Spoilage
- Learning Curve
- Regulatory
- Environmental
- Obsolescence
- Upgrade
- Efficiency

- Spare Parts
- Service
- Disposal
- Warranty

TCO – version: Scratch-to-Scrap / Cradle-to-Grave



(Pre-) Acquisition, Investment & Commission Cost

(Pre-) Acquisition, Investment & Commission Cost

- Cost induced by having a project team
- Costs due to internal and external in-depth (business) case studies
- Design, prototype, test phase / ‘debugging’ costs
- Costs due to purchase and commission of the asset (including: buying test equipment, training of personnel, permits and patents, etc.)
- etc.

Operational & Maintenance Cost

Operational & Maintenance Cost

- Energy costs (e.g., fuel, kWh)
- Inspection costs
- Maintenance costs
- Costs due to (hard- and software) updates and upgrades
- etc.

Decommission, Demolition & Recycling Cost

Decommission, Demolition & Recycle Cost

- Costs as a result of asset decommission (e.g., de-registration, etc)
- Costs due to stripping, demolition and scraping
- Costs (reduction) due to recycling, disposed and sold materials
- etc.

In Utrecht practice



Application on a Dutch Bus(iness) Case

- Concession holder receives a reimbursement per hour of bus service + passenger revenues
- Small margins ($\leq 4\%$) between costs and reimbursements
- Demand side: (When) back to pre-COVID levels?



In Utrecht practice – e-Buses



Application on a Dutch e-Bus Case: Additional Issues

- Higher down time (e.g., due to repairs, charging, etc.)
- Routes / Timetables must be re-optimized for e-buses – routes / timetables were optimized for diesel buses

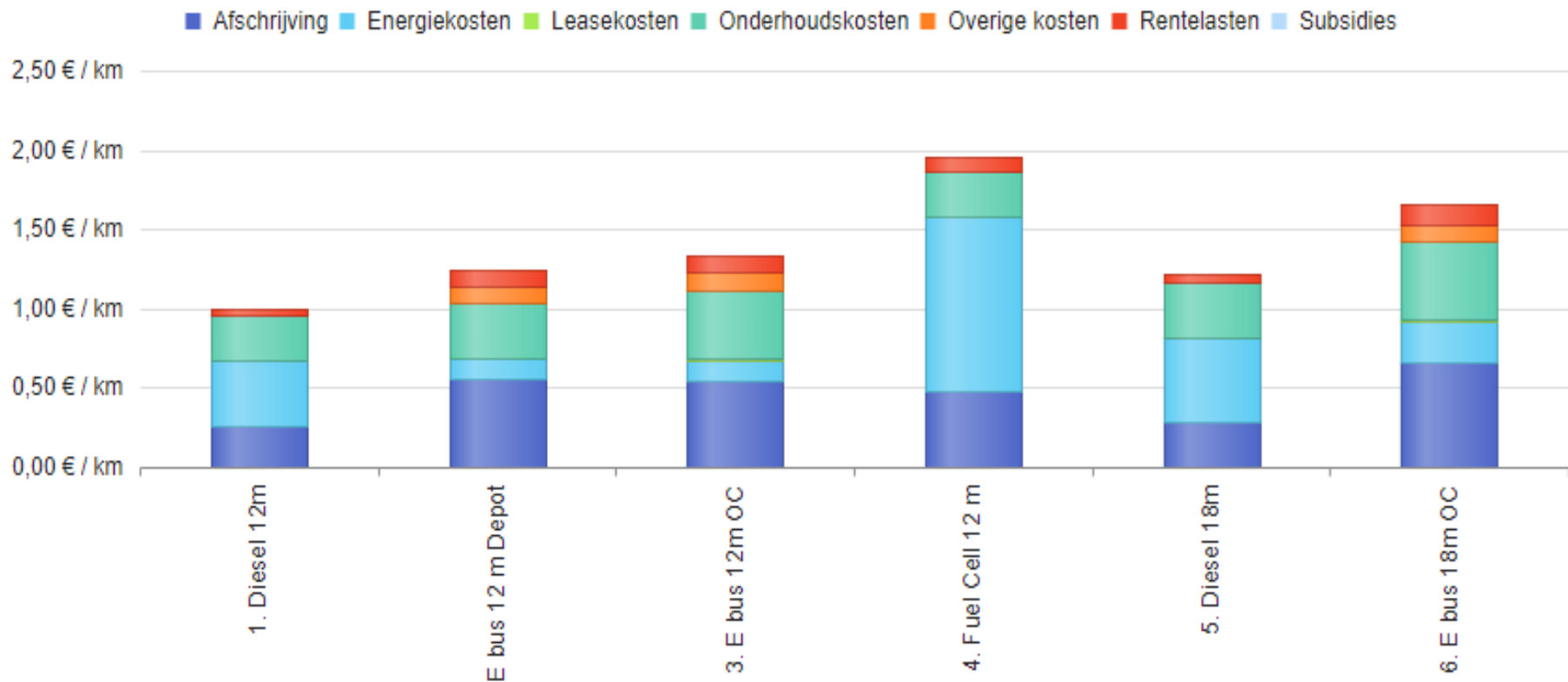


TCO – A Scenario Study



A study by CROW: 10% extra e-buses compared to diesel buses

Euro per kilometer - Meerkosten Mat. & Infra + Pers.



TCO – Additional Cost Estimates



CROW (2020b) estimates of additional cost of the commission of e-buses in various scenario's

Scenario / bus length+charge type	12m depot charge	12m OC	18m OC
	<u>Additional costs per bus per annum</u>		
+ 20% extra e-Buses	€35.000	€44.000	€53.000
+ 10%: the discussed case	€24.000	€32.000	€40.000
1-to-1 operational replacement (no extra e-buses)	€6.000	€15.000	€24.000

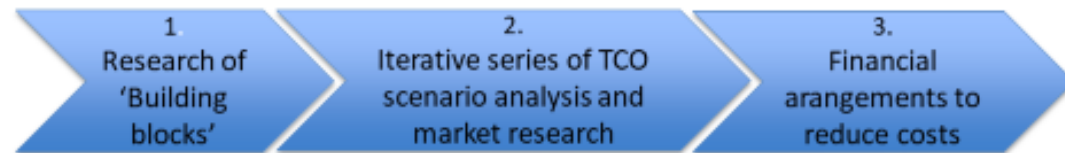
TCO - The Role of Financing



Sketched overview of the conclusions of Pieter Tanja (CROW) ... and the impact of financial arrangements

2. THE APPROACH

- 3 step approach, TCO analysis as a central step



- Joint team, chaired by province of Utrecht
 - Provincie Utrecht,
 - Municipality of Utrecht,
 - Transport operator Qbuzz
 - Grid provider E-laad / Stedin



Example: PT Amsterdam



Loans with favorable conditions

- 2 state-owned public banks (BNG and NWB) issued loans for €400 mln to e.g. the GVB (concession holder in Amsterdam)
- To replace older rolling stock and commission more sustainable vehicles (buses, trams, metro's, ferries), ICT, installations, etc.
- Joint initiative of concession granter and holder
- Aim: Compensation of the cost of financing (interest cost)



Retrospects & Prospects (1/2)



- ❖ *ex ante* iterative TCO-study with a sensitivity analysis provides useful financial information for decision-makers and parameter estimates for optimization processes
- ❖ Provides understanding and estimation of the cost of investment incurred in e-buses and the electric infrastructure + its residual market value (e.g., when a new concession holder takes over)
- ❖ CROW provides the needed tooling and support (free of charge), However, only available in Dutch. Estimates are based on small sample!

Retrospects & Prospects (2/2)



- ❖ Future developments may change overall picture.
 - low price per kWh is likely to rise to compensate for the decline in Diesel taxes
 - The residual value at end of service life? (is there a 2nd hand market?; cost of new battery packs?, etc.)
 - Assumption: depreciation period of charging equipment of 15 years. Realistic?
 - Policy regarding loans / subsidies on 'green' investments
- ❖ Lifespan e-bus + equipment \neq concession period



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Thank you!



QUESTIONS?

A person in a dark suit and tie is holding a white rectangular sign with the word 'QUESTIONS?' written in bold, dark blue capital letters.

Questions welcome