Acoustic comfort

The acoustic comfort and emissions sound to the neighborhood is also influenced by the light construction. To evaluate the acoustic quality inside, the times of reverberation had been measured during a concert. The results indicate that it is possible to stay within the optimum area for jazz, but with one time measuring around the limits for the bass frequencies as a consequence of the light construction of the model. An optimisation of the model with big awnings made of cloth tensed across the ceiling of the tent, contributes to improve the periods of reverberation in order to reach a satisfactory level for the jazz. (LAST et al., 2011). During the analysis, a noise pollution had been detected in case of strong wind, resulting from the movement of the construction and the ceilings. This annoying noise is the result of the fact that cloth skin is not put under tension and therefore can float in the wind. This kind of repetitive noises can be really disturbant for spectators and musicians, especially when the sound volume of the concert is low. One last aspect is concerning the sound emissions outwards and inwards, that are very important and generate significant noise coming from inside for the neighborhood and coming from outside for spectators. However measured values on different positions in the neighbourhood are far above the legal limits. Even if this type of ephemeral use often benefits from a certain tolerance on the part of the neighborhood, a level that is so high reduces possibilities of implementation on certain sites (LAST et al. 2011).

Consumption of non-renewable energy (NRE) and environmental impacts (GWP)

Another aspect that is revealed by the assessment of current practice limits considering criteria of sustainability is the environmental impact of materials choices. Indeed the necessary grey-energy isn't subject to special verifications, especially regarding the influences on the environment. For example in this case study, aluminium is the main material used for the structure, as it offers interesting characteristics of lightness and hardiness, but it although requests a lot of energy during its production. As illustrate on figure 4, it represent until 63% of non-renewable energy (NRE) and 51% of global warming potential (GWP). In this way a better planning regarding the material use could optimize this aspect. Another environmental impact revealed by this assessment is the huge energy consumption required to heating system. To reach an acceptable inner climate during cooler periods, it is necessary to compensate the thermal losses of the casing of the tent by using temporary heating oil devices, whom energy is quickly dispersed due to the light construction (FUMEAUX and REY 2012)

TARGETED OBJECTIVES FOR THE "ONSTAGE PROJECT"

Regarding the analysis and the significant points mentioned above, the following targeted objectives are formulated:

1. Flexibility is the first objective. The project has to be able to offer adequate advantages for the current practice. Constructive modalities by elements offer an important level of modularity in term of size and comfort of the structure.
2. Comfort optimization of the planned structure must permit the users the optimal management of the thermal and acoustic comfort. The objective is to keep the inner climate in a comfortable zone, which is the same condition as outside and the occupancy rate (ROULET 2010).
3. For an optimal use of resources the project will include architectural bioclimatic principles, especially regarding the thermal insulation, protection from the sun, natural ventilation and passive refection, which allow the reduction of its energetic demand (warmth and cold) and the prior valorisation of resources that are locally disposable (AIULFI and REY 2010)
4. The project aims at establishing a basis of a concept of efficient economic exploitation of the structure. By rationalizing the process, the project has to reach an economic feasibility for the operator. The project aims at establishing bases of a financially balanced concept, regarding its lifecycle including an optimization of production costs and exploitation (REY and RYTER 2003)
5. The concept and the realization of the new infrastructure, likewise temporary and permanent, will include a special care for the architectural expression. The system will be well conceived in a way that it will contribute to the expression of a spatial coherence and offer a harmonic integration of the object in the different contexts where it will finally take place.

FROM A CONCEPTUAL VISION TO AN OPERATIONAL PROTOTYPE

Subsequent to the definition of the objectives of the project, a conceptual vision has been developed in order to set the basis of the constructive system and to specify the components that have to be developed in detail regarding the specific objectives mentioned. This conceptual vision is the basis of integrated design in the course of which the interdisciplinary competences of the different partners of the project (civil engineers, experts for thermal and acoustic, carpenters, specialists for photovoltaic and operators) have to optimize the conceptual vision.

Bioclimatic strategies and reduction of energy demand

The scheme of figure 1 shows the planned principle for the management of overheating situation at daytime. To avoid overheating, the conceptual vision includes architectural bioclimatic principles. A passive strategy which is based on the given space between the two layers of the casing, which is used as a sealed space that helps to deflect warm air by providing a tempered layer, which contributes to the thermal insulation for inside temperature's stability even in cooler periods. After reducing the needs of energy through bioclimatics strategies, the project implements a concept of comfort ventilation with heat recovery, coupled to a battery (hot-cold) powered by an air heat pump. A device tested in the field of sustainable buildings, but which apperars as a pionner experience in the field of temporary constructions. Finally, photovoltaic panels integrated into the roof structure (rigid / flexible technologies) provide renewable source of electricity.

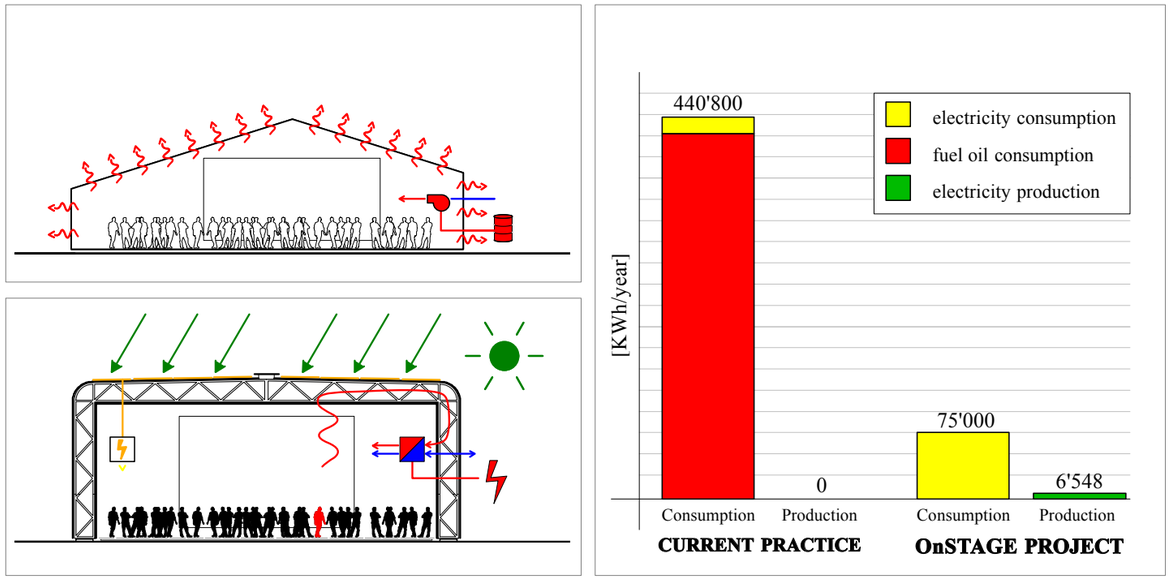

Figure 1 Comparison of energy consumed and produced (final energy) for annual use (100 days per year) for the conventional device and the project "On STAGE".

Inner acoustic quality and noise transmission

Regarding the acoustic and as illustrates on figure 2, the additional mass that is filled inside the acoustic panels will help to control the acoustic of the room better, especially in term of low frequencies. The double side acoustic panels (smooth and absorbent) avoid flexible inside skin configuration for an optimal acoustic diffusion according to size and need of use. For the reduction of the noise toward outside and inside the project proposes to add an acoustic skin of 10 kilograms per square meters to reduce sound emissions towards the envelopp up to 25 dB. It may therefore benefit from a certain tolerance from the neighbourhood, and increase opportunities for implementation on most sites.