



International Energy Agency

# 5896

INTERNATIONAL ENERGY AGENCY

ENERGY CONSERVATION IN BUILDING AND COMMUNITY SYSTEMS PROGRAMME

EXECUTIVE COMMITTEE MEETING

TECHNICAL DAY - SOPHIA ANTIPOLIS

*2nd JUNE 1992*

**ENERGY AND URBAN PLANNING**

**J.P. TROCHE (*Groupe RE-Sources, France*)**

# **ENERGY AND URBAN PLANNING**

Jean-Pierre Troche / Groupe RE-Sources.

## **PRESENTATION OF RE-SOURCES :**

*Re-sources is a small consulting and research firm created in 1982 and is specialized with energetic and environmental issues linked to town and city planning*

*Re-sources as developed with the support of the ADEME tools and policy guidelines aiming to help planers to draft a more energetic conscious urban planning. Re-Sources as also coordinated a large scale experiment conducted by the ADEME'S Nord Pas de Calais regional agency as to develop local energetic expertise in land-use and city planning.*

*J.P.Troche is taking part of the "Energy conservation in buildings and community systems" program annex 22 workshop -design of energy efficient communities*

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## 1/ LOCAL ENERGY PLANNING PROJECTS -L.E.P.- IN FRANCE

Participants of annex 22 workshop have focused their efforts on local energy planning projects.

Local energy planning must be considered in relation to specific national situations : the legal framework and responsibilities of municipalities in these matters differs considerably from one country to another and of course is also related to the structure of the supply and distribution system.

In France with a highly centralized supply and distribution system, municipalities have developed only a few projects related to electricity and gas production and distribution ( as opposed to Germany or Sweden for example where the system is more "decentralized), however french municipalities have developed many LEP projects in the following fields:

-> conservation and rational use of energy in municipal buildings and public services and utilities.

-> promotion of energy conservation and the use of local resources, or to a certain extent, use of renewable energy in dwellings and for industrial uses. These type of actions are generally managed in relation with the support of ADEME.

-> creation or extension of district heating, in some cases with cogeneration projects, and also projects related with urban waste disposal and incineration.

-> more recently integration of energetic and environmental criteria's in urban and land use planning.

These different points and topics, are going to be extensively described in the french documents submitted to the annex 22 workshop, the presentation for the INTERNATIONAL ENERGY AGENCY EXCO technical day meeting will focus on this last point as it seems to be an original experience and concerns a field of practice (urban and land use planning ) in which municipalities are, in nearly all national context, always responsible for. There is also a growing feeling that this issue has been under estimated during the past considering the important structural effects of urban development on the energetic system.

## **2/ URBAN AND LAND USE PLANNING, SITING REGULATIONS STRUCTURAL EFFECTS ON ENERGY DEMAND**

Urban history, urban form are clearly related to the nature and availability of energy. For example towns of the last Century and at the beginning of this century have developed in a way to permit access to energy (coal near mines or near heavy load transportation by water, access to the gas grid or later on to electricity). The land use pattern, integration or physical separation of activities (by "zoning") is also clearly linked to available means of transportation and thus to energy availability. During the past decades urban forms have been produced in the context of "energetical permissiveness" which have created long term effects and high level of energetical dependance.

Even more recently the fall of energy prices as, to a certain extent, permitted the outspread of very low density urban area which could cause on along term future a difficult functional and social problem.

If it is possible to analyzes the links between urban form and energy, urban and land use planning could be in the future one of the key issues for urban development and re-development on a low energetical cost basis, less vulnerable, environmentally friendly and on a long term sustainable way.

Relationship between energy and urban form is certainly complex to analyze but our experience as shown that **general trends can be highlighted in a sufficiently operational manner to formulate policy guidelines and develop adequate tools for planners and municipal decision makers.**

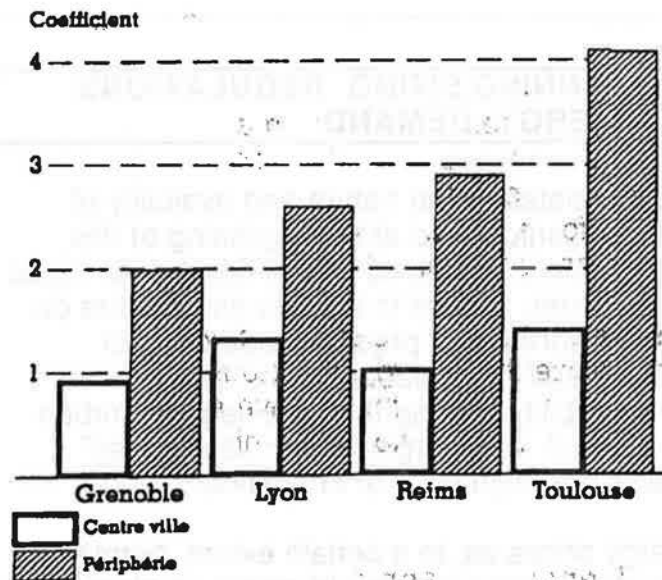
Urban form and land use patterns as effects on space heating energy demand and of course with a high level of interaction on the transportation energy requirement.

### **URBAN FORM TRAVEL NEEDS AND TRANSPORTATION ENERGY REQUIREMENTS.**

Theoretical studies results have been confirmed by processing transportation surveys <sup>1</sup> conducted in 5 major french cities using an energy indicator the B.E.T per family ("budget energy transport/energy budget for transportation per family, indicator expressed in GEP each travel being credited of a consumption depending on distance and mean of transportation used).

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<sup>1</sup> study and survey conducted by IRT-CETUR J.P.ORFEUIL 1981 to 1983 on Paris, Toulouse, Grenoble, Lyon, Reims (journeys from monday to friday are monitored).



The B.E.T. varies considerably depending on location, if you compare a suburban family to a town center family this variation is of a factor 2 to 4.

To simply oppose inner town center to suburbia of very few practical importance as of course there are physical and economics limits to concentrating population in the inner center, this can also result in energetical counter effects. Nevertheless this shows that there is a strong correlation between energy demand and urban density.

Some further analysis will have more practical applications, as comparison of different urban situations where the quality and proximity of public transportation and the level of equipment in commercial and community services is different and shows that there is **at equal density and at equal distance of the inner city the BET can change of a factor 1,5 to 2.**

These correlations show that any decision in urban and land use planning can have very important energetic impacts, and it can be argued that a more sustainable urban development or redevelopment can be achieved if special attention is paid on the followings :

- > promoting urban mixing of activities as opposed to zoning with physical separation of urban functions. as to reduce the basic travel needs (home <-> work)

- > producing urban form and density compatible with the implementation of community services and commercial facilities.

Studies have shown that these "small travels" (less than two kilometers) by car in urban areas related to shopping leisure or community services have a very high energetical impact and can account for nearly half the petrol consumption of private cars within the urban area.

- > realizing better integration or coordination of public transportation planning with any form of urban design is also of vital importance. Designing new means of public transportation as to adapt the public



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transport system to a more and more diversified demand can also be considered a key issue.

-> designing urban form as to (re)encourage bicycling and walking can also produce important effects on the long term, this does not only imply dedicating specific equipments to bicycling or developing pedestrian zones, but there is also need for a global horizontal approach of travel needs (car parking, 30 Km/h zones, etc...).

It is also evident that these issues are also heavily related to environmental control and it not necessary to emphasize that energy conscious urban planning must completely considered in relation to the positive effects on global or local environment (air pollution, acidification, greenhouse effects etc...).

### Space heating urban form and energy planning

There are also many linkage effects between space heating energy demand and urban structure. Calculations and surveys shows that a **detached isolated individual house can need two to three times more energy than a collective dwelling.**

Orientation, siting regulations, general layout design as also an important energetical effects (our studies currently show up a figure of **15% / 20 % savings between an energy conscious design solution and a average non energeticaly concious solution**, this for a equivalent cost for design land development and with the same level of building regulation constraint).

A better control of microclimatic conditions by mastering the interactions between microclimate and urban form can lead to important energy saving, this approach is also related to the use of **passive solar** in building design which can be very much favoured if the general layout plan and siting regulations have taken into consideration solar orientation. If **passive solar design** is itegrated in a coherent maner at levels energy **savings can go up from 30% to 50%.**

The case of urban planning and space heating energy is not confined to climatic or solar considerations.

Perhaps the more non-reversible energetical and environmental effects are to be considered in relation to the degree of coordination between urban planning and management and planning of the energy supply system.

**Integration and coordination between urban planning and local energy supply planning** can reduce future energy needs but can also influences in a structural, often non reversible, way the means used to meet these energy needs.

The average situation mainly consists in a absence of coordination. The energetical choices, (which often consist of absence of thinking and choice)

are mostly made by urban planners or site developers on a short term basis considering only the investment cost.

Integrating urban planning and energy supply planning can be of vital importance considering as to promote sustainable, environmental friendly solutions on a long term basis.

Developing a new site or redeveloping existing urban areas can produce an opportunity for identifying solutions based on **local energetical resources** or district heating. There is an important relation between urban design and extension of a district heating network as district heating develops on better economic basis in certain conditions of density and on minimal scale of project.

In this field criteria's proposed to the decision makers must enhance **long term thinking as to promote solutions that are environmental friendly and easily adaptable, at a low social cost, in context of future changes of energy prices and supply constraints.**

Most of our experiences have consisted in proposing different "energetical scenarios" for specific urban development projects. The different scenarios are compared with a **global cost** economic indicator (integration of investment and running cost on the long term) and on qualitative criteria's in terms of adaptability to energy changes, environmental impacts, economic and social issues, and other linkage effects as comfort.

### **3/ FOR AN ENERGY CONSCIOUS URBAN PLANNING AND PROMOTING A BETTER INTEGRATION OF LAND USE, LAND DEVELOPMENT AND ENERGY SUPPLY PLANNING.**

Energy conscious planning can be developed at any level of land use and urban planning:

• **On the level of development schemes and site developing layouts plans and regulations** (in France it concerns the ZAC "Zone d'aménagement concerté" and "lotissement")

-> choice of energy on global cost basis for heating and hot water, quantification of the energy requirements / coordination with local energy supply planning :

+ in relation to energy supply planning : assessing and promoting use of local resources.

+development of district heating.

+coordination with energy utilities.

-> microclimatic design and integration of passive solar gain of general layouts plans as to reduce energy requirements and induce better comfort.

-> measures to reduce travel needs and dependance to car transportation:

+ implementation of local community services and shopping facilities.

+ integration of activities.

+ street design as to render attractive / comfortable and safe walking and bicycling.

-> assesment of transport needs and coordination with public transportation services.

-> Assessment of environmental impact of the proposed solutions.

• **On municipal level or inter-municipal city level.**

In France this is the key level of land use and urban planing, the resulting land use and site regulations are contained in the "POS " (Plan d'Occupation des sols) and are drafted under the responsibility of municipalities

-> quantificationof the energy requirements for urban development or redevelopment, assesment of present and future situation on economic basis, degree of vulnerability to energy changes ( constraint on supply, cost).

-> coordination with local energy supply planning :

+ in relation to energy supply planning : assessing and promoting use of local resources.

+development of district heating.

+coordination with energy utilities.



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-> analyze of climate constraint and microclimatic changes in the area / assesment of microclimate for the new development zones (zone "Na).

-> if feasible design of land use zone regulations and general layout plans in relation to passive solar gain as to reduce energy requirements and induce better comfort.

-> measures to reduce travel needs and dependance to car transportation:

- + planning implementation of local community services and shopping facilities
- + land use regulation permitting integration of activities on a centralized or on a "concentrated decentralization" pattern.
- + street design as to render attractive / comfortable and safe walking and bicycling, proposition projects in this field

-> assesment of present situation and coordination with public transportation services.

-> Assessment of environmental impact of the proposed solutions.

• on a **district or global urban area level**. In France municipal plans and land use regulations (POS) must comply to a inter-municipal plan that covers the global urban area : the " Schémas Directeur". These plans are drafted with a long term vision (15-20 years) of the urban area development. The Schémas Directeur establishes the land use policy of each specific zone or urban entity, and designs solutions the transportation equipments (highways and public transport). The Schemas directeur also can contain, on any relevant issues, specific policy guidelines. At this level including an energetic and environmental approach is evidently compelling. The energetic/environmental approach could be resumed in a policy document ("schemas directeur environnement et énergie") and must be also included in all the multi-criteria's decisions and proposals of the schémas directeur.

#### 4/ THE ADEME A.E.U. EXPERIENCE IN THE NORTH OF FRANCE

As to develop local energetic expertise in land-use and city planning the ADEME'S Nord Pas de Calais regional agency is conducting a large scale experiment.

Any municipality involved in a development scheme, in land use and urban planning can ask to benefit from a specialized consultant advice.

The idea is to include in the circuit of municipal decision making concerning urban planning a "urban energy conscious man".

This "A.E.U" (Analyse energetique sur l'urbanisme) is financially supported by ADEME, RE-Sources as coordinated the project and realized the training of the local experts.

Professionally the local experts are mostly independent city planners or architect organised by ADEME in a network including also specific experts on energetics, transportation and environment.

The "AEU" consist of a preliminary study and formulation of a consultant's advice. The goal is to identify a first series of recommendations and guidelines based on the consultant's expertise and to propose, if necessary, any specific studies such as: feasibility studies for an alternative energetical supply system or for a new public transportation line.

The experiment as two years of existence and it is difficult for the moment to evaluate the results and effects because of the time needed to realize any form of urban planing document.

Nevertheless there are strong indications of already many positive short term effects, as for example, the decision based on the AEU study concerning a major developing scheme in LILLE (Euralille ZAC), to extend the district heating grid for this project (600 000 square meters) instead of the electric heating initially planned.

Methodological work is under way as to include in the AEU different environmental issues.

One of the first learnings of this experiment shows that it is necessary to work on decision making pattern related to planning and not only on the "rational technical aspects" of urban energetics.

It is quite clear that a urban planning decision will never be taken on the unique grounds of energetical considerations. In consequence it is of vital importance to describe and argue the energetical propositions in a way such that all the linkage effects, all the non energetical benefits (comfort, impact on the local economy, qualitative amelioration of the environment etc...) will appear quite clearly to the decision maker.

This it not a difficulty, because, generally speaking, what is good for a sustainable energetic future is environmentally friendly and is also a positive amelioration to the immediate quality of life in our cities.

*"Ce qui est bon pour l'énergie est bon pour la ville et réciproquement"*