



SDA AND EXTENDED CBA – A NEW HOLISTIC APPROACH TO INCLUDE SOCIAL IMPACTS IN APPRAISAL PROCEDURES FOR ROAD INFRASTRUCTURE INVESTMENTS

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SDA - Sustainable Development Analysis

→ Evaluation tool of holistic term of sustainability

3 dimensions of sustainable development

- ecological
 - economic
 - social society
- } goals



eCBA - extended Cost Benefit Analysis

→ Evaluation tool including the effects of

- induced/suppressed travel demand
- indirect impact of regional economic value added (location attractiveness)
- distribution of cost and benefit (winners and losers)



- Methodological considerations

Case study for SDA

- Elements of eCBA

Examples

- Conclusions



DEFINITION OF SUSTAINABLE DEVELOPMENT

(1.) World Commission on Employment & Development
(1987, Brundtland-Report):

Sustainable development (SD) means to satisfy the needs of the current generations keeping options open for future generations and their needs.

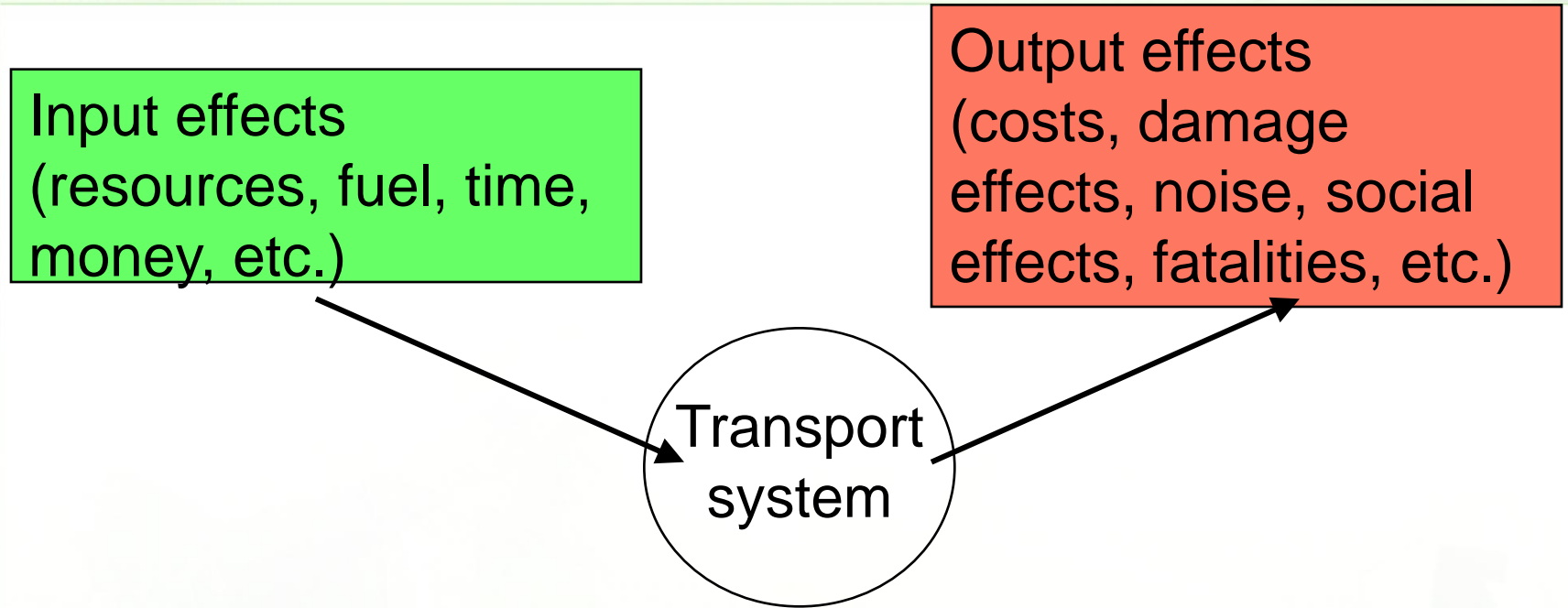
(2.) Rio Conference (1992) of UNCED:

Sustainable development is based on a balance between the three sectors of ecology, economy and social society.

→ **Sustainable development = Optimization concept**



OPERATIONALIZING SUSTAINABILITY (DEFINITION OF CONTENTS)



Criteria of sustainability for each single effect and for synergetic effects

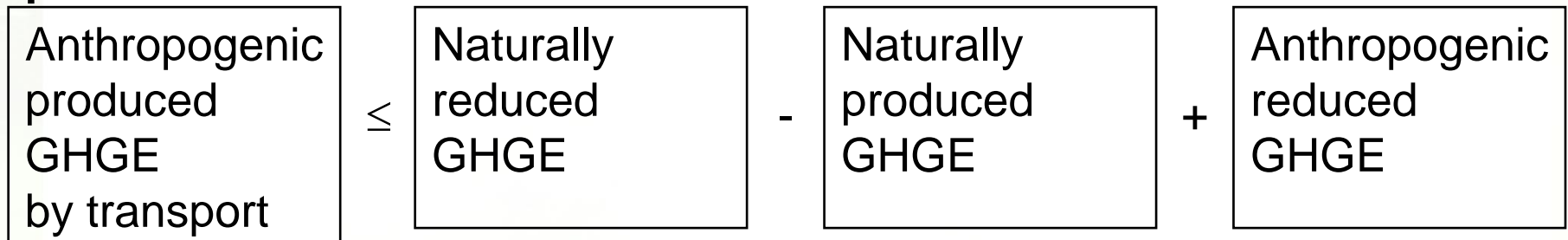
Method of synthesis of single effects



OPERATIONALIZING SUSTAINABILITY FOR DAMAGING IMPACT – E.G. GREENHOUSE GAS EMISSION

Indicator = anthropogenic produced GHGE by transport system
[quantity / time]

part-index = 100 %



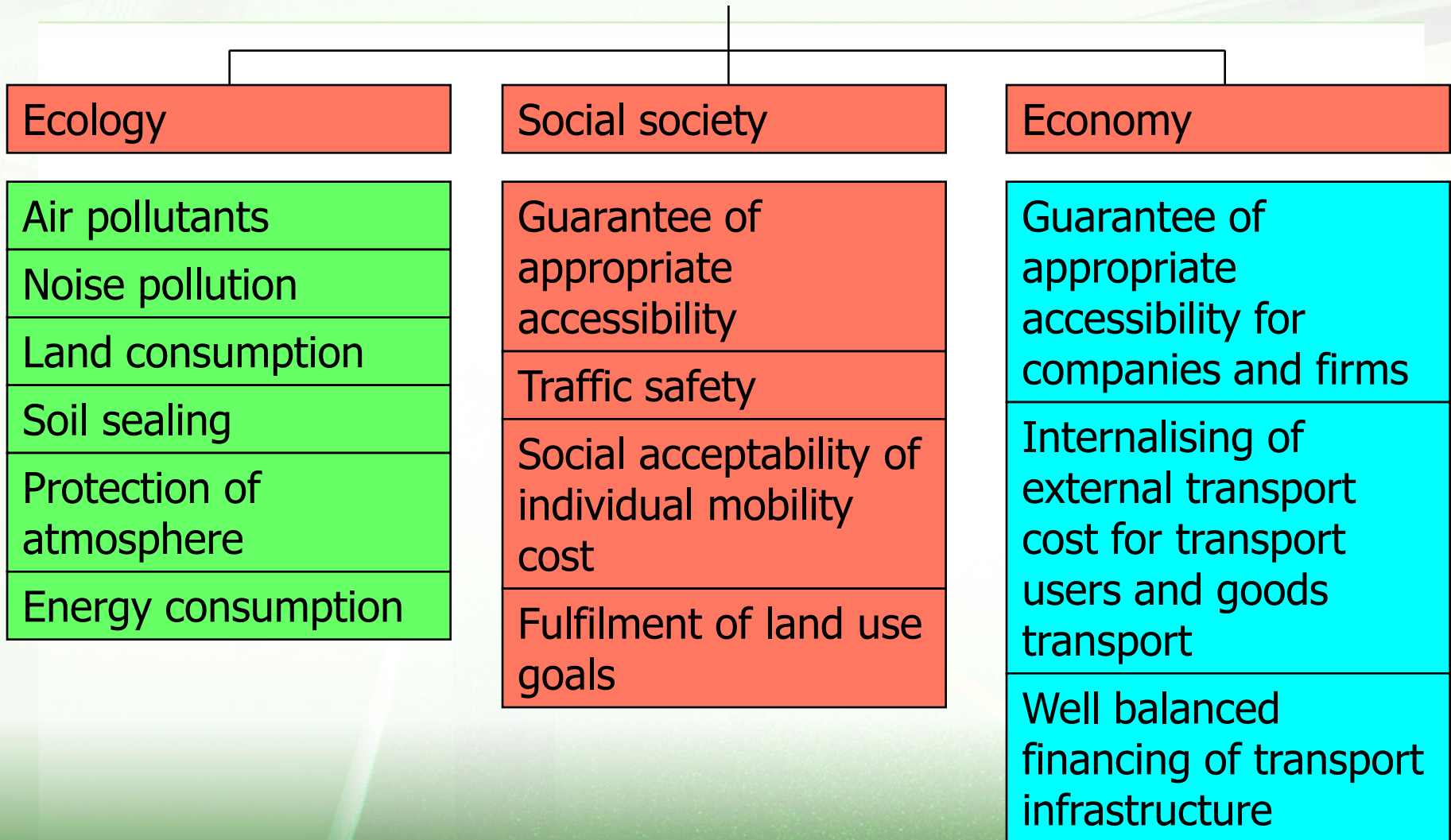
$$AP \leq \int_{t_0}^{t_1} NR(t) \cdot dt - \int_{t_0}^{t_1} NP(t) \cdot dt + AR$$

Part-index = 0 %

Maximum possible / conceivable anthropogenic produced GHGE by the transport system



OBJECTIVES FOR SUSTAINABLE DEVELOPMENT (EXEMPLARY)



EXAMPLE: INTERNALISATION OF EXTERNAL TRANSPORT COSTS FOR TRANSPORT USERS

Indicator = cost-coverage of transport user costs [%]

part-index = 100 %

Indicator: cost-coverage of transport user costs = 100 [%]

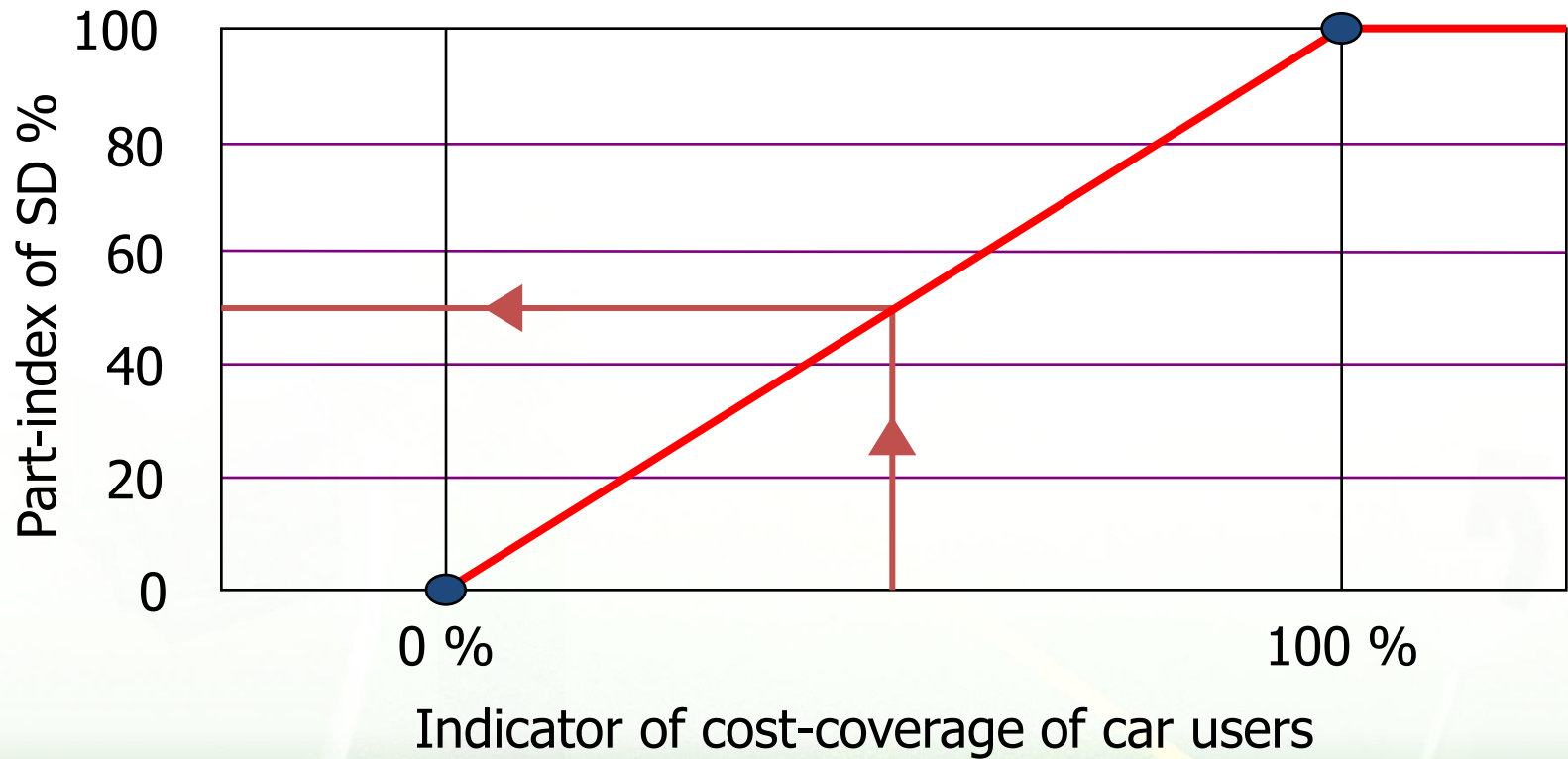
part-index = 0 %

Transport user pay no user costs = 0 [%] in the study area

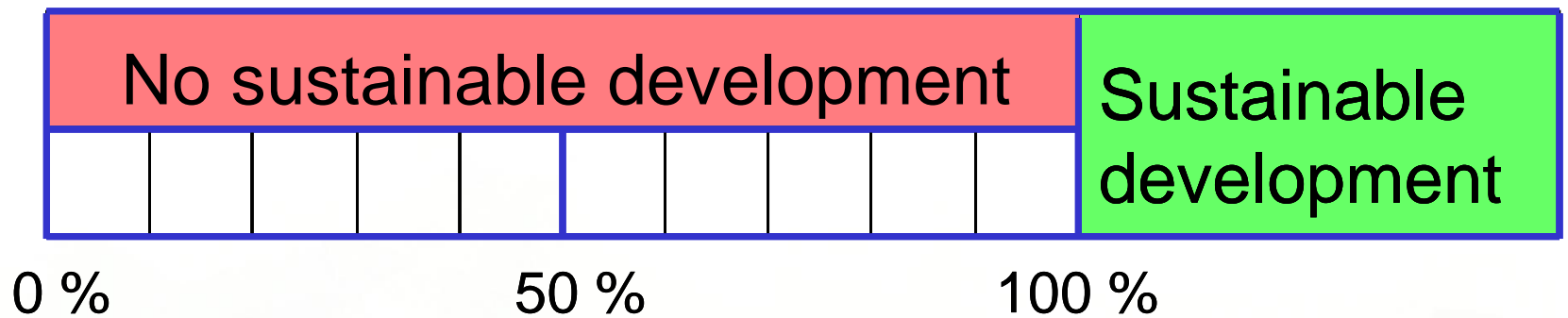


DEFINITION OF VALUE FUNCTION

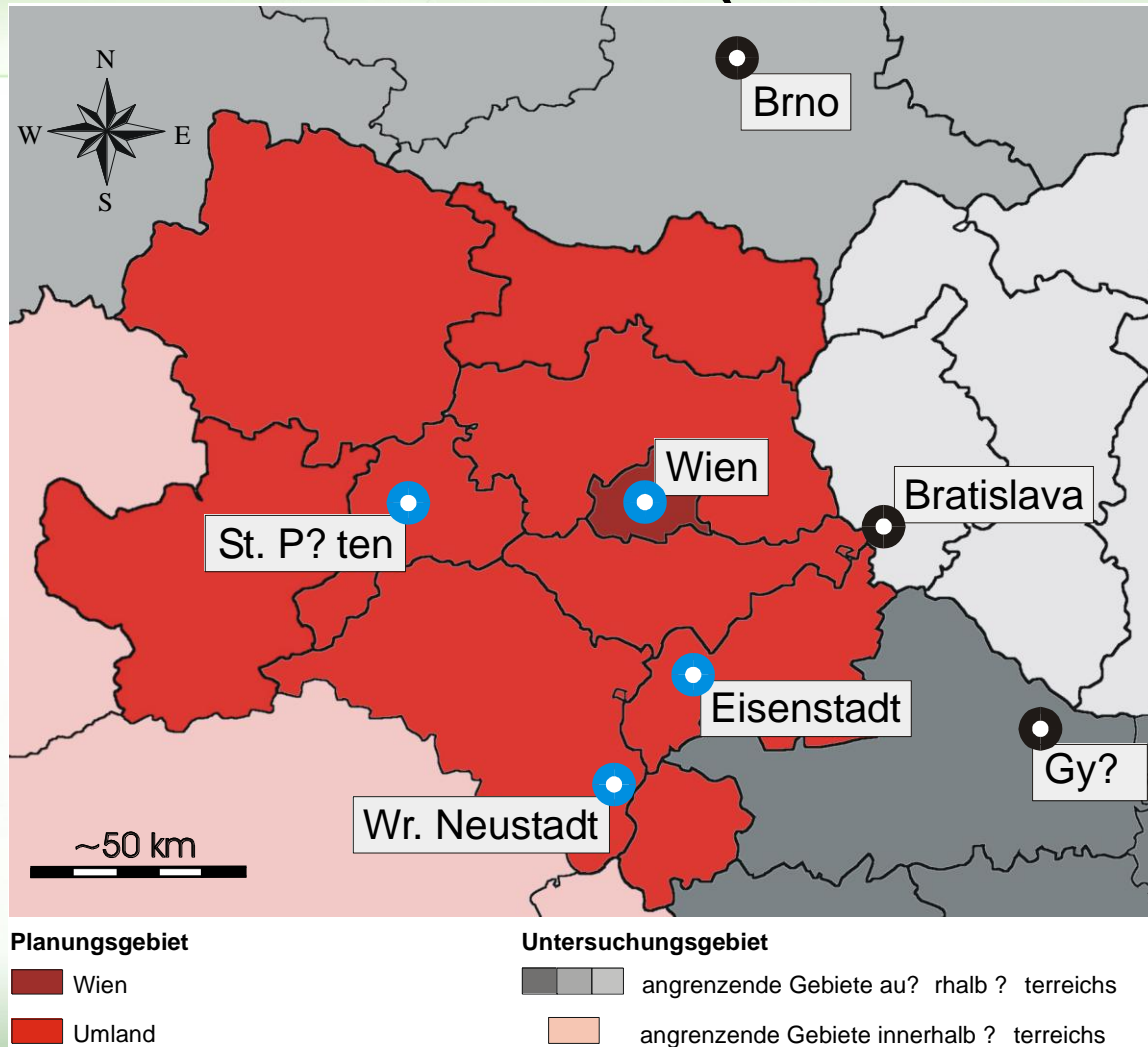
EXAMPLE: INTERNALISATION OF EXTERNAL TRANSPORT COSTS FOR CAR USERS



RESULT OF SDA INDEX FOR SUSTAINABLE TRANSPORT DEVELOPMENT (STD-INDEX)



CASE STUDY: MOBILITY SCENARIOS (VIENNA REGION 2035)



DEFINITION OF SCENARIOS (VIENNA REGION 2035)

Scenario Trend business as usual

- Infrastructure development in accordance with the transport master plan
- Extension of parking restrictions
- Decentralized development of housing

Scenario A with measures Goal: sustainable development

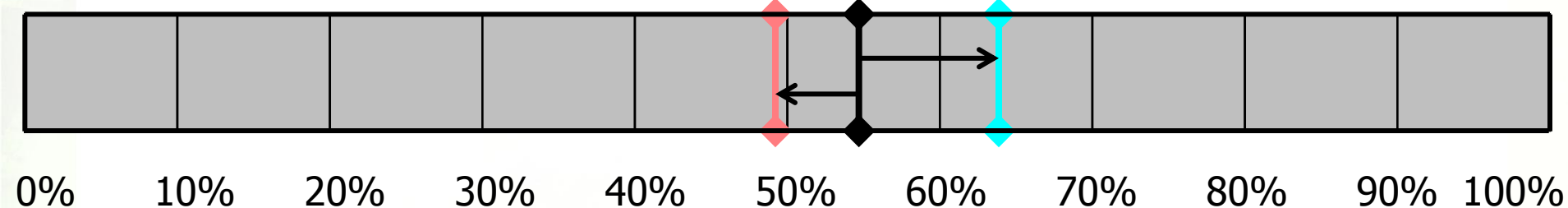
- Road Pricing:
Vienna 0,04 Euro/km
surrounding 0,02 Euro/km
pay double during peak hours
- Reduced new construction of road network
- Strong promotion of p.t. and non-motorized mode
- Mobility management
- Alternative technology of motor
- Public awareness campaigning



RESULT: SD-INDICES OF SCENARIOS (VIENNA REGION 2035)

Trend Scenario 2035
49%

Scenario A with measures
64%

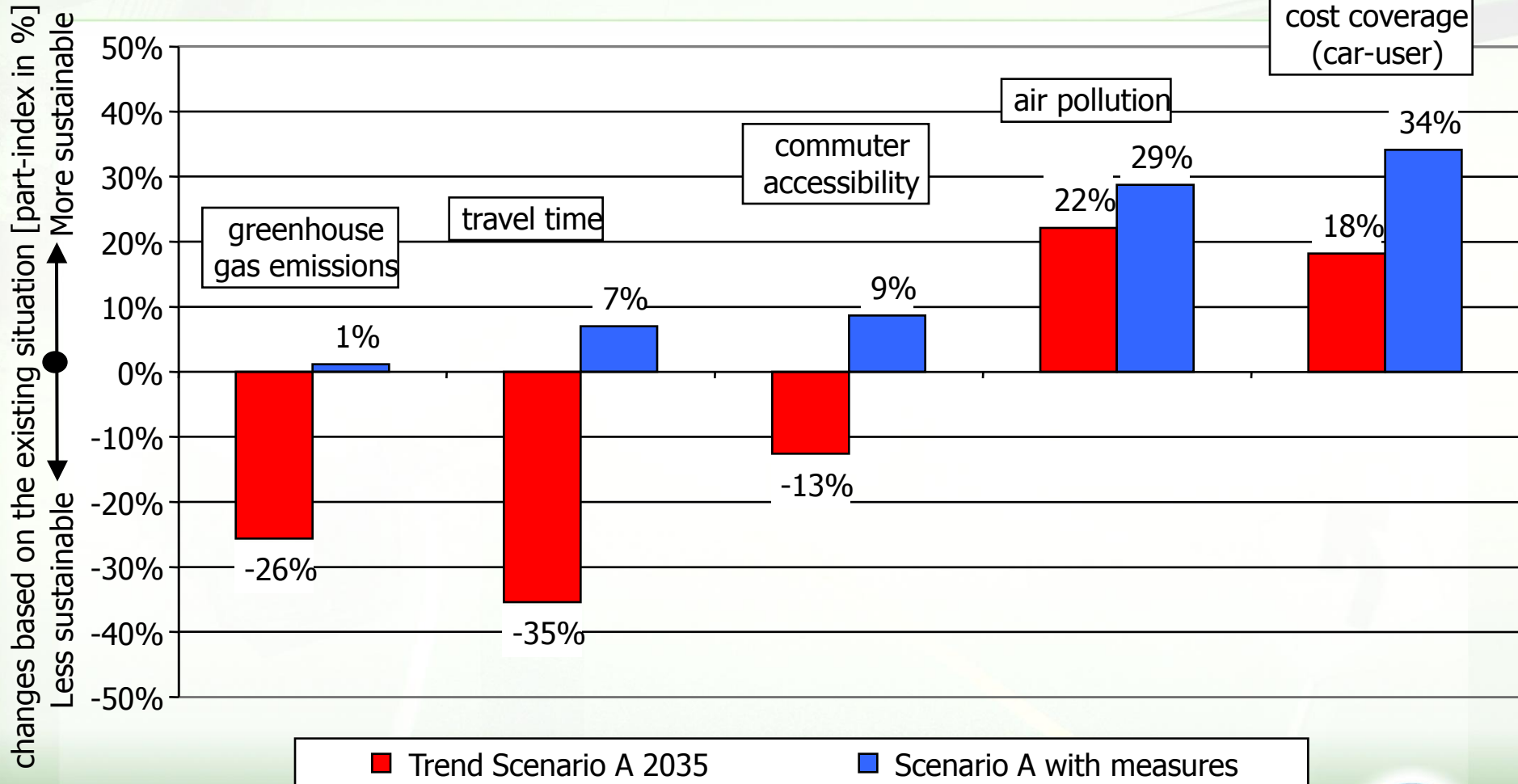


55%

Existing situation



CONTRIBUTION OF KEY CRITERIA TO SUSTAINABLE TRANSPORT DEVELOPMENT (VIENNA REGION 2035)



Reference: Shell Study, BOKU 2004



3 ELEMENTS OF eCBA

- Induced/suppressed travel demand
- Indirect impact of regional economic value added (location attractiveness)
- Distribution of cost and benefit (winners and losers)



EFFECTS OF TRANSPORT INFRASTRUCTURE INVESTMENTS

Effects during the operation phase

Direct effects

instantaneous effects

Effects related to users, operators, neighbours of new infrastructure

e.g. travel time, travel costs caused by new infrastructure

Direct network effects

relative instantaneous effects

Effects related to users, operators, neighbours outside of new infrastructure caused by behavioural changes

e.g. travel time, travel costs, noise of not directly affected persons, etc.

Indirect effects "third party effects"

lagged and long term effects

Effects outside of transport system caused by better accessibility

e.g. new shops, new residential estates, etc.

Indirect network effects

relative instantaneous effects

Effects of the transport system caused by indirect "third party effects"

e.g. induced demand, noise, etc.

covered by traditional CBA

not covered by traditional CBA



DEFINITION OF INDUCED/SUPPRESSED TRAVEL DEMAND

Effects by reduced generalized user costs (increased accessibility)

- New trips, additional new trip-length (new destinations)
- New travel demand by new development caused by reduced generalized user cost

Quantification of induced travel demand (ITD)

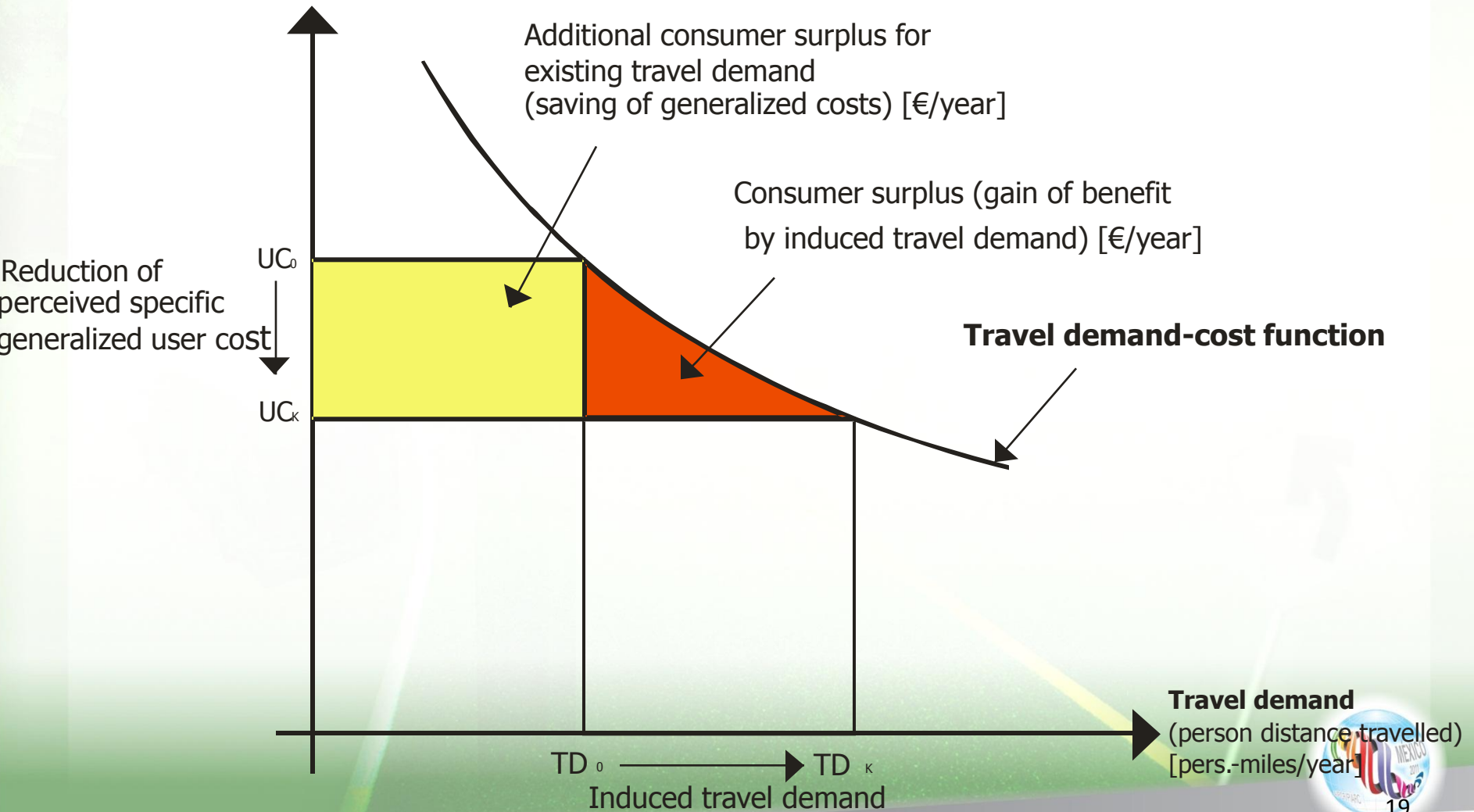
- Transport model
- Estimation: $ITD_k = TD_0 \left[\left(\frac{UC_k}{UC_0} \right)^\varepsilon - 1 \right] [pers. - miles / year]$

price-elasticity of travel demand $[-0,1 < \varepsilon - 1,0]$



CONSUMER SURPLUS OF INDUCED TRAVEL DEMAND

Perceived specific generalized cost [€/pers.-miles]



REGIONAL ECONOMIC VALUE ADDED (REVA) (REGIONAL ATTRACTIVENESS)

$$Accessibility_i = \sum_{i,j}^n SV_j \cdot e^{\beta \cdot UC_{i,j}}$$

i, j = 1, n index of zones

$UC_{i,j}$ = generalized user cost

SV_j = variable of regional structure
(e.g. residential population)

$REVA_i$ = function of accessibility, jobs,
density, urbanization

[Basler & Partner 2005]



ESTIMATES OF REGIONAL ECONOMIC VALUE ADDED BY TRANSPORT INFRASTRUCTURE PROJECTS IN AUSTRIA

Investment project	Network length of extension	Regional economic value added per year in % of total investment cost
Motorway Ennstal	78 km	~ 59 %
Railway Südbahn	160 km	~ 10 %
Underground lines U3 and U6 in Vienna	20 km	~ 8 %



DISTRIBUTION OF COST AND BENEFIT (1)

- Traditional CBA
→ information about overall cost and benefit

- No information
→ who wins }
→ who loses } what, when, where, how much?

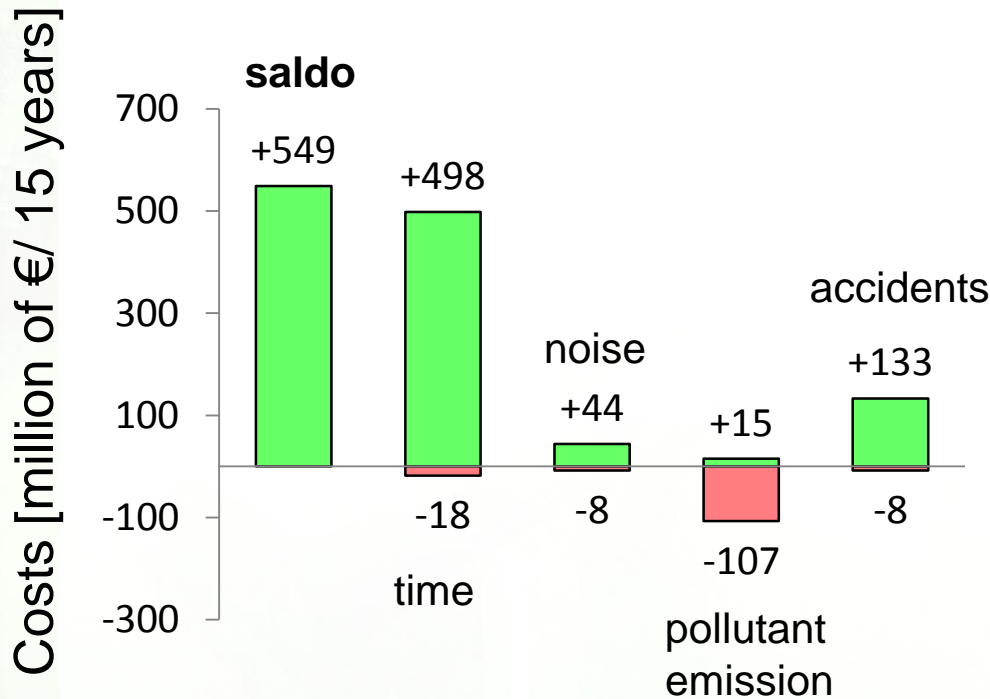


DISTRIBUTION OF COST AND BENEFIT (2)

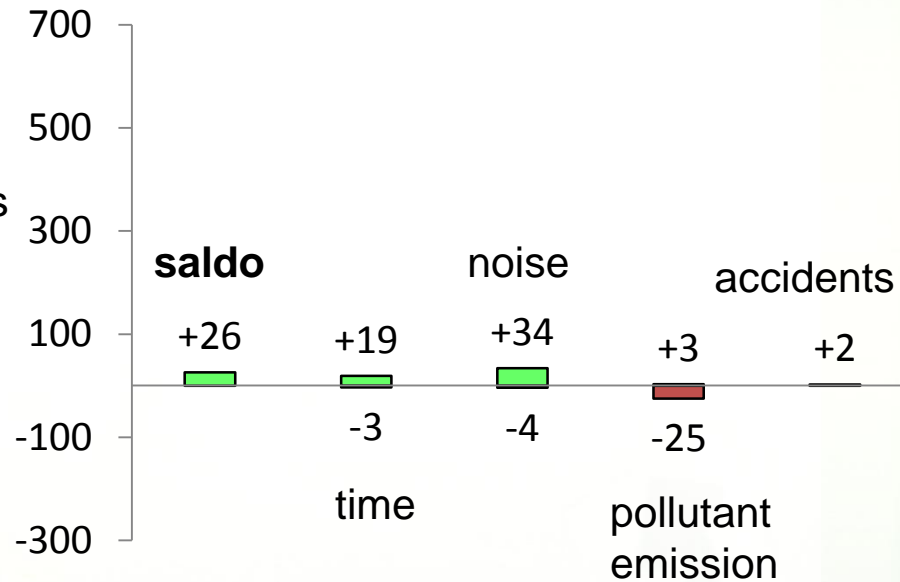
- Identification of winners and losers for cost & benefit (accidents, travel time, travel cost, environmental cost)
- Obligation to disclosure
 - numbers of winners and losers
 - for each component of cost and benefit
 - characteristics of winners and losers
 - etc.



DISTRIBUTION OF BENEFIT FOR POSITIVE AND NEGATIVE IMPACTS UPON PEOPLE



**Scenario 1:
Extension by express road**



**Scenario 2:
Extension by local by-pass road**



- **SDA and eCBA enable**
 - additional information about relevant impacts
 - distribution effect of impacts
- **Austrian guidelines for Strategic Impact Assessment of Transport Infrastructure**
 - 4 tools: eCBA (partly extended)
SDA
Environmental Impact Assessment
Functional Analysis of Transport System
 - Intermodal definition of alternatives
 - Alternatives with constructional and transport management measures
 - Travel demand model with confidence interval
- **SDA and eCBA need further research**





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