Martin Schmied, Head of Transport and Environment Division

Scenario building for urban transport

Leipzig, 19th of May 2014
Agenda

1. What are scenarios, how to use them?
2. How to create a baseline?
3. Cause-effect relation of potential mitigation actions, procedures for scenario development
What does the future hold for urban transport and how to reach sustainable mobility?

- From today perspectives it is hardly possible to forecast or predict the future since the future development of urban transport is highly complex and inherently unpredictable.
- To avoid forecasts and predictions scenario techniques were developed.
A book from 1980: Electric cars as economic and environmental option for the future
What are scenarios and why they are different to forecasts and predictions?

- “Coherent, internally consistent and plausible descriptions of possible future states of the world.” (IPCC, 1994)
- “Scenarios are consistent and coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present, and future developments, which can serve as a basis for action.” (Van Notten, 2005)
- “Visions or images of the future are often static ‘snapshots’ in time, whereas scenarios are dynamic, logical sequences of events.” (Banister, 2004)

⇒ Scenarios describes a **coherent and consistent way of future development** based on assumptions as starting point for actions

⇒ Scenarios gives only **information about possible and preferable futures**, but not about probable futures
What scenarios are for?

To help identify choices and policy options

To explore alternatives in the face of uncertainty

To illuminate potential problems and future opportunities

To uncover assumptions (mental maps) and discuss them

To share understanding and concerns

Source: Andrea Ricci, ISIS
Different types of scenarios: Explorative and normative scenarios

- Trend scenario / baseline
  - Environmental impact (e.g. GHG emissions)
  - What might happen?
  - Back-casting

- Explorative scenario
  - What we would prefer to happen?

- Target scenario / normative scenario
  - Target in the future

INFRAS | Urban Scenarios | 19th of May 2014 | Martin Schmied
Zurich: Example of a normative scenario on city level including urban transport

Result of a popular vote:
Target 1 t CO₂e/Person in 2050 (all sectors) ⇒ scenarios shall show possible ways to reach this goal

Source: Tiefbauamt Zurich.
Examples of scenario results for the transport sector (incl. air traffic) 2050 in Germany

Final energy consumption of the German transport sector in 2050

Differences caused by assumption of
• transport demand
• fuel efficiency
• vehicle technologies (fuels, propulsion concepts)
Agenda

1. What are scenarios, how to use them?
2. How to create a baseline?
3. Cause-effect relation of potential mitigation actions, procedures for scenario development
Trend scenarios describes the business as usual case

- “Reference scenarios” or “Baseline scenarios” are also called “Business as Usual (BAU) scenarios”
- A reference scenario reflects the continuation of present trends in transportation, moderated by likely changes in legislation and technology
- Only transport measures are considered which are still implemented or will be implemented within the time scale of the trend scenario ⇒ scenario only "with existing measures"

⇒ Trend scenario is baseline for the assessment of the impact of additional measures

⇒ On national level officially published trend scenarios (e.g. from the Ministry of Transport) are very often used to avoid discussions about correct baseline definitions
Trend scenarios are bordered by best and worst case scenarios

**Concept of trend scenarios:**
- The best and worst case scenario are based on extremely positive or negative development of the external factors and frame conditions
- Probability of trend scenario is higher than the probability of the both extreme scenarios

**Identification of trend scenario:**
- Identification of (external) impact factors
- Identification of key indicators/factors
- Assumption for future development of key indicators/factors
- Analyses of consistency of key indicators/developing scenarios
- Identification of trend scenario
Example for external factors influencing passenger transport

<table>
<thead>
<tr>
<th>Internal Factors</th>
<th>External Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Measures</td>
<td>Society</td>
</tr>
<tr>
<td>Service Quality</td>
<td>Life Style</td>
</tr>
<tr>
<td>Cost of Service</td>
<td>GDP Employment Income</td>
</tr>
<tr>
<td>Modal Split</td>
<td>Land Use Pattern</td>
</tr>
<tr>
<td>Mileages / VKT</td>
<td>Economy</td>
</tr>
</tbody>
</table>

Source: Andrea Ricci, ISIS
Example for external factors influencing freight transport
Reference scenarios are often based on historical analyses: Example crude oil prices

Development of crude oil prices in US-$/barrel 2005-2035

Source: Oeko-Institut
Reference scenarios are often based on historical analyses: Example transport volume

Zurich: Development of number of trips by cars and public transport

Result of an new household survey
Reference / baseline scenario: Calculation of transport demand and GHG emissions

Transport demand model

- Infrastructure
- Costs of Mobility
- Population
- Employment
- Land use pattern

Emission model (+fleet model)

- Alternative fuels
- Fleet development
- Alternative propulsion concepts
- Fuel efficiency

Transport demand by mode of transport

Energy consumption and GHG emissions of transport
Zurich: Transport volume in 2005/2010 and in the trend scenario 2025

-6% percentage points!
Agenda

1. What are scenarios, how to use them?
2. How to create a baseline?
3. Cause-effect relation of potential mitigation actions, procedures for scenario development
Scenario with additional measures and their impacts on the transport sector

Scenario “with additional measures“:
- Impact of measures will be investigated against baseline
- Intensity of measures depend on baseline definition

Impact of measures will be investigated against baseline. Intensity of measures depend on baseline definition.

Scenario with additional measures and their impacts on the transport sector

| Urban Scenarios | 19th of May 2014 | Martin Schmied 20 |
---|---|---|

Impact

- **Avoid** (reduction of trips and distances)
- **Shift** (shifting to environmental-friendly modes)
- **Improve** (enlargement of energy efficiency)
- **Fuel** (reduction of CO₂ intensity of energy carrier)

Measures

- Market regulations and access
- Regulatory measures (e.g. bans or incentives)
- Economic measures (e.g. taxes, fees or PPP)
- Extension or new infrastructure
- Integrated land use and transport planning
- Subsidy programme (e.g. R&D, pilot projects)
Cities have only limited possibilities to introduce GHG mitigation measures

Example of Zurich: How to reach the goals of a 2000 Watt Society in the transport sector

- City Zurich
- Canton Zurich
- National Government

Goal: 0.4 t CO₂e/person (only transport)

Scenario “2000 Watt Society”

Gap?
Analyses of the impact of the scenario by using different methodologies

### Scenario “with additional measures”

- **Avoid**
  - Potential influence of cities
    - Transport demand models
    - Econometric models
    - *Experts' estimates based on literature reviews (Urban transport)*

- **Shift**
  - Limited influence of cities
    - Vehicle stock model (as part of an emission model)
    - Econometric models

- **Improve**
- **Fuel**

#### Transport demand
- Passenger cars
- Public transport

#### Fuel efficiency
- Trucks

#### Fuels/drive train
- Motorcycles
Experts' estimates of the impact of measures based on literature reviews

Example of Zurich: Impact analyses for parking management

<table>
<thead>
<tr>
<th>Passenger cars</th>
<th>Trips</th>
<th>Perform. (pkm)</th>
<th>Load factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2025</td>
<td>-2%</td>
<td>-2%</td>
<td>1%</td>
</tr>
<tr>
<td>2050</td>
<td>-5%</td>
<td>-5%</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Public Transport</th>
<th>Trips</th>
<th>Perform. (pkm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2025</td>
<td>85%</td>
<td>85%</td>
</tr>
<tr>
<td>2050</td>
<td>85%</td>
<td>-85%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-motorised traffic</th>
<th>Trips</th>
<th>Perform. (pkm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2025</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>2050</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Reduction compared to trend scenario / baseline
Share of trips and traffic performance shifted (missing percentage points are avoided traffic)
Assessment of GHG mitigation potential of selected measures: Example Zurich

Zurich: GHG emission reductions for different measures

Responsibility of Zurich
Vehicle fleet can only partially be influenced by cities

Zurich: Fleet composition 2010-2050

Development of fleet composition will mainly be affected by measures on national or European level
Thank you for your attention

Martin Schmied
Head of Transport and Environment Division
INFRAS
Muehlemattstr. 45
CH-3007 Bern
Switzerland
Tel +41 31 370 19 16
martin.schmied@infras.ch