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## 11. RECOMMENDATIONS TO LOCAL AND REGIONAL AUTHORITIES

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### 11.1. Introduction

This section presents the final recommendations to local and regional authorities which can be formulated on the basis of the outcomes of the whole project. Some policy recommendations are directly derived from the policy simulations: those policies were therefore quantitatively evaluated. Some other policies recommended are derived from the case cities ; they were not quantitatively evaluated and look rather like “best practices”. They are mentioned here because they contain innovative aspects or should become more generalised. Finally, some recommendations related to the institutional aspects derive from the analysis on inter-institutional cooperation.

These recommendations are intended for any small, medium-size or large cities implementing new public transport which will improve the accessibility with suburban areas, for cities simply facing sprawl, for suburban municipalities involved in a sprawl process, or any cities concerned by sustainable urban development, like those which committed in the Aalborg process<sup>1</sup>. Some of these recommendations can be implemented at the local, municipal level ; some others require coordination at a supra-municipal level.

### 11.2. The specific case of urban sprawl due to public transport investments

The simulations in Brussels and Helsinki have shown that new radial rail services providing a significant improvement in the accessibility between the suburban areas and the urban centre generate indeed sprawl of population and concentration of employment. A consequent change in the home-to-work mobility pattern is the lengthening of the home-work trips (e.g. increase by 8% due to the implementation of the RER in Brussels ; increase by 12 % in the scenario of local investment plan + speeding up the rail services by 25 %, in Helsinki). It is worthwhile noting that households decide to out-migrate towards suburban areas not only because of the improved accessibility by public transport, but also because of the consequent better accessibility by road (the modal shift due to the rail investments alleviates to some extent the congestion on the roads)<sup>2</sup>.

On the other hand, the rail investments lead to an improvement of the indicators related to the modal share: decrease of the car mileage and increase of the public transport share. In the 2 scenarios mentioned above, the decrease in CO<sub>2</sub> emissions is by 8 % (Brussels) and 2 % (Helsinki). However, the potential total “short-term” improvement (i.e. the improvement which would have occurred if there was no change in activity location, neither lengthening of the trip distances) would have been even higher. In other words, one negative effect of

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<sup>1</sup> The Aalborg Charter is a Charter about sustainable urban development and was adopted at the First European Conference on Sustainable Cities and Towns, that took place in Aalborg, Denmark, in 1994. The 4<sup>th</sup> European Sustainable Cities and Towns Conference, which took place in 2004 (“Aalborg +10”), adopted the “Aalborg + 10 Commitments”, which are seen as an important step from theory to real actions. Cities having signed the Commitments agree to make an environmental review of their city, identify targets and monitor progress.

<sup>2</sup> It is well known that generally, in congested areas, at short term (i.e. without change in location), the users who benefit the most from public transport investments, in terms of travel time savings, are the car drivers, rather than the public transport users. This was quantified for example for the case of the RER within the study area of Brussels, in a previous study by Stratec, on behalf of the Brussels -Capital Region (study IRIS 1, 1991-1996).

sprawl is to “consume” a part of the potential benefits of the public transport investments, with regard to the reduction of car mileage and emissions.

### 11.3. Mono-centric versus polycentric approach

As a foreword to the policy recommendations, it is worth noting that the approach adopted in SCATTER, with regard to the identification and measurement of sprawl, was a poly-centric approach rather than a mono-centric approach. This means that when evaluating the effects of policies in the work package dedicated to simulations, two types of indicators were calculated: the first ones were related to the “urban centre” (as opposed to all the peripheral areas), while the second ones were related to “all the urban zones”, i.e. all zones urbanised, including small or medium-size urban centres in the periphery. In this view, “increasing the urban concentration” meant “increasing the share of population and activities located in all the urban zones taken together”, and not necessarily “increasing the share of population and activities located in the urban centre”. This more comprehensive approach is essential, in particular in connection with the necessary inter-institutional cooperation, which is tackled later below in this report. To give a more precise idea, here are the definitions of the “urban centres” and “urban zones” which were adopted in the 3 case cities for which simulations were carried out: respectively in Brussels, Helsinki and Stuttgart, the “urban centre” was defined as the Brussels-Capital Region, the city centre of Helsinki, the city of Stuttgart ; the “urban zones” were defined, in Brussels: as the total set of communes defined as urban in the regional land use plans (i.e. 60 communes in all), in Helsinki: as the whole metropolitan area and its suburbs, in Stuttgart: as the city of Stuttgart and the outer urban ring (i.e. 37 communes in all). Finally, it is worth noting that secondary urban centres (small or medium-size cities) may themselves also face sprawl.

### 11.4. Policy recommendation 1: Tax on suburban residential development (“impact fee”)

This policy means applying a tax on suburban residential developments, in order to internalise a part of the external costs generated by these new housings in terms of equipments and infrastructures. It is an application of the “polluter pays” principle. The recommendation is derived from the results of the simulations performed for Brussels, Helsinki and Stuttgart. The scenario simulated was indeed the application of such a tax on the housings locating in non-urban areas, combined with a fiscal incentive (i.e. a tax reduction) for the housings located in the urban areas. In the scenario, the tax in the suburban areas amounted, in all 3 cities, to 670€/housing/year, which correspond to a one-shot tax of 13 400 € distributed on 20 years. In the case of Helsinki only, two other tax levels were also simulated, namely 340 € and 1 000 €/housing/year. The tax reduction in urban zones was in each case calculated so that globally, the total policy had no cost for the authority. The conclusion of the simulations was that this measure was efficient to concentrate the population in the urban zones (at least as efficient as better known policies based on car use pricing) and also tended to concentrate the induced employment<sup>3</sup> in urban areas. However this scenario had no or poor effect on the car mileage and the CO<sub>2</sub> and pollutant emissions, contrary to car use pricing policies.

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<sup>3</sup> *Induced* employment: employment generated by the local demand, i.e. by the demand from households or economic activities located in the study area. The location of the induced employment is therefore depending on the accessibilities within the study area, contrary to *basic* sectors, which do not respond to a local demand, but respond to an external demand; their location is therefore not or poorly depending on the accessibilities within the study area. Basic sectors are for example agriculture, industry, central public administration.

That kind of fiscal measure has been among others recommended by the European Conference of Ministers of Transport<sup>4</sup>. It is used for more than 3 decades in the United States, under the name “impact fee”, to control urban sprawl and to internalise the external costs of the suburbanisation<sup>5</sup>. Already in the ‘50s, the municipalities were annoyed that the developers made only minimum works to equip the site, so that those minimum works had anyway to be improved by the municipalities on their own public resources. The tax was born in the years 70’ and has the form of a one-shot tax imposed to the developers for new suburban developments. At the begin, the tax was intended to finance the works to be done on the site itself. Then the tax was extended to cover also the works necessary to connect the new developments to existing networks (sewage, water provision, road network, ...) (“off-site tax”). Later, the Supreme Court of the US put some stricter rules on the way this tax had to be calculated. Currently, 23 States impose this tax to any new housing development to cover the long-term marginal cost of the improvements to be provided to infrastructures, equipments and services.

This type of fiscal measure raises the issue of the decision level authorised to levy the tax: in a context of spatial competition between municipalities, it is possible that most municipalities do not collect the tax, even if they may legally do it.

In the current French urban planning system for example, the concept of impact fees to offset the cost of local government provision of infrastructure (*taxe locale d’équipement*) exists. Since 2000, a legal procedure (*Participation pour le financement des voies nouvelles et de leurs réseaux*)<sup>6</sup> authorizes municipalities to ask to land owners a financial participation to the building of new streets and technical networks when their land is recognized as a future residential space in the local spatial planning document. However, at least in some regions, the local authorities do not collect the tax, to remain competitive as a location, compared with the neighbouring municipalities.

In the same way, in the United States, out of 18 000 or so jurisdictions with the power to charge such impact fees, only 500 actually operate such instruments<sup>7</sup>. These both examples highlight the importance of raising awareness about the effects and costs of urban sprawl, among others by cognitive actions (see below).

Another difficulty is the acceptability of any fiscal measure, but this acceptability could be enhanced if the tax is implemented jointly with a tax reduction in the urban zones.

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<sup>4</sup> *Politiques spatiales et transports – Le rôle des incitations réglementaires et fiscales, Conclusions de la Table Ronde de la CEMT n° 124, Paris, 7-8 November 2002.*

<sup>5</sup> Source: Duncan associates and Cooper Consulting Company: Impact Fee Study – Policy Directions Memorandum – Fayetteville, Arkansas, April 2001.

<sup>6</sup> This makes part of the framework of the law “*Solidarité et renouvellement urbain*”, 13 December 2000.

<sup>7</sup> Source: interviews of US experts Richard Brail, Robert Burchell and Reid Ewing by Michaël Batty (CASA), in the work package 4 of SCATTER (case studies).

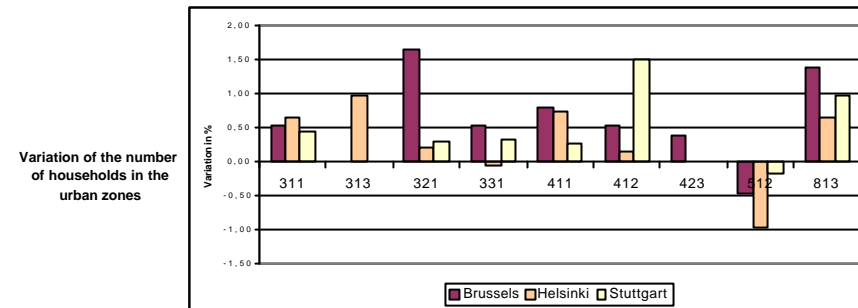
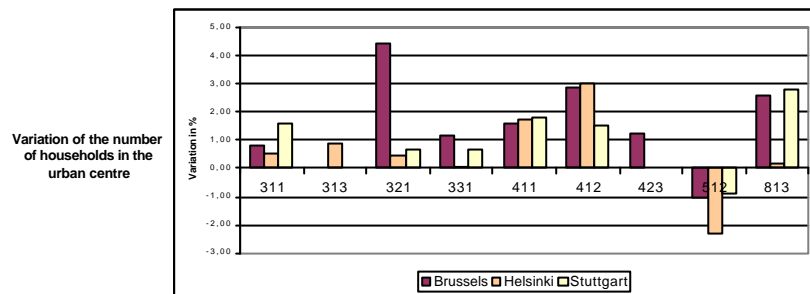


Figure 11.1 : Simulation results in Brussels, Helsinki and Stuttgart.

Effects of policies on the number of households in the urban centre and the urban zones. Scenarios 311-313: tax on residential suburban developments (respectively 670 €/year/housing and 1 000 €/year/housing) combined with tax reduction in urban areas – Compare with scenario 411 (increase of car use cost by 50 %) and 412 (cordon pricing).

Note: The overall level of the variations may seem low. It has to be reminded that some categories of households and economic activities (the so-called “basic” sectors) are assumed not to be affected by the policies simulated, and that they represent a significant percentage. In the Brussels case for example, the retired and old people represent about 25 % of the households (in 2001). Similarly, central administrations, universities, heavy industries do not respond to a local demand, but rather to an inter-regional or national demand; their location is assumed to be not influenced by the policies. To give a better idea, in terms of population, 1% change in the urban centre represents respectively a variation by 4 700 households in Brussels, 3 000 households in Helsinki, 5 900 inhabitants in Stuttgart ; 1% change in the total urban zones represents a variation by 9 000 households in Brussels, 7 700 households in Helsinki, 14 200 inhabitants in Stuttgart.

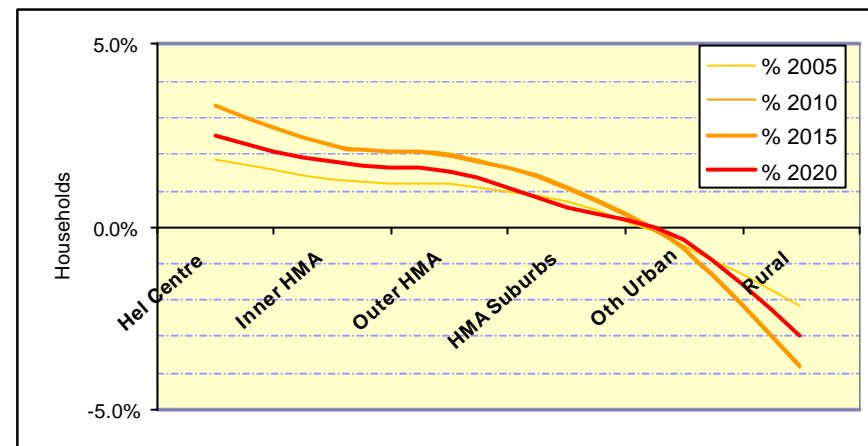
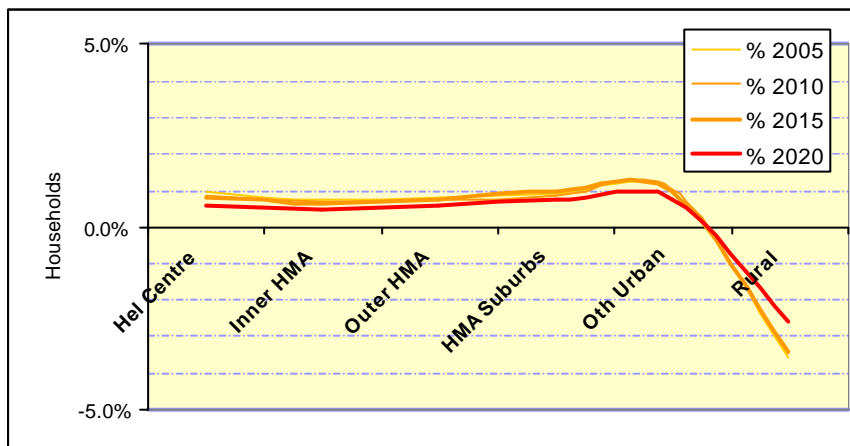


Figure 11.2 : Simulation results in Helsinki. Left: Effect of a tax (development impact fee 670 €/year/housing) in non-urban areas combined with a tax reduction in urban areas. Right: Effect of a increase of car use cost by 50 %.

## 11.5. Policy recommendation 2: Tax on offices located in zones not served or poorly served by public transport

This measure is inspired from the ABC approach<sup>8</sup> which was developed in The Netherlands. The measure is based on the distinction between “A-type” zones and “non-A type” zones, the “A zones” being zones which are well served by high quality public transport at regional or even national level (e.g. areas surrounding railway stations served by inter-city rail services). The measure consists in putting an annual tax on the offices located in “non-A zones” and is of course intended to incite companies to locate in A-type zones. The tax is intended to cover the social marginal cost of transport generated by the location of economic activities outside A-zones. Again, it is an application of the “polluter pays” principle. The simulations performed in Brussels have shown that this measure was efficient to move jobs towards this type of zones, and that, as indirect effect, the measure also incites households to move towards urban areas, to follow employment. In fact, the potential effectiveness depends of the percentage of jobs already located in that kind of zones, in the reference scenario. For example, the percentage in the reference scenario was 37 % in Brussels, versus 70 % in Helsinki, which explains that the policy appeared to be much more effective in Brussels than in Helsinki. Besides, in Brussels and Stuttgart, this measure targeted to work places had a significant indirect effect on the household location. *The simulation results in all the 3 cities show that, with regard to the concentration of the population in urban zones, this measure combined with the previous one would be roughly as effective than a drastic increase of car use cost (by 50 %).*

In the scenarios simulated, the measure was applied to the sector “business services”. The amount of the tax was defined as the actual cost<sup>9</sup> of a yearly public transport season ticket (the tax levels simulated were respectively 1 985 €/job/year in Brussels, 710 €/job/year in Helsinki, 975 €/job/year in Stuttgart). The underlying idea is that if a job locates in a non-A zone, the employer should pay the real cost of providing public transport to that location or, in other words, that the revenue from the tax should make up the operating loss of the public transport company. This approach is close to the tax called “*versement transport*” already enforced in France.

On the other side, like the previous one, this measure has no or poor effect on the transport indicators according to the simulation results. The only case where land-use targeted policies led to a significant decrease in the car mileage was a drastic regulatory measure forcing *all* jobs of the “business service” sector to locate in A-type zones.

In practice, the tax could be adjusted according to the type of location and the level of public transport service (i.e. according to a classification finer than a rough binary system A/non-A). The tax could also be combined with a fiscal incentive, i.e. a tax reduction for companies locating in A zones.

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<sup>8</sup> Roughly, the ABC theory states that there should be a good adequacy between the “mobility profiles” of the companies and the “accessibility profiles” of the locations (A, B, C profiles). A-type companies (i.e. with high concentration of employment, and/or large number of visitors, and whose activities are not very dependent on access by road) should be located in A-type sites (i.e. sites with high-quality access by public transport and poor access by car). On the opposite side, C-type companies (low concentration of jobs, small number of visitors, activities heavily dependent on access by road) should be located in C-type sites (with high-quality access by car or lorry).

<sup>9</sup> Actual cost: i.e. cost including the state subsidies.

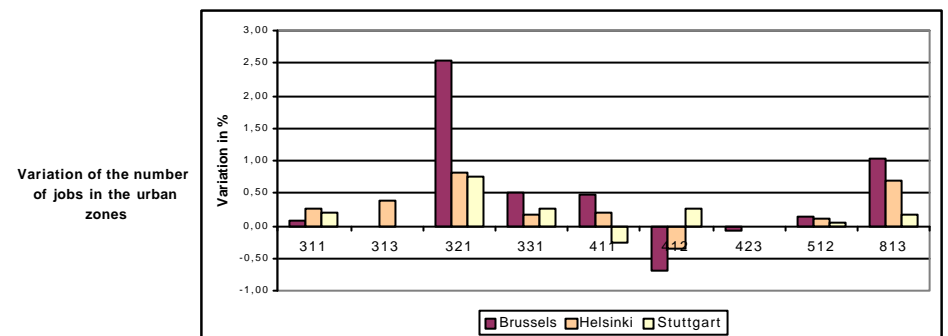
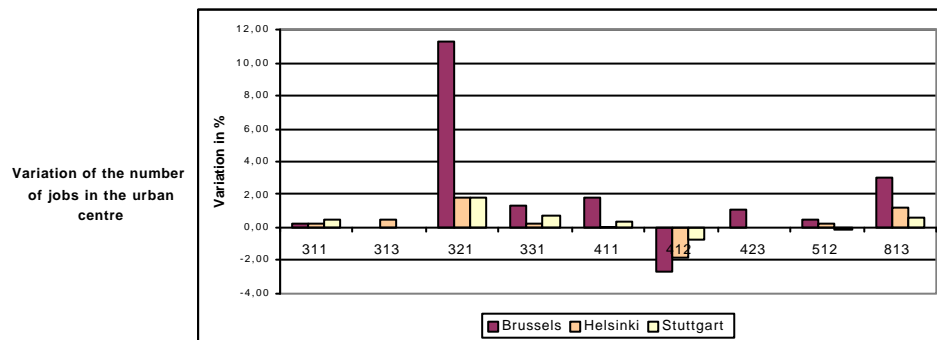


Figure 11.3 : Simulation results in Brussels, Helsinki and Stuttgart. Effects of policies on the number of jobs in the urban centre and the urban zones. Scenario 321: regulatory measure forcing the business services to locate in A-zones. – Scenario 331: fiscal measure inciting the business services to locate in A-zones. Compare with scenario 411 (increase of car use cost by 50 %) and 412 (cordon pricing). See the indirect effects of 321 and 331 on population on Figure 11.1. Compare the sum of the effects of 311 and 331 to the effects of 411, on Figure 11.1.



## 11.6. Policy recommendation 3: Congestion pricing

Congestion pricing means increasing the cost of car use during peak hours, in congested areas. The scenario simulated in Brussels, Helsinki and Stuttgart was an increase of the car use cost by 50 % for all drivers in the study area. The simulations have shown that this measure clearly leads to a concentration of the population in the urban zones. In Brussels and Helsinki, it also leads to a concentration of the employment in the urban zones. The effect of concentration of population is just an application of the following general principle: households tend to out-migrate towards suburban areas when the travel cost (or times) decreases, and on the contrary, tend to concentrate around the work places, when the travel cost (or times) increases. The second positive effect of the measure is a significant decrease in the total car mileage, and consequently, in the CO<sub>2</sub> emissions and pollutant emissions.

In practice, in some cases (like in Brussels), the increase in car use cost could be implemented through various measures, such as the suppression of the system of company cars which provides some categories of employees with cars whose costs are totally or partially covered by their employer.

This transport measure as well as the next one have been added to the two first fiscal measures focussed on land use, because land use measures alone have no or low impact on the total car mileage (this has been shown by the simulations). Transport measures have therefore been added to the package of recommendations, because they contribute to the urban concentration (counter-acting the negative effects of the public transport investments), and also because they reinforce the positive effect of the public transport investments which is to reduce the car mileage.

The three first policies recommended consist therefore all three in an internalisation of external costs, i.e. an application of the “polluter pays” principle. The principle is economically fair, but the acceptability of the practical measures is generally low. However, this type of measure provides the authorities with financial resources for new investments, and it can be made more acceptable by ear-marking, for example for public transport services or urban embellishment.

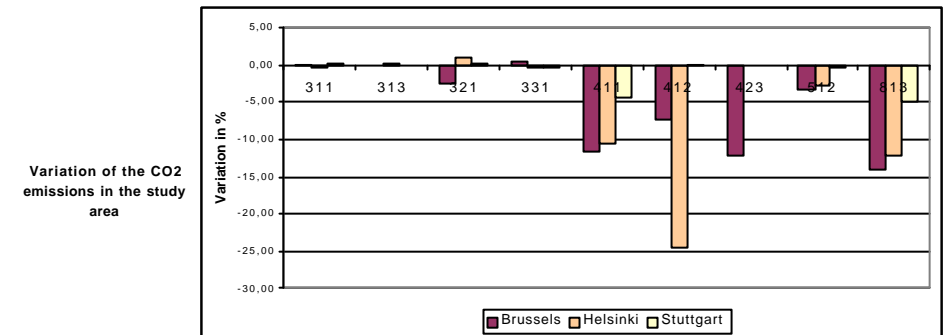
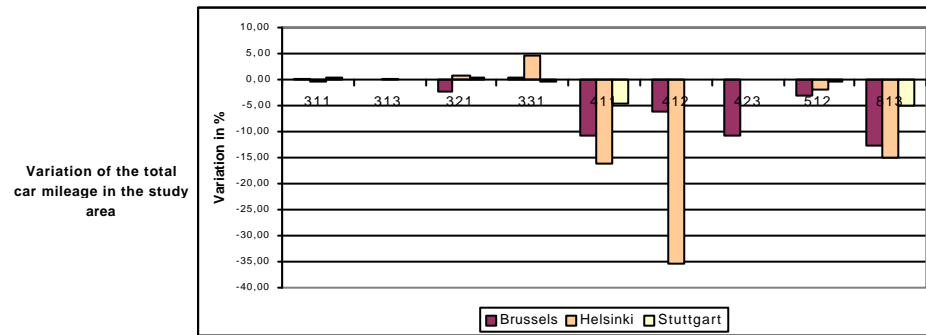


Figure 11.4 : Simulation results in Brussels, Helsinki and Stuttgart. Effects of policies on the total car mileage and the CO<sub>2</sub> emissions. Compare scenarios 311-313 (tax on residential suburban developments), 321 (regulatory measure forcing the business services to locate in A-zones), 331 (fiscal measure inciting the business services to locate in A-zones), 411 (increase of car use cost by 50 %) and 412 (cordon pricing). See the indirect effects of 411 and 412 on population on Figure 11.1.

## **11.7. Policy recommendation 4: Reduction of the fare of public transport only in the urban centre**

In several countries and cities, the idea of a drastic reduction of the fare of public transport is quite topical, because it is expected to cause a significant modal shift and because of social reasons. However, the simulations performed for Brussels, Helsinki and Stuttgart have confirmed that a decrease of the fare of national-level or regional-level public transport services, linking the urban centre and the suburban areas (e.g. suburban railway), would generate urban sprawl. This result was clear in the 3 cities.

However, one simulation (performed in Brussels only) showed that when the accessibility is improved *only* within the urban centre, then the effect of the measure is to make the urban centre more attractive both for households and for economic activities. In fact, the measure simulated was an increase of the commercial speed of the surface public transport within the Brussels-Capital Region. Therefore, in the same way, a reduction of the fare *only* within the urban centre should improve the attractiveness of the urban centre.

The cost of this measure could be compensated by the revenue of the congestion pricing (previous measure), which would be a way to make the congestion pricing more acceptable for the users, through ear-marking for public transport.

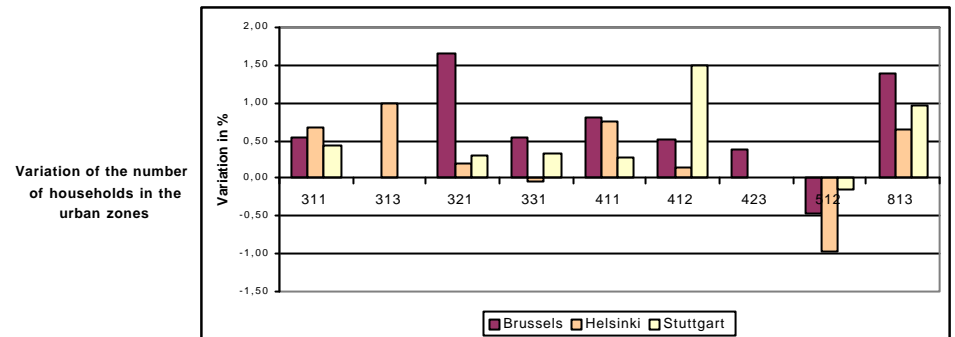
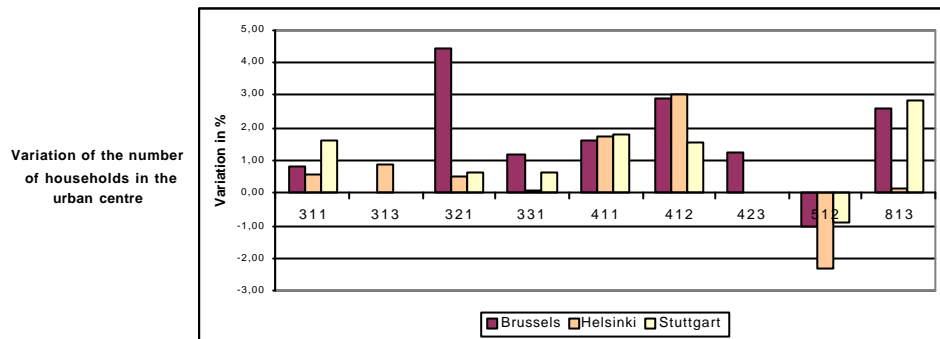


Figure 11.5 : Simulation results in Brussels, Helsinki and Stuttgart. Effects of policies on the number of households in the urban centre and the urban zones. Scenario 512: reduction of the fare of public transport by 20 %. Scenario 813: combination of 311 (tax on residential suburban developments), 331 (fiscal measure inciting the business services to locate in A-zones), 411 (increase of car use cost by 50 %) and 512 (reduction of public transport fare by 20 %).

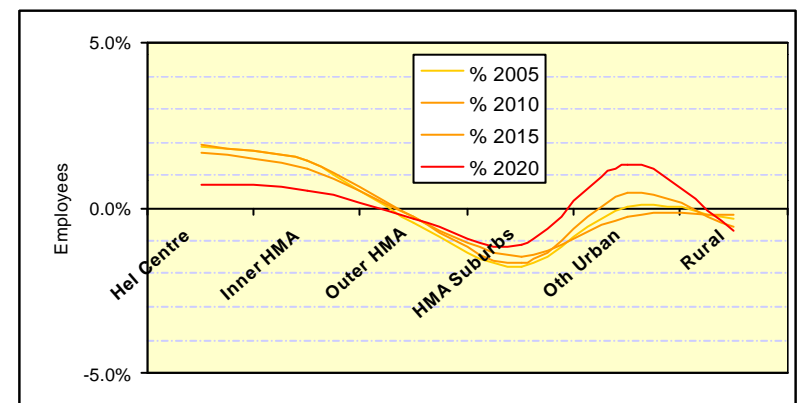
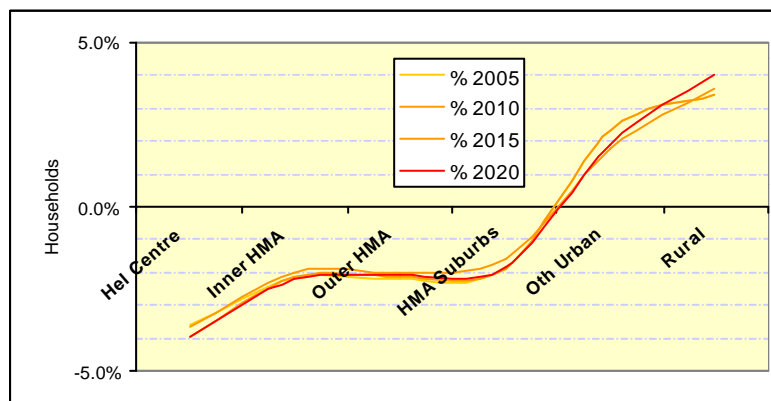
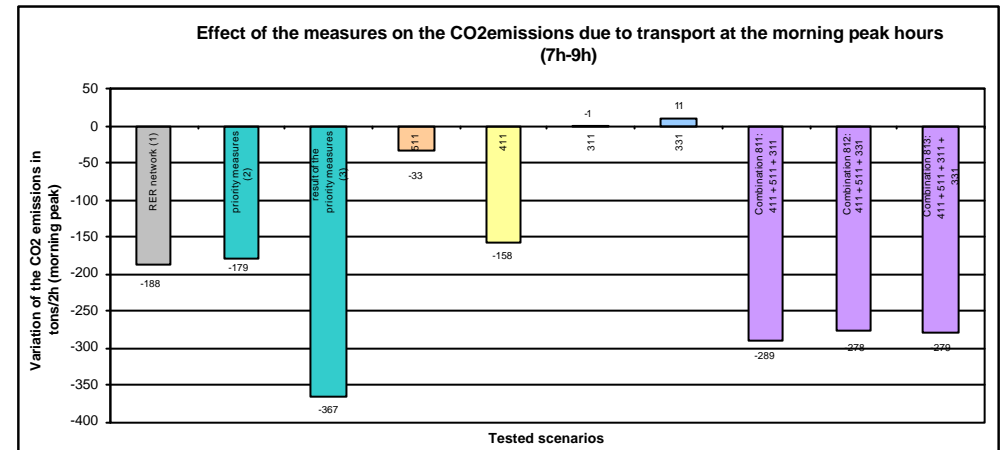
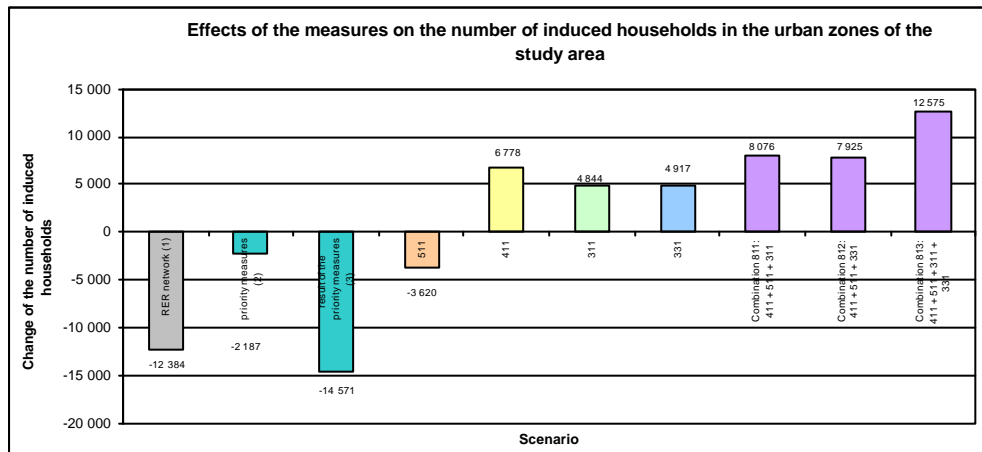


Figure 11.6 : Simulation result in Helsinki. Effect of a reduction of public transport fare by 20 %.



Types of scenarios:					
	2021 RER network		Decrease of PT fare		Fiscal measure on households
	Priority measures (new 2021 reference)		Increase of car use cost		Fiscal measure on services to business
					Combination of measures

- (1) The effect of the RER network is calculated in comparison with the 2021 reference scenario
  - (2) The effect of the priority measures is calculated in comparison with the 2021 RER scenario
  - (3) The effect of the priority measures is calculated in comparison with the 2021 reference scenario
- The effects of the other measures are calculated in comparison with the priority measures

- (1) The effect of the RER network is calculated in comparison with the 2021 reference scenario
  - (2) The effect of the priority measures is calculated in comparison with the 2021 RER scenario
  - (3) The effect of the priority measures is calculated in comparison with the 2021 reference scenario
- The effects of the other measures are calculated in comparison with the priority measures

Figure 11.7 : Simulation results in Brussels: Left: How the combination of the four policies mentioned so far (311, 331, 411, 511) together with the local investment plan (so-called “priority measures”) offset the out-migration of households due to the Regional Express Railway Network (REN). Right: The effect of this combination of four policies, together with the local investment plan, on the CO<sub>2</sub> emissions.

## 11.8. Policy recommendation 5: Land use and land rent regulation by the authorities (through negotiations, exchanges and public-private partnerships)<sup>10</sup>

The regulation of land use and land rent by the public authorities is a well known strategy. We however mention it here to emphasize that if the measures aiming to increase the concentration of population in urban areas reach their goal, it might be accompanied by an increase in the land rent in the urban centre. More generally, there are close interactions between the cost of transport and the land rent, as it was stressed by the European Conference of the Ministries of Transport (ECMT)<sup>11</sup>: measures increasing the travel cost (and in particular the car use cost) can have significant effects on the land market. The more costly the transport is, the more this contributes to reduce the urban sprawl, the more there will be a pressure to an increase of the urban land rent. This increase in land rent may in turn have effects on the social segregation<sup>12</sup>.

Therefore, beside the regulation of land use, at least a monitoring of the land rent should be set up and if possible, a policy of regulation of land rent should be implemented.

This policy is also mentioned here because the case studies have shown some original practices. Land banking, one way to achieve public land regulation, is a costly policy and not all cities can afford it. But the case studies (especially Rennes) have shown some less costly practices, based most often on negotiations, exchanges and private-public partnerships rather than on pure land banking. Rennes is a medium-size city (population of the urban region: 521 000 inhabitants), however it is facing urban sprawl just like larger cities. Examples of practices experimented in Rennes are as follows. (i) By controlling land (public land banking) or the use of land (land-use regulative plans), the city of Rennes influences the localisation of new urban developments and the type of this development (density, residential/economic activities). (ii) A land action to preserve agriculture has been designed and starts to be implemented. The *Communauté d'agglomération* builds land banking of agricultural zones and exchanges these plots of agricultural land with farmers owning grounds at the fringe of the urban agglomeration: the farmers transfer their plots of land to the city authority and receive in exchange larger plots situated further from the city (the objective here is also to keep agricultural activities). (iii) But to constitute public land banking represents a important cost for the public budget; that is why negotiation between the authorities and local property developers is developed, to control the building of new dwellings and the type of housing built in the city centre. For example, the authority transfers grounds to private developers provided that they develop housing types leading at least to some density threshold or provided that they include social housing in their projects. The authorities also use financial incentives: currently, Rennes Métropole gives a financial contribution to municipalities to buy lands if the municipality has the ability to build an integrated urban project (housing, services, transport). In the programme of measures proposed for Rennes (chapter 2), a further proposal is made: the *Communauté d'agglomération* could provide a financial help to municipalities that would agree to control their residential development (in a way, this can be seen as a funding for the maintenance of the natural landscapes). More classically, the authority also aims to keep a certain rhythm of

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<sup>10</sup> As said in the introduction, this policy was not quantitatively evaluated.

<sup>11</sup> *Politiques spatiales et transports – Le rôle des incitations réglementaires et fiscales, Conclusions de la Table Ronde de la CEMT n° 124, Paris, 7-8 November 2002.*

<sup>12</sup> This effect is to some extent taken into consideration in the models. The Helsinki and Stuttgart models include a sub-model of land market or housing market.

building to limit the increase in the price of housing and to avoid an increase in the social segregation.

### **11.9. Policy recommendation 6: Intermediate housing/urban design, or how to combine household social aspiration and density**

This is a “push” measure, aimed to make the urban centres more attractive for households. However clear the negative effects of sprawl may be, one has also to admit that for a proportion of the households, it corresponds to a social aspiration for a certain life style: a life style characterised by a single-family housing, in a low density environment, if possible surrounded by open spaces. In some cases, this aspiration is accompanied by a wish for social homogeneity. Among the households who leave the urban centres and migrate towards the suburban areas, some households really have an aspiration for a non-urban life style and environment; some others would prefer to stay in the urban centre, but do not find there a housing or neighbourhood fitting at the same time their needs and wishes (in terms of intimacy, floor space, open spaces, safety for children, etc), and their budget. This was confirmed by several surveys<sup>13</sup>. The measure described here is addressing this second category: it is the development of alternative housing forms, intermediate between collective housing and individual single-family housing. These alternative forms could be intended to urban centres or to make suburban areas more dense.

The key question is: how make density attractive ? Examples of innovative urban forms exist in many, if not all, European countries (among others Germany, France<sup>14</sup>), but they should spread and become more generalised. Features of these housing/neighbourhood designs may be: a reflection on how to provide the inhabitants with more space while still meeting a minimum density constraint, a reflection on the concepts of privacy, private space and public space, a mix of private/collective/semi-collective gardens<sup>15</sup>, collective play grounds for children, a varied housing supply, allowing to different household types to live together in a same neighbourhood (young adults, families, retired people), careful design of paths for walk and cycle, mix of functions (residential and retail), proximity with nature, sometimes participative process involving the inhabitants, etc.<sup>16</sup>

Of course, these intermediate-type housings should also be affordable for the households who are the target of the policy.

Last but not least, the diffusion of new forms of housings, in urbanised and in peripheral areas, can be successful only if local authorities are convinced. To obtain this active participation, a sort of collective pedagogy should be achieved, because politicians and

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<sup>13</sup> A stated preference survey conducted in Brussels, in the framework of the European project ESTEEM (4<sup>th</sup> Framework Programme), has shown that middle-class families with children assigned a higher value to urban residential neighbourhoods, peaceful and green, protected from through-traffic, where children could safely play on street, than to “standard” urban neighbourhoods, and also a value higher than to a housing in rural environment. The value was expressed in terms of a percentage of their housing-budget, inside the affordable budget.

In Munster (Germany), a survey among households having moved towards suburban areas showed that about 70 % of them would have preferred to stay in the urban area but could not find a housing fitting their needs, wishes and budget. (Patricia Gout, Munster case study, Conference “Architectures du transport: Territoires en mutation”, IPRAUS-Ecole d’architecture de Paris -Belleville, Paris, May 2004).

<sup>14</sup> In France, the PUCA, a research centre depending from the Ministry of Housing has financed between 2001 and 2004 several operations showing that a gain in density could be obtained by architectural innovations.

<sup>15</sup> Example: 3 floors buildings, including 4 apartments, with a collective garden (usual in some German dense suburbs).

<sup>16</sup> One particular form of this urban design approach is the US concept “New Urbanism”.

technicians often have a negative perception about density. Hence, cognitive actions are essential: conferences, documents, etc, should be organised in order to change the shared opinion that there are just two opposed concepts (single-family and collective housing), and that there is no alternative, further to that.

The case study Rennes provides some examples of practices encouraging the development of these urban forms: regulatory measures about density included in spatial planning documents; public financial contribution to help innovation in housing developments ; negotiation between local authorities and developers to encourage the production of urban forms which use less space. It must be noted, to be complete, that an overall context of growth and demographic pressure, as it is the case in Rennes<sup>17</sup>, makes easier for public authorities to negotiate with private property developers.

### **11.10. Policy recommendation 7: Setting up mechanisms for inter-institutional co-operation**

When tackling urban sprawl, there are obviously institutional barriers to the implementation of efficient policies such as: too much territorial fragmentation, competition between institutions covering contiguous territories (e.g. municipalities, communes), and a lack of coordination between various services, while urban sprawl is a highly multi-dimensional issue and hence requires an integrated strategy (including urban planning, transport, housing, environment, fiscal matters, social matters, economy). As a result from the 12 case studies analysed in the project, integration appears as a key success factor. It is a necessary response to the fact that there are interactions between the policies and between the different effects of the policies.

To control urban sprawl, there is therefore a need for a more or less formal supra-municipal structure of cooperation between the concerned institutions, to achieve urban management at the scale of the metropolitan area.

On the other hand, the 4 main features of any institution are: the democratic legitimacy (political composition), the power (action instruments), the matters of competence, the territory on which the institution has authority: this is what is called the "institutional square". And, for a supra-municipal institution just like for any other institution, a key condition for efficiency is balance and consistency between these 4 features and the objectives that the institution has to achieve. In the particular case of urban sprawl and urban management, examples of imbalances are: imbalance regarding the territory covered (too small with regard to the sprawl issue); imbalance in the matters covered, imbalance in the action instruments (ex.: shortcomings in the fiscal instruments), imbalance regarding the political composition (usual example: representatives elected locally, at municipality level, and delegated in a supra-municipal level, may tend to defend their local interests sometimes to the detriment of the interests of the supra-municipal institution ; besides, they know that they have to account to their local electorate ; another example is the possible mistrust towards representatives of the city centre; in the case of Rennes, the solution was to give to the central municipality, the Rennes District, a weight lighter than its actual demographic weight: in the supra-municipal structure *Pays de Rennes*, the District Rennes has 50 % of the votes while it represents 80 % of the population).

With regard to the competences, one competence to be addressed should be a permanent monitoring of the policy effects, against criteria in relation with sustainability.

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<sup>17</sup> Growth can occur simultaneously with sprawl: when the overall growth has a scattered pattern.



In practice, the responses to the institutional barriers, to the territorial fragmentation, etc can be categorised in 3 types: (i) creation of a new institution, (ii) more or less deep transformation of the existing institutions (e.g. creating a common service between 2 or more institutions, transferring fiscal power from one level to another, designing a flexible revising mechanism for the territory over which the metropolitan institution acts, modifying the political composition of the metropolitan institution so that it holds the general interest as a priority, etc.), (iii) improvement of cooperation mechanisms between existing institutions (e.g. limited technical agreements, general cooperation, etc.).

There is therefore a broad variety of institutional responses. Which are the most effective ones to control sprawl ? It is obvious that, the stronger the institution, the most efficient it will be. Ideally, there should be strong supra-municipal institutions, with full democratic legitimacy, and strong power (including legal power and fiscal instruments). According to some experts, the municipal institutional level is just an heritage from the past which is no more adequate to the current cities and the problems they face.

However, two points have to be mentioned and moderate this principle. First, voluntary cooperation is needed. And the willingness to cooperate may be enhanced by symbolic actions (see the next sub-section). Secondly, when the ideal strong supra-municipal institution is not (or not yet) feasible for historical or political reasons, less formal structures, with low or medium power, are also useful: "institutional scene", place for a dialogue, mechanisms for sector-specific cooperation, etc. They can be part of a step by step process, by which a stronger structure could progressively be built. They can generate a permanent dialogue between municipalities, contribute to raise awareness among decision-makers (awareness of the need of cooperation on at least some matters), etc. Stabilisation of political arrangement needs time and non formal cooperation helps to define collectively rules, identities, references or values which make possible a political integration in a later stage.

Another crucial point is to take into account locality, and the local specificities, in the definition of the new modalities of government. Each territory has its own resources (political resource, expertise, budget) whose stock and characteristics influence the choice of most appropriate modalities of political cooperation. Configurations of political leadership (collegial, individual) represent opportunities or constraints, for the feasibility of the settlement of a new political institution. Mobilisation of private interest organisations on institutional aspects depend also from the locality. Presence of social values shared by inhabitants, like consensus or collective action capacity, is a specific resource which can make possible the creation of a new political institution.

Finally, municipalities are often well informed about the potential revenues that they could get from new residential developments (through the income tax) or new economic activities. However they may be not as well aware about costs generated by these new developments. Some suburban municipalities discover sometimes that the migration of households represent a cost that they can no more afford, in terms of equipments and services to be provided (schools, etc) ; the problem is that they become aware of that too late, once the households have already moved<sup>18</sup>.

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<sup>18</sup> A German researcher for example showed that in the case of Greater Hamburg and the German fiscal system, new housing developments in most of the suburban locations have no fiscal effect on the municipal revenues, as additional revenues and additional expenditures more or less match. Jens-Martin Gutsche, "The role of the municipal fiscal system in the traffic increase in conurbations", Technical University of Hamburg-Harburg, paper presented at the European Transport Conference, Strasbourg, October 2003.

In the US, there are consultancies specialised in fiscal impact analysis. A fiscal impacts analysis projects the net cash flow to a jurisdiction resulting from new developments, taking into account the benefits and the expenses (ex. : analyses conducted by the experts Robert Burchell and Paul Tischler).

## **11.11. Policy recommendation 8: Symbolic and cognitive actions**

At the current stage, an important part of the problem is no more technical (what to do ?) but cognitive (how to build a consensus on the objectives and the ways to reach them ?). Symbolic or cognitive measures are therefore crucial to increase the awareness among the various players: local and regional public authorities, players from the private sector (property developers, companies, ...), citizens. In this clearly multi-dimensional, multi-disciplinary issue, each player holds a part of the solution. The cognitive measures should among others inform about the effects and costs of urban sprawl and about the existing solutions, experiences in other cities, best practices, etc. The final objective is to create a common culture at a supra-municipal level, to enable consensus building, coordination and cooperation.

Compared to states and towns, metropolitan supra-municipal institutions have usually no high symbolic, historic or democratic legitimacy. They have generally low visibility and technocratic legitimacy: they acquire legitimacy mainly through actions and achievements ; but symbolic actions should contribute as well.

Examples of symbolic actions are: forums, workshops, community planning (involving inhabitants in an urban planning exercise), awareness campaigns intended to inhabitants, visits of local projects by local authorities, conferences intended for local authorities, conferences bringing together authorities, planners, architects, technicians, property developers, etc ...

## 12. AN URBAN SPRAWL EXPLORATORY TOOL AVAILABLE ON INTERNET

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### 12.1. Objectives

To fulfil its objectives of dissemination, raising awareness and support to cities in tackling urban sprawl, SCATTER has developed an Urban Sprawl Exploratory Tool intended for local authorities and planning actors involved in decision making. The Urban Sprawl Exploratory Tool (USET) is an interactive tool implemented on Internet. Its objectives are to inform and raise awareness about issues related to urban sprawl (especially among authorities of small and medium-size cities) and to explore (monitor) variables related to sprawl. The final objective is to provide some help in making a diagnosis about sprawl and building a strategy.

The Urban Sprawl Exploratory Tool is available on [www.casa.ucl.ac.uk/monitor](http://www.casa.ucl.ac.uk/monitor) and also from the SCATTER web site [www.casa.ucl.ac.uk/scatter](http://www.casa.ucl.ac.uk/scatter).

The USET is the perspective of SCATTER on: local governments information needs, what is essential to know about urban sprawl (indicators), what local governments should do to act strategically on urban sprawl.

Practically, USET gives:

- definitions of concepts related to urban sprawl
- a set of relevant indicators, and the possibility to calculate some of them, if input data are provided by the user
- values for these indicators, calculated in the 6 SCATTER case cities
- a policy database referring to the policies evaluated through simulation and through the case studies.

The USET binds together planning objectives and information needs in an interactive web-based information explorer.

### 12.2. USET: a support to the elaboration of a strategy

Urban sprawl is hard to define. Urban sprawl is a multi-dimensional phenomenon about which it is quite difficult to make a distinction between causes, conditions and consequences. Furthermore it is perceived differently from place to place and even called differently from one country to another.

But there is an agreement on its negative effects. The usually admitted negative effects of urban sprawl are the following ones:

- consumption of land, loss of high quality agricultural land and open space
- destruction of biotopes and fragmentation of eco-systems
- higher costs of new neighbourhood infrastructures
- higher costs of public services and especially transport services
- land use patterns which are unfavourable to the development of collective and other sustainable transport modes ; hence, increase of the level of use of private car
- increased trip lengths
- congestion on the radial roads giving access to the urban centres

- increase in fuel consumption
- increase in air pollution
- contribution to the decay of downtown areas
- social segregation and reduction of social interaction
- poor access to services for those with limited mobility such as the young and elderly.

The fact of generally considering these impacts as negative reveals an underlying assumption according to which we should eliminate them and restore the previous situation.

Today our societies are confronted with obligations of reducing their energy consumption and pollutant emissions. The necessity to do something about urban sprawl which generates some unacceptable nuisances is driven by recent international agreements. In Belgium for instance the Government recently decided to decrease CO2 emissions by 9,4% over the next 8 years.

Even if it is a collective obligation it might happen that some cities or areas find it impossible to realize because of their size, or their economic situation,... In this case benchmarking studies can help a lot defining the targets.

In this context, USET is a tool to support cities (especially small and medium-size cities) in building a strategy, classically composed of three phases:

- Make a diagnosis of the recent evolution and the present situation, comparing the case study with other cases
- Define the targets to be reached in the long term
- Take measures to decrease the observed main negative effects of urban sprawl

## **12.3. A strategic approach in three phases**

### **12.3.1. Diagnosis of the recent evolution and the present situation**

#### ***Analyse the present situation and the recent evolution of the case study***

The first phase consists of collecting data which are essential to the analysis of the negative effects of urban sprawl (as mentioned above). The nature of these statistics might be different from one country to another or from one city to another, according to the availability of the data : for instance there is no population census in Germany contrary to other countries ; some cities have made household surveys, others have not; some cities have a GIS, others have not, etc.

The data which are indispensable for a good diagnosis are these indicated in the exploratory tool : evolution of population, evolution of the number of jobs, sectorial net densities (essentially residential net density), average space consumption per inhabitant or job, average home-to-work distance, public transport market share. These basic statistics are available almost everywhere. The other available data will confirm the diagnosis, giving more details on its negative aspects : estimation of the total fuel consumption in the system, estimation of the main pollutant emissions, evolution of the area allocated to agriculture, evolution of the area allocated to natural spaces, age pyramid, average income per inhabitant, structure of the local economy, etc. These last data will also put in light the probable causes of the situation and help to pinpoint the priorities and the best means to overcome urban sprawl.

### ***Compare it to other cases and formulate a diagnosis***

The first type of comparison will be made in space and time with other cities or neighbourhoods of the same country in order to comprehend the underlying mechanisms of city growth and specify the range of possibilities in the framework of a well defined local culture.

A second type of comparison can be made with foreign cities or neighbourhoods having other cultural attitudes, behaviours, incomes, land prices, laws, etc.

### **12.3.2. Define the targets to be reached in the long term**

Targets should be reduced to a small number in order to stay coherent. They should be expressed in terms of impacts and not in terms of causes and be simply formulated. For instance : what rate of decrease of the main emissions of pollutants can we expect in the 10 coming years, at a national level ?

### **12.3.3. Take measures to decrease the observed main negative effects of urban sprawl**

Since there are always several ways to reach a target, define the best strategy to reach the predefined targets, according to the local perception of what to do, the financial resources, the acceptability by the inhabitants,...

#### ***Aim***

The aim of the strategy is to arrange a spatial organization of the territory, able to minimize the negative impacts of urban sprawl.

#### ***Measures to be taken***

There will always be several possible spatial organizations compatible with the targets. Each city or area will choose the solutions corresponding to its perception of what to do. The only matter that counts is to reach the target. This leaves much room for democratic debate and participation of people to the decisions. Freedom of choice and governance is also an important part of sustainable development.

So far already many measures have been explored either in reality in different cities or with computer simulations. The reader will find a summary of the findings in the following chapters.

#### ***A temporal strategy also***

Define the main steps in time of this strategy. Indeed it is important not only to follow the results through time – which justifies again the existence of an exploratory tool – but also to conceive a real temporal strategy. The sequence of measures taken through time can influence the results. The temporal strategy will then focus on the optimization of the sequence of measures through time.

#### ***Legitimacy of the strategy***

Define the best institutional tools to implement the strategy. A strategy might be totally inefficient if it doesn't fit into the proper institutional tools giving to it its legitimacy. The example of Belgium is very enlightening in this matter. For the moment it is impossible to implement some wide scale measures to decrease urban sprawl around Brussels because there is no legitimate place to discuss these matters.

## 12.4. The Exploratory Tool proposed

USET is addressing two different spatial scales:

- concentric macro-zones: urban centre, outer urban ring, hinterland
- or micro-zones: single municipalities, communes or wards.

The user is asked to choose the scale in which he is interested.

To make the diagnosis about the urban growth and possible sprawl, the USET tool suggests a set of indicators, belonging to the following fields:

- densities (gross and net densities)
- part of build-up land
- individual land consumptions
- housing prices
- transport indicators
- emissions.

The tool suggests to calculate values for these indicators at two dates, to get a view on their evolution.

The next pages present the USET table of indicators completed for the case city Brussels (the table was completed for the 6 case cities and the values are provided in the tool, for purpose of example and benchmarking).

The Urban Sprawl Exploratory Tool is available on [www.casa.ucl.ac.uk/monitor](http://www.casa.ucl.ac.uk/monitor) and also from the SCATTER web site [www.casa.ucl.ac.uk/scatter](http://www.casa.ucl.ac.uk/scatter) .

INDICATORS	UNITS	1991 Situation								
		Commune St Jesso	Zone 1 City center	Commune Wabermal	Zone 2 Rest of the urban center	Commune Laens	Zone 3 Outer urban ring	Commune Nivelles	Zone 4 Hinterland	Total Area
<b>GENERAL CHARACTERISTICS</b>										
<i>Population characteristics</i>										
Total population	inhabitants	21 317	311 329	24 567	642 116	12 729	577 518	23 217	1 311 052	2 842 016
<i>Age structure of population</i>										
<15 years	%	23.4		16.1		20.4		18.3		
15-64 years	%	65.1		64.7		69.9		67.3		
65 years and more	%	11.5		19.2		10.7		14.4		
Part of population living in apartments	%	81.1		43.0		9.8		24.0		
<i>Jobs characteristics</i>										
Total nb of jobs	jobs	14 186	354 886	11 408	268 172	2 944	204 799	13 051	386 267	1 214 124
<i>Jobs structure</i>										
Agriculture, forestry	%									
Retail and local services	%									
Other	%									
<b>SUPERFICIES CADASTRALES</b>										
<i>Built-up area</i>										
Residential land	ha	70	2 112	239	4 687	794	16 797	736	41 232	64 828
Non-residential land	ha	44	2 466	1 054	6 874	3 928	15 079	5 324	263 937	368 355
<i>Unbuilt area</i>										
Agriculture (fields, meadows, fruit trees)	ha	0	257	16	902	2 763	49 957	4 404	213 439	268 955
Woods and parks	ha	7	529	676	2 802	691	14 421	277	30 667	46 619
Other	ha	37	1 679	180	3 170	474	11 301	843	30 631	55 781
<b>Total area</b>	ha	<b>114</b>	<b>4 577</b>	<b>1 293</b>	<b>11 561</b>	<b>4 722</b>	<b>91 876</b>	<b>6 060</b>	<b>325 169</b>	<b>433 183</b>
<b>GENERAL INDICATORS</b>										
Gross density of population	Population/total area	187	68	19	56	3	8	4	4	7
Net residential density	Population/residential land	484	308	140	221	17	47	67	44	67
Gross density of jobs	Jobs/total area	124	78	9	23	1	2	2	1	3
Net jobs density	Jobs/non-residential built-up land	546	323	178	151	50	46	36	35	66
Urban density	(Pop + jobs)/total built-up area	607	315	181	194	20	47	49	41	63
Part of built-up land in total land	%	61.4	46.1	18.5	40.5	16.9	18.3	12.1	12.7	15.0
Average taxable income per inhabitant	Euros/INH	4 432		10 141		11 760		9 090		
<i>Housing price</i>										
apartments	Euros/m <sup>2</sup> of the housing surface									
houses	Euros/m <sup>2</sup> of the housing surface									
<i>Car ownership</i>										
Market share of public transport	vehicles/100 inh.									
<b>INDIVIDUAL CONSUMPTIONS</b>										
Residential land	m <sup>2</sup> resid. land/INH	21	33	71	45	577	214	163	230	163
Non-residential (built-up) land	m <sup>2</sup> non-resid. land/job	18	31	58	68	200	217	274	288	152
<b>DIRECT IMPACTS</b>										
Average home to work distance per worker (one way at the peak morning)	km/trip									17.8
Total vehicle* km by car during the 2 hours morning peak	vehicle* km/2 h morning p (10 <sup>6</sup> )									9.1
Total passenger* km by public transport during the 2 hours morning peak	passenger* km/2 h morning p (10 <sup>6</sup> )									8.6
<b>INDIRECT IMPACTS</b>										
CO <sub>2</sub> emissions during the 2 hours morning peak	ton/2 h morning peak									1 657
CO emissions during the 2 hours morning peak	kg/2 h morning peak									19 363
COV emissions during the 2 hours morning peak	kg/2 h morning peak									1 809
NO <sub>x</sub> emissions during the 2 hours morning peak	kg/2 h morning peak									5 642
PM <sub>10</sub> emissions during the 2 hours morning peak	kg/2 h morning peak									301



INDICATORS	UNITS	2001 Situation								
		Commune St Josse	Zone 1 City center	Commune Watermaal	Zone 2 Rest of the urban center	Commune Laane	Zone 3 Outer urban ring	Commune Nivelles	Zone 4 Hinterland	Total Area
In yellow: mandatory input variables (for calculations)										
In green: outputs										
In orange: mandatory inputs for diagnosis										
In white: optional input variables										
<b>GENERAL CHARACTERISTICS</b>										
<i>Population characteristics</i>										
Total population	inhabitants	22 208	311 380	24 600	653 016	13 634	604 433	23 882	1 376 878	2 944 716
<i>Age structure of population</i>										
<15 years	%	23.9		17		19.6		16.8		
15-64 years	%	67.0		68.3		67		65.8		
65 years and more	%	9.1		19.7		13.4		17.4		
Part of population living in apartments	%	61.9		38.8		3.9		24.4		
<i>Jobs characteristics</i>										
Total nb of jobs	jobs	14 278	378 000	12 304	297 919	3 917	261 314	14 278	443 630	1 380 863
<i>Jobs structure</i>										
Agriculture, forestry	%									
Retail and local services	%									
Other	%									
<b>CADASTRAL AREAS</b>										
<i>Built-up area</i>										
Residential land	he	70	2 192	256	4 951	951	19 652	837	49 771	76 566
Non-residential land	he	45	1 052	192	3 126	899	14 671	442	36 651	55 499
Unbuilt area	he	25	1 140	64	1 625	62	4 961	395	13 120	21 067
Agriculture (fields, meadows, fruit trees)	he	44	2 364	1 037	6 611	3 771	72 225	5 223	275 397	356 617
Woods and parks	he	0	209	14	745	2 636	46 156	4 394	211 060	258 171
Other	he	7	536	867	2 729	653	13 693	165	30 938	48 094
Total area	he	37	1 639	100	8 130	482	12 170	604	38 401	59 352
<i>GENERAL INDICATORS</i>										
Gross density of population	Population/total area	195	68	19	56	8	7	4	4	7
Net residential density	Population/residential land	494	296	128	209	75	47	54	38	53
Gross density of jobs	Jobs/total area	125	93	10	26	1	3	2	1	3
Net jobs density	Jobs/non-residential built-up land	571	332	192	163	63	52	36	34	66
Urban density	(Pop + jobs)/total built-up area	521	315	144	192	78	44	46	37	56
Part of built-up land in total land	%	61.4	47.9	19.0	42.0	20.1	21.4	13.0	16.3	17.7
Average taxable income per inhabitant	Euros/inh.	5 796		72 643		14 532		72 419		
<i>Housing price</i>										
apartments	Euros/m <sup>2</sup> of the housing surface									
houses	Euros/m <sup>2</sup> of the housing surface									
<i>Car ownership</i>										
Market share of public transport	vehicles/100 inh.									
<b>INDIVIDUAL CONSUMPTIONS</b>										
Residential land	m <sup>2</sup> resid. land/inhab	20	34	78	48	602	24.3	185	266	188
Non-residential (built-up) land	m <sup>2</sup> non-resid. land/job	18	30	52	61	158	191	277	296	159
<b>DIRECT IMPACTS</b>										
Average home to work distance per worker (one way at the peak morning)	km/trip									18.8
Total vehicle*km by car during the 2 hours morning peak	vehicle*km/2 h morning p (10 <sup>6</sup> )									11.2
Total passenger*km by public transport during the 2 hours morning peak	passenger*km/2 h morning p (10 <sup>6</sup> )									8.0
<b>INDIRECT IMPACTS</b>										
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak									2 042
CO emissions during the 2 hours morning peak	kg/2 h morning peak									23 698
COV emissions during the 2 hours morning peak	kg/2 h morning peak									2 289
NOx emissions during the 2 hours morning peak	kg/2 h morning peak									8 863
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak									363



INDICATORS In yellow: mandatory input variables for calculation In green: outputs In orange: mandatory inputs for diagnosis In white: optional input variables	UNITS	1991-2001 evolution													
		Commune St-Joseph	Zone 1 City center		Commune Watermead	Zone 2 Rest of the urban center		Commune Lesse	Zone 3 Outer urban ring		Commune Nivelles	Zone 4 Interland		Total area	
			abs. val.	%		abs. val.	%		abs. val.	%		abs. val.	%	abs. val.	%
<b>GENERAL CHARACTERISTICS</b>															
<b>Population characteristics</b>															
Total population	inhabitants	897	60	0.02	42	10 900	1.70	905	26 915	4.66	655	64 826	4.94	102 701	3.6
Age structure of population															
<15 years	%	0.5	0		0.9	0		-0.8	0		-1.5	0		0	
15-64 years	%	1.9	0		-1.4	0		-1.9	0		-1.5	0		0	
65 years and more	%	-2.4	0		0.5	0		2.7	0		3	0		0	
Part of population living in apartments	%	-19.2	0		-4.8	0		-5.9	0		-0.1	0		0	
Total nb of working people															
working in the commune of residence	%	0	0		0	0		0	0		0	0		0	
working outside the commune of residence	%	0	0		0	0		0	0		0	0		0	
<b>Jobs characteristics</b>															
Total nb of jobs	jobs	82	23 774	6.51	896	29 747	11.09	973	56 515	27.60	1227	57 363	14.85	166 739	13.7
Jobs structure															
Agriculture, forestry	%	0	0		0	0		0	0		0	0		0	
Retail and local services	%	0	0		0	0		0	0		0	0		0	
Other	%	0	0		0	0		0	0		0	0		0	
<b>CADASTRAL AREAS</b>															
<b>Built-up area</b>	ha	0	00	3.79	17	264	5.63	157	2855	17.00	101	8539	20.77	17 738	18.7
Residential land	ha	1	40	3.95	17	214	7.35	154	2920	18.78	84	8547	21.75	9121	19.7
Non-residential land	ha	-1	40	3.84	0	50	2.82	3	935	12.03	37	1992	17.90	2817	14.2
<b>Unbuilt area</b>	ha	0	-81	-3.29	-17	-263	-3.83	-157	-2 051	-3.00	-101	-8 540	-3.01	-17 738	-3.2
Agriculture (fields, meadows, fruit trees)	ha	0	-48	-18.68	-2	-156	-17.29	-127	-3201	-6.49	-20	-2379	-1.11	-5784	-2.2
Woods and parks	ha	0	7	1.32	-11	-73	-2.61	-38	-528	-3.66	-92	69	0.22	-525	-1.1
Other	ha	0	-40	-2.98	-4	-34	-1.07	8	875	7.74	11	-6230	-15.72	-5429	-0.7
<b>Total area</b>	ha	0	-1		0	1		0	1		0	-1		0	
<b>GENERAL INDICATORS</b>															
Gross density of population	Population/total area	8	0	0.04	0	1	1.69	0	0	4.66	0	0	4.94	0	3.6
Net residential density	Population/residential land	9	-12	-3.78	-12	-12	-5.27	-2	-6	-11.89	-7	-6	-13.80	-8	-13.4
Gross density of jobs	Jobs/total area	1	5	6.54	1	3	11.08	0	1	27.59	0	0	14.85	0	13.7
Net job density	Jobs/non-residential built-up land	26	9	2.78	14	12	8.05	19	6	19.89	0	-1	-2.59	0	-0.4
Urban density	(Pop+jobs)/total built-up area	14	-1	-0.30	-6	-2	-1.11	-1	-9	-5.41	-4	-5	-11.19	-6	-3.7
Part of built-up land in total land	%	0.0	1.8		1.3	2.3		3.3	3.1		1.7	2.5		2.7	
Average taxable income per inhabitant	Euros/inh.	764			2502			2772			3829				
Housing price															
apartments	Euro/m² of the housing surface	0	0		0	0		0	0		0	0		0	
houses	Euro/m² of the housing surface	0	0		0	0		0	0		0	0		0	
Car ownership	vehicles/100 inh.	0	0		0	0		0	0		0	0		0	
Market share of public transport	%	0	0		0	0		0	0		0	0		0	
<b>INDIVIDUAL CONSUMPTIONS</b>															
Residential land	m³ resid. land/inhab.	-0.4	1.3	3.93	6.8	2.5	5.56	74.6	28.9	13.49	22.3	36.8	16.01	25.3	15.5
Non-residential (built-up) land	m³ non-resid. land/job	-0.5	-0.8	-2.70	-4.1	-4.9	-7.45	-42.1	-25.5	-12.20	2.3	7.7	2.68	0.6	0.4
<b>DIRECT IMPACTS</b>															
Average home to work distance per worker (one way at the peak morning)	km/trip													1.5	8.7
Total vehicle*km by car during the 2 hours morning peak	vehicle*km/2 h morning p (10 <sup>6</sup> )													2.1	23.1
Total passenger*km by public transport during the 2 hours morning peak	passenger*km/2 h morning p (10 <sup>6</sup> )													0.1	1.2
<b>INDIRECT IMPACTS</b>															
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak													385	23.2
CO emissions during the 2 hours morning peak	kg/2 h morning peak													4 335	22.4
COV emissions during the 2 hours morning peak	kg/2 h morning peak													469	25.4
NOx emissions during the 2 hours morning peak	kg/2 h morning peak													1 221	21.6
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak													62	20.6

## 13. CONCLUSIONS AND FURTHER RESEARCH WORK

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### 13.1. Conclusions

The main results of the project are summarised below.

#### ***Statistical analysis***

The statistical analysis, which used original indicators developed in SCATTER, together with more classical indicators, has shown that the 6 case cities of the project had different patterns of de-concentration. In fact, the 6 cities can be clustered into three groups:

- Milan, Bristol: continuing and rather strong spatial de-concentration of activities (population and employment)
- Stuttgart, Brussels: moderate spatial de-concentration of activities, tending towards a stagnation of the pattern
- Rennes, Helsinki: continuing spatial concentration of activities: these two metropolitan areas do not exhibit all conditions of urban sprawl, but the growth of the population and of the employment is nevertheless scattered to a certain extent. In both areas, there is in the same time an out-migration of the rural population towards the urban centre and especially the outer urban ring, and a scattered growth pattern, but at a lower level than in the 4 other cities.

#### ***Some conclusions from the qualitative evaluation of policies through case studies***

All the case studies show some degree of policy (e.g. land use/transport) or institutional integration and coordination. Integration in these cases is the response to the acknowledgment that interactions between policies and between the different effects of policies must be dealt with. Integration is therefore recognised as a key success factor.

The analysis also highlighted that new forms of planning practice are emerging which represent an adaptive response of local and regional authorities to the challenges posed by the changes in the scale and type of urban growth, demographic migration and economic activities relocation. Besides innovating the contents of planning policies, public institution and organisations are also changing the practice, the “how to” of planning (e.g. more entrepreneurial approaches ; regional planning strategies coupled with local regulations and detailed plans ; bottom-up approaches ; institutions building coalitions).

A essential challenge for cities, which are undergoing processes of significant urban growth or change, is the necessity to balance the promotion of economic competitiveness (both against other cities in the metropolitan area or region and at the national or international level) with the control of spatial growth and its impacts (land and natural resources consumption, social segregation). In this field EU regulatory framework can play a key role.

#### ***Some conclusions from the analysis of institutional barriers and ways of inter-institutional cooperation***

The analysis has shown that there is in practice a great variety of structures of inter-municipal coordination.

It is obvious that a strong metropolitan institution, with strong democratic legitimacy and strong action instruments, will be more efficient. However, the creation of a strong metropolitan institution, depriving partly other authorities of their powers, can be very difficult in practice because of historical and/or political reasons. In such cases, a less formal

structure of cooperation between existing institutions is the only feasible solution. This type of solution should not be neglected for that all, because it can generate a permanent dialogue between municipalities or other institutional levels, contribute to raise awareness among decision-makers (awareness of the need of cooperation on at least some matters), and can be the first step on which progressively a stronger structure could build on. Stabilisation of political arrangement needs time and non formal cooperation helps to define collectively rules, identities, references or values which make possible a political integration in a later stage.

Besides, the range of appropriate responses to any situation can vary greatly from one urban situation to another, because of local specificities, as mentioned above. Each territory has its own resources. Configurations of political leadership (collegial, individual) represent opportunities, or constraints, for the feasibility of the settlement of a new political institution. Mobilisation of private interests organisations on institutional aspects depend also from the locality. Presence of social values shared by inhabitants, like consensus or collective action capacity, is a specific resource which can make possible the creation of a new political institution.

### ***Simulation results: they confirm that regional-level public transport services generate sprawl***

The simulations in Brussels and Helsinki have shown that new radial rail services providing a significant improvement in the accessibility between the suburban areas and the urban centre generate indeed sprawl of population and concentration of employment. A consequent change in the home-to-work mobility pattern is the lengthening of the home-work trips (e.g. increase by 8% due to the implementation of the RER in Brussels ; increase by 12 % in the scenario of local investment plan + speeding up the rail services by 25 %, in Helsinki). It is worthwhile noting that households decide to out-migrate towards suburban areas not only because of the improved accessibility by public transport, but also because of the consequent better accessibility by road (the modal shift due to the rail investments alleviates to some extent the congestion on the roads)<sup>19</sup>.

On the other hand, the rail investments lead to an improvement of the indicators related to the modal share: decrease of the car mileage and increase of the public transport share. In the 2 scenarios mentioned above, the decrease in CO<sub>2</sub> emissions is by 8 % (Brussels) and 2 % (Helsinki). However, the potential total “short-term” improvement (i.e. the improvement which would have occurred if there was no change in activity location, neither lengthening of the trip distances) would have been even higher. In other words, one negative effect of sprawl is to “consume” a part of the potential benefits of the public transport investments, with regard to the reduction of car mileage and emissions.

### ***Simulation results: which policies are most effective to reduce sprawl and its negative effects ?***

With regard to *urban concentration* and *land consumption*, the most effective policies in the 3 cities are:

- road pricing: effective in all 3 cities

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<sup>19</sup> It is well known that generally, in congested areas, at short term (i.e. without change in location), the users who benefit the most from public transport investments, in terms of travel time savings, are the car drivers, rather than the public transport users. This was quantified for example for the case of the RER within the study area of Brussels, in a previous study by Stratec, on behalf of the Brussels-Capital Region (study IRIS 1, 1991-1996).

- impact fee on new suburban residential developments: effective in all 3 cities
- in some cases, fiscal measure to incite services (offices) to locate in zones served by high quality public transport (e.g. around rail stations), or constraining regulatory measure with the same purpose. For this type of measure, the potential effectiveness depends of the percentage of jobs already located in that kind of zones, in the reference scenario. For example, the percentage was 37 % in Brussels, versus 70 % in Helsinki, which explains that the policy appeared to be much more effective in Brussels than in Helsinki.

When looking at the indicators “number of households in the urban zones”, the impact fee policies score roughly as well as the car use cost increase. This result of course depends on the level of the respective parameters (new fee and cost increase).

With regard to *climate change* and *air pollution*, the most effective policies are: road pricing and parking policies.

Although they were the most effective with regard to these criteria, the cordon pricing and the parking strategies were discarded from the final selection of measures for the combinations, because of their negative effects on employment.

In all 3 cities, land use policies seem to have only little impact on the transport indicators and especially on the CO<sub>2</sub> emissions due to transport, except one quite drastic measure in Brussels (regulatory measure forcing all jobs in the business services sector to locate in A-type zones).

### ***Simulation results: final package of measures to be recommended***

Finally, the simulation results led to select the following package of measures, to be recommended as accompanying measures to new public transport services linking the urban centre and suburban areas:

- fiscal measure (“impact fee”) on new suburban residential developments (combined with a tax reduction in the urban areas)
- fiscal measure to incite offices to locate in areas well served by public transport (e.g. rail stations)
- increase of car use cost
- reduction of the fare of public transport only on the territory of the urban centre.

### ***Policy recommendations addressed to local and regional authorities***

Further to the policies selected on the basis of the simulation results, some other policy recommendations were derived from the case studies; those policies were not quantitatively evaluated and look rather like “best practices”. They were selected because they contain innovative aspects or should become more generalised. Some other recommendations derive from the analysis on inter-institutional cooperation.

The set of recommended policies is as follows:

- tax on the suburban residential developments (“impact fee”), possibly combined with a tax reduction for housings in urban areas
- tax on all offices located in zones not served or poorly served by public transport
- increase of the cost of car use, through congestion pricing
- reduction of the fare of public transport *only* in the urban centres
- land use and land rent regulation by the public authorities, through negotiations, exchanges and public-private partnerships

- alternative housing forms, intermediate between collective housing and individual single-family housing, and innovative urban design
- setting up mechanisms for inter-institutional cooperation
- symbolic and cognitive actions, to build a consensus on the objectives and the ways to reach them.

Some of these recommendations can be implemented at the local, municipal level ; some others require coordination at a supra-municipal level.

These recommendations are intended for any small, medium-size or large cities implementing new public transport which will improve the accessibility with suburban areas, for cities simply facing sprawl, for suburban municipalities involved in a sprawl process, or any cities concerned by sustainable urban development, like those which committed in the Aalborg process<sup>20</sup>.

## 13.2. Further research work

Some potential areas for further research work are listed below.

### ***Evaluation of some effects and costs of urban sprawl***

The evaluation framework used in SCATTER allowed to clearly identify the policies which were most efficient with regard to the urban concentration (concentration of population and employment in urban areas rather as opposed to sprawl) and with regard to emissions due to transport and other transport-related indicators.

However, some effects related to land consumption are not or not completely taken into account or valued: loss of open spaces and agricultural spaces, effect of land urbanization on the water streaming coefficient, higher infrastructure and equipment collective costs in suburban areas, compared with urban areas. These topics are therefore potential areas for further research.

Similarly, further research should be performed to evaluate with accuracy the external costs of the suburban location choices of households and companies. Indeed, urban sprawl generates higher costs of new neighbourhood equipments, infrastructures and public services. The marginal cost generated by a new household or a new economic activity in terms of equipments, infrastructures and public services is higher in a low-density suburban context than in a dense urban environment, and this cost is not (or not completely) covered by the household or activity who generates it, but is often supported collectively.

This situation even leads to an issue of equity, when the external costs are shared by urban lower-income households and suburban higher-income households.

### ***Acceptability and equity of fiscal and pricing policies***

Several of the policies recommended by SCATTER consist in an internalisation of external costs, i.e. an application of the “polluter pays” principle. The principle is economically fair, but the acceptability of the practical measures is generally low. This type of measure can be

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<sup>20</sup> The Aalborg Charter is a Charter about sustainable urban development and was adopted at the First European Conference on Sustainable Cities and Towns, that took place in Aalborg, Denmark, in 1994. The 4<sup>th</sup> European Sustainable Cities and Towns Conference, which took place in 2004 (“Aalborg +10”), adopted the “Aalborg + 10 Commitments”, which are seen as an important step from theory to real actions. Cities having signed the Commitments agree to make a environmental review of their city, identify targets and monitor progress.

made more acceptable by ear-marking, for example for public transport services or urban embellishment.

However, further research should be performed to assess the equity of these measures, in particular by evaluating and comparing their costs and benefits for the different socio-economic segments of the population.

### ***Optimisation of combinations of policies***

In SCATTER, simulation with integrated land-use/transport models has allowed to evaluate policies and select the most effective ones, against some pre-set criteria. The simulation results led to recommend a package of policies. However, a further step should be to optimise the level of the parameters defining the policies (level of the taxes, increase of the car use cost, reduction of the fare of public transport), under some constraints.

Those constraints could include financial constraints (taking also into account the cost of the policies), but also political constraints and acceptability.