EVS24
Stavanger, Norway, May 13-16, 2009

The challenges of electric vehicles in land-use planning and economic development of mountain resort: Decision Support for sustainable mobility

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Abstract

In the frame of electric vehicles deployment, EDF and ANMSM (association nationale des maires des stations de montagne – French association of ski resorts mayors) have launched a large project, lead by Atlante Conseil, to design decision support to help local decision makers to implement alternative transport systems based on electric vehicles. The main purpose is to enforce environmental local policy This project takes place into the sustainable development charter in which several French ski resorts are involved.

The search for balance between development and protection of the mountains is a fundamental principle in the development of mountain areas.

Over the last decade, we have seen a profound change in mentality. There still remains much to be done.

The mountain resorts do not remain apart from changes in society and the demands of their clients, who are more and more appreciative of high-quality services and sensitive to environmental preoccupations. They have begun a process of urban renewal and modification of the permanent and tourist housing; of innovation and diversification of activities, that will allow them to respond to climatic uncertainties.

In partnership with EDF on the basis of benchmarking in Europe and the United States and a thorough investigation with members of the ANMSM (French association of ski resorts mayors), key success factors to implement electric vehicles projects in mountains have been identified.

Decision support tools must be supplied to local decision makers to help them to implement more attractive mobility services, using vehicles the most suited to the constraints of the station. The availability of these tools for local decision makers aims to deploy real alternative transport system, not only electric vehicles, in mountain so as to develop a soft electric mobility, ensuring an environmental, economic, and social development of the ski resorts.

Keywords: Demonstration, Environment, EV, mobility

1 Introduction

The ski resorts have experienced constant growth since the 50s. This development was made at the time the car was seen as the main mode of travel. This has led to a development dedicated to traffic and parking. This development model is no longer acceptable. Tourists who want clean air, nature, residents who have chosen to live in a protected area, are grappling with the same problems as urban pollution, stress, omnipresent cars. The implementation of an overall policy of sustainable development is therefore a need to ensure the quality of life of resident populations, but also the tourist attraction of these holiday locations.

These measures go through a new vision of the territory, but also in services, particularly mobility for people. It is therefore to reduce the car number, visual and air pollution, noise while providing the answer to the needs of mobility.

Given these objectives, the use of electric vehicles is obvious. However, given the specificities of these sites, which are radically different models of urban models, it is not possible to establish direct systems using electric vehicles regardless of changes in population mass and typology, but also technical aspects related to the use of electric vehicles in altitude and under the sometimes harsh climates.

This paper presents the results of the benchmarking of the most innovative solutions implemented in Europe and in the US, the core elements to establish a mountain resort typology and the related most promising systems and a synthesis of the criteria to establish a comprehensive decision support tool to implement alternative transport systems.

2 State-of-the art

2.1 Alpin Pearls project

Alpine pearls is a project to promote soft and mobile holidays in various European alpine towns in Germany, France, Austria, Italy, Slovenia and Switzerland.
It is now a real label, and identified offers are now available to vacationers.

Alpin Pearls offer a new concept of holiday soft-mobile in 10 points. Are presented here the points directly related to the problem of mobility:

a) a relaxed arrival by bus or train is guaranteed
b) in-situ, all the destinations can be reach without car
c) News areas and spaces to walk, car-free are under creation
d) A full mobility service is offered: booking are taken in charge and personalized advice is given.
e) Special offers to discover soft mobility are available

Here are some examples of ski resorts having implemented electric vehicles n innovative systems

2.1.1 Germany: Bad Reichenhall and Berchtesgaden

To get out and about: with the lift or our new electric bicycles, called “movelo”

2.1.2 Italy: Chamois

Bicycle hire and electric cars. Electric cars are for transporting persons and luggage within the community - from the lift to the hamlets and hotels and return. During the summer months mountain bikes and bicycles with electric motors are available.

2.1.3 Austria: Werfenweng

Because of the global vision of the project (mobility, environment and electric transportation) we want to highlight te SAMO project (soft mobility” in Werfenweng.

Soft mobility is the encompassing offer for soft-mobile guests in Werfenweng: tourists arrive by train or leave their car at the public parking and rent electric cars, electric scooters, electric bikes, or bicycles. Shuttle transfers are offered day and night as well as transfers to the train station. Every family receives a mobile phone in order to able to call the local taxi.
34 hotels have joined the SAMO-summer and SAMO-winter vacation program in order to offer a large variety of activities - without car. Most of the activities are for free for SAMO-customers.

How to become a beneficiary of the soft-mobility SAMO vacation program:

- arrive per train or
- leave the car-key at the reception of the tourism office
- stay at one of our 34 SAMO vacation partners and

- get the Soft Mobility Card

Examples of Soft mobility offer (related to mobility) in winter

- Elois, private chauffeur, is available for soft-mobile guests daily from 9 a.m to 10 p.m.
- Night taxi from 10 p.m. to 4 a.m. on weekends
- Transfers from and to the train station Bischofshofen for free
- Free shuttle service from Werfenweng to Bischofshofen (for guests arriving by train)
- card-charged mobile phone
- One test drive with a Toyota Prius

During summer, it is possible to hire electric vehicles (car, bikes…)

2.1.4 Swizerland: Arosa

In summer the lifts and cableways, electro bikes and even the train to and from Langwies are all free of charge. A free shuttle has been implemented

2.1.5 Swizerland: Zermatt

The whole town is combustion-engine car-free zone. Local shops handle their transportation needs with small electric vehicles.

2.2 The USA

In the USA, The ski resort industry is at risk from global warming as glaciers melt and snowfalls diminish. But the industry has recognized the danger and is taking steps to limit its own emissions of greenhouse gases responsible for climate change. Ski lifts are powered by the wind, energy efficient building techniques are in use, and resort vehicles are running on alternative fuels.

2.2.1 Aspen

Aspen Skiing Company purchases wind energy to power the Cirque Lift at Snowmass and the Sundeck Restaurant on Aspen Mountain. Aspen Skiing is offering free parking all season to guests driving low pollution hybrid vehicles, such as gasoline-electric hybrid cars that cut CO2 emissions in half and do not need plugging in.

In March 2009, the City of Aspen recently approved the installation of 27 electrical outlets at the Rio Grande Parking Garage in town. The outlets will allow neighbourhood electric vehicles (NEVs) the ability to park and re-charge.

There is a big increase in the number of NEVs in Aspen. Many NEV owners don't live in town but work here and want to use the vehicles during the day to run errands, etc. This gives them an option for parking the vehicles at night and charging them. Neighbourhood Electric Vehicles are speed-limited battery electric vehicles that operate on only a fraction of the fossil fuels as a standard vehicle by plugging into a standard outlet. It is said the Parking Department will set up contracts with NEV owners for an access charge that will recoup the electricity fees associated with charging each vehicle. The spaces/outlets should be up and running by summer. NEVs already receive free parking in town because of their special designation as a no-emission vehicle. This is even more of an incentive to be eco-conscious with your vehicle choice."

The city of Aspen Police Department announced that it is taking the radical step of implementing a completely hybrid police fleet, making it among the first in the nation to do so. The decision to utilize a fleet of hybrid Toyota Highlanders, complete with a full electrical police package of radio, emergency lights, radar, video & laptop computer, is also a first in Colorado.

2.2.2 Sundance

Sundance uses hybrid vehicles on property to promote the conservation of energy and lessening of polluting emissions. Sundance Resort offers a carpooling incentive for ski guests.

2.3 The French situation

People transportation represents 50% of the Co2 emissions in ski resorts. These are due to the individual cars and the visitors' travels by plane. A major issue in France is the lack of heavy modes between valleys and ski resorts. As seen in Austria, trains arrive directly in the village, which is not the case in French alpen. Tourists have to use coach between the station or the airport to reach their final destination. That could be seen as a hindrance to avoid car use for vacation. But as seen in the case studies, it doesn't prevent to offer alternative solutions into the ski resort.

Several problems have been identified. The issue of managing the space allocated to the car is a recurring problem, either in terms of access to the station, or parking, generally insufficient in winter and sufficient, even above the demand in summer.

Concerning the practice of soft modes, walking, in inner cities or secondary inner cities is generally easy. The interconnection is more problematic.

The perception of the use of bicycles as means of transport is very variable depending on the ski resort. It appears however that the bicycle is primarily a hobby, and given the topography and climatic conditions, it does not seem to be a relevant alternative.

The transport of tourists is often provided through the establishment of shuttle. For most of the resorts, this service is operated by the lifts company lifts in the frame of its contract of public service delegation. This organization has several impacts including:

- The reduction of service after the closure of ski lifts. The municipality takes over to ensure a minimum service.
- The reduction or even complete removal of the service during the summer.

There are very few policy measures in terms of mobility or sustainable transportation. Key actions include:

- A review of the POS (space occupation regulation), and putting up a PLU (local urban planning plan to regulate the use of space), whose vocations are essentially parking management and development of tourist areas.
- To ease walking more in terms of safety (snow) than regarding the development of soft mode.

As a conclusion of the state-of-the-art, good practices in terms of mobility and electric vehicles do exist. But French ski resorts are late regarding the shift towards sustainable mobility. Our project is then to support ski resort to implement alternative modes to individual cars, at least into the villages and cities.

To set up this support a 3 steps methodology has been designed:

1. Creation of a resort typology
2. Identification of the most promising transport solution
3. Redaction of handbooks to implement solutions or policies.

3 Typology of mountain resorts

3.1 Methodology development and issues

The National Association of Mayors of Mountain Resorts (ANMSM), , created a “town and country planning and sustainable development” commission in 2006. The work of this commission led, in 2007, to the establishment of a charter for mountain resorts in favour of sustainable development.
It expresses the will of the Mayors of mountain resorts to provide concrete responses to climatic changes in order to ensure the continuation of the local economies and make sure that tourism is sustainable. It forms part of an overall approach in the medium and long terms in order to integrate the principles of sustainable development into local public policy.

3.2 Methodology

To establish a ski resort typology and to better understand the question of urban planning and mobility, a survey has been prepared and sent to all the association members.
The main objective is to identify common features and related similar mobility problems
Based on this survey, in-depth interviews have been carried out.

3.3 Issues n barriers

We identified 5 main theoretical features:

1. Date of creation
2. Urban forms: Village sprawl or Star Village with downtown and main city centres and secondary station without a car,
3. High, medium, low altitude
4. Geographical position (Alpen, Pyénées, massif central, Jura, Vosges)
5. The share residents/touristic beds

This choice is based on urban studies and experts opinions.
But the results of the survey didn’t give real and obvious differences allowing to set the typology regarding transport and land-use issues. We had to add other parameters and to carry out interviews.

3.4 Typology

The aim of the typology is essentially to define specifications adapted to the characteristics of the resorts, for the establishment of systems of alternative transportation systems.
The first version of the typology is based on the following criteria:

- Urban Form
- beds / inhabitants ratio
- Availability of transportation in the station,
- The difficulties :

- to walk
- to bicycle
- to park cars

- Existing policies for development and mobility

As a result of interviews with the previous stations, the typology has evolved to reach the following analysis grid

- Urban Form / Urban planning
- Top-down / bottom up access
- Economic model, interpreted here as a typology of services, taking into account the differences between summer and winter, and the presence and profile of the permanent population,
- The structure that could operate transport

3.4.1 Urban form

Alongside the typology above mentioned, another component of the urban form can be analyzed, the liaison between the station and the ski area.
The connection between the various components of the ski area can take two forms: Either as a liaison “bottom-up” "by a public transport service regularly enough to be considered as a shuttle service, a liaison “top-down”" or with your ski at your feet.

In contrast to the regular urban centres that have begun the shift to a reduction of cars, the mountain resorts continue to adapt the space in favour of the individual car, mainly because of the difficulties to develop a real alternative, either in the access to the valleys or in the inter-station.

The French supply shows a wide architectural disparity between low altitude resorts and medium or high altitude ones. In the first case, these resorts have been developed on the basis of village pattern. The infrastructure has been improved to facilitate access and communal extensions were carried out. Medium altitude Mountain resorts have experienced two forms of development; either the traditional village was used as a basis for the development of the offer, or a satellite town was created out of the blue. The high mountain resorts, have developed from scratch, motivated by the desire to structure the country to more effectively address the decline in economic activity in the mountain area.

These patterns of development have generated very different architectural achievements. When the expansion of villages and communes relied on already established structures, compliance with the architectural traditions was more or less followed. In this scenario, a few collective buildings were created with limited impact on the traditional urban image.

In the stations created ex nihilo, the respect of local architectural traditions and the integration of housing in the territory were not the main concern, because at the time of their creation, these values were not seen as a promotional vector. These achievements were designed to accommodate tourists in mass on relatively small surfaces and arranged in a "modern" way, at a time when the characters (authenticity) were considered as Witnesses of the past. The structure of these buildings was to promote access to property.

But today, major real estate projects, such as huge buildings in major French ski resorts are in step with customer expectations. These homes no longer meet their expectations, and are considered either too small or impersonal. And the connection between satellites is often limited after the ski-day. However, this type of habitat has the advantage of being located directly on the ski area and to limit urban sprawl. In addition, some creations are real architectural prowess regarding both geographical location and the level of the internal layout.

If these "new" buildings inadequate with the local heritage are no longer praised, they nevertheless retain the attributes for which they were designed: functionality, limiting urban sprawl, concentration of tourist populations, ease of accessibility. In contrast, traditional villages developed in compliance with the architectural traditions offer other advantages: village life, nightlife, local people often from the village, diversified tourism activities with a less pronounced seasonality.

3.4.2 Economic issues

Despite the features offered by resort ex-nihilo, tourists are increasingly looking for a certain authenticity that these ones cannot provide. Resorts of medium and low altitude have been experiencing a little revival of attractiveness, which is reflected in a steady increase in the price of land.

In addition, the summer season is an issue of increasing importance to the economic equilibrium of the mountain resorts. Conversion of high-

altitude ones raises a certain problem. Indeed, the landscape of high mountains is a major hindrance to the attractiveness of these residential tourist sites, exacerbated by the gap between modern living and the natural environment, higher in summer than winter.

In this context, the resorts located at lower altitudes (below 1500m) more easily attract vacationers whose major goal is less to practice intensive hike or activities related to the high mountains (hiking ice climbing ...), than to relax in a natural host. (

3.4.3 The role of the resident population

The building differences between resorts also deal with the demographic aspects. The ex-nihilo ones are mainly devoted to tourists. On the contrary, the ones based on traditional villages are inhabited the whole year.

It is then obvious that the residents have a major role to play in the development of alternative mobility and they must be seen as the first target by the decision maker. To allow them to reduce the use of individual car though an environmentally-friendly system is relevant regarding sustainable development: it improves the quality of life, improves the social context and is in favour of economic development.

Furthermore, visitors will be more inclined to use a permanent system (even capacity-increased during pick season) and to adapt their behaviour to the existing general one. It is what is seen in urban cities where public transport accessibility is good or even with more specific system such as bike-sharing.

4 Building the Decision Support Tool

The challenges to achieving sustainable travel by tourists are diverse. Unlike school and employment sites, tourist hotspots do not necessarily have a standard pattern of travel. In addition, on arrival in an unfamiliar area (often both geographically and linguistically), tourists need information that is clear, concise and up to date. The cities and regions that receive tourists have to deal with a massive population increase during peak season months which places considerable strain on their transport systems and often on the environment that visitors come to enjoy. Coping with seasonal or irregular demand also interferes with regular traffic flow. Many sites and cities depend on tourism economically and are motivated to manage mobility to ensure tourism in these areas grows whilst safeguarding the environment and quality of the environment.

4.1 Goals and targets of the mobility services

Two major axes have been identified:

- Travel master plan for residents with extension to tourists
- Holiday's soft mobility for tourists, but also for seasonal workers.

We have the three main targets with different needs and expectations

- Residents: their travel patterns and needs must be identified according to their age, occupancy, habits. This analysis must be made in the frame of land-use planning and carbon foot-print reduction.
- Tourists/ their expectations are well-known: relaxing, sport, nature, entertainment, these being more and more encompassed by green considerations. Services must fulfill all the sides of those needs.
- Seasonal workers: improved mobility at low cost must be a priority, which means the implementation of transportation consistent with the specific work hours and constraints. Adequate commuters plan should be considered.

There are obviously interwoven interactions between the targets and one's solution can benefit to the others.

Providing a mix of transport options to tourist hotspots improves accessibility for visitors as well as people employed in the tourism industry. Mobility Management is therefore beneficial to tourism in the following ways:

- Reduced traffic congestion and parking problems;
- Better traffic conditions provides a less stressful driving experience for tourists, therefore improving the tourism experience;
- Travel by an alternative mode e.g. by boat or bike can become part of the tourism experience and attract visitors;

- Tourists and employees can save on parking costs;
- Improved community livability and support for strategic policy objectives, such as preservation of environmental and cultural resources (visual amenity, clean air, ambience, traditional customs etc.);
- Increased transport choice enables non-drivers to access tourism;
- Improved walking and cycling conditions;
- Increased road safety;
- Reduced impacts of tourist travel on residents; and
- A more enjoyable experience for all visitors through less impact of parking or moving vehicles on and around the site.

4.2 Most promising systems

To summarise, the alternative systems must:
- Offer a real alternative to individual car in terms of comfort, flexibility
- Be environmentally friendly
- Improve residents life and holidays quality

A collateral impact is the valorisation of the resort image, and then of its attraction. “Green is beautiful” and the shift is also a way to create a concurrent advantage.

The challenge for the ski resort is to provide mass transit but also neighbourhood mobility.

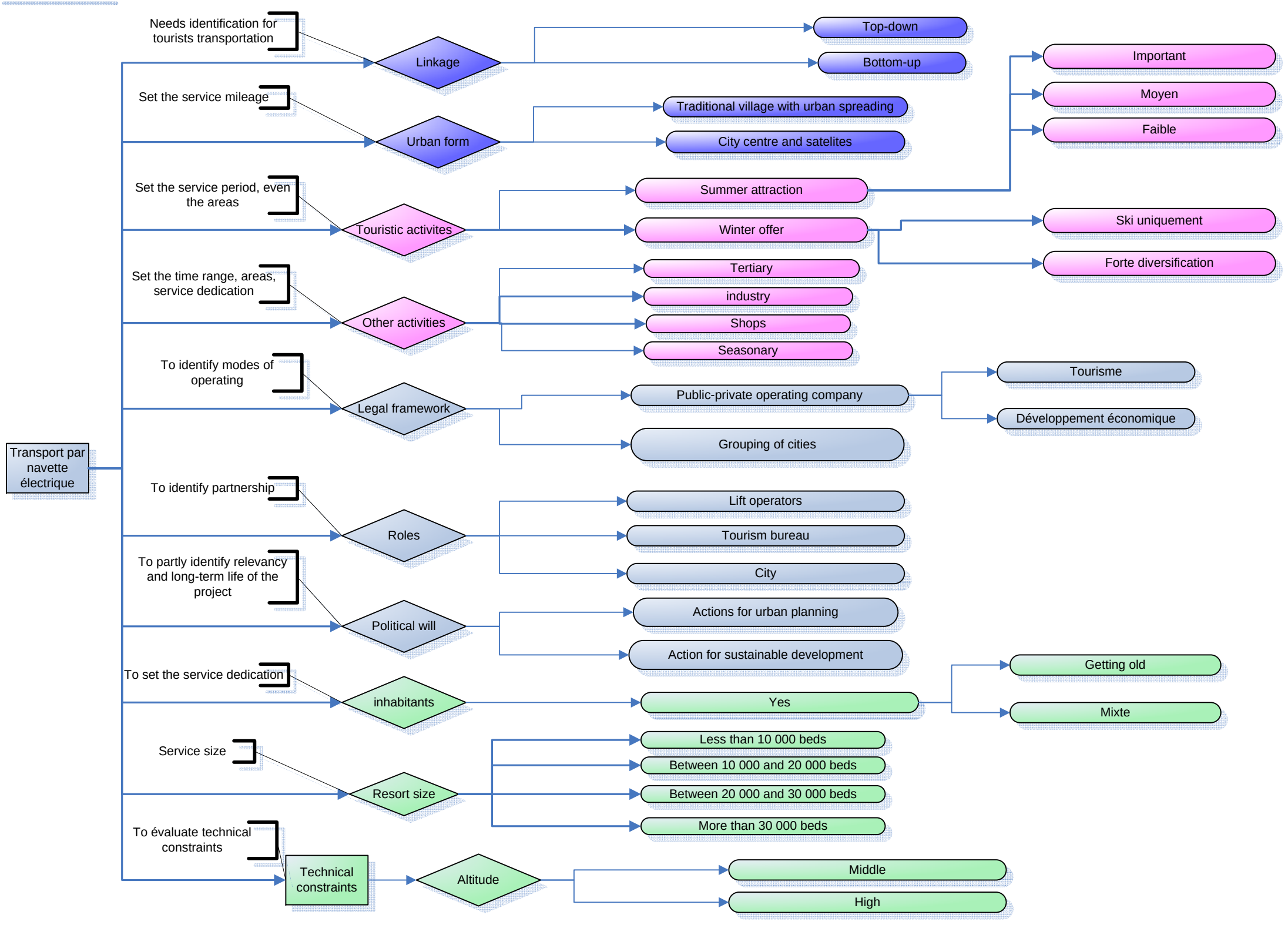
<u>For mass transit:</u>
Electric buses in the frame of a public transport scheme

<u>For neighbourhood mobility:</u>
NEV
E-bike or pedelec hiring
Segways

These systems can’t be stand alone projects based on technical requirements. They must be part of a real sustainable mobility management policy and the related adequate tools/
On one hand: information and communication to raise awareness and to pamper customers
On the other hand: parking regulation, urban planning, car-free zone and incentives

4.3 Components of the decision support

We just present here the general frame of the support decision tool related to the implementation of electric buses.
Even if some parameters and constraints are different, the structure and logics beyond the DSS for neighbourhood electric systems are the same than this one.


Transport par navette électrique
Needs identification for tourists transportation
Linkage
Top-down
Bottom-up
Set the service mileage
Urban form
Traditional village with urban spreading
City centre and satelites
Set the service period, even the areas
Touristic activites
Summer attraction
Winter offer
Important
Moyen
Faible
Ski uniquement
Forte diversification
Set the time range, areas, service dedication
Other activities
Tertiary
industry
Shops
Seasonary
To identify modes of operating
Legal framework
Public-private operating company
Grouping of cities
Tourisme
Développement économique
To identify partnership
Roles
Lift operators
Tourism bureau
City
To partly identify relevancy and long-term life of the project
Political will
Actions for urban planning
Action for sustainable development
To set the service dedication
inhabitants
Yes
Getting old
Mixte
Service size
Resort size
Less than 10 000 beds
Between 10 000 and 20 000 beds
Between 20 000 and 30 000 beds
More than 30 000 beds
To évaluate technical constraints
Technical constraints
Altitude
Middle
High

5 Conclusion

This project is on-going. Lots remain to be done in French ski resorts but the political will to shift towards sustainable mobility is obvious, as it is in other countries.
Regarding the societal evolutions, the economical situation and the global warning fight, the implementation of alternative systems based on electric propulsion is a win-win strategy.

Motivations for implementing Mobility Management in ski resorts are:

- To soften the impact of tourism related traffic on the area, its residents and the environment
- To enable accessibility to the attractions and maintain their attractiveness to tourists Transport as the centre of the tourism strategy: Car-free tourism, barrier-free tourism

Key to success:

- Leading the necessary studies to know travel needs and patterns
- Balancing the success of tourism with the negative impact of traffic on the tourist experience
- Communication – getting residents, staff and tourism businesses involved into the process
- Marketing
- Industrials and dealers

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