CBA and sustainable development
A French point of view

Emile Quinet

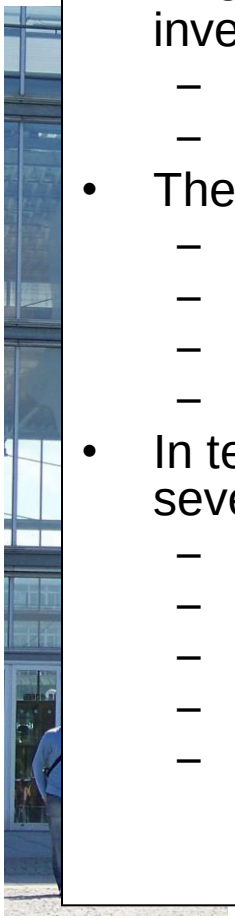
PSE, Ecole des ponts-ParisTech

Outline

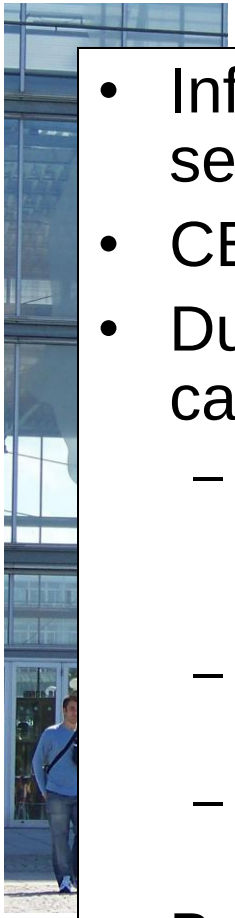
- The framework
- Long term issues
- Uncertainty
- Stock effects
  - Carbon price
  - Biodiversity
  - Agricultural land value
- Flow effects
  - Pollution
  - Upstream-Downstream effects
  - Noise
- Overview of the changes in the distribution of benefits

The framework

- A recent working party revised the methodology for CBA of public investments
  - Part of a regular updating, which takes place every 5 years
  - A collective work
- The report addressed many issues
  - Updating unit values
  - Redistributive concerns
  - Spatial effects
  - …
- In terms of sustainable development, the recommandations were marked by several closely related concerns going at the top of the agenda:
  - Long term issues
  - Uncertainty
  - Climate change and Carbon price
  - Other stock effects (biodiversity, value of agricultural land)
  - And also of course, flow effects (air pollution, ….)



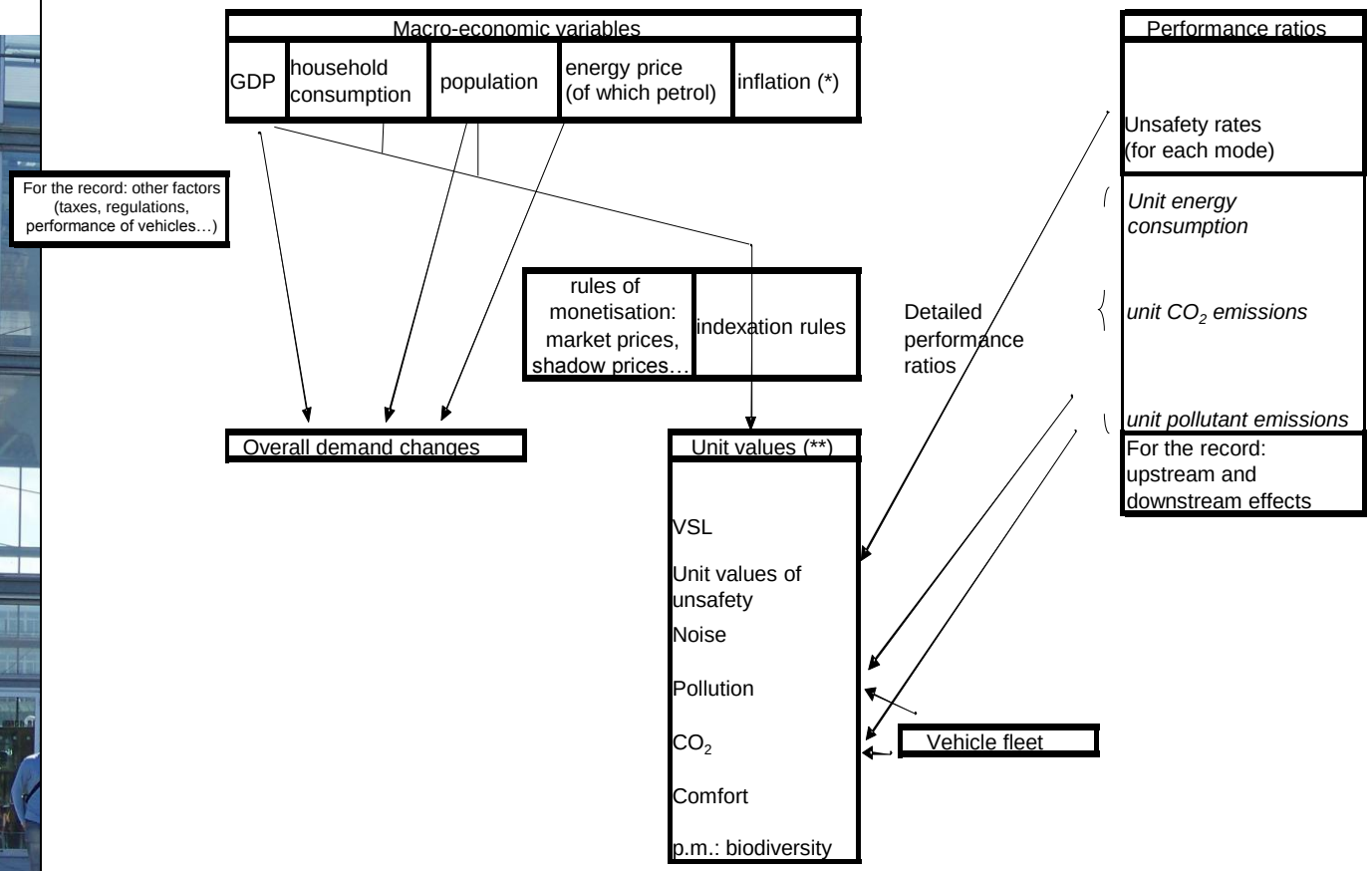
Long term issues:The need for a long term strategy



- Infrastructure investments have a long life-time (often several hundred years)
- CBA is carried out at the margin of a growth trajectory
- Due to the ongoing transitions, these growth trajectories cannot be extrapolated from the present trends
  - They must take into account
    - macro-economy
    - Other related sectors: spatial organisation, energy,
  - They need to be extended to longer time span than the usual #20 to 30 years
  - They need to be standardized in order to make CBA comparable from one project to another
- Besides, the horizon is postponed to 2140

Figure 1. Reference trajectories for project appraisal

(horizon: 2012 – 2080)



(*) Used for links between socio-economic and financial appraisal

(**) The factors to use for surplus calculations are provided by the traffic models

Uncertainty

- The problem: to take into account the random walks of surpluses drawn from an investment and GDP
  - Around fixed trends, the higher the future GDP, the lower the utility of future surpluses expressed in Euro
  - The expected utility of a future surplus depends on the correlation between this surplus and GDP
    - When correlation is negative the investment plays the rôle of an insurance and is more valuable then when correlation is positive
  - The analysis comes to a result similar to what is commonly used in finance:

Uncertainty

- The discount rate to be used for a project is specific to each project:

$$r = r_f + \varphi\beta$$

- where
  - r is the risk-factored discount rate specific to the project,
  - r_f is the risk-free rate, set by the report at 2,5%
  - φ is the general risk premium, set by the report at 2%
  - β is specific to each project and measures the correlation between the surpluses and the GDP

Uncertainty

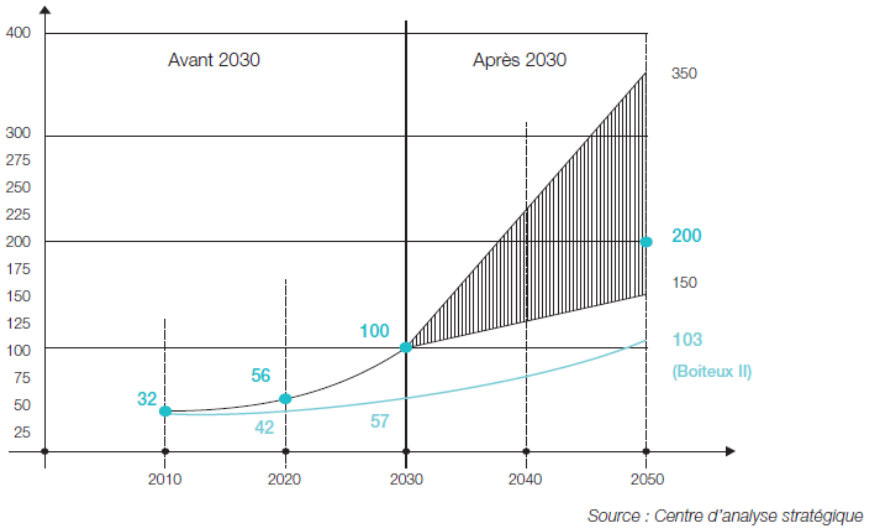
- The coefficients β lie between 1,00 (for urban public transport) and 1,50 (for intercity long distance transport)

Stock effects : the price of carbon

- The 2009 report on carbon price:
  - The objective was to estimate prices implied by the international agreements, not to estimate the cost of damages: cost-efficiency, not cost-benefit
  - The recommendations were based on:
    - A review of existing recommended estimates in similar countries
    - The teachings of the permit markets
    - The results of three models

Stock effects : the price of carbon

- For year 2010: the value used in the previous recommendations: 32 Euro per ton of carbon
- For year 2030: 100 euro per ton of carbon (coming from the results of the modelling exercise)
- After year 2030: the Hotelling rule: 4% per year



Source : Centre d'analyse stratégique

Stock effects : the price of carbon

- The updating:
  - To keep the 2010 and 2030 values, for which an agreement has been difficult to reach
  - After 2030, to adapt the growth to the new discounting system
    - Which value of the correlation between carbon price and GDP?
      - Few estimates, some are negative, other positive
      - The choice was based on a study by Gollier (2013)
      - The result: the β of carbon price is set to 1,00
      - Then the price of carbon grows at a 4,5% rate

Stock effects : biodiversity

- The diversity of biodiversity
- It was deemed not possible yet to recommend a comprehensive set of mandatory values
- Biodiversity is taken into account through regulations (« no net loss »)
- The need to develop estimates of the services provided by bio diversity

Stock effects: value of agricultural land

- We have a good knowledge of market prices
- But they do not reflect the economic value:
  - Many subsidies
  - Pollution externalities
  - Biodiversity effects
  - Long term considerations : food security, independance

Flow effects: air pollution

- A raise in the economic costs of air pollution, due to the raise in the Value of life : from around 2 Million Euro to 3 Million Euro
- Values transferred from the Impact study, taking into account the French specificities (type of vehicles, population density, …)

Flow effects : upstream/Downstream effects

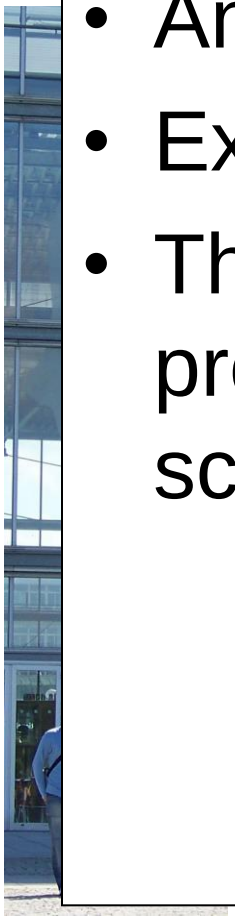
- Introduced using the Impact study, transferred to the French case

Flow effects : noise

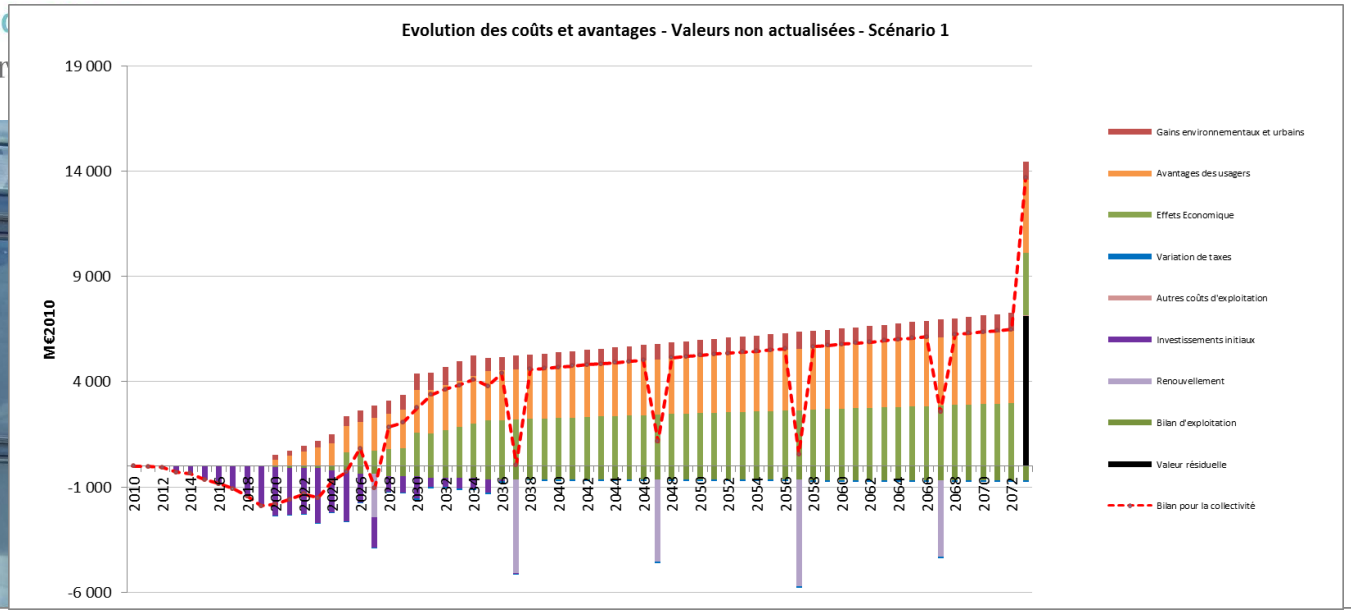
- The problem: at the stage where CBA takes place, noise cannot be properly assessed
  - The mandatory values are given per veh*km
  - They are highly uncertain

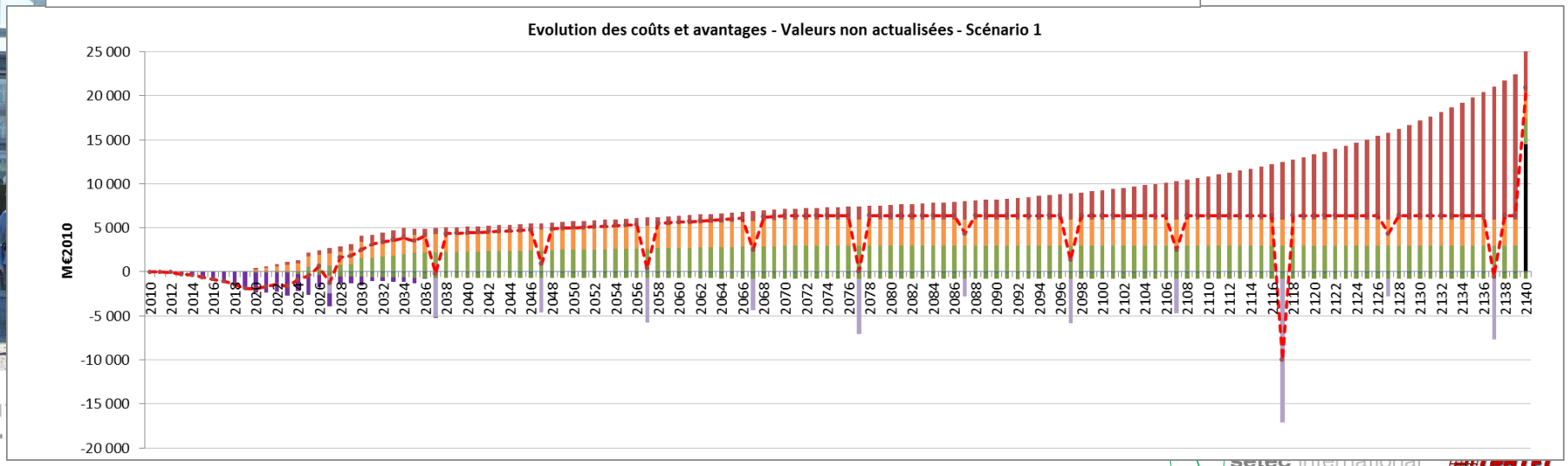
Induced changes

- An increase in the proportion of amenities
- Example of the « Grand Paris » study
- The main change should come from proper long term strategies (reference scenarios)



Advantages and costs

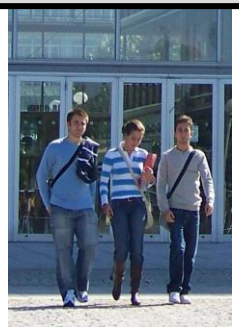




Cost Benefit Analysis

Former procedure	S1 (Md€2010)		
Avantagesd	2025	2035	NPV
Time savings	1,0	1,9	27,6
Reliability	0,2	0,2	3,4
Comfort	0,1	0,2	2,2
Environmental and urban effects	0,5	0,7	10,4
Spatial effects: changes in location	0,0	0,5	5,5
Spatial effects: changes in density	0,0	0,6	6,3
Employment effects	0,0	1,1	12,2
Total Advantages	1,7	5,1	67,6

Advantages	S1 (Md€2010)		
	2025	2035	NPV
Time savings	0,9	1,8	21,8
Reliability	0,2	0,2	3,1
Comfort	0,0	0,1	0,7
Environmental and urban effects	0,4	0,6	12,6
Spatial effects: changes in location	0,0	0,5	4,6
Spatial effects: changes in density	0,0	0,6	5,4
Employment effects	0,0	1,1	10,4
Total Advantages	1,5	4,8	58,6



NPV in Md€ 2010	De Robien	Quinet
Pollution	0.3	-0.9
Safety	0.5	1.0
Carbon emissions	2.9	6.5
Noise	-0.0	0.2
Urban effects	6.7	5.7
Total	10.4	12.6

* Valeur actualisée à l'année 2010 en Md€2010