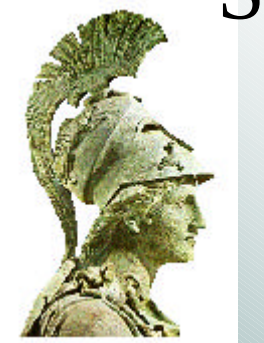
Techno Economic Methodology for the Evaluation of Telecommunication Investment Projects.

Sensitivity and Risk Analysis Incorporation



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International Telecommunication Union- Telecommunication Development Bureau

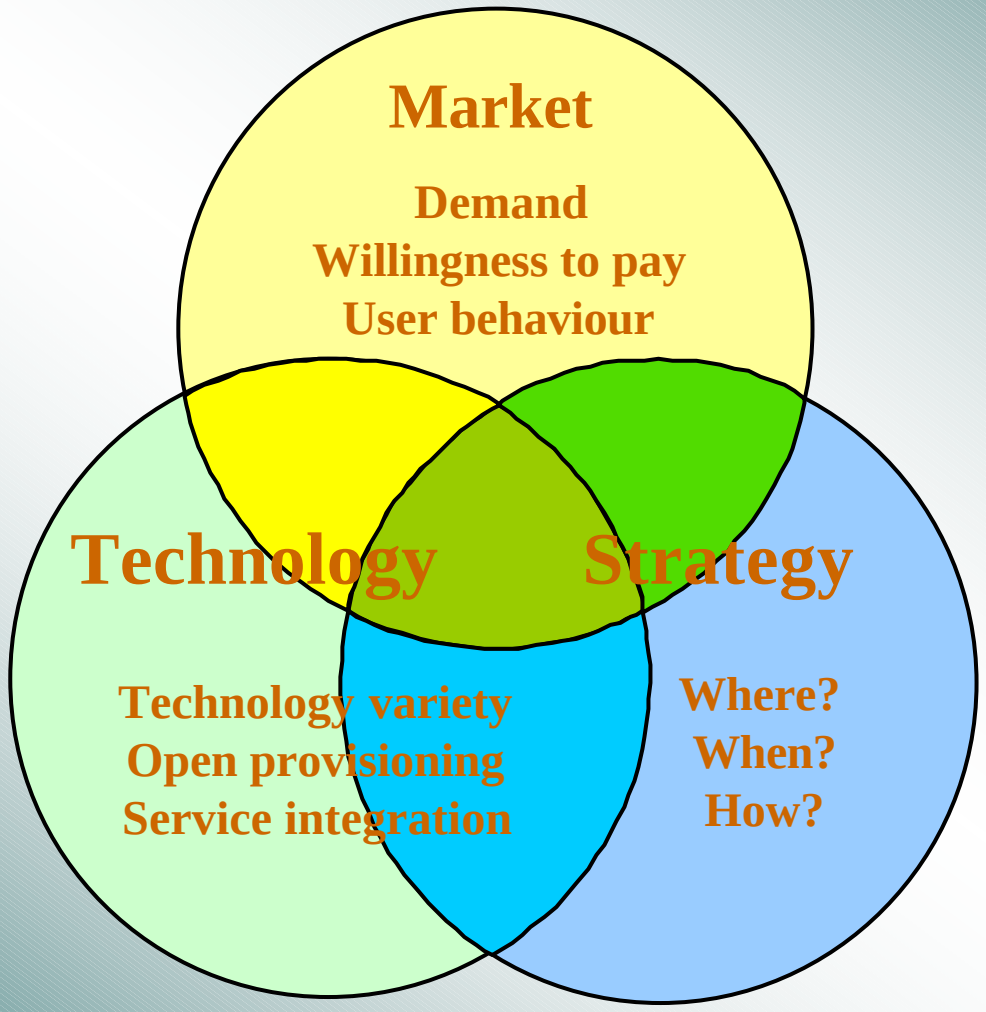
Market, Economics & Finance Unit

Expert Dialogues:

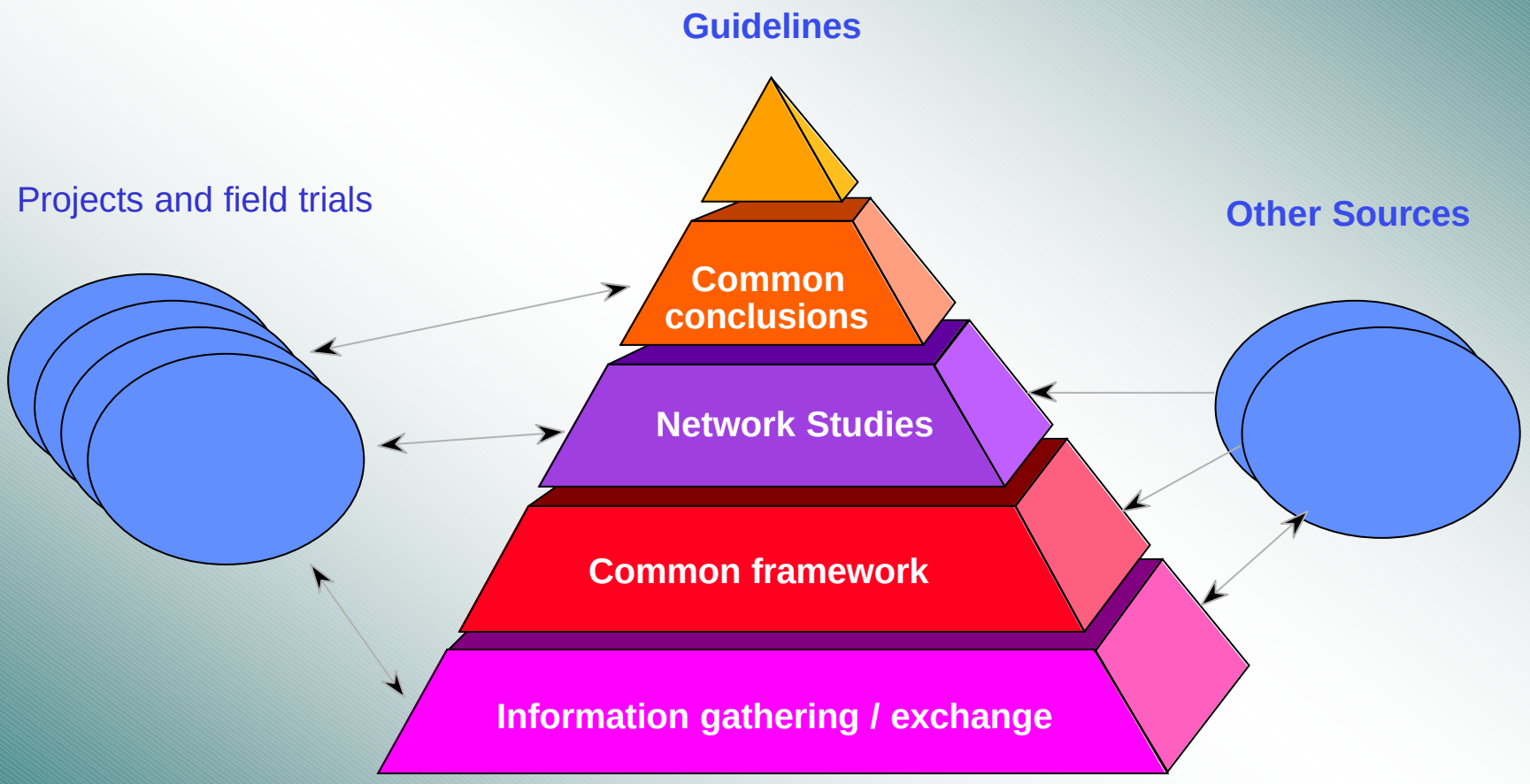
28-29 October 2004

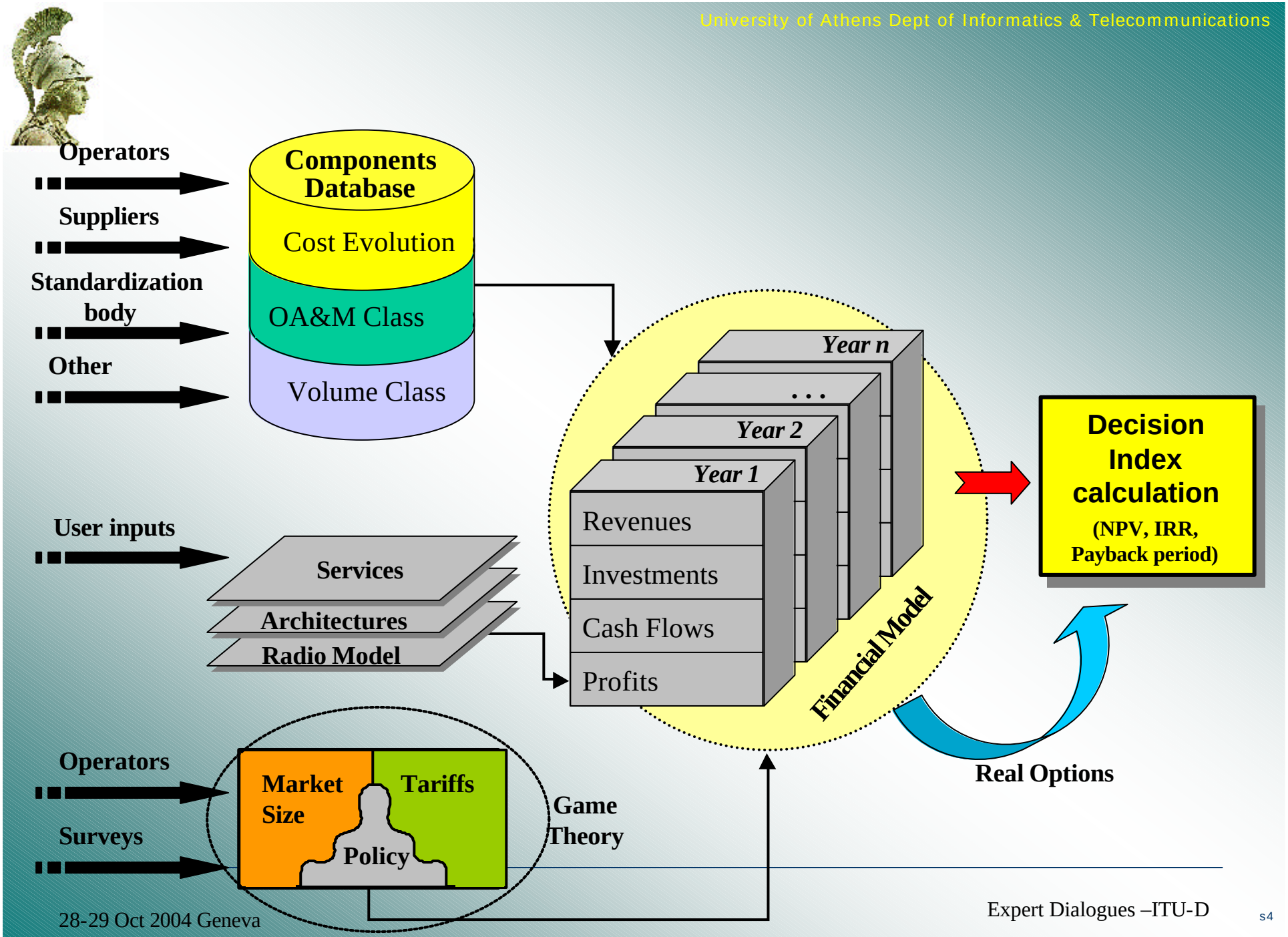
Geneva, Switzerland

The challenge



Consolidation of Results and Guidelines for deployment scenarios

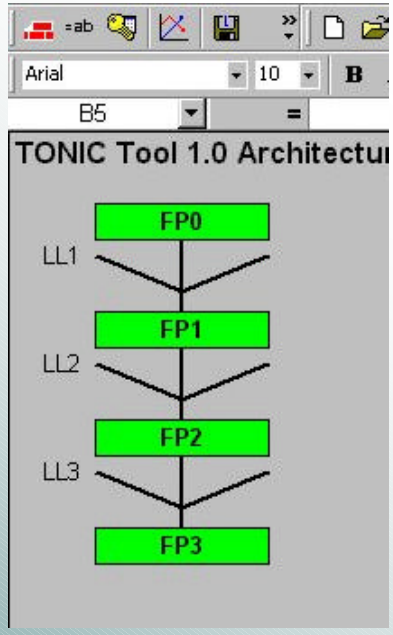



Operators
Suppliers
Standardization body
Other
Components Database
Cost Evolution
OA&M Class
Volume Class
Year n
. . .
Year 2
Year 1
Revenues
Investments
Cash Flows
Profits
Financial Model
Decision Index calculation
(NPV, IRR, Payback period)
User inputs
Services
Architectures
Radio Model
Operators
Surveys
Market Size
Tariffs
Policy
Game Theory
Real Options

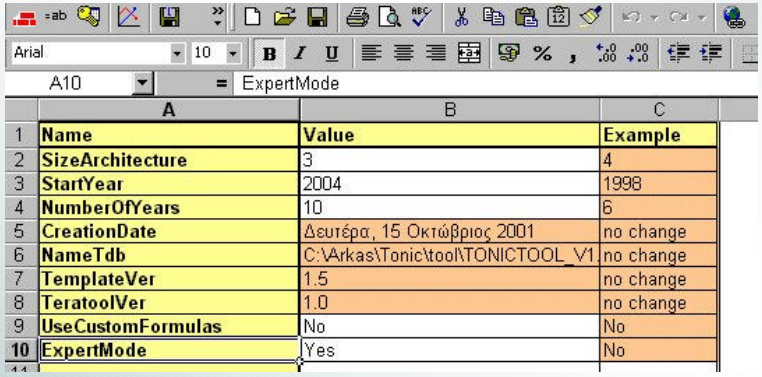
Steps in Network Evaluation

- Definition of service basket
- Network scenarios
- First Simulations – Main Financial results
- Sensitivity and Risk Analysis
- Evaluation Recommendation and Guidelines

The TONIC Tool



- Based on Office 2000 platform
  - Excel & Access
- Automatic sensitivity analysis
- Compatibility with Risk Analysis Tool(s)



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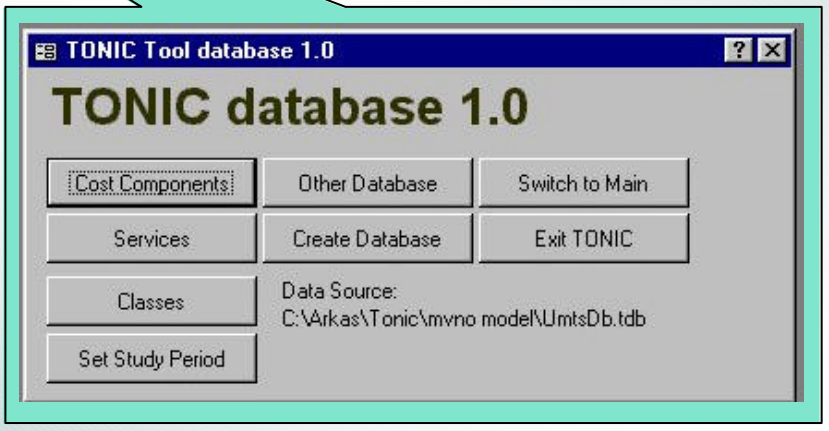
1	Name	Value	Example
2	SizeArchitecture	3	4
3	StartYear	2004	1998
4	NumberOfYears	10	6
5	CreationDate	Δευτέρα, 15 Οκτώβριος 2001	no change
6	NameTdb	C:\Arkas\Tonic\tool\TONICTOOL_V1.	no change
7	TemplateVer	1.5	no change
8	TeratoolVer	1.0	no change
9	UseCustomFormulas	No	No
10	ExpertMode	Yes	No

The TONIC tool & its database

Component	Auto Update	Level	ItemType	M_Rate	M_Hours	WriteOff	ReferencePrice	Referer
GPRS_and_UMTS_DNS	1	FP1	Material/Electronics	0,08	0	5	15.000	
GPRS_and_UMTS_Firewall	1	FP1	Material/Electronics	0,08	0	5	70.000	
GPRS_Charging_gw	1	FP1	Material/Electronics	0,08	0	5	380.000	
Middleware	1	FP1	Material/Electronics	0,05	0	5	15	
UMTS_Billing_system	1	FP1	Material/Electronics	0,05	0	5	6.000.000	
UMTS_Call_Processing_Serv	1	FP1	Material/Electronics	0,05	0	5	2.000.000	
UMTS_HSS	1	FP1	Material/Electronics	0,05	0	5	2.000.000	
UMTS_MediaGateway_circuit	1	FP1	Material/Electronics	0,05	0	5	600.000	
UMTS_MediaGateway_ip_mu	1	FP1	Material/Electronics	0,05	0	5	2.100.000	
UMTS_MSC_Server	1	FP1	Material/Electronics	0,05	0	5	1.800.000	
UMTS_MSC_upgrade	1	FP1	Material/Electronics	0,05	0	10	200.000	
UMTS_OMC	1	FP1	Material/Electronics	0,08	0	10	7.000.000	
Authentication Server	1	FP0	Material/Electronics		0	5	500.000	
GPRS_and_UMTS_GGSN_S	1	FP0	Material/Electronics	0,08	0	5	1.300.000	
UMTS_CAMEL_Server	1	FP0	Material/Electronics	0,08		10	3.600.000	
UMTS_GMSC_Server	1	FP0	Material/Electronics	0,08	0		1.800.000	
UMTS_HLR/AuC	1	FP0	Material/Electronics	0,08	0		000.000	



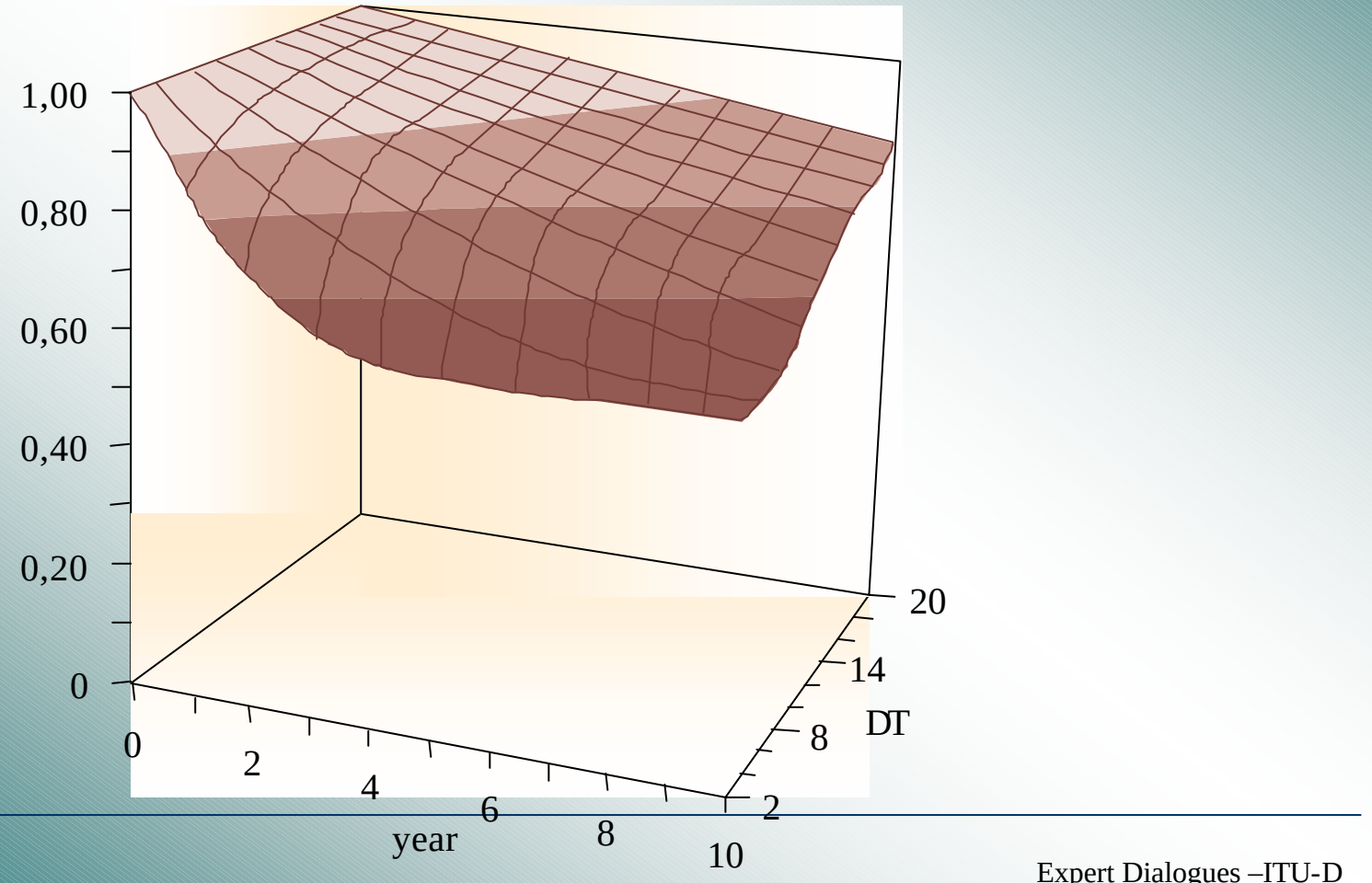
Cost model

- P(0), the price in the reference year 0
- $n_r(0)$, the relative accumulated volume in year 0,
- ΔT , the time for the accumulated volume to grow from 10 % to 90 %,
- K , the learning curve coefficient.

$$P(t) = P(0) \cdot \left[n_r(0)^{-1} \cdot \left(1 + e^{\left\{ \ln\left[n_r(0)^{-1} - 1 \right] - \left[\frac{2 \cdot \ln 9}{\Delta T} \right] \cdot t \right\}} \right)^{-1} \right]^{\log_2 \cdot K}$$

Relative cost evolution as a function of Δ T

with $n_r(0)=0.001$



"Ecosys" project

WP0 - Project Management and Coordination

WP1 Market dynamics

WP2 Techno-Economic methodology development

WP3 Tool development for T-E modelling

WP4 Broadband for all - Economics of new networks and services

WP6 Convergence

WP5 Mobile and wireless network economics beyond 3G

WP7 Dissemination and Exploitation

The new Tool “Ecosys”

- Based on Office 2002 platform
  - Multiplayer environments
  - Real Options implementatio
  - New demand models
  - …..

Main Financial Results

- Net Present Value, NPV
- Internal Rate of Return, IRR
- Payback Period
- Financial indicators
  - Investments
  - Running Costs
  - Revenues
  - Cash Flows
  - Depreciation
  - Profits
  - Taxes
  - Retained Cash Flows
  - Cash Balance
  - Rest Value

Scalability of the tool

- Sensitivity Analysis
- Risk Analysis

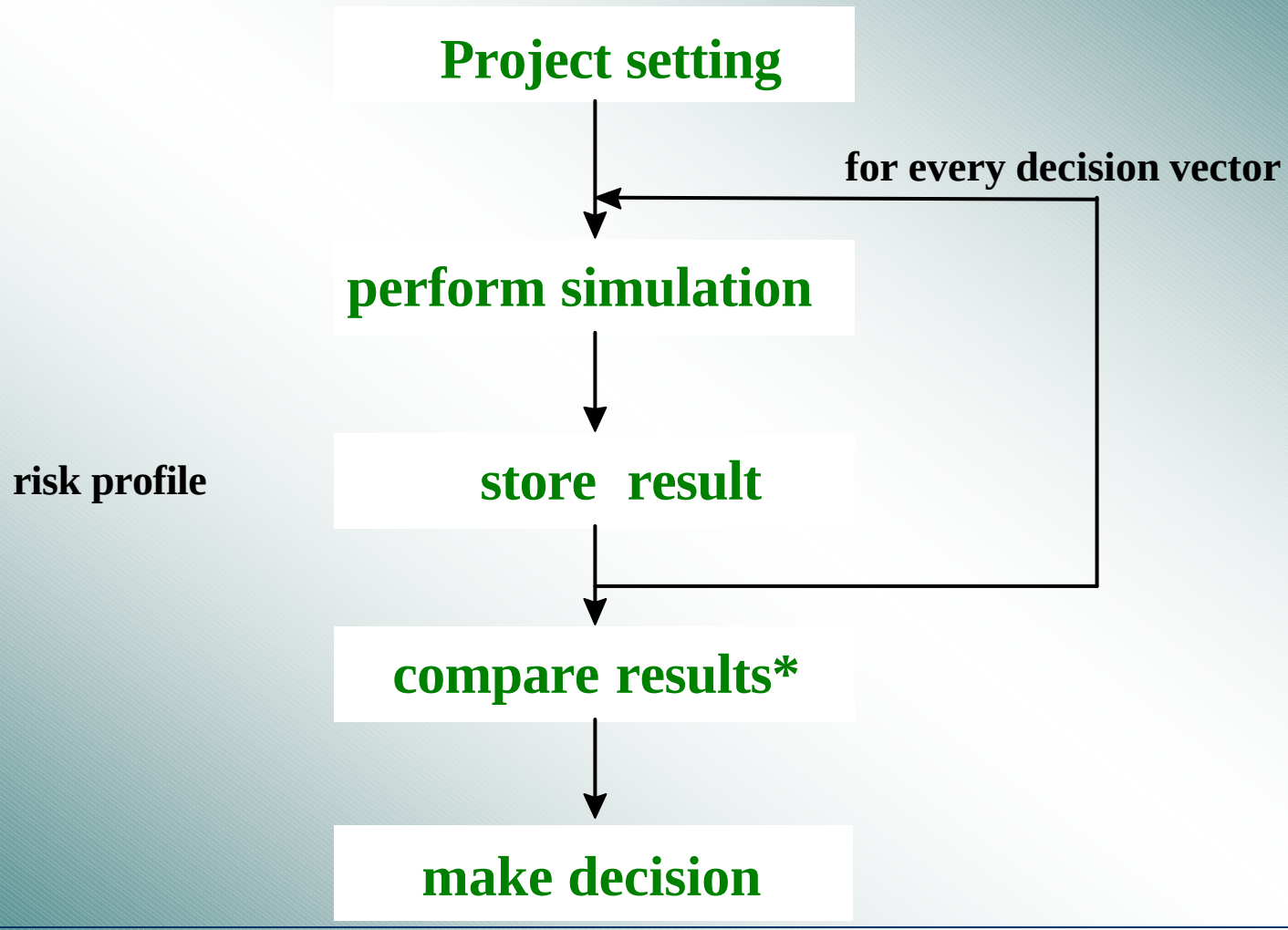
Sensitivity Analysis

- What if…?
- Approach
  - select the most critical input parameters
  - establish boundaries for their variation with a « 95% confidence interval »
- Results
  - impact on NPV
    - at boundary input parameter values: new NPV
    - sensitivity factor: how NPV varies (slope at base value)
  - impact on IRR
    - at boundary input parameter values: new IRR
    - sensitivity factor: slope at base value, although variation usually non linear

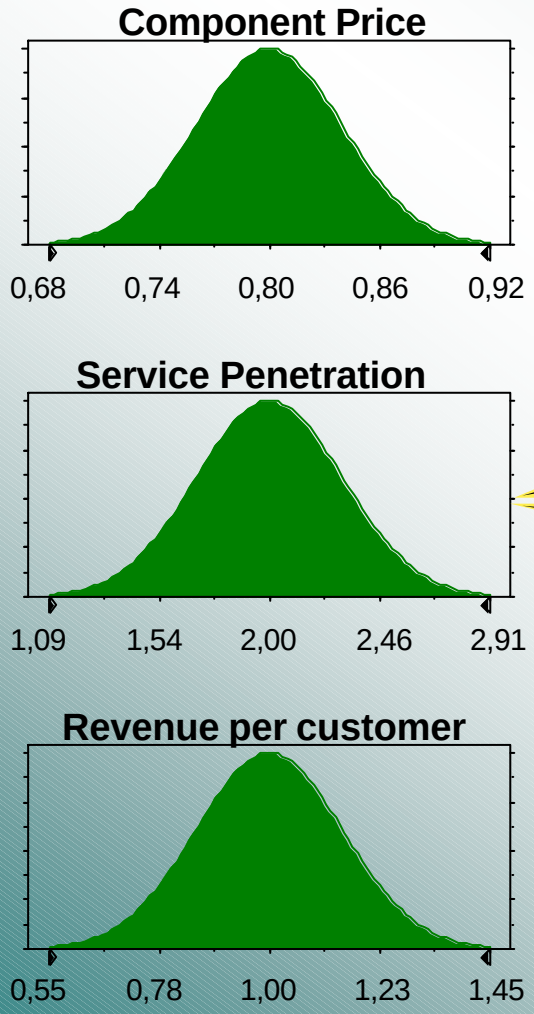
Risk Analysis

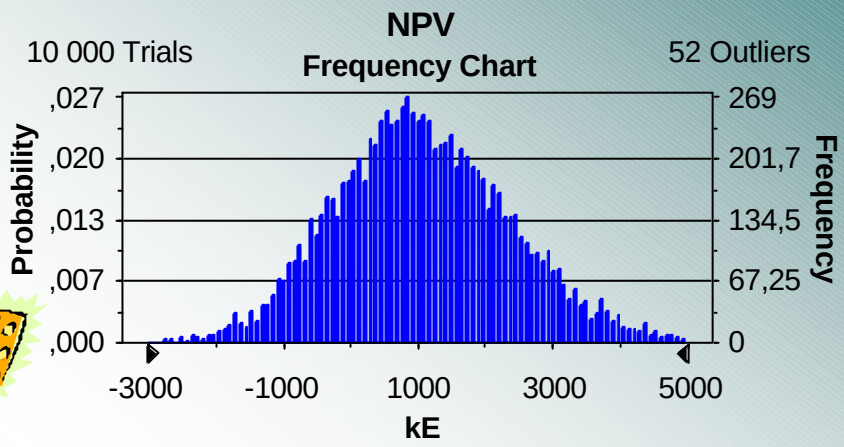
- **Input:**
  - **Uncertainty in market parameters**
    - **Market size**
    - **Market share**
    - **Broadband services characteristics**
  - **Uncertainty in Cost parameters**
    - **Cost units**
    - **Cost evolution**
    - **Area characteristics**
- **Outputs:**
  - **Probability measures for a reduced set of parameters**

Method


Project setting
for every decision vector
perform simulation
risk profile
store result
compare results*
make decision

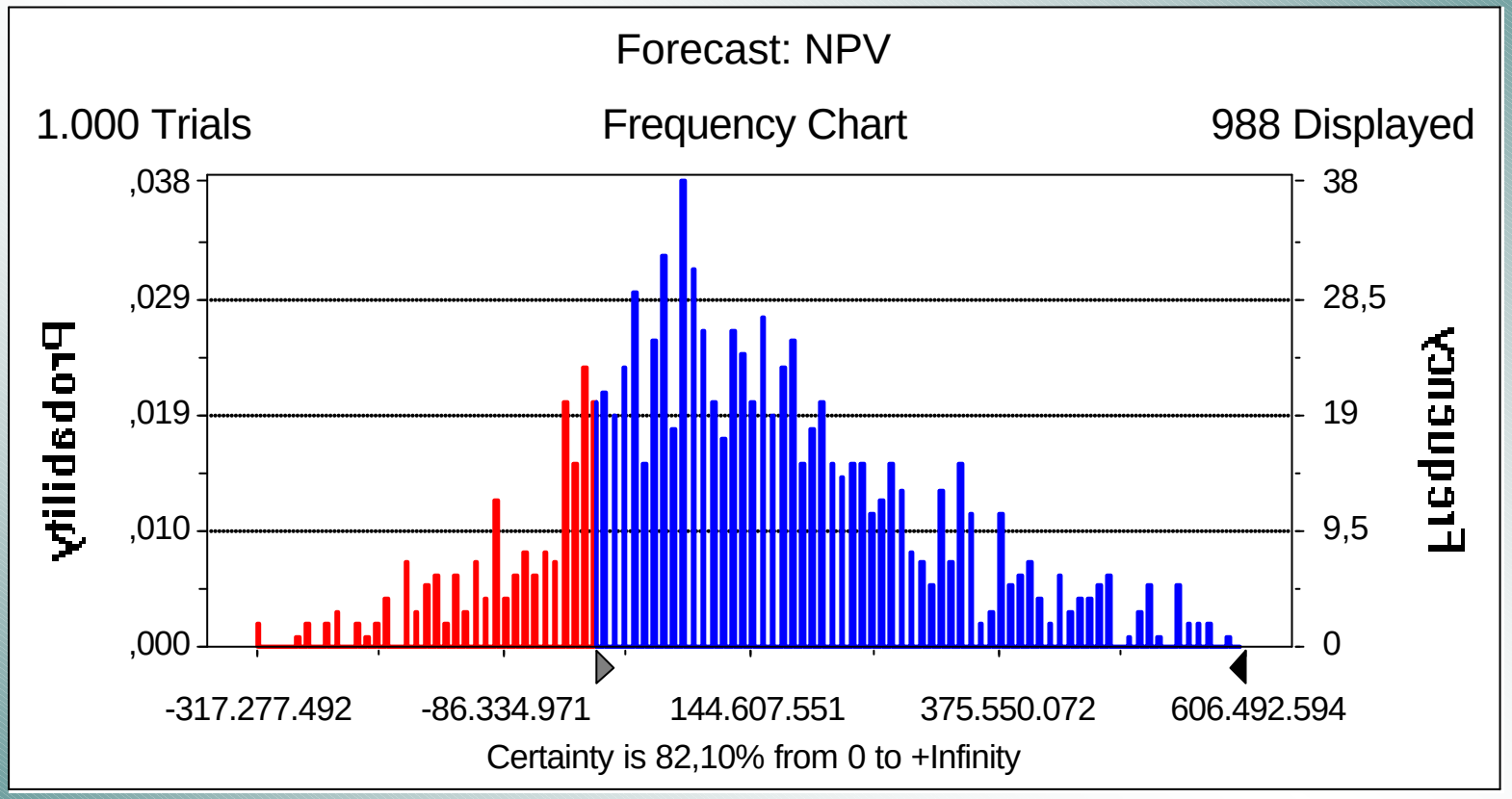
Risk Analysis





- Statistical Variation of the input parameters
- Using Monte Carlo Simulation
- Results: probability distribution, risk profile of the business case
- Extended basis for investment decisions

Risk Analysis - NPV

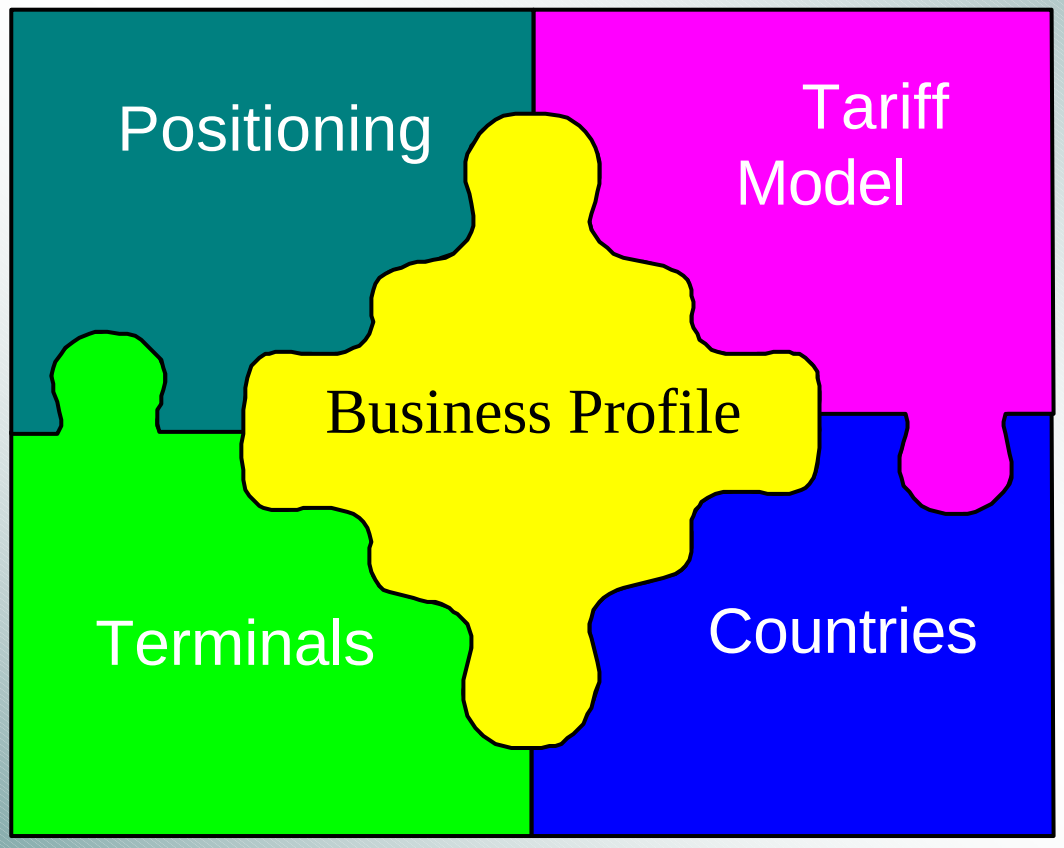


Requirements for a T-E study

- Services Scenarios
  - Dimensioning
- Commercial Network Architectures .
  - For these services
  - Database
  - Serving areas
- T-E Model Constructions
  - Study period (years?)
- Potential market
- Market Shares (e.g operator)
- Pricing
- **Runs- Results**
- **Sensitivity and Risk Analysis**
- **Evaluation of the results – Recommendation and Guidelines - Commercial viability**

Example case
Location base Service LBS

Blend of …cases



Country Types:

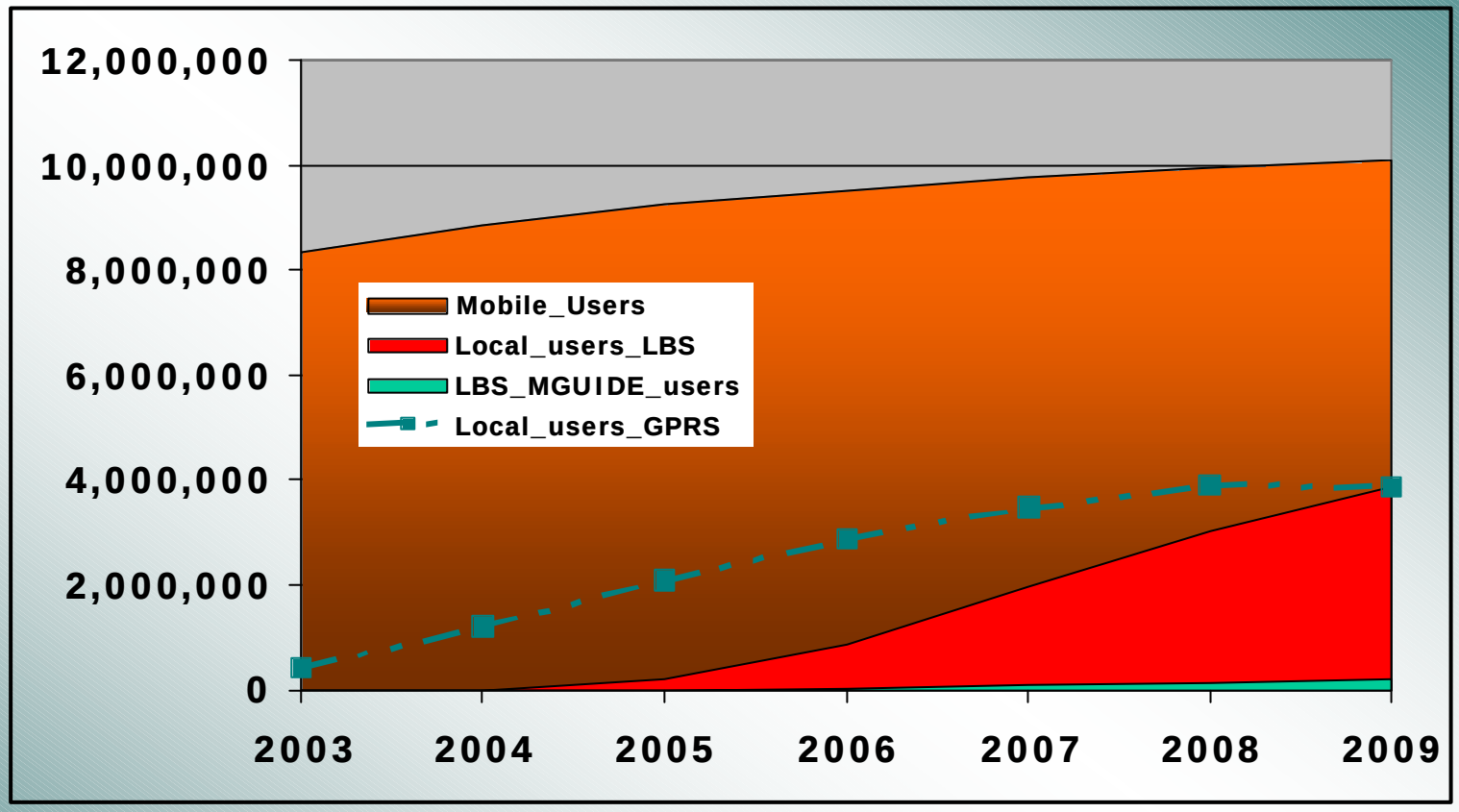
Country Type	*Large*	*Small*	*Description*
Area size	370,000	132,000	Size of surface area of the country (km^2)
Area dense	185	7	Size of dense urban area (km^2) .
Area urban	2,960	4,000	Size of urban area (km^2)
Area suburban	37,000	10,956	Size of suburban area (km^2.
Area rural	303,400	109,956	Size of rural area (km^2).
Population dense	50,000	10,000	Number of inhabitants in dense urban area per km^2
Population urban	4,000	1,216	Number of inhabitants in urban area per km^2
Population suburban	1,000	174	Number of inhabitants in suburban area per km^2
Population rural	40	35	Number of inhabitants in rural area per square km (during busy hour)
Total Population	65,000,000	11,000,000	Total population

Tariff and revenue forecasts

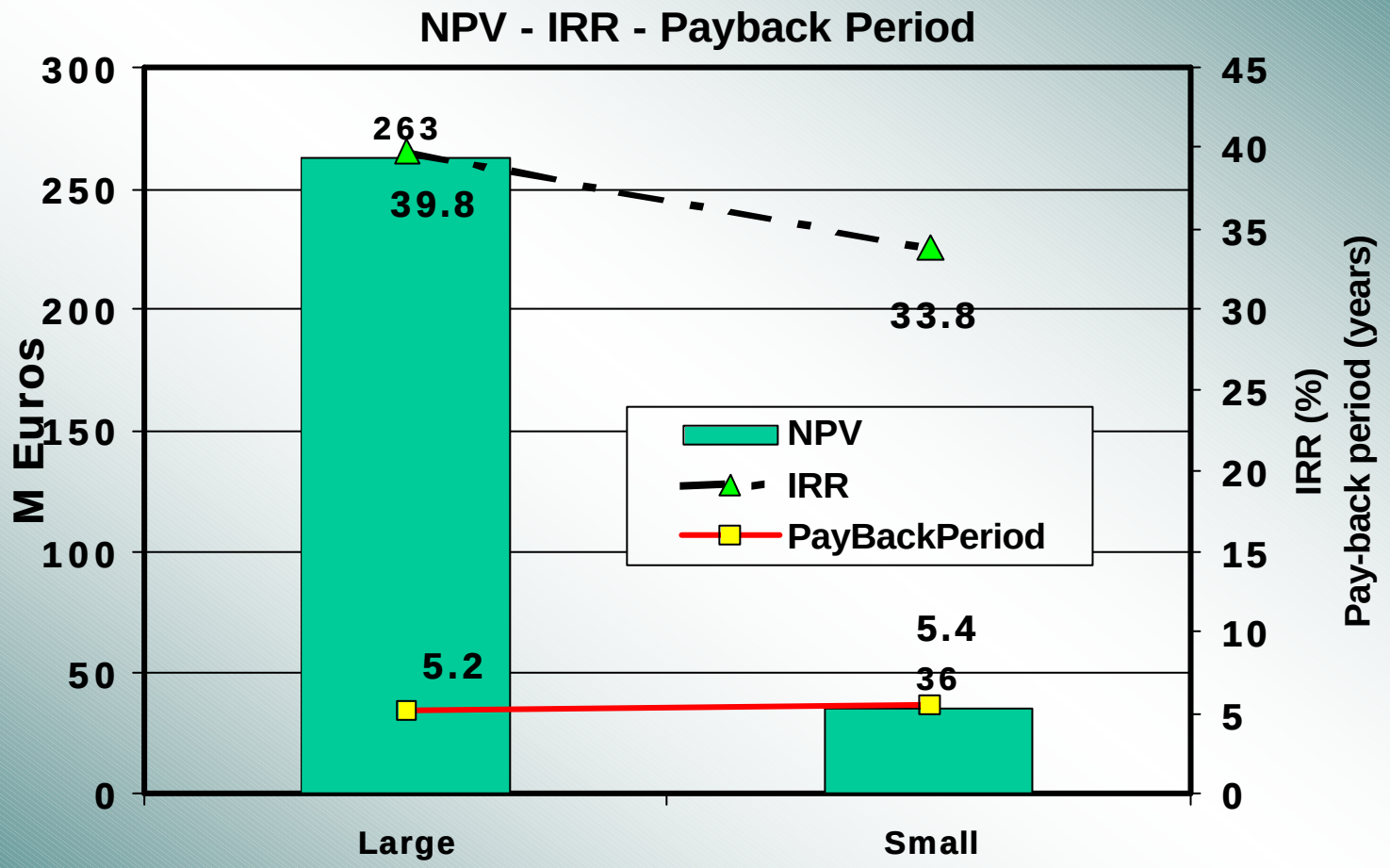
- Services
  - a) LBS services
  - b) M-Guide Service
- Study Period: 7 years

Parameters	Value
Nr of Queries per day (2004)	0.2
Start Price per Query (€)(2004)	1.00
End Price per Query (€) (2009)	0.50
Nr of main Services	7

Demand models



Main Financial Indexes



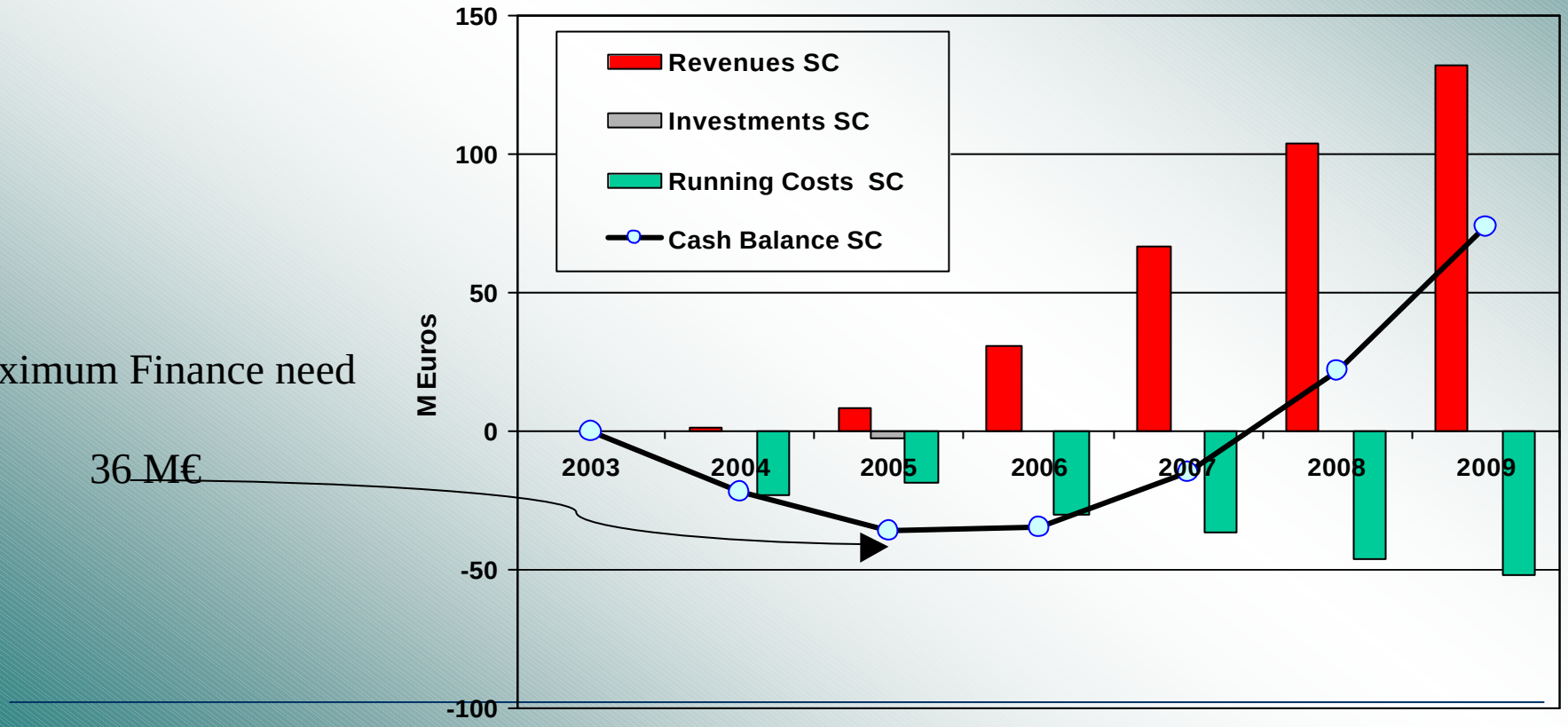
Main results

Small

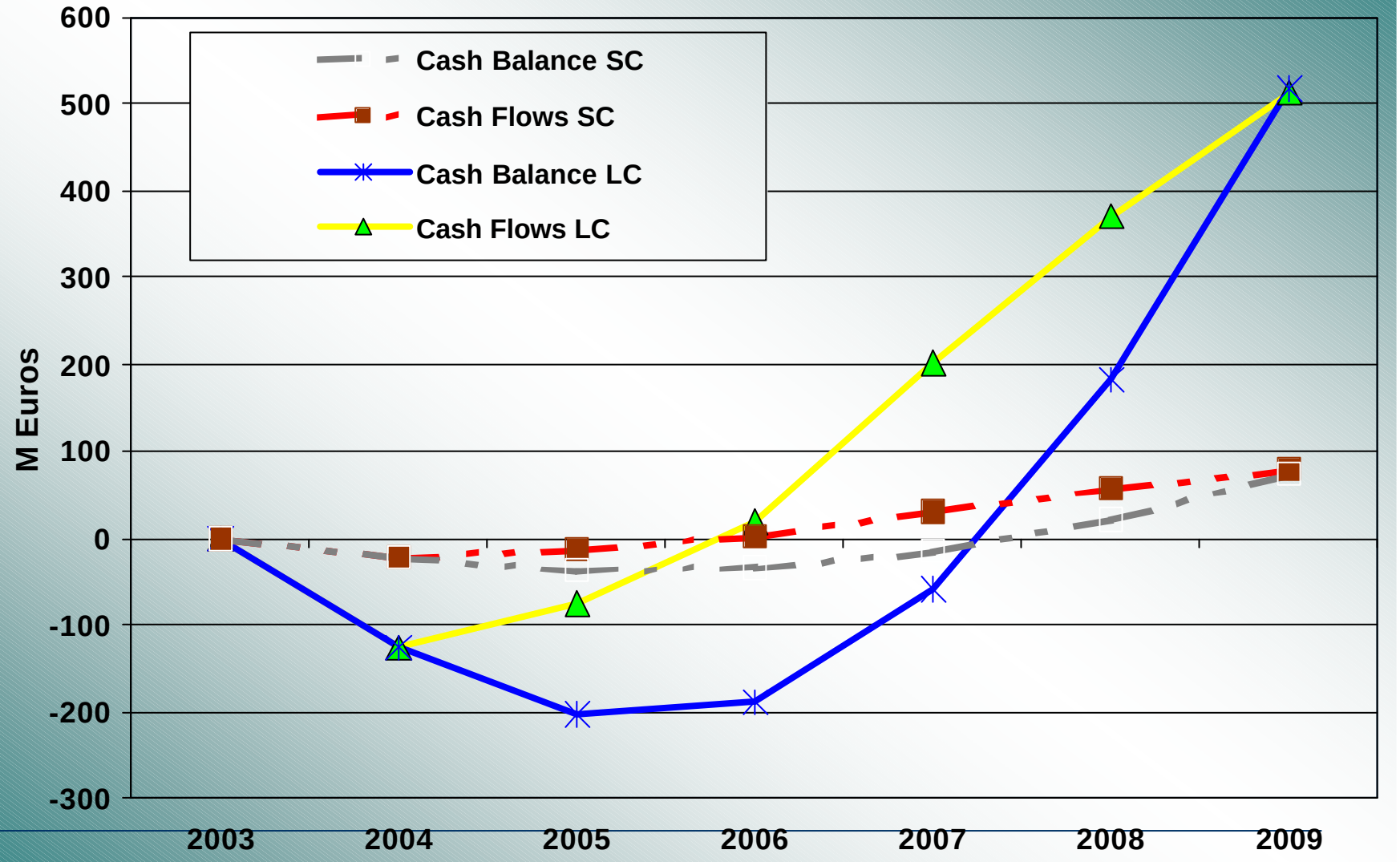
Net present value	35.7 M€
Internal rate of return	33.8%
Payback period	5.4 years

Maximum Finance need

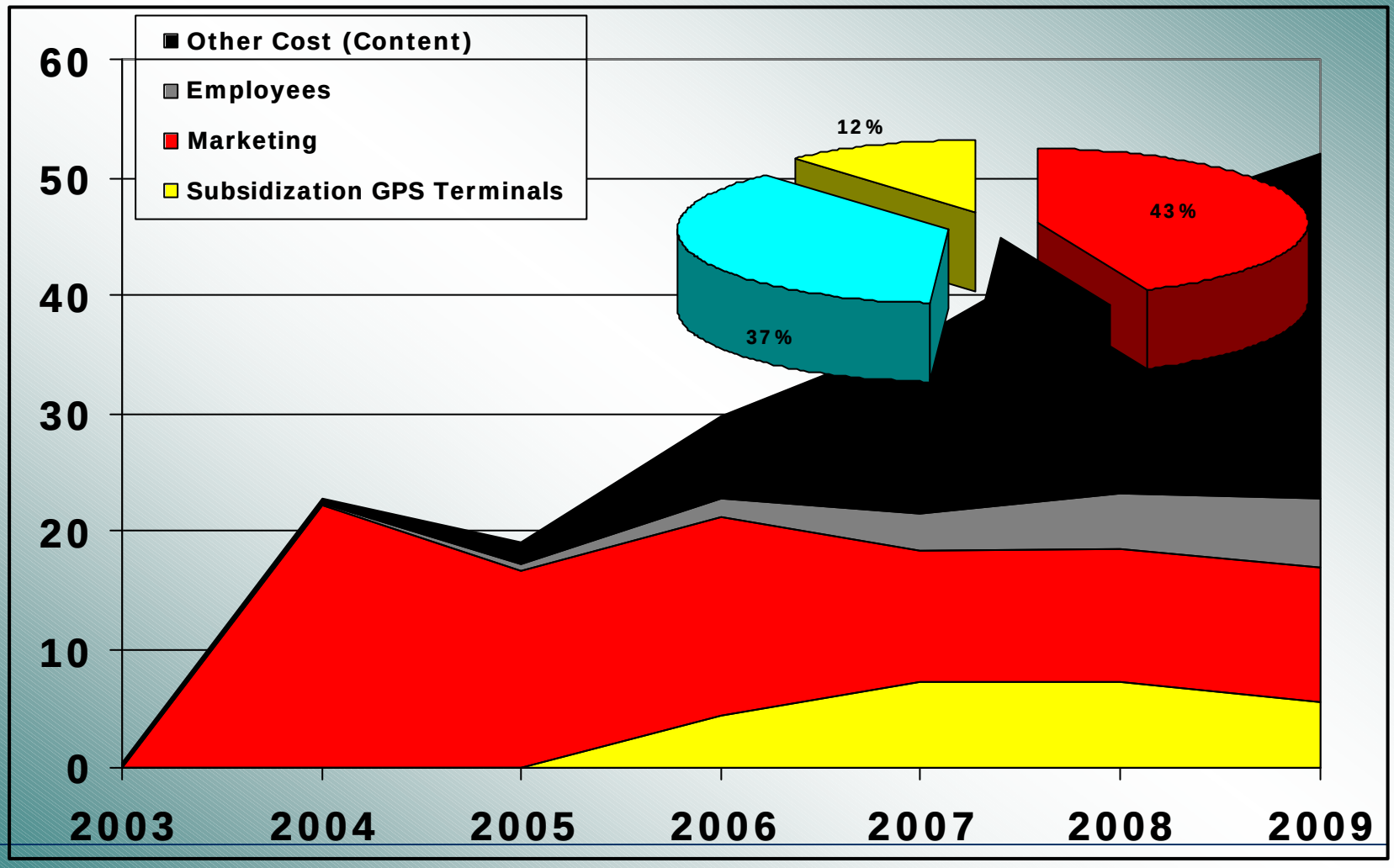
36 M€



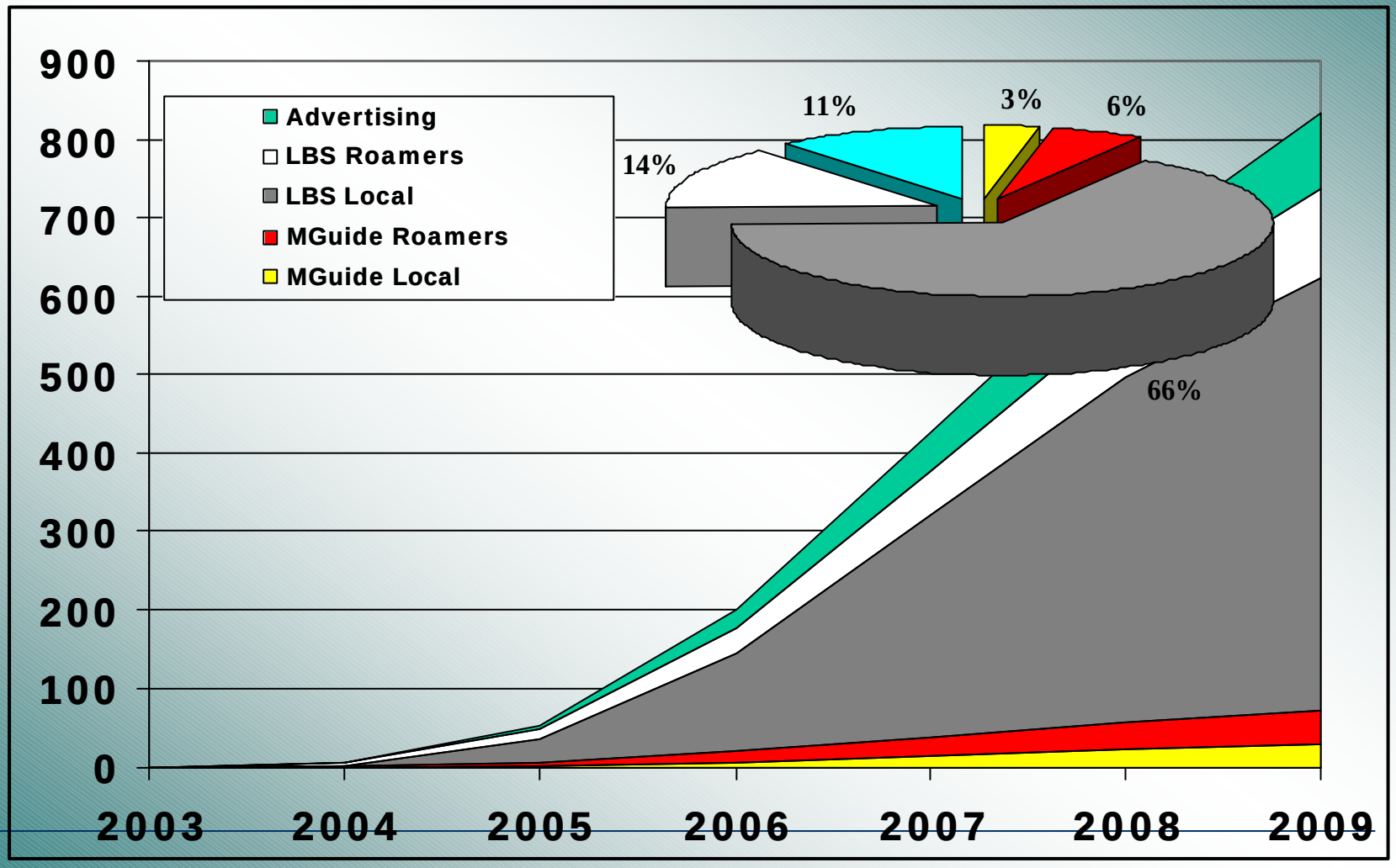
Cash Balances Large and Small Country



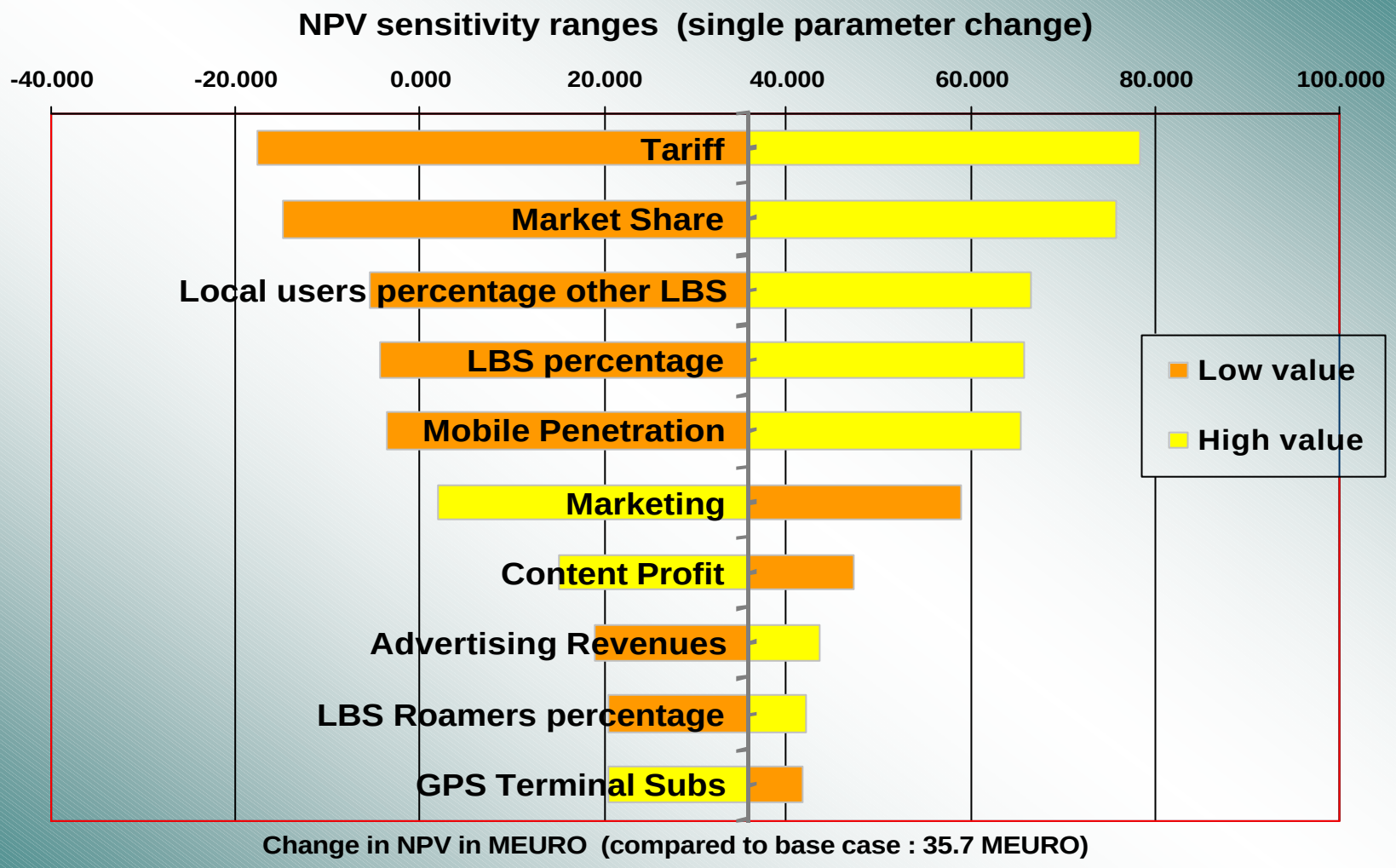
Operational Expenditures (OPEX) SC



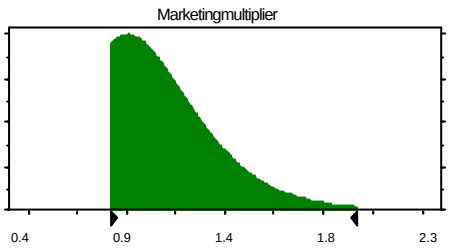
Revenues LC

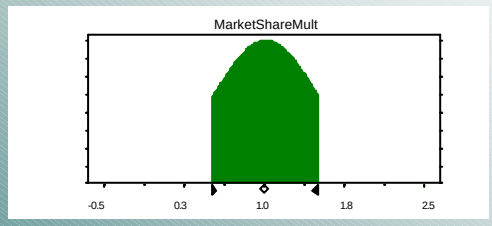

900
800
700
600
500
400
300
200
100
0
2003
2004
2005
2006
2007
2008
2009
Advertising
LBS Roamers
LBS Local
MGuide Roamers
MGuide Local
11%
3%
6%
14%
66%

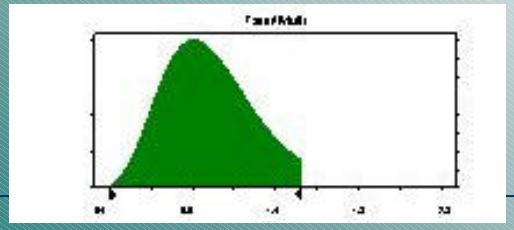
Sensitivity Analysis

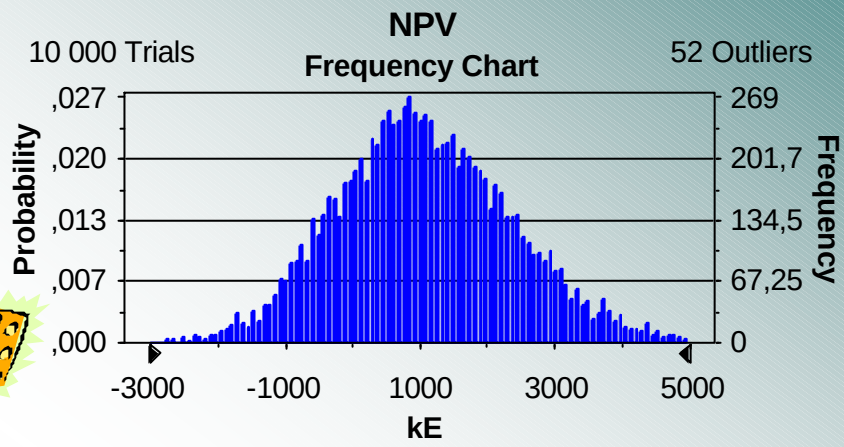


Risk Analysis









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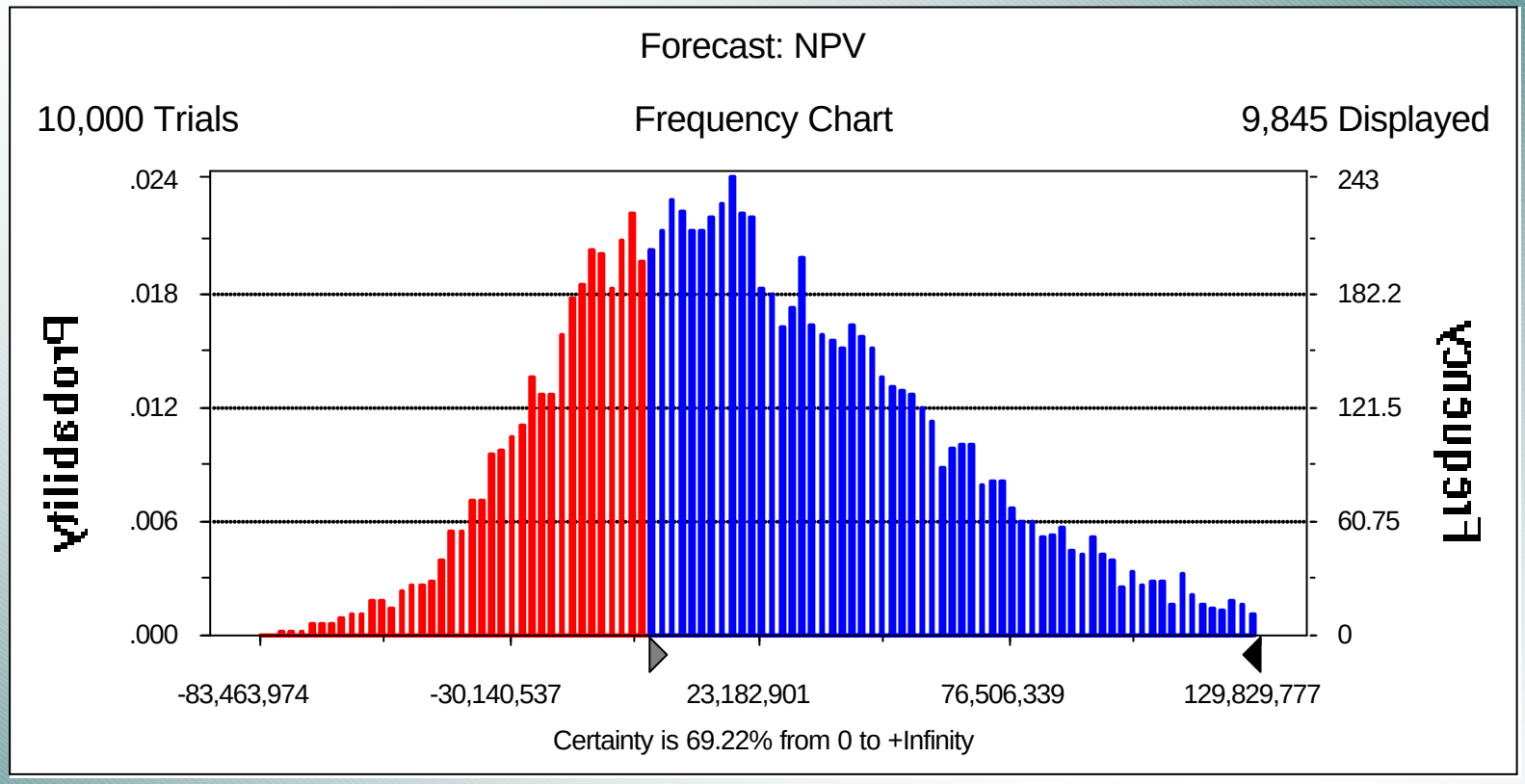
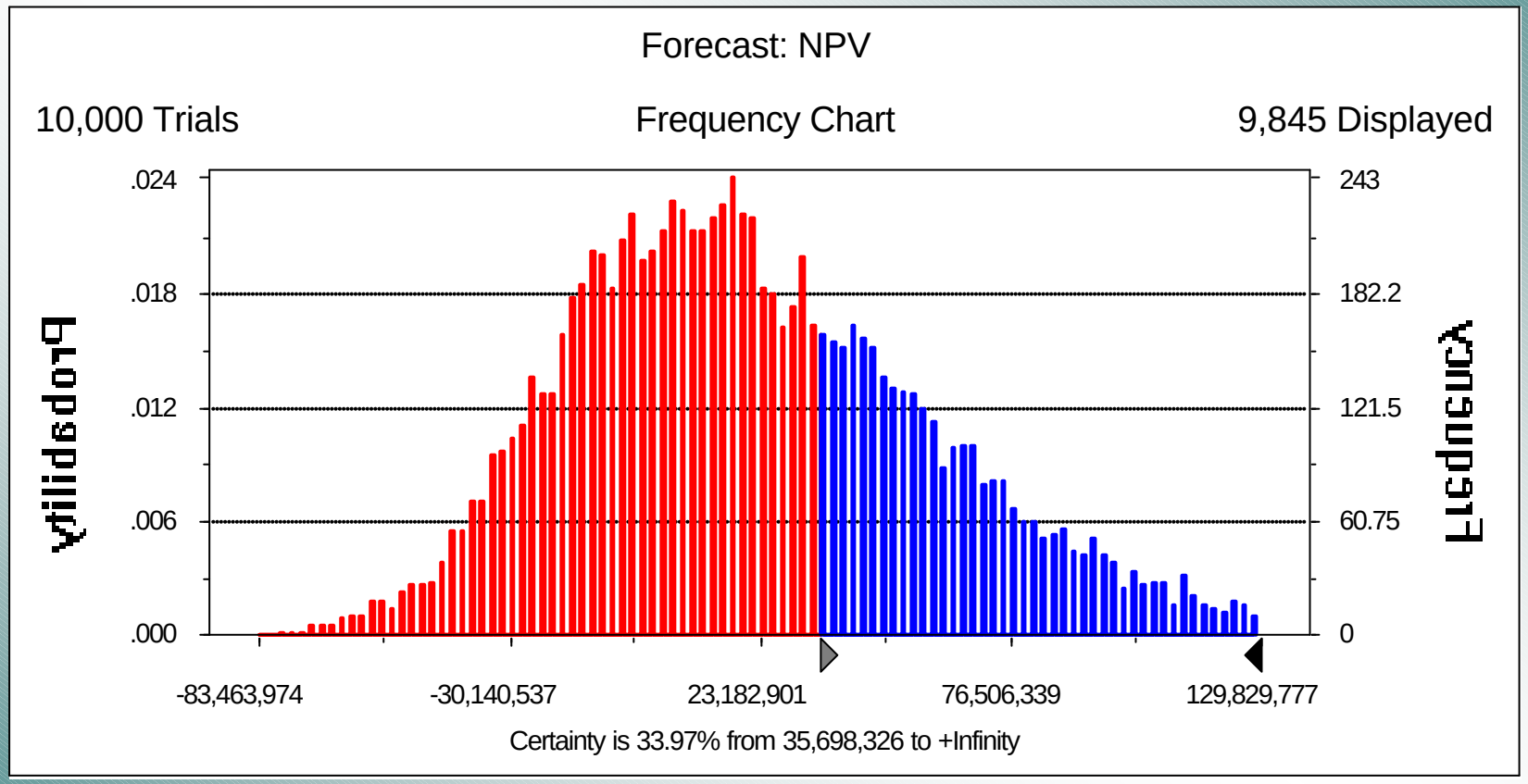
Risk Analysis - NPV



Risk Analysis – NPV (2)



Conclusions LBS Case

- Acceptable business opportunities
- LBS can still be an attractive opportunity for companies with or without telecom background
- Payback period of 5 to 6 years, with a yearly ARPU of over than 27€ for more enthusiastic testbeds
- Worst-case scenario
  - ***Risk analysis evaluation*** shows that almost 30% of the project cases could have significant profits and 70% of them remain positive
  - **The uncertainty level is high mainly** relating to the LBS penetration and market share
- ***One-year delay*** of this project could be reasonable in order to answer some critical questions

Time for Questions & Answers

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