After the oil age: Do we have to rebuild our cities?

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Transport and urban development

The growth of the modern city is based on mobility. The railway and later the automobile made the expansion of cities into metropolitan areas possible.

Because transport is fast, efficient and cheap, households can afford to enjoy life in the suburbs and continue to work in the city.

Mobility is commonly associated with freedom of choice and the pursuit of desirable activities.

The limits to mobility are determined by time and money budgets.

Problem

This implies:

- If travel becomes faster or less expensive, people will make more and longer trips.
- If travel becomes faster or less expensive, people will choose more distant locations.
- If people will get more affluent, they will make more and longer trips and choose more distant locations.
- If people have to work less, they will make more and longer trips and choose more distant locations.
- If all this happens together, people will make more and longer trips and choose more distant locations.
New Challenges

The Kyoto Protocol of the United Nations Framework Convention on Climate Change adopted in 1992 set mandatory targets for the reduction of greenhouse gas emissions compared to 1990:
- 5.2% world-wide
- 8% for Europe
- no reductions for developing countries
Signed by 169 countries, in force since 2005

Emission targets

On 9 March 2007, the EU heads of state signed a resolution to achieve until 2020:
- 20% less energy
- 20% renewable energy
- 20% less CO₂

Emission targets

On 13 March 2007, the British Prime Minister Blair announced that Great Britain will reduce its greenhouse gas emissions by 26% to 32% until 2020 and by 60% until 2050.

Emission targets

On 9 June 2007, the leaders at the G-8 Summit committed their countries to aim at a world-wide reduction of greenhouse gas emissions by 50% until 2050.

From research to action

"Ecological self-destruction is well in the range of possibilities of evolution. It is necessary to at least take account of the possibility that a system affects its environment in a way that it later cannot survive in that environment."

Niklas Luhmann: Ecological Communication (1986)

The Hubbert Peak

If the world-wide consumption of petroleum continues to rise as in the past, the petroleum resources known today will be exhausted by the year 2060.
Non-OPEC oil production decline
LBST (2004)

World oil consumption 1970-2025

New York Times, 8-9 May 2004

The oil crunch is not going to go away

We can neither drill nor conquer our way out of the problem. What we have to do is adapt.

China’s thirst for oil

China’s energy consumption
- has grown by 60% 1990-2003 (EU 15%)
- is second only to that of the US

China’s energy intensity
- is five times that of the US

China’s CO₂ emissions
- are second only to those of the US
- are larger than those of the EU

China’s car ownership
- is 10 million cars today
- is 7-8 per 1,000 population (EU 470)

Energy prices
Between 1970 and 2007 the price of crude oil has grown by a factor of seven (in real terms). In the last two years it has almost doubled.

Experts believe that, because of the ultimate depletion of oil resources, political instability in the Middle East and growing energy demand by fast developing countries like China, India and Brazil, energy will continue to become more expensive.

Will we have to rebuild our cities?

What will be the consequences of high energy prices for our cities?
Will their more and more dispersed land use patterns still work under severe mobility constraints?
Or will we have to rebuild them in high-density mixed-use form like the medieval city?

The STEPs Project (2004-2006)
The EU 6th RTD Framework project STEPs (Scenarios for the Transport System and Energy Supply and their Potential Effects) developed and assessed possible scenarios for the transport system and energy supply of the future.

In the project five urban/regional models were applied to forecast the long-term economic, social and environmental impacts of different scenarios of fuel price increases and different combinations of infrastructure, technology and demand regulation policies.

Here the model results for the urban region of Dortmund, Germany, will be presented.
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### STEPs Project partners

- Bucks Consultants International, NL
- Athens University of Economics, GR
- University of Leeds, UK
- European Commission JRC/IPTS
- Katholieke Universiteit Leuven, BE
- WSP LT Consultants, FI
- Senter Novem, NL
- Spiekermann & Wegener, DE
- STRATEC, BE
- Trasportes, Innovaçao e Sistemas, PT
- Transport Research Laboratory, UK
- Trasporti e Territorio, IT
- Transport and Travel Research, UK
- Universidad Politecnica de Madrid, ES

### The STEPs Project: Scenarios

The project developed a set of scenarios assuming different rates of energy price increases with three sets of policies:

<table>
<thead>
<tr>
<th>Fuel price increase</th>
<th>Do-nothing</th>
<th>Business as usual</th>
<th>Infrastructure &amp; technology</th>
<th>Demand regulation</th>
<th>All policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>+1% p.a.</td>
<td>A-1</td>
<td>A0</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
</tr>
<tr>
<td>+4% p.a.</td>
<td>B-1</td>
<td>B0</td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
</tr>
<tr>
<td>+7% p.a.</td>
<td>C-1</td>
<td>C0</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
</tr>
</tbody>
</table>

### Model Framework

#### Model levels

- Regions
- Zones
- Raster cells

#### Economic impacts

According to the SASI model, the fuel price increases and related policies of the scenarios have significant negative impacts on the economy of the Dortmund urban region:

- Do-nothing: 
- Business as usual: 
- Infrastructure & technology: 
- Demand regulation: 
- All policies: 

#### Mobility Impacts
Land Use Scenarios

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Business as usual | Polycentric | Compact city

Population

Scenario B3 compared to Scenario A-1 in 2030 (%)

Impacts of land use on travel (1)

High-density mixed-use urban forms have a significant impact on travel distance:

Impacts of land use on travel (2)

High-density mixed-use urban forms have a significant impact on choice of mode:

Where are we going?

The existing land use and mobility patterns in cities are not sustainable and tend to become less sustainable:

Further growth in income will result in:
- further spatial decentralisation of land uses,
- higher car ownership,
- more and longer trips,
- more energy consumption and greenhouse gases,
- more traffic noise and air pollution,
- less open space and natural habitats.

We cannot go on like that forever.

New challenges

The prospects of climate change and energy scarcity require action to reduce greenhouse gas emissions and energy consumption by transport.

Technological innovation alone is not likely to achieve the necessary reductions. This implies that also reductions in mobility will be required.

The most efficient way to reduce mobility is to increase the price of energy.

It is therefore likely that fuel prices will rise significantly, either by exogenous world market developments or by political intervention in form of taxes or user charges.
Economic impacts
Fuel price increases will have significant negative impacts on the economic development of urban regions.
Growing fuel costs and related policy responses will lead to a reduction in accessibility and economic growth.
Higher costs of transport will make goods more expensive and increase the cost of living.
The economically stronger urban regions will be affected more – in absolute terms. This will lead to a reduction in polarisation and a more balanced urban system.

Mobility impacts
Fuel price increases will lead to significant changes in daily travel behaviour.
The long-term trend towards more and longer trips and more trips by car will be stopped or even reversed.
Average travel distances per capita will return to the level of the 1990s, average travel distances by car to the level of the 1980s and before.
There will be a renaissance of walking and cycling, and the share of public transport trips will more than double. The share of car trips will decline to that of the 1970s.

Social impacts
These changes in travel behaviour will not be voluntary but forced responses to severe constraints and will imply a substantial loss of quality of life.
The reductions in trips and trip distances will affect social or leisure trips most: every such trip not made will mean a friend not visited, a meeting not attended or a theatre performance or soccer match not seen.
Rising costs of transport will mean also financial stress for households, who will have to spend more on travel than before, although their income will grow less and housing will become more expensive.

Environmental impacts
The positive side-effects of the reduction in traffic caused by rising fuel prices will be its environmental effects.
Every car trip not made and every km the remaining trips will be shorter will mean less greenhouse gases, air pollution and accidents.
The efforts to develop more energy-efficient cars and alternative vehicles stimulated by fuel price increases will contribute to the positive environmental balance.
From the point of view of achieving the Kyoto objectives, high fuel prices are the best possible prospect.

Do we have to rebuild our cities?
European cities contain a huge potential for internal re-organisation by better co-ordination of activities.
If travel will be more expensive, daily life will become more local: far destinations will be replaced by nearby ones that can be reached by cycling/walking.
Accessibility will again become important in location decisions: households will move closer to jobs, shops and schools and firms closer to workers and clients.
High-density mixed-use urban structures will result in further reductions in fuel consumption without severe loss of quality of life.

Integrated strategies
The challenges of climate change and energy scarcity cities are facing today require integrated and long-term land use and transport strategies.
Successful integrated land use and transport strategies at the municipal and regional level include:
- a combination of pricing policies directed at car users with moderate public transport fares,
- public transport infrastructure investments to improve public transport speed and service,
- a land use plan supporting living near central areas, in satellite cities or along public transport corridors.

Governance
Integrated and long-term land use and transport strategies at the municipal and regional level require:
- a strong regional planning system and efficient mechanisms of horizontal and vertical co-ordination,
- a broad public debate between researchers, policy makers, stakeholders and citizens,
- raising public awareness of the importance of adopting a more sustainable way of life.

More information