GENERAL INFORMATION

PETUS description of tool in use	
Name of the case	Sustainable design of DR City
Name of the tool	MEMPD (Manual on Environmental Management in Project Design (in Danish: ”Miljørigtig projektering”).
Country	Denmark
City / region Total area (km2) Population Density (people/km2)	Copenhagen 89 km^2 502.000 5640 people/km^2
Tool user’s profile a. Organisation name (municipality, NGO, national or regional department, company, etc.) b. Field of activity c. Detailed contact/feedback (project website, e-mail, address, tel., fax)	a. Danish National Broadcasting (DR, a national public institution) b. Broadcasting, media, culture, building c. http://www.dr.dk/drbyen/
Reviewer, date: Jesper Ole Jensen, DTU d. 30.11.2004	

Short description of the case

abstract up to 300 words

DR City (DR-Byen) is the new headquarter for Denmark’s Radio, the national broadcasting for radio and television. It is located in Ørestad, a new urban development area in Copenhagen. The head quarter will house a number of functions, including radio- and TV-production, studios, workshops, offices, concert-hall etc., covering app. 130.000 m^2. The construction started in November 2002, and it is planned to finish in 2006. The new headquarter includes a number of sustainable efforts, which place it at the forefront of current sustainable building projects in Denmark. In the project, tools and concepts as MEMPD (“Manual on Environmental Management in Project Design” (In Danish: ”Miljørigtig Projektering”), ”partnering” and “facilities management” are being used. DR City is under construction, but there are already several experiences on the use of MEMPD and other tools. MEMPD has been adapted to the specific case. Due to the involvement of users, indoor climate was given a high priority in prioritisation of the environmental goals. Using MEMPD has been new for many of the actors involved. Therefore a main result has been the learning process of environmental management for the involved.

The case was chosen as it is one of the largest construction projects in Denmark, using the main tool for sustainable building. The case relates to the key problems in the building sector: Energy efficiency, indoor climate, emission reductions, construction process and human impacts.

Sector	Waste	Energy	Water	Transport	Green/blue	Building & Land Use
						X

Scale of project	Component	Building	Neighbourhood	City	Region
	X	X	X	**(x)**	

Status of project	Starting up	Ongoing	Finished	Start date	End date (exp.)
		x			2006

Key words

Sustainable building, MEMPD, partnering, process, technology, innovation

Project a. Object (building, city park, wind farm, etc.) b. Type of activity (regeneration, renovation, new development, etc.) c. Type of product (plan, scheme, design project, etc.)	a. Building / group of buildings b. New development c. Design project
Tool a. Character (according to WP3final0704.doc) b. Benchmarks (qualitative or quantitative) c. Availability (paid/ free)	a. Process tool b. No c. The tool has to be paid for, so has the services from the consultants if they design the buildings according to the MEMPD (“Manual on Environmental Management in Project Design”).
Decision-making process a. Stage of the tool implementation (preliminary, midterm, etc.) b. Level (political, technical, etc.)	a. Design / preliminary b. Technical and political c. The users of the building were involved

c. Public participation	
Other *(optional, if needed)*	

DETAILED INFORMATION

A. Detailed description of project and tool	
1. Description of context (existing strategies, laws, policy, action plans, etc.): EU, national, regional, municipal	DR City (DR-Byen) is the new headquarter for Denmark's Radio, the national broadcasting for radio and television. It is located in Ørestad, a new urban development area in Copenhagen. The head quarter will house a number of functions, including radio- and TV-production, studios, workshops, offices, concert-hall etc., covering app. 130.000 m^2. The construction started in November 2002, and it is planned to finish in 2006. When completed, DR will be located in one building, whereas today it is spread over 12 different addresses in Greater Copenhagen.  Ørestad is expected to develop into "a center for culture, medias and communication". The Ørestad corporation has defined asset of environmental goals that DR City has to follow. DR City is based on partnering between builder, consultants, contractors, suppliers and authorities. The version of partnering in this project is called "the DR-Model", which include a number of different organisational changes compared to traditional construction management. This concerns the collaboration between the owner and the consultants inside each segment, and is a part of the general management of DR, which is based on "Value-based Management". This means that other values than just budgets and time schedules can be prioritised, for instance the employee's satisfaction. In practice, DR City has defined the following 7 superior values for the project: Professionalism, Openness, Honesty, Dialogue, Punctuality, Respect for others and Good collaboration partners. According to DR, value-based management also means that the client is constantly kept up to date with the state of the project, and that the partners feel a commitment to the management process they are a part of (source: DR website).
2. Description of project a. Background (What caused the initiation of the project?; What was the problem? Who initiated the project?); b. Objectives/aims (sustainability statement – what issues of sustainability were attacked);	a. DR-City has given environmental issues a high priority in planning and designing the buildings and the green areas around it. One decisive factor for the green profile in DR City and using the tools has been that sustainable concerns were prioritized right from the beginning, and was clearly defined in the building program. Another factor is that the chairman of the building committee as a person was strongly committed to sustainability. The chairman, Finn Åberg, is also the major from the municipality of Albertslund, which is a leading municipality in sustainable urban policy (see also the case of Dogme 2000). b. The sustainable goals and initiatives have been an integrated part of the partnering concept. The partnering concept has influenced the way MEMPD has been used in the project, which has included user involvement in decisions on sustainable goals and building design. The emphasis on sustainability is a part of the overall concept for DR City. To ensure that all environmental requirements are fulfilled, the principles of ISO 14001 on environmental management are laid down over all phases of the project (www.dr.dk). DR has formulated six policies for DR City, including an environmental policy: *"DR Byen should be a building leading, but not experimenting, in relation to green buildings and implementation of ecological elements in the building, and a project where there is openness on the environmental state of the projects"* The environmental efforts in DR City are divided in two separate projects: **Buildings** and **production technology**. These are two different tasks, requiring different approaches. **Buildings** The General Building Program includes a number of environmental goals on energy and water consumption, landscape, contaminated land, waste, use of materials, indoor climate, noise and safety. Although the ambitions are high, only a few goals have defined quantitatively. • On energy a main goal is to reduce the "energy-frame" of the buildings (consumption of heat and electricity) by 33% compared to the present demands in the Building Regulations (BR 95). This reduction is expected to become a part of the next Building Regulations (BR 2005). This includes optimising the use of daylight, using low energy

	lights and low energy appliances in the building. • For landscapes, recreational areas and contaminated soil the goals are defined rather soft. • On water, rainwater is being collected and used for toilet flushing • For waste, it is a goal to make waste sorting at the source easy, to minimise need for transport on the ground when waste is collected, and to consider local composting of garden waste. • On materials, the energy consumption from the production of the materials should be as low as possible, based on an LCA-screening (using for instance BEAT-2002). There is a long list of demands for the materials used, e.g. to use materials with longevity, avoid environmentally harming materials (e.g. VOC, radioactive, cancer- inducing etc.), reducing waste of materials on the building process and so on. Each consultant on the four segments will have to make an environmental screening of the materials used, and choose the least environmentally damaging. • Comfort and indoor climate has a high priority, as it is a precondition that the buildings should be nice and attractive to work in. In the General Building Program, it is formulated in a number of quantitative goals on temperature, humidity, static electricity and well-being. The latter is defined from the PMV–index (Predicted Mean Vote), the PPD-index (Predicted Percentage of Dissatisfied) and the PD-factor (Percentage of Dissatisfied). Similar, there are strong demands on the acoustics. As the concert hall of DR's Symphony Orchestra will be located right next to the metro as well as the airport, special efforts have to be made to reduce the noise from outside. Due to the functional demands, there are a number of limitations on possible alternatives, especially in relation to materials. For instance, when materials for the floor were going to be decided, the only material able to fulfill demands on being able to carry rolling camera wagons without making traces in the surface changing, was Epoxy, which is not very environmentally friendly. On this point is had also been suggested to use clay, treated with linseed oil, which would be more environmentally friendly, but probably would not last for many TV-transmissions. Also, the demand for noise reduction in the buildings reduced the possibilities for natural ventilation. **Production / technology** The largest environmental impacts from DR City are expected to come from the production equipment (for actually producing the television and radio programmes, i.e. all types of electronic equipment, light, cooling etc.). Therefore, a number of different technology projects to reduce the environmental impacts are included in this part: • A 1.200 m^2 solar cells plant (photovoltaics / PV's) will be established, which will be Denmark's largest plant when completed • Ground water cooling in an Aquifier cold storage (which has not been used in Denmark before). It substitutes the mechanical ventilation by using cold groundwater for cooling in the summer, stores the heated water in the ground, and in the winter turns the direction, and uses the warm water for heating. There are no experiences with such a system, but according to calculations made, the energy consumption is expected to be 38% compared to a "traditional" solution. • Natural and hybrid ventilation (intelligent double facades) • Collection of rainwater (planned to become the largest in Denmark) There is a limited number of benchmarks or quantitative goals defined in this part. The reason is mainly lack of references; in the Building Regulations there are no benchmarks of measures from which goals can be defined. Also in general, there are little experiences or standards for e.g. the energy use of such office buildings, with so much production equipment. Therefore, the demands on the production equipment have not been described that much in detail, but have been defined as using "best available technology", finding some good solutions on the site by being innovative.
c. Time interval and stages of project realization; d. Financing – amount, sources, institutions involved, partnerships, levels.	c. The project started in 2002 and is planned to be finished in 2006. d. The budget for the buildings is 3 billions DKK (app. 400 mill. €), for the production equipment 740 mill. DKK. It was originally planned that the environmental measures should be implemented within the total budget. However, as an opportunity for extra financial EU-support on the technology project (IT-ECO) showed up, it was decided to implement some more experimenting environmental technologies. Recently, it has been revealed, that the DR City will not be able to follow the budget, therefore more finances (623 mill. DKK, or. app. 85 mill. €) will be required.
e. Other sectors involved in the particular	e. The project covers several sectors (energy, water, waste, transport, green-blue). Another important asset in DR City is to reduce accidents in the construction phase. They

project/problem (conflicts and/or links)	have been very successful in this, as there have been no serious accidents since the construction started. On security, they are one of the best organized buildings in Europe, which was the reason they recently (November 2004) received EU's Good Practice Award 2004 on work environment.
3. Description of tool a. Character (according to WP3final0704.doc) - calculation tools, process tools, assessment methods, generic tools, simulation tools, guidelines, framework tools, schemes, indicators and monitoring, checklists, case-specific tools; b. Availability of the tool (web-based / paper, paid / free, etc.) c. Based on existing tool or newly elaborated; d. Adaptation of the tool to the local context (are there local experts involved in tool's development?) e. Other tools implemented to support the project development	a. The MEMPD is the main tool. It is a voluntary tool which describes procedures to be followed in designing sustainable buildings, and suggests other tools to be used (see WP2 review). It does not necessarily require or guarantee any environmental improvements, but leaves it up to the owner and consultants to define environmental goals for the building. b. MEMPD has to be paid for, so has the services from the consultants if they design the buildings according to the MEMPD. c. The tool MEMPD is not based on existing tools. d. The tool was adapted to the case by the consultant, who has experience using the MEMPD from other projects. The MEMPD was not adapted in its full version to the project. Due to the environmental consultants experience from using MEMPD on other projects, she suggested that in DR City MEMPD should be applied in a more "loose" way. This means, that not all the steps in MEMPD are followed strictly as described. Also, the structure in MEMPD does not match the partnering-approach very well. e. Other tools involved: • Environmental Declaration of Buildings (labeling tool). DR City has been used as a case for testing the tool • The General building Program for DR City is generally based on the principles of ISO14001 (a process tool). In relation to the building process MEMPD is the main tool • Also more specific tools are being used. For instance, in relation to the indoor climate, tools as PMV–index (Predicted Mean Vote), PPD-index (Predicted Percentage of Dissatisfied) and a PD-factor (Percentage of Dissatisfied) are used. These tools can be characterized as scoring-tools.
B. Tool implementation	
1. Argumentation for choosing the tool a. What were the reasons for the implementation of the tool? (voluntary or requested by what local, national, etc regulation) b. Who took the initiative for choosing /elaboration the tool? c. What were the criteria for choosing the tool? d. Was there knowledge of other tools and were they considered?	a. It was voluntary and a part of the green profile for the DR City. b. The environmental consultant for DR, Mrs. Marianne Fox, comes from the consultant company COWI who played an active role in developing MEMPD about 10 years ago. She has experiences using the MEMPD, but is rather critical towards the tool, or parts of it. For instance, the handbook recommends environmental screening, but describes little about how to carry it out in practice, or gives any examples on screenings. Her general experience is that tools, to work in practice, have to be simple and manageable. c. According to the environmental consultant for DR, MEMPD was the only tool available for the purpose and the consultant was familiar with this tool (interview). d. See above. It was also planned also to use the LCA-tool BEAT 2000 (see WP2), for the environmental screening of building materials and components. This was however dropped, as it would require a lot of data collection, and also it was uncertain how much new knowledge the tool would provide.
2. Barriers for the tool implementation What were the main problems in the tool implementation? (Regulation, information available, public	There are different problems related to using MEMPD. For instance, the handbook recommends environmental screening, but describes little about how to carry it out in practice, or gives any examples on screenings. MEMPD is very comprehensive in its full version. Therefore it was used in a "flexible" way that corresponded to the specific case. In general, MEMPD does not guarantee any environmental improvements. It only suggests the user which steps to follow, including setting of environmental goals. Therefore the results on using MEMPD depend on the client's ability and ambitions on defining and pursuing such goals.

awareness, lack of clear SD definitions and benchmarks, communication etc.)	
C. Influence of the tool on the decision-making process	
1. Description of the decision-making process/ procedures a. Stages	The decision-making process in relation to sustainable issues has consisted of different steps: 1. Formulating a general building program 2. Settling a Building Committee 3. Environmental screening 4. Defining goals, involving users The consultants for each segment in DR City have had the responsibility to establish their own environmental management system for the segment, and to carry out the environmental screenings of the materials and constructions used. The plans and the screenings have had to be approved by DR City's environmental consultant. Generally, this has worked well. Only in one case it has been necessary to ask a segment-consultant for a remake of the management plan. In the prioritization of environmental goals, the users, i.e. the present staffs of DR, who are going to work in DR City when finished, were asked to prioritize different goals for the buildings, including environmental goals. One of the things they prioritized was natural ventilation and daylight.
b. Levels (political, technical, etc.)	b. MEMPD was used on a technical level
c. Sources of information used during the dmp;	c. Documents and direct communication between partners
d. Who are the decision-makers?	d. The main decision-maker is client, DR City. DR City is physically and organizationally divided in 4 segments, containing different functions of the DR City. The projects in the four segments have different consultants and contractors, and are based on architect competitions (including a competition for the whole area). Other main actors involved are (with different consultants and contractors in the four segments): • Consultant for the client (DR City): COWI A/S and PLH arkitekter • Technical consultants on the four segments: A number of Danish architects and engineers. At segment 4, the concert hall, Jean Nouvel is the architect, as well as there are foreign consultants connected • Contractors on the four segments • Others: The Municipality of Copenhagen (environmental guidelines for new buildings and renovations), Ørestad Consortium (developers, with a number of environmental guidelines also), EU (financial support for the technology project, IT-Eco).
e. Who made the final decision for the project implementation? Was it political or technical decision?	e. It was a political decision by the board of the DR, that the DR City should be designed as a sustainable building.
2. Tool in decision-making process a. At what stage was the tool implemented? By whom? (experts, politicians, etc.)	a. The decision-making stages on sustainable issues included the following steps: 1. Formulating a general building program 2. Settling a Building Committee 3. Environmental screening 4. Defining goals, involving users MEMPD was used in step 3 and 4.
b. How did the tool output influence the process (added or skipped levels/stages in the existing decision-making process, etc.)?	b. The tool included added stages in the design phase. The consultants for each segment in DR City have had the responsibility to establish their own environmental management system for the segment, and to carry out the environmental screenings of the materials and constructions used. The plans and the screenings have had to be approved by DR City's environmental consultant. Generally, this has worked well. Only in one case it has been necessary to ask a segment-consultant for a remake of the management plan. In the prioritisation of environmental goals, the users, i.e. the present staffs of DR, who are going to work in DR City when finished, were asked to prioritise different goals for the buildings, including environmental goals. One of the things prioritised was natural ventilation and daylight.
c. Quantitative goals or benchmarks defined? (If	c. The sustainable goals and initiatives have been an integrated part of the partnering concept. The environmental goals in DR City are related to respectively **Buildings** and

YES, which – and what were they compared to?) d. Was the tool used to support argumentations?	**production technology**. **Buildings** The General Building Program includes a number of environmental goals on energy and water consumption, landscape, contaminated land, waste, use of materials, indoor climate, noise and safety. Although the ambitions are high, only a few goals have defined quantitatively. • On energy a main goal is to reduce the "energy-frame" of the buildings (consumption of heat and electricity) by 33% compared to the present demands in the Building Regulations (BR 95). • For landscapes and recreational areas the building should be planned to minimise negative effects on the local nature and climate • For contaminated soil the goals are to avoid health—damaging influence on users and neighbours in the building process and building operation • For waste, it is a goal to make waste sorting at the source easy, to minimise need for transport on the ground when waste is collected, and to consider local composting of garden waste. • On materials, the energy consumption from the production of the materials should be as low as possible, based on an LCA-screening (using for instance BEAT-2002). There is a long list of demands for the materials used, e.g. to use materials with longevity, avoid environmentally harming materials (e.g. VOC, radioactive, cancer- inducing etc.), reducing waste of materials on the building process and so on. • A number of quantitative goals have been defined on temperature, humidity, static electricity and well-being. The latter is defined from the PMV–index (Predicted Mean Vote), the PPD-index (Predicted Percentage of Dissatisfied) and the PD-factor (Percentage of Dissatisfied). For the acoustic performance on the building, a number of quantitative demands were formulated. • On working environment (including safety) the goal is to establish the best possible working environment in the construction and operation phases • On water the consumption of clean drinking water should be reduced, and the disposal of waste water. This includes use of water saving installations and considerations on collection and reuse of storm-water. **Production / technology** The largest environmental impacts from DR City are expected to come from the production equipment (for actually producing the television and radio programmes, i.e. all types of electronic equipment, light, cooling etc. The sustainability goals defined in this part include: • To establish 1.200 m^2 solar cells plant (photovoltaics / PV's) • The energy consumption is expected to be 38% compared to a "traditional" solution. This is expected to be reached by using ground water cooling in an Aquifier cold storage, which will substitute mechanical ventilation • Using natural and hybrid ventilation (intelligent double facades) – no benchmarks defined • Reduction of groundwater use by collection of stormwater – no benchmarks defined There is a limited number of benchmarks or quantitative goals defined in this part. The reason is mainly lack of references; in the Building Regulations there are no benchmarks of measures from which goals on this type of projects can be defined. Also in general, there are little experiences or standards for e.g. the energy use of such office buildings, with so much production equipment. Therefore, the demands on the production equipment have not been described that much in details, but have been defined as using "best available technology", finding some good solutions on the site by being innovative. d. MEMPD is mainly a process tool, which suggests the client and consultant which steps to take to design a sustainable building. MEMPD was not followed completely, but was adapted to the specific situation. In this way, the decisions made on sustainable issues were framed by the procedures described in MEMPD.
3. Transparency of decision-making process a. How was the information of the dmp disseminated? - directly (decision makers – public) or indirectly (decision makers - NGO, PR company, etc. - public); sources of dissemination used	a. The partnering concept has the main advantage that the client is always orientated on the state of the project, and that the partners are committed to the project. One practical implication of the partnering is that the client, the consultants and contractors share the same office-complex, the same facilities etc. This makes meetings and direct communication much easier.

(mass media, internet, brochure, etc.) b. How was the public involved? c. Was there a public discussion over the project and at what stage of the project development?	b. The users were involved in the design process, as they were asked to prioritize between different environmental goals. There was no intention to involve the public in general in the project. Citizens in Copenhagen have been informed through the planning procedures in the law on spatial planning, which gives citizens a right to comment or complain over the project). c. DR City is a very big project, by a national institution, therefore the building project has caused a lot of attention, but not much discussion.
D. Expert assessment/analysis/comment of the tool effectiveness	
1. Assessment by tool users a. Were there measurable improvements as a result of the tool implementation? If YES, what? If no: why not? b. Were there any spun-off's or unintended consequences? c. General view on the tool? Lessons learned?	a. According to the environmental consultant it is very difficult to assess the influence on using MEMPD; many initiatives are just a matter of common sense. The user involvement, that was a matter of using MEMPD, meant that the issues of indoor climate probably got a higher priority than if the users had not bee asked. b. There have been no recorded spin-off's. c. Lessons learned: • Using the MEMPD in the DR City has served as a learning project for the involved actors (owners, consultants and contractors). The actors will most likely take the experiences from this project with them to other projects. • Use of benchmarks has been limited. A large part of the sustainable measures have been defined by choosing "green" technologies, and to choose the most sustainable solutions along the way. • The problem that many have experienced using MEMPD is one reason for the limited use of the tool. This case illustrates that once the actors get familiar with the ideas, processes and methodologies, it becomes easier to use. Participating in a project like this will probably make it easier for the actors to use the methodology of MEMPD in other projects, and to and to recommend it to others. • The client have put many resources into the project, and wanted it to be a state-of-the-art project for sustainable building. For most clients and designers, this is not a realistic model to apply on buildings in general. • One decisive factor for using the tools has been that sustainable concerns were prioritized right from the beginning, and was clearly defined in the building program. Another factor is that the chairman of the building committee as a person was strongly committed to sustainability.
d. Potentials for further use of the tool?	d. By testing, measuring and demonstrating the energy-saving devices it is, according to the consultants, an ambition that such technologies will become better known and spread to other projects. However, this will probably be versions adapted to the specific case, as in DR City. Some consultants have made their own versions of the MEMPD, which they will use in the future. Also, a new version of MEMPD has been developed: ABC Planner, which is a web-based tool, making the procedures and choices described in MEMPD easier to use. Special adapted editions of the ABC Planner can be made for customers, which different municipalities and designers already have shown interest in.
e. Will the actors recommend it or use it in other cases - why / why not?	e. Yes. Using the MEMPD in the DR City has served as a learning project for the involved actors (owners, consultants and contractors). The actors will most likely take the experiences from this project with them to other projects.
2. Reviewer's assessment of the tool (usefulness, sustainability relevance, who are the actors excluded? etc.) Suggestions and needs for further development of the tool	The tool MEMPD has proved to be useful, but not necessarily applied in its full version. The case illustrates that once the actors get familiar with the ideas, processes and methodologies, it becomes easier to use. Participating in a project like this will probably make it easier for the actors to use the methodology of MEMPD in other projects, and to and to recommend it to others. A new version of MEMPD has been developed: ABC Planner, which is a web-based tool, making the procedures and choices described in MEMPD easier to use. Special adapted editions of the ABC Planner can be made for customers, which different municipalities and designers already have shown interest in.

E. Additional information on the case study available	
Websites	http://www.dr.dk/drbyen/
References *concerning the case but also the key words or problem* (papers, articles, reports, laws, etc.)	Miljøredegørelse august 2003. *Status for miljø i DR Byen – miljø, energi, indeklima og arbejdsmiljø*. DR BYEN. DR Ørestad (2003). Generelt byggeprogram, version 10, 4.3.2003. Uddrag om miljømålsætninger. Bilag om miljøledelse.
Other sources (Interviews, conferences, discussions, etc.)	Interview with Mrs. Marianne Fox, environmental consultant at DR-City d. 29.10.03.
Contact details for further information	Mrs. Marianne Fox, environmental consultant at DR-City