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PrimeEnergyIT EFFICIENT DATA CENTERS

Case Studies: Public Procurement of Energy Efficient Data Centres

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Content

Introduction

In this time of new innovative IT services solutions such as cloud computing, and higher technological needs, data centres and server rooms are increasingly becoming critical pieces of the overall IT services panorama. In this evolving context, and always considering that the main costs of running a server room go in parallel to its consumption of energy, the need to reorient the construction and renovation of data centres towards a more sustainable, environmental-friendly approach, becomes palpable. "Green" data centres not only suppose a significant reduction of monetary costs, but also offer a sustainable, innovative, safer and energy efficient computing solution.

The present series of case studies, compiled within the European PrimeEnergyIT project, align with this view from the perspective of public organizations. The different scenarios included in this compilation confirm that the public procurement of newly constructed data centres originates from the necessity to achieve more efficient energy consumption (i.e. a lower Power Usage Effectiveness (PUE) value), reduced operative and maintenance costs, and safer data storage through higher availability and improved redundancy.

As the different case studies show us, these needs are met through a range of different contracting methods, including highly detailed technical and environmental tender specifications (e.g. compulsory use of Energy Star standards), joint tender processes and framework agreements (which offer reduced costs through economies of scale) or market surveys and dialogue with the relevant stakeholders in order to guarantee a market friendly set of requirements.

The public procurement awards of these contracting methods translate into the implementation of highly innovative solutions, such as servers that utilize sea water cooling systems or absorption chillers powered by waste heat.

The resulting newly acquired data centres offer what was expected: a significant reduction of monetary costs (up to 30% of operative costs in some cases), a significant reduction of energetic costs (up to 78% of total server room in some cases), system reliability and positive

environmental externalities, such as fewer CO_2 emissions (savings of up to 47% in some cases).

The public procurement of energy efficient data centres is, however, still subject to certain challenges, such as the need of internal resources with hands-on technical skills, the optimization of ecological and economical goals, the verification of technical specifications or the long-term performance monitoring of the solution, among others.

Nevertheless, the present compilation of case studies points towards a clear trend: The increased incorporation of energy-saving and sustainable requirements when addressing the public procurement of data centres.

Clearer and more comprehensive technical specifications as well as a growing awareness of the environmental and economical benefits that green data centres offer to public organizations are expected to mark the way forward.

High tech cooling for town-hall servers (Germany)

1. Summary

According to current information, cooling technology can be responsible for up to 50% of total energy consumption in server rooms. Therefore, the municipality of Marburg (Germany) invested in 2011 into a new highly efficient cooling technology for their existing server room. The installed combined heat, power (CHP) and cooling system provides the cooling power as well as the required electricity for the IT-equipment. Turning from standard cooling solutions towards a new integrated energy solution enables the municipality to save more than 70% of total server room energy. This allows energy-cost savings up to 15,000 € per annum.

The major challenge in the procurement of a new cooling system was to find an optimal ecological and economical solution. This case demonstrates that the growing importance of energy efficiency in data centres has also reached the attention of small public authorities. A recent survey shows that 58.9% of companies asked, intend to setup data centre projects to increase the energy efficiency (IT SME Index 2011 by Techconsult).

2. Procurement objectives

High availability and improvement of redundancy was the major design goal for the server room upgrade of Marburg's municipality. Additionally, the performance of the new cooling solution should be improved, so that less energy is required. Right dimensioning according to the actual needs and economic feasibility had to be taken into account. It was important to realize the improvements without affecting the security of service supply. Changing the basic cooling system including equipment parts of the heating system was a considerable investment and risk factor. Therefore, the procurement process was based on a long planning phase with a first concept in summer 2008. To ensure the commercial success of this measure, the municipality applied in 2009 for a demonstration project with financial support from the federal state and succeeded in autumn 2010. The energy consultancy Freischlad supported

the magistrate with analyses of suitable technological solutions. Finally, it was decided to combine a cogeneration plant (CHP unit) with a cooling system from InvenSor.

3. Background

The city of Marburg is located in the state of Hessen, Germany. The municipality of Marburg is responsible for 19 city districts and approximately 80,656 inhabitants. The 6 municipality departments are connected via one server room. A second server room works as backup solution. Therefore, the small data centre forms the backbone for the administration service of Marburg's municipality.

A security check showed that the existing server racks did not fulfil today's fire protection, water protection and security requirements. Therefore, the decision was made to purchase hermetically sealed server racks from Rittal which meet the latest technical requirements. However, this closed rack system required the implementation of a new cooling solution. Due to the fact that the original cooling system could not be upgraded it was decided that a new cooling system is purchased with the focus on energy efficiency and cost effectiveness. During the market screening for a best practice cooling solutions fulfilling the technical requirements, the use of a CHP unit in combination with an adsorption chiller soon became the focus of interest.

4. Procurement criteria used

As mentioned above, the most critical factor was system reliability. The key criterion for the procurement process was to ensure the reliable operation of over 700 connected computers in the public administration. The chosen cooling solution has the advantage of a second, grid independent power source which increases the overall reliability significantly. In addition, the new cooling system consumes less power and decreases the carbon dioxide emission for the infrastructure. The following calculations demonstrate that the upgrade with the selected combination of CHP and chiller technology has environmental and also financial benefits.

4.1 Selection criteria

	Initial situation		CHP with cooling adsorption	
	Energy (kWh)	**Expenses**	**Energy (kWh)**	**Expenses**
Gas consumption for building	335,000	18,458,- €	402,871	22,198,- €
Electricity procurement for building	177,000	37,878,- €	92,000	19,688,- €
Maintenance and repair costs		400,- €		2512,- €
Revenues for CHPR[1] bonus		--		-2248,- €
Revenues for tax on oil and gas		--		-999,- €
Total costs p.a.		**56,736,- €**		**41,150,- €**
Energy cost savings p.a.				**+ 15,585,- €**
One-off funding of from state of Hessen				**32,000,- €**
Static amortization of CHPR system				**3.08 years**

Besides the main objective to save electrical energy for the servers the municipality also addressed the server room's and adjacent office building's carbon footprint. The carbon dioxide emission of data centres is defined as emitted CO_2 during operation time. In this case

[1] CHPR: Combined Heat-Power-Refrigeration

the CO_2 emissions are related to the power consumption of the IT and thermal energy used in the building infrastructure.

With respect to the combined CO_2 reduction focus for server room and office building, different time and planning frameworks apply and needed to be considered. A typical data centre or server room is – compared to a typical office building – more energy intensive. However, the office building has an additional energy overhead for heating during wintertime. Furthermore data centres operate on very different life cycles (data centre: 10 years, office building: 50 years). According to this, investments for office building have a much longer amortization period compared to data centre investments.

The selected solution is in many ways interesting. Not only was an effective reduction in electricity consumption achieved, the slightly higher utilization of gas improved the overall carbon footprint. The new cooling and heating system saves about 47% (34 t) of carbon emissions. Additional savings of 4 t CO_2 emissions are possible by utilizing the waste heat of the CHP unit for the heating system during winter time.

4.2 Technical specifications

- Electrical load for server room: 70,000 kWh/a
- Senertec cogeneration plant with 5.5 kW electric power and 12.5 kW heating power output (integrated condenser)
- InvenSor adsorption chiller with 9 kW effective output
- Cold water buffer storage 500 l closed dry re-cooling
- Combined free cooling option for cold climate periods
- 3 hermetic seal server racks with integrated air/water heat exchanger (Rittal Liquid Cooling Package)

5. Results

This best practice case demonstrates impressively that an innovative new power and cooling concept not only improves the energy efficiency of the data centres but the overall carbon footprint of the office building as well. The implementation measures resulted in substantial electricity savings of 78%. Furthermore, the improved cooling system allowed up to 47% less

CO_2 emissions. The decisive advantage here is that with a combination of CHP unit and adsorption chiller the cooling electricity was reduced to a minimum.

The use of CHP unit as an additional independent power source for the server room increased the service redundancy significantly compared to traditional solutions with UPS as emergency backup.

Due to the fact that the combined heat and electricity generation approximately saves up to 40% primary energy, the German energy law "EEWärmeG" treats the generated electricity 100% equally to renewable resources. Feeding the excess power into the public grid has thereby also economic benefits. As additional environmental improvement, the cooling process uses only water without any greenhouse gas relevant additives.

Summary of final results

- high efficient power supply solution for server
- very cost-effective server cooling by using wasted heat from CHP
- added value for office heating during winter time
- twofold reliability
- free cooling option

6. Lessons learned

This best practice case has shown that the used cooling solution is economically feasible within the extended framework of the server room and office building infrastructure. The lesson learned here is the necessity for extending the focus of the improvement, incorporating adjacent areas such as the office building as well as calculating the improvement in a holistic manner, e.g. overall carbon footprint.

Although the concept phase was an extremely time consuming process, the final trade-off was worth the effort. The greatest challenge was the integration of all responsible departments in order to plan the integrated solution.

7. Outlook

The municipality intends to use the CHP combined with UPS in future as emergency power system.

8. Contact

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MatInfo, a French framework contract for the efficient procurement of IT equipment (France)

1. Summary

The MatInfo tender was launched by a group of French public institutions in the technological and scientific fields (called the "groupement inter-EPST[2]" in French). Respectively 5 and 13 institutions were part of this group in 2005 (first tender notification, called MatInfo1) and in 2009 (second tender notification, called MatInfo2, also including some non EPST organisations). The grouping of public institutions was specifically created for this opportunity. MatInfo stands for "Matériels Informatiques" (IT equipment). The objectives of the initiative were to better manage the purchase costs of IT equipment, and optimise the administrative costs thanks to a joint procurement process.

The tender is composed of four different Lots:

- Lot 1: Personal computers;
- Lot 2: Laptops;
- Lot 3: Apple equipment (including Apple compatible servers); and
- Lot 4: Servers.

The object of the tender is the purchase, the delivery and if appropriate the installation of the materials described in the Lots. Only specifications related to Lot 4 are presented in this case study as other lots are not specific to the focus of PrimeEnergyIT. The aim of the tender was to include sustainable development criteria (in particular environmental and social criteria) in the purchase of IT equipment.

MatInfo represented 30 million Euros annually in 2005 and approximately 40 million Euros annually in 2010.

[2]For « Établissement Public à caractère Scientifique et Technologique » : Public organisation whose activity is scientific and technological.

2. Procurement objectives

MatInfo is a specific type of framework contract[3] without any minimum or maximum amount. The contract is agreed over a period of one year and can be renewed three times, each renewal covering a period of one year. The total duration of the framework contract is therefore four years and it will end on 30th June 2013. Each member of the grouping is free to award its contracts: there is no obligation of purchase; each member is independent in its specific procurement contracts depending on his needs. A monitoring committee has been constituted and is composed of representatives of the organisations taking part in the market grouping. This committee is in charge of monitoring the execution of the framework contract, the evolution of prices and of the configurations.

3. Background

The public organisations that were involved in MatInfo2 are the CNRS (Centre National de la Recherche Scientifique), the CEMAGREF[4](Centre national du machinisme agricole, du génie rural, des eaux et des forêts), the ENSCM (Ecole Nationale Supérieure de Chimie Montpellier), the IRD (Institut de recherche pour le développement), the INRA (Institut national de la recherche agronomique), the INSERM (Institut national de la santé et de la recherche médicale), the INRIA (Institut national de recherche en informatique et en automatique), the INED (Institut national Études Démographiques), the University of Bordeaux I, the University of Bourgogne, the University of La Rochelle, the University of Rennes I and the University Paul Verlaine-Metz[5].

The CNRS[6] is the leader of the grouping. It is a government-funded research organization, under the administrative authority of France's Ministry of Research. As the largest fundamental research organization in Europe, it covers all fields of knowledge. Some of its missions are the following:

- To evaluate and carry out all research capable of advancing knowledge and bringing social, cultural, and economic benefits for society.
- To contribute to the application and promotion of research results.
- To develop scientific information and support research training.

[3] « Marché fractionné à bons de commande » in French.

[4] Now called IRSTEA (Insitut national de recherche en sciences et technologies pour l'environnement et l'agriculture)

[5] Now called Université de Lorraine.

[6] For « Center National de la Recherche Scientifique » : National Center for Scientific Research.

In the research sector, needs for reliable and powerful IT equipment as well as regularly updated configurations are important. Given the important number of members in the grouping, the specificities of the MatInfo initiative are the following:

- Joint effort amongst several organisations, and agree on common needs;
- Wide range of equipment and services covered;
- Customisable configurations proposed so that each member can cover its needs.

4. Procurement criteria used

4.1 Subject matter

IT equipment

4.2 Selection criteria

No selection criteria were related to energy efficiency (or sustainable development in general).

4.3 Technical specifications

All proposed equipment had to be certified Energy Star 4 or respect equivalent specifications, in terms of energy management of the different components.

4.4 Award criteria

Sustainable development criteria were included in the award criteria (11% of the total award points): 65% of these were for ecodesign, 20% for social aspects and 15% for other aspects.

Ecodesign criteria included in particular:

- The use of ecolabels (or equivalent performance), depending on the level (bronze to gold): TCO, EPEAT, 80+[7]
- Recyclability rate or measures to enhance recycling
- Distance travelled by the equipment/components before and after manufacturing and modes of transport
- Carbon offsetting actions

[7] For further information: http://www.tcodevelopment.com/ ; http://www.epeat.net/ ; http://www.plugloadsolutions.com/80PlusPowerSupplies.aspx

- Indicator proposed for the environmental performance labelling on the webshop

Social aspects were covered by:

- A code of conduct developed specifically for the tender, established with the support of an NGO and to be applied also to subcontractors
- References to the fundamental conventions of the ILO (International Labour Organisation)
- Working hours limit
- Safety measures, etc.

4.5 Contract performance clauses

The successful tenderers shall set up a dedicated webshop for the purchasers of the grouping, presenting an environmental performance labelling, besides the usual characteristics (prices, technical specifications, etc.).

5. Results

There was no major obstacle to the definition and evaluation of the environmental criteria, except for the need of internal resources.

Most of the suppliers accepted the criteria and provided the required information as far as possible despite some surprises. The weight given to the sustainability criteria was important and substantially penalised the suppliers not fulfilling them. The criteria might not have been decisive in the award of the contract, but candidates were forced to communicate elements, on which the grouping can now request some progress. The follow-up of the contractor's commitments, made by the tendering organisations during the progress of the framework contract (renewable each year for four years maximum) could enable an influence of the market on the long term strategy of manufacturers, especially since the market is important.

In particular, one of the requirements during the framework contract execution is the labelling of products on the dedicated web shop, regarding "sustainable development" performance. This is intended to raise awareness of the user/purchaser of the environmental and social stakes, and provide him with additional elements for the purchase decision. It required important efforts from the winning tenderers (HP for Lot 1, DELL for Lot 2 and Lot 4 and

France Systèmes for Lot 3) to satisfy this requirement. However, the grouping has no feedback on the influence of some measures on the user/purchaser behaviour yet.

When examining the bids, three different types of providers could be identified: those having not thought at all about the environmental considerations; those trying to consider them but without a true involvement; and those who were already aware of these issues.

6. Conclusions and lessons learned

Overall, the results have been very positive. The grouping was provided with prices and services (before, during and after purchase) that no single organisation would have obtained: e.g. dedicated teams, customised web shop, respect of environmental criteria. Besides, the diminution of other public tenders from the grouping members shows that the material and services within the scope of the tender meet the needs of these institutions. The benefits from the mutualisation of the administrative efforts result in requests from other organisations to join the grouping.

One of the main issues is that internal resources and skills are necessary to analyse the answers from candidates and carry out an active follow-up of the commitments of the contractor. The size of the market is an important factor to catch the manufacturers' attention and have an influence on their future strategy. Joint tenders can be an interesting opportunity in this perspective. On the other hand, the drawback of the market size is that the implementation and follow-up of a large market is more demanding. It has to be planned a long time in advance and needs to cover several years. Consequently, a reliable vision on the current and future needs of the organisation(s) is necessary.

7. Outlook

The initiative will be renewed for a new period 2013-2017 under MatInfo3.

Possible considerations for the future framework contract include a higher pressure on the social responsibility of providers: one option could be to ask for an overview of audit outcomes for the production facilities (normally included in the annual reports of manufacturers) of the manufacturers, and of their sub-contractors. Furthermore, considerations on the electric and electronic waste management could be included too.

8. Contact

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GreenIT data centre for CRED, Regione Campania (Italy)

1. Summary

The Campania Region has identified the development of ICT as a means to ensure efficiency, effectiveness, and transparency in administrative action. The implementation of innovative solutions will help improve the general level of services both internally and externally to the Regional Council towards the various stakeholders such as institutions, associations, businesses and citizens.

To this purpose, the "Regional Data Processing Centre" was identified as a structure appointed to coordinate all activities related to the development of Information Systems and competent to ensure continuity of services through ICT, also with actions for the development of facilities in support of CED regional infrastructure.

The Campania Region, in future, is called to attend to the needs raised by the guidelines on digitization of government, the commitment as manager of European funds and the need to support with the IT the renewal of its administrative areas of General Coordination.

Moreover, different Campania Region Coordination Areas, in recent times carried out independently IT Projects for which a request can be accommodated at the CRED. The realization of the following project is therefore preparatory to the implementation of all actions that will implement a fast and proper growth of the Information Systems of the Campania Region.

2. Procurement objectives

The main objective of the contract is to ensure maximum support and maximum continuity in the delivery of the Regional ICT services, in particular:

- optimizing and rationalizing the use of energy resources available through the adoption of more efficient IT equipment, in order to produce lower amounts of heat with the same computational power, improving the efficiency of the cooling system in order to reduce the related power consumption;
- increasing the level of reliability of the data centre by providing a double power electric circuit and a redundant chiller system together with a monitoring system;

- increasing reliability and flexibility of computing systems hosted using blade and virtualization technologies for servers and storage.

The procedure chosen by the contract has been the competition-tender. For the preparation of the technical specifications internal expertise was employed.

3. Background

The Campania Region is among the first public administration in Italy to have turned to face the challenge of energy efficiency services including IT. The existing data room (about 250 sq.m.), in 2008 hosted more than 200 servers in 34 racks and was characterized by a stratification of equipment and technologies, most of them obsolete.

The exponential growth in terms of IT services and equipment provided and hosted put a strain on the facilities available in terms of cooling capacity and electrical power used. It is clear that this situation did not allow hosting additional server systems, affecting both the performance reliability and the safety of the entire infrastructure.

For electricity supply insufficiency and obsolescence of infrastructure, the Department of Technical Information Systems proposed the contest to build a new infrastructure and the adaptation of existing infrastructure in the CRED data centre.

4. Procurement criteria used

The requested action was mainly to design and build a new infrastructure implementing the latest technologies in the field of "Green IT" and adapt the existing infrastructure in the CRED data centre. In particular, should be guaranteed the design, supply, installation and configuration of the following subsystems:

- "Green IT" infrastructure
- Integrated Data Network for the facility
- Electric system
- New cooling system
- System for measurement and monitoring of performance data and temperature

The proposal had to provide the following additional services:

- Equipment (electrical and thermal) management and maintenance for three years
- Maintenance (Next Business Day) and on-site support for all ICT equipment provided for three years
- Training of staff of the Campania Region and provision of operating manuals in Italian for the operation on systems and of measurement and monitoring appliances
- Waste clearance and correct disposal of equipment

The following award criteria applied: 20 points out of 100 evaluated the bid, the remaining 80 the technical offer.

The criteria used to evaluate energy efficiency were mainly the technical and the qualitative characteristics of the single elements: design, infrastructure, network, data, cooling, electrical, etc.

The criteria used were derived from the maximum PUE expected, evaluated for different levels of use of the infrastructure.

It is important to note that the efficiency levels of the data centre were meant to be monitored periodically. This was included in detail in the specification of the monitoring equipment.

4.1 Selection criteria

Quality and completeness of the proposed design solution in relation to:

- Team Work
- Quality of technical solutions
- Monitoring systems and IT infrastructure
- Expected PUE value
- Quality and effectiveness of any additional proposal

Technical and qualitative characteristics of the infrastructure GreenIT in relation to:

- Quality of components
- Server Modularity and flexibility, connectivity of Slave System
- Total processing capacity of provided servers (SPECint, tpc)
- Solution for server virtualization
- Modularity and flexibility of storage
- System storage virtualization

Technical and qualitative data of Network Integration Features, of the cooling and of the electrical system in relation to:

- Quality of components
- Modularity
- Expandability

Plan for providing services in relation to:

- Quality and effectiveness of management services
- Quality and effectiveness of facilities maintenance services
- Quality and effectiveness of ICT services maintenance
- Quality and effectiveness of training services.

The economic score was calculated using the formula of the "minimum price": Px=20*Imin/Ix

5. Results

The contract was awarded to Telecom Italia and Dell (consortium), scoring 97.17 out of 100 points with a total cost of 3.494.125 €.

Substantial energy savings are expected (an efficiency increase of at least 40% is estimated), compared to a considerable services increase.

The PUE planned for the new infrastructure is 1.5, but after the migration and working at regime on new appliances. Currently the data centre as a whole has a PUE of 1.6 (January 2012). Among all bids appeared to meet the tender's requirements.

6. Conclusions and lessons learned

The tender documents appeared to competitors well-structured and well-defined. During the contest any lack of information was noted. Indeed almost all the bidders presented excellent and complete projects from a technical standpoint.

During the awarding phase was highlighted the importance of the criteria for assigning the economical score. The formula used (minimum price / offer price) in this case with slight differences between offers, produced differences in score of about 5 points on the 20 available. The problems of the economically advantageous offer is large and complex, the variables (number of bids, min / max, abnormal offer, etc.) does not allow detection of a universal solution and, therefore, must be very well evaluated and set correctly the weight to the economic part.

8. Contact

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The Suvilahti data centre in Helsinki – use of energy efficient district heating and cooling (Finland)

1. Summary

The Suvilahti project consists of a Tier III/IV data centre with initially 2000 square meters of server space (with the possibility for an upgrade) and high-density racks deployments. Public-owned Helsingin Energia provided a former substation facility where a hall was built within the substation building ("building in a building"-solution).

Apart from the facility itself, Helsingin Energia provides district cooling and electricity. Furthermore, the data centre's security-sensitive data cables are safely hidden in the city's ever-growing underground tunnel network.

2. Procurement objectives

Academica Oy, the partner in this cooperation, specializes in data and server management. In order to expand its services the company needed new Tier III/IV data centres that would fulfil several requirements.

The facilities and their utilities should

- be easily accessible but safe from intrusion for data security reasons,
- have a safe and reliable supply of energy and communication infrastructure,
- be cheaper in maintenance than conventional data centres, and
- do not compromise the company's goal to offer green and energy-efficient solutions.

3. Background

Helsingin Energia, one of Finland's largest public utility companies, delivers not only electricity to the Helsinki area but also district heating and district cooling for the Capital region. In recent years, the City of Helsinki invested a lot in its utility infrastructure and built an extensive underground network of fully accessible multi-utility tunnels that function as utility supply channels providing the city with electricity, water, and district heating and cooling through this expanding network.

Together, public-owned Helsingin Energia and Academica Oy, a Finnish IT service company, built two highly energy-efficient data centres. In 2009, Academica and Helsingin Energia first installed a smaller pilot data centre (300 sqm) in the city centre of Helsinki, right beneath the Uspenski Cathedral in a former bomb shelter. Together with underground access for communication infrastructure through Helsinki's underground utility system around 30 meters below the surface, Helsingin Energia could offer a safe and reliable supply of energy and cooling. The Uspenski pilot project proved successful and cooperation between the two companies was deepened.

The Suvilahti project consists of a data centre with initially 2000 square meters of server space (possible upgrade to 4000 sqm). Helsingin Energia provided a former substation facility where a closed hall was built inside the substation building. The experience gained in the Uspenski data centre allowed for a more integrated approach. It was thus possible for both partners to further optimise the energy-efficiency technology in the facility by using district cooling and heat exchangers especially devised for the requirements and needs of the data centre.

4. Criteria, objectives and goals

4.1 Subject Matter

Construction of a new data centre with partly Tier III and Tier IV safety measures (designed to host critical servers and systems, with fully redundant subsystems for cooling, power, network links, storage, and high security measures). High importance is put on an energy-efficient architecture, including district cooling and other energy-saving mechanism.

4.2 Technical specifications

- 2000-4000 sqm server surface and IT space, 2000 sqm auxiliary space
- customisable suites from 200 to 900 sqm
- high-density racks deployments (up to 3 kW/sqm)
- district cooling with cold sea water and heat pumps as well as physical cold water batteries
- refurbishment of a former substation

4.3 Energy efficiency criteria

The PUE limit was set previously at 1.0. However, the heat recovery process enables Helsingin Energia and Academica to reach figures far below one as the facility not only consumes energy but also produces energy (heating). Therefore, a new PUE limit value, going near zero, is possible.

4.4 Follow-up and monitoring

Monitoring of energy consumption and heat production is managed through remote read meters in real time and checked on a monthly basis for optimisation potentials. Monitoring is organised by Helsingin Energia in cooperation with data analysis and management services company BaseN that provides real time monitoring of the servers and their condition.

5. Results

Construction for the Suvilahti data centre began in spring 2011. It started to be put into use in September 2011. The servers are cooled either with district cooling produced with cold sea water or heat pumps and absorption chillers. Overall electric energy consumption was reduced up to 50 per cent in comparison to a conventional solution.

Compared to conventional cooling methods, district cooling consumes only 12.5 per cent of direct electricity per unit of cooling energy. At the same time it costs only one fifth of the price of conventional cooling solutions, such as vapour-compression based free circulation air conditioning or other cooling technologies using chemical refrigerants. Approximately 70 per cent of the excess heat can be returned to the district heating network (up to 40 GWh per year, equals the heating requirements of approximately 2000 households), making the data centre essentially a supplementary heat plant. By measuring and reporting the energy consumption in real-time, energy saving capabilities of the servers in use were optimised.

The emissions of a 1-MW data centre that uses district cooling will be significantly reduced: The current solution is estimated to consume 3000 MWh of primary energy less per year than

conventional cooling solutions, which creates a saving of 600,000 kg carbon dioxide emissions.[8]

Helsingin Energia found out that energy costs usually make up about 60 per cent of the operational cost structure of data centres and that half of these energy costs are caused by only cooling the IT infrastructure such as servers. With district cooling, the benefits of additional heat gained with heat exchangers and optimised server monitoring energy costs were reduced significantly. As district cooling does not produce any significant noise, noise reduction was another achievement.

Another environmental achievement: Traditional (compressor-generated) cooling equipment often contains refrigerants based on halocarbons or other organic compounds that can be harmful to the environment. With the district cooling system, no such equipment is needed in Suvilahti, further reducing the environmental impact of the cooling process.

The data centre is situated in Sörnäinen, a former industry and harbour district of Helsinki that has been focus of re-development in recent years. In the very nearby there is the Katri Vala heating and cooling plant, adding to efficiency.

6. Conclusions and lessons learned

The situation in Helsinki with an ever-growing district cooling, a highly advanced district heating system and an extensive multi-utility tunnel network is very advantageous for the Finnish capital but at the same time also very special. However, district cooling schemes are possible in many parts of Europe, especially in Northern Europe where it is becoming an increasingly popular technology. The Uspenski and Suvilahti data centres are only among the first examples where district cooling (and heating) is combined with the technical infrastructure needed for data centres.

It was important to have the data centre in the capital region of Finland, where most clients are and where infrastructure and professional man power are concentrated. At the same time it is essential to control access to and from the data centre for security reasons. Reliable

[8] Based on calculations provided in EN 15603, Energy Performance of Buildings – Overall energy use and definition of energy ratings; Ecoheatcool WP 3, Guidelines for assessing the efficiency of district heating and district cooling systems

supply of energy and safety for the communication infrastructure are crucial for the project's success.

Both, the pilot project under the Uspenski Cathedral and the Suvilahti data centre received several awards, e.g. the Green Enterprise IT Award in 2010 by the Uptime Institute[9] and the Green IT Award by Tekes in 2011. Helsingin Energia and Academica gained significant public interest as international media coverage on the project shows.

7. Outlook

The cooperation between Academica as a private IT company and Helsingin Energia as a publicly owned utility company developed only coincidentally. Helsingin Energia initially was only approached for utilities and energy supply of a possible data centre. However, Helsingin Energia could offer solutions for all of the above mentioned objectives.

Both Helsingin Energia and Academica are very satisfied with the cooperation. The data centres proved as success and plans are already made up to build up more of such highly energy-efficient data centres in the future.

8. Contact

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[9] Green Enterprise IT Award in 2010, http://symposium.uptimeinstitute.com/geit-awards/geit-awards-green-enterprise-it-awards-symposium-2010/2010-geit-awards/551-2010-green-enterprise-it-award-winners

Free cooling by outside air (Spain)

1. Summary

The purpose of this case is the "Procurement and installation of interior equipment chillers of central data processing", as specified in the conditions included in the Bidding Techniques Reference Bidding Procedure (061/2010).

The tender was presented by EJIE, The Computer Society of the Basque Government, and the adjudication of the contract was given to Venticlima, SA (www.venticlima.es).

Venticlima is a company located in Vitoria-Gasteiz (Basque Country) and its activity is the manufacture of steam generators, with the exception of central heating boilers. It was set up in 1976, and today constitutes a large company with a huge experience in cooling systems. Their activity is focused in the following working areas: design, construction and maintenance of ventilation, air-conditioning, refrigeration, heating, solar energy, pump heat, energy recovery, humidification, drying and filtration.

2. Procurement objectives

The aim of the procurement was the purchasing of a new air-conditioning system for the computer lab located inside EJIE's headquarters, adapting it to the demand of the new server equipment installed by using the outside air for cooling. By implementing this technique, the consumption of energy necessary to cool the data centre would be optimized. Just by making use of the climatic elements the same energetic output could be achieved.

The tender price of the contract was up to a maximum amount of EUR 205,000.00 (excl. VAT).

3. Background

The Computer Society of the Basque Government, EJIE, has its headquarters in Vitoria-Gasteiz. It occupies an entire building and the back part of the first floor is used exclusively as the Data Processing Centre.

In this case study, the action is focused on the Climate Centre Data Processing, specifically in the computer room. Over the years, this room has put up with the renovation of the equipment several times, replacing main computer groups with a large amount of server groups. It has also been increasing its logic capacity due to the increase of the service demand in our region for new digital services.

This has prompted a total renovation of the installation to adapt it to the actual situation. For this purpose, it was decided to run with a longer and reliable solution which could have been done in three ways:

- Civil works
- Electrical installation (general derivations and distribution box)
- Air Conditioning installations, which is the subject of this case study

4. Procurement criteria used

4.1 Selection criteria

Financial offer: 50%

Implementation time: 20%

Maintenance services: 10%

Specifications: 20%

4.2 Technical specifications

Production of cold water

2 cooler floors of air condensed water, with hydronic module of dual pump, low noise option and protocol converter for the optimization of the starting mechanism:

- Scroll compressors, encapsulated
- Double pump with automatic water filter
- Pressure gauge and water control valve
- R410a refrigerant with low loading and sealing guarantee
- Bidirectional communication
- 391 kW and 3.93 ESEER
- Air flow condensation 27083 l / s
- Noise level at 10m: 55 dB (A)
- 400V/3/50Hz - 191 kW maximum power (compressors and fans)

1 Element for hydraulic circuit protection:

- Closed expansion vessel, 50 litres, maximum pressure 10 bar, maximum temperature 70 ° C.
- Safety valve 1 ¼ "
- Connection to drain.

1 Hydraulic net including the following elements:

- Hydraulic compensator of 12"
- 4 collectors of round and return 6"
- 30 ml of black steel pipe 5"
- General insulation according RITE
- 8 butterfly keys of 5", 3" filter and 4 anti-vibrators of 5 "
- 2 manometers and 2 thermometers
- 1 balancing valve
- Installation of emptying and filling the system

1 Electric connection to the chillers

1 Electrical connection and commissioning of the installation, testing, etc.

Circuit number 1 and Thermal Units

2 Air conditioner equipments designed for the computer room to control temperature and humidity

- 80.9 kW cooling capacity
- Ethylene Glycol Fluid 15%
- Water temperature 7-12 ºC
- Humidification 13 kg/h of steam
- G4 filter
- Power ventilation 3x2,7 kW
- Noise level in room 66.4 dB(A)
- Energy Efficiency 10

2 circulation water pumps to the air conditioners, one in reserve:

- Flow Unit 27500 litres/hour
- Available pressure 7m.c.a.

1 Hydraulic net for the circuit

- 10 ml black steel pipe of 3"
- 108 ml of black steel pipe 2 ½"
- 8 butterfly keys of 3", 6 of 2 ½", 2 anti-vibrators, 2 valves of 2 ½"
- Thermometers and pressure gauges
- 2 balanced valves 2 ½

Including:

- Integration of all the installed equipment in the centralized control
- Electric installation including the control panel of the pumps
- Commissioning and performance of testing protocol
- Assembly of all the installation elements
- Documentation "As Built" by the whole installation project and construction management

4.3 Award criteria

1) The contract was awarded by restricted procedure based on the following weighting:

- Financial offer 50%
- Maintenance services 10%
- Delivery and implementation 20%
- Specifications 20%

2) The processing of the application will be ordinary.

3) The contracting authority shall be the General Director of Ejie, SA

4) The contracting authority to assess the tenders may request reports such as it deems appropriate.

5) Period of Delivery: November 30, 2010.

6) Tendering No.: 061/2010

7) Form of Award: Limited procedure by evaluating a single criterion

4.5 Contract performance clauses

Special emphasis is placed on the unique characteristics of the installation to be developed:

- The activity of the building should not be interrupted. In order to do that the necessary meetings will be held just to clarify how many points and what changes are needed in order to achieve success in the installation.
- It is compulsory to maintain the overall system performance, avoiding any stop.
- In these meetings the necessary conditions and the activity to be carried out by each party will be raised. The Technical Manager will act as the main coordinator.

- The planning of all actions and activities to be performed will be done. All the companies involved in the development of the tasks have to accept. The strict compliance off all the conditions is absolutely necessary.
- Is required a commitment document whit the strict conditions, implementation phases, planning, testing, installation and dedicated personnel information.
- Because of the involvement of different type of professions, is understood that they will be coordinated properly for the best progress of the work (civil works and electrical connections to the main frame).
- It is necessary to present a health and safety study, although the management of it will be made directly by EJIE.
- Since this is a very complex installation due to its characteristics, it is proposed to maintain the necessary prior consultations with the technical direction and the technical manager of EJIE.

5. Results

The results presented below are not only achieved by the procurement of the described machinery. The data concerning the energy and electric consumption also include the savings achieved by the use of outside air for cooling. Therefore, it is evident that the percentage of use is fully linked to the weather conditions.

Making contact with the Building Maintenance Service and based on the data provided, the following results have been obtained:

- The power measurement obtained on 16 March 2011, i.e. before the installation, indicated a power consumption of 5494 kW/day.
- Measurements on 27 November 2011(i.e. after making the installation and similar climatology to 16 March) indicate a consumption of 3448 kW/day.
- Cost of contracted kW for 2011: 0.062 €/kW.
- Reduction in the daily costs according to previous measurements of the Service Maintenance: 5494-3448 = 2046 kW. This punctual measurement would suppose savings of 37% of the total energy consumption.
- Taking into account the practical estimation of the Maintenance Service and based on the measurements taken and their experience, the savings can be estimated in margins between minimum 20% and maximum 37%.

6. Conclusions and lessons learned

It is estimated that an average saving of 28% of the total energy consumption can be considered:

• Cost per day according to earlier estimations: 28% of 5494 = 1538 kW.

For one year, as the system works 24 hours per day, this estimation would be:

1,538 x 365 = 561.370; with the cost of 0.062 €/ kWh the estimated savings are 34,800 € per annum.

7. Outlook

For the coming year 2012 it is estimated a rise of approximately 15% in price of the kW, i.e. each kW would cost 0.0713 €, with the resulting impact on the figures estimated.

8. Contact

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The Czech Ministry of the Environment tender for energy efficient IT equipment (Czech Republic)

1. Summary

Tender for IT equipment with higher energy efficiency and lower impacts to an environment. The tender started in 2010 and took two months to complete. Among the IT equipment procured by the Czech Ministry of the Environment (MoE) was also new blade server. The goal of the blade server was to increase the data centre performance with respect to data centre power consumption. The blade server was bought in reaction to growing needs of the MoE's database applications.

2. Procurement objectives

The Czech Ministry of the Environment (MoE) used an "electronic market" approach for the public procurement of IT equipment, including blade servers, in line with the Government decision No. 683/2002. According to this decision, all state bodies should buy IT equipment in this "e-market". The electronic market allows specification of the environmental requirements by the public procurers. Such application brings energy savings and induced energy savings of CO_2 emissions, reduced inner environment pollution and other environmental benefits.

The environmental requirements included in the tender were based on national Rules for the implementation of environmental requirements in public procurement of state administration and self-administration which implemented EC Toolkits from EC Communication COM 2008/400 final - public procurement for better Environment. The process of implementation included also a market survey and discussions with stakeholders in order for the requirements to reflect the market situation in the Czech Republic.

3. Background

MoE was established as of 1 January 1990 by Act no. 173/1989 Coll., dated 19 December 1989, to function as the central state administrative authority and supreme inspection authority in environmental affairs.

The main aim of MoE in this tender was (apart from the obvious purchase of IT equipment) confirming the possibility of using the environmental requirements set by the National legislation Rules.

4. Procurement criteria used

The tender included environmental requirements as technical specifications in order to guarantee that the equipment procured would comply with those environmental requirements. As it is mentioned above, the environmental requirements were based on national Rules for the implementation of environmental requirements in public procurement of state administration and self-administration, which implemented EC Toolkits from the national EC Communication (COM 2008/400 final - public procurement for better Environment).

4.1 Technical specifications

a) All products must meet the requirements of Law No. 22/1997 on technical requirements for products

b) All products must meet the requirements of the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive) which was transposed by Act on waste (No. 185/2001)

c) All products must meet the latest ENERGY STAR standards for energy performance, available at www.eu-energystar.org (Commission Decision 2009/489/EC);

Operational Mode Power Requirements:

- Off Mode: ≤ 2 W
- Sleep Mode (if applicable): ≤ 2 W
- Idle State Category A: ≤ 12,0 W
- Idle State Category B: ≤ 15,0 W
- Capability:
- Wake On LAN (WOL)

d) PCs must be designed so that:

- The memory is readily accessible and can be changed.
- The hard disk and, if available, the CD drive and/or DVD drive, can be changed.

e) Notebooks must be designed so that the memory is easily accessible and can be changed.

f) The background lighting of LCD monitors shall not contain more than 3.5 mg of mercury on average per lamp.

g) The 'Declared A-weighted Sound Power Level' (re 1 pW) of PCs or notebooks, according to paragraph 3.2.5 of ISO 9296, measured in accordance with ISO 7779, shall not exceed:

- For PCs:

  4.0 B(A) in the idle operating mode (equivalent to 40 dB(A)).

  4.5 B(A) when accessing a hard-disk drive (equivalent to 45 dB(A)).

- For notebooks:

  3.5 B(A) in the idle operating mode (equivalent to 35 dB(A)).

  4.0 B(A) when accessing a hard-disk drive (equivalent to 40 dB(A)).

h) Ease of disassembly

- Connections are easy to find, accessible with commonly available tools, and as standardised as possible.
- Plastic parts heavier than 25g shall have a permanent marking identifying the material, in conformity with ISO 114 69: 2000. Excluded from this criterion are extruded plastic materials and the light-guide of flat panel displays.
- Plastic parts shall be of one polymer or compatible polymers, except for the cover, which shall consist of no more than two types of polymer, which are separable

Note: SPECpower standard haven't been used at that time.

5. Results

A contract was successfully signed. However some difficulties were noticed while evaluating the bids received. Bidders had problems on how to proof technical specification of the goods (despite the fact that all potential options on how to proof the fulfilment of the requirements were described in the tender) and, on the other hand, for us (team of experts – purchasing officer, GPP expert, IT expert) was pretty hard to verify data stated in the provided documents or documents themselves.

6. Conclusions and lessons learned

Environmental requirements should be as easy to read and verify as possible due to the difficulties encountered while evaluating bids, as described in the previous point. Therefore MoE plans to revise and modify Rules and Toolkits in a way that will eliminate potential burdens, lack of clarity, etc.

7. Outlook

A 2010 decision of the Czech government, which set Rules for implementing environmental requirements in public procurement of state administration and self-administration, confirmed an instruction for national ministries to include environmental requirements in tenders. The same practice was recommended for other state bodies. Therefore all national ministries shall include environmental requirements in all tenders in given product groups (IT equipment, furniture).

A number of product groups should increase (in line with Toolkits of EC) in the near future. A commitment to comply with "Rules" should be extended to rest of public bodies.

8. Contact

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Banca d'Italia: New modular islands for data centres (Italy)

1. Summary

In April 2012, the Bank of Italy has launched an ongoing public tender for the upgrading of the infrastructure used for hosting the ICT equipment of its data centres.

The future commercial partners, who will be selected on the basis of technical and economic criteria, will be responsible for the supply and construction of modular islands that will be installed in the two data centres currently operating. The modular islands will be equipped with racks, a power distribution system, a cooling system, management and monitoring systems and any other elements necessary for the operation of ICT equipment. The PUE index will be used to measure the energy efficiency of the islands.

2. Procurement objectives

The main goal of this tender is the refurbishment of the existing data centres, which shall become a more sustainable system, through the adoption of the best available technologies and design solutions. This innovative approach has been initiated by public tendering (open procedure).

The tender specifications were drawn up internally; internal knowledge on the required technology has been acquired by Internet specialized sources, interviews with key suppliers and participation in specialized events.

3. Background

The Bank of Italy is a public-law institution and the central bank of the Republic of Italy. Its Head Office is organized in different departments that perform administrative and technical duties; the ICT Operations and Infrastructure department, among other tasks, is responsible for purchasing IT and telecommunications goods and services.

The design of the data centres of the Bank of Italy dates from the early nineties; the air conditioning system, while renovated over the years, is designed to dispose heat loads of low power density computing equipment. However, during the last years new ICT development projects provided a greater presence of systems with high power density. To

enable proper operating conditions to this type of equipment, the ICT Operations and Infrastructure department has designed the renovation of the physical infrastructure of the data centres. The economic sustainability of the project will be provided by the improvement of its energy efficiency. The procurement procedure chosen is a competitive public tender which will be awarded based on the best score. The final score will be a combination of technical and economical points.

4. Procurement criteria used

Green considerations are included in the selection criteria of the tender. The PUE (Power Usage Effectiveness) cannot be higher than the established value in the tender specifications. The actual PUE value will be measured during the functional test. During the operational period of the refurbished data centres, the PUE value will be checked regularly in real time by its internal monitoring system.

4.1 Subject matter

The technological infrastructure that will be implemented in the refurbished data centres is an integrated solution for the installation, the power supply and the refrigeration of servers and networking equipments addressed to:

- guarantee an appropriate flexibility in the usage of the data centres' physical and energy resources;
- reduce power consumption and operating costs;
- simplify the system's installation and supporting physical infrastructure management activities.

Such a solution has to:

- integrate racks, power supply and air-conditioning systems in a unique infrastructure;
- ensure high levels of business continuity;
- use of high energy effectiveness technologies;
- use of a centralised tool for management, monitoring and analysis of the performance of all components of the infrastructure.

In more detail the tender specifications include the provision of:

- HW and SW components of the modular islands;
- Customer service for the installation;
- Customer service for the maintenance of the HW and SW components of the modular islands.

Due attention has been paid to the description of the functional test phase. Fictitious heat loads will be used to simulate load conditions foreseen during business phase in order to assess performance levels guaranteed by the proposed solution. The following aspects of the solution will be assessed:

- air-conditioning system power dimensioning and set-points;
- power supply and air-conditioning system redundancy and effectiveness;
- Power Usage Effectiveness (PUE), at maximum 1.6;
- Environmental neutrality (intended as influence of new appliances vs. the existing systems).

4.2 Selection criteria

The tender issued by the Bank of Italy is open to all participants with the technical and economical requirements that are compliant with the tender specifications. This meets the need to select a list of participants that are able to comply with a long-term contract with their technical capabilities and economical stability. The high quality of the technical capabilities requested is mandatory, taking into account the level of criticality of IT infrastructure that will be hosted in the modular islands foreseen in the technical annex of the contract. The long-term nature of the contract is due to the duration of the business phase of the infrastructure, which is foreseen to run from four to eight years. For this reason, the tender specifications expect a four year long maintenance period as a minimum, with the possibility of being renewed for four additional years.

4.3 Technical specifications

Among the overall objectives included in the tender specifications, power effectiveness improvements and innovative management solutions are deemed very important. For this reason, the tender specifications have defined an accurate technological solution for the data centres' physical infrastructure upgrading. The tender specifications have been written specifying the features of the solutions in detail, thus reducing the degree of freedom of the enterprises participating in the tender. Such approach has been chosen to allow an

unbiased assessment of the proposed solutions by means of the adoption of awarding criteria easy to be estimated. In particular, the use of modular islands for the upgrade of the Bank of Italy's operative data centres has been considered the most suitable solution to guarantee an appropriate level of interoperability among the different technological components already implemented.

The tender specifications are divided into several sections. Each of them deals with a specific hardware component of the solution. The list of the identified sections follows below:

- rack and physical frame;
- power supply system;
- air-conditioning system (with a required set-point of 23°C for inlet air and a maximum outlet T of 33°C);
- structured cabling system;
- management and monitoring system.

Constructive details of each component and its relative dimensioning have been described in the relevant section of the tender. Minimum performance standards, such a requested PUE <= 1.6, were included in the technical specifications (see contract performance clauses section).

4.4 Award criteria

The contract will be awarded following the criteria of the most advantageous proposal under the economical point of view. It has been decided to assign the 60% of the total score to the technical merit and the remaining 40% to the economical one. This choice wants to underline the orientation towards a high quality solution. Aspects under assessment regard:

- air-conditioning system power dimensioning;
- air-conditioning system high reliability and operative flexibility;
- structured cabling system flexibility.

Energy efficiency has been added among the set of mandatory requirements included in the tender specifications but it does not belong to the set of awarding criteria adopted for the solution selection.

5. Contact

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Building a new data centre for EUMETSAT in Darmstadt (Germany)

1. Summary

EUMETSAT is the European operational satellite agency for monitoring weather, climate and the environment and it operates a system of meteorological satellites monitoring the atmosphere and ocean and land surfaces which deliver weather and climate-related satellite data, images and products.

To support its operations of meteorological satellites, a New Infrastructure Building (NIB) has been constructed in Darmstadt, Germany. The new facility, that is estimated to be fully operational by Summer 2012, will house both the data centre for internal IT services as well as a data centre for operating EUMETSAT's meteorological satellites, with the Operations Control Centre in the nearby.

2. Procurement process

As satellites are the backbone of Europe's highly advanced meteorological services, the requirements for a safe and reliable data centre infrastructure included in the tender document were very high, e.g. stable energy supply, advanced cooling infrastructure or multilevel security systems (Tier IV).

With EUMETSAT's focus on weather and climate, the organisation integrated green IT principles in the procurement process of the new infrastructure:

- The data centre follows the "European Code of Conduct for Data Centre Efficiency" (including CO2-reduction guidelines), with the expectancy of increasing its current energy-efficiency levels to 80% or higher.
- Energy will not only be consumed, but also produced (heating). A PUE limit value below 1 is, therefore, possible to achieve.

3. Results

The construction of the New Infrastructure Building (NIB) resulted in:

- Gross floor space: 4,300 m2
- Net surface space: 3,300 m2
- Server room: 1,000 m2

- Overall project cost: €12 million
- Architecture: Pielok-Marquardt-Architekten
- Structural services: ISG Ingenieurbüro
- Outdoor installation: M. Ottenbacher
- Mechanical services: Dc-Ce-Rz Beratung
- Electrical services: Schnabel AG
- General contractor: Leonhard Weiss

4. Reference

http://www.eumetsat.int/Home/Main/News/CorporateNews/818132

Building a new data centre for the City of Zurich (Switzerland)

1. Summary

The City of Zurich Council's IT Department or OIZ ("Stadt Zürich Organisation und Informatik") is in the process of finalising the construction of a new green data centre in Albisrieden, Zurich, which is expected to be functional by autumn 2012.

OIZ, which is part of the Council's finance department, can be defined as the technological nerve centre of the city administration; among its core activities is the development and maintenance of key applications and networks that support the city's public services daily operations.

Up until now, OIZ has operated with several server rooms, distributed in various service departments at over 100 locations in Zurich. This situation will now be changed, with the centralization of all server rooms in the Albisrieden data centre (with an additional location as a back-up), achieving a more energy efficient, cost effective and safe solution.

2. Procurement process: Energy efficiency focus

The technical criteria, on which the procurement process for the construction of the new data centre was based, include energy-efficiency and environmental considerations.

Therefore, the new data centre is thoroughly focused on an efficient use of energy, and its expected energy consumption will be highly improved. An intelligent and innovative energy cycle will be implemented, making use of the extra energy generated by the servers for heating purposes. Such and innovative concept will allow an exemplary efficient power consumption, achieving an expected PUE value of 1.3, which will place the City of Zurich on the top of the Swiss leaderboard for energy efficient data centres.

3. References

http://www.stadt-zuerich.ch/content/hbd/de/index/hochbau/geplante_bauten/rechenzentrum_oizalbis.html;

http://www.stadt-zuerich.ch/hbd/de/index/ueber_das_departement/medien/medienmitteilungen/2011/januar/110128b.html

About PrimeEnergyIT

PrimeEnergyIT supports the market development for energy efficient central IT equipment, including server, data storage, network and facility equipment, as well as new power management technologies. The PrimeEnergyIT initiative is operated by an international consortium of national agencies and research institutions in cooperation with a number of associate partners from industry.

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