Environmental advantages of video conferencing systems - results from a simplified LCA

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Starting position

Video conferences can substitute meetings where all participants are physically present by virtual meetings where the participants can take part without all of them being physically present at the same location. The advantages of this technique are obvious: No more - or better much less - travelling is necessary. Which is both less stressful and more environmentally sound, additionally it also comes cheaper. Admittedly video conferences are not similaryly suitable for all types of meetings. In case of conflicts or emotional discussions, video conferencing might not bring satisfying results. Likewise for situations where participants/conversational partners do not know each other. As a consequence video conferences could most successfully be used for replacing regular meetings among participants that know each other rather well. Even if only every other meeting would be substituted, half of the business travel could be spared.

In principal there are two types of video conferencing systems to be distinguished: systems suitable for communication between two workplaces, each equipped with a computer, a camera, a microphone, an audio card and the appropriate software. On the other hand there are systems made for group communication, which means that several people can participate in a conference at one location. Besides a pivoting camera that focuses on the currently speaking person, the system includes a microphone, a screen and the video conference system itself. It is possible to add other devices on the periphery like a document camera, a whiteboard etc. Additionally one can distinguish between conferences that connect two locations and conferences that connect three or more locations. The latter are called multipoint conferences.

In the subsequently shown analyses, performed on behalf of the Deutsche Telekom, we looked at one multipoint-group system. We analysed the environmental impacts of production and operation of the video conference system in comparison to conventional meetings connected with the production and operation of means of transportation. The influence of the infrastructure was also looked at. In the second step we also analysed the anticipatory costs.

Accomplishment of the analyses

Life cycle analysis has been developed within the last 15 years to an internationally accepted method to evaluate the environmental burdens associated with product systems or services. It describes the energy and materials used, wastes released into the environment and assesses the impacts on the environment, including the entire life cycle. The principles, procedures and terminology of LCA are harmonised in DIN EN ISO 14040 to 14043 on an international level. The environmental assessment worked out in this study is based on the methodological framework for LCA described above. Nevertheless, this work is to be considered as a "simplified" LCA due to the following reason: no critical review has been performed and some simplifications have been made concerning the system boundaries and the considered processes (see below).

In order to compare video conferences with ordinary meetings, we chose two meeting situations. The first one, *situation 1,* was a meeting of only two people working at different locations. It was very simple, in order to show the key factors. The "situation 1" is defined in a way that only one person has to travel for the meeting. Both the distance and the length of the meeting are varied. Additionally, the means of transportation can be modified.

The second one, *situation 2*, a meeting of 5 people that work at three different locations, represents a typical everyday meeting situation. *Situation 2* is somewhat different from *situation 1*. Both the distance and the means of transportation are set. Only the length of the meetings has been varied.

The calculation was done in two steps: first, only the operation of the video conferencing system (including screen) and the means of transportation respectively were taken into account. Three transportation systems were considered: train (electrified), car (gasoline), car (diesel). In the second step, the production of the video conferencing system and the means of transportation were also included. Assumptions[1] were made concerning the lifetime and the composition of the devices. These assumptions were set rather conservatively or disadvategeously respectively for the videoconference system[2]. In the third step, the influence of the infrastructure was investigated. The results of this third step are not shown here.

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[1] The following assumptions were made concerning lifetime: video conference system 5 years; screen 10 years; train 25 years; car 10 years.

[2] Knowing that the video conference system was likely to be environmentally advantageous, we assumed relatively few hours of use over the whole lifetime and allocated the screen completely to the video conference system.

Results

The results for *situation 1* show, that at a distance longer than 15 kilometers, travelling always gives rise to more environmental impacts[3] than a video conference arising from a 4-hour meeting. As might be expected, transport by train causes much less impact than travel by car. For the latter, the diesel car shows the better performance. Taking production also into account, the picture changes slightly. As the general framework (e.g. relatively few hours of use over the whole lifetime) is rather disadvantageous for the video conference system, the break even point moves up to around 50 kilometers distance for a 4-hour meeting and transportation by train. The impact of a car ride exceed the impacts of the video conference already at a distance of less then 20 kilometers. The longer the distance, the bigger the advantage of a video conference. At a distance of e.g. 1,000 kilometers, a video conference of 4 hours (production phase included) needs only 5% of the primary energy of a train ride or around 1% of the primary energy of a car ride or a flight.

The framework for *situation 2* was set rather rigidly. Apxoximattely 3,000 passenger kilometers had to be coverd by train for each meeting. The meetings were assumed to take 6 hours. The results showed that the video conference could reduce the environmental impacts by 88 percent (acidification potential) or more, taking into account only the operation. The inclusion of the production phase changed the picture slightly again. The performance of a video conference reduces the impacts by 63 percent for the acidification potential and around 90 percent for the primary energy demand and the global warming potential. The POCP could even be reduced by 99 percent.

Significance for Germany

In Germany business travel contributes with 160 billion person kilometers or 17 percent to the over all volume of traffic every year. 21 million single paths are being taken for business trips (Langbein et al. 1995). Underlying the average mix of means of transportation in Germany, 3 percent of the person kilometres are covered by plane, 16 percent by train, tramway or bus, 82 percent are travelled by car as driver or passenger. Based on the available statistics, it is not possible to state the percentage of business trips that are being undertaken for meetings. Likewise, assumptions can only be made according to the share that could be substituted by video conferencing. Nonetheless, even a 10 or 20 percent reduction would correspond to a definite reduction of transporttion and environmental impacts as our calculations show.

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[3] The following impact categories were regarded: primary energy demand, global warming potential, acidification potential and photooxidation potential.

Conclusions and outlook

The substitution of meetings by video conferences reduces the environmental impacts by a percentage of up to more than 90 percent. The range of acheavable reduction depends on the general framework in each individual case (means of transportation, number of participants resp. travellers, distance, etc.). The longer the distance, the more participants that have to travel and the shorter a meeting is set, the more impact can be saved by substituting a video conference.

As our results have shown clearly, the substitution of meetings by video conferences has definite environmental advantages. Nevertheless, it has to be mentioned that they also hold some risks: one cannot dismiss that an increase of video conferences could lead to an increase of especially long travels. Video conferences simplify the contact and collaboration between people that work far apart (e.g. on two continents). As it is unsatisfying never to meet each other personnally while working together, one can expect some additional flights every year. This would mean that although there is a deacrease at one point, the overall environmental burdens increase due to other connected activities. This effect is called rebound effect. It has been found in many other applications of information and communication technologies. Due to complex circumstances, its influence usually cannot be calculated precisely.

It is very important now to work out the critical factors for success (and failure) that would help to increase the sustainable use of this technology. This is one of the aims of the ongoing work in the project.

Final Remarks

In case of acceptance, the long paper will contain - amongst other things - a more detailed discussion

- on the influence of infrastructur,
- on the Rebound effect (calculation of a break-even-point),
- on current trends concerning the application of video conference systems (e.g. medicine, education).