EC Code of Conduct – Best Practice v2 draft

Number items in each section

2.1 Involvement of Organisational Groups

Group involvement	Establish an approval board containing representatives from all disciplines (software, IT, M&E). Require the approval of this group for any significant decision to ensure that the impacts of the decision have been properly understood and an effective solution reached. For example, this could include the definition of standard IT hardware lists through considering the M&E implications of different types of hardware. This group could be seen as the functional equivalent of a change board.	Yes	~~3~~ 4

2.2 General Policies

Consider the embedded energy in devices	Carry out an audit of existing equipment to maximise any unused existing capability by ensuring that all areas of optimisation, consolidation and aggregation are identified prior to new material investment.	Yes	~~2~~ 3

2.3 Resilience Level and Provisioning

Design to maximise the part load efficiency once provisioned	The design of all areas of the data centre should be maximise the achieved efficiency of the facility under partial fill and variable IT electrical load. This is in addition to one off modular provisioning and considers the response of the infrastructure to dynamic loads. e.g. VFD for compressors and ~~variable speed~~ fan units.	During retrofit	3

3.1 Selection and Deployment of New IT Equipment

Multiple tender for IT hardware – Basic operating temperature and humidity range	Include the operating temperature and humidity ranges of new equipment as high priority decision factors in the tender process. The minimum range, at the air intake to servers, is 18-27C and 5.5C dew point up to 15C dew point & 60% RH. The current relevant standard is the ASHRAE ***Recommended*** range for Class 1 Data Centers as described by ASHRAE in "2008 ASHRAE Environmental Guidelines for Datacom Equipment".	New IT Equipment	~~4~~5
Multiple tender for IT hardware – Extended operating temperature and humidity range	Starting 2012 new IT equipment should be able to withstand the extended air inlet temperature and relative humidity ranges of 5 to 40°C and 5 to 80% RH, non-condensing respectively, and under exceptional conditions up to +45°C. The current relevant standard is described in ETSI EN 300 019 Class 3.1.	New IT Equipment from 2012	5~~4~~

	All vendors should indicate the maximum allowable temperature and humidity for all equipment to maximise the efficiency opportunities in refrigeration and free cooling. It should be noted that where equipment with differing environmental requirements is not segregated, the equipment with the more restrictive temperature range will influence the cooling conditions and corresponding energy consumption for all of the IT Equipment.		
Select equipment suitable for the data centre –	Select and deploy equipment at the design power density (per rack or sq m) of the data centre to avoid running the cooling system outside design parameters.	No	34

Enable power management features	Formally change the deployment process to include the enabling of power management features on IT hardware as it is deployed. This includes BIOS, operating system and driver settings.	New IT Equipment	3 5
Energy Star hardware	The Energy Star Labelling programs for IT equipment should be used as a guide to server selection where and when available for that class of equipment. Operators who are able to determine the in use energy efficiency of hardware through more advanced or effective analysis should select the most efficient equipment for their scenario.	No	52
Control of equipment energy use	Select equipment which provides mechanisms to allow the external control of its energy use. An example of this would be the ability to externally restrict clock speed in a server to restrict maximum energy use.	No	54

3.3 Management of Existing IT Equipment and Services

Audit existing physical and service estate	Audit the existing physical and logical estate to establish what equipment is in place and what service(s) it delivers. Consider the implementation of an ITIL type Configuration Management Data base and Service Catalogue.	No	3 4
Shut down idle equipment	Servers, networking and storage equipment that is idle for significant time should be shut down or put into a low power 'sleep' state. It may be necessary to validate the ability of legacy applications and hardware to survive these state changes without loss of function or reliability.	No	43

4.1 Air Flow Management and Design

Design – Contained hot or cold air	There are a number of design concepts whose basic intent is to contain and separate the cold air from the heated return air on the data floor; Hot aisle containment Cold aisle containment Contained rack supply, room return	During Retrofit	5 4

	Room supply, Contained rack return Contained rack supply, Contained rack return This action is expected for air cooled facilities over 1kW per square meter power density.		

Design – Return plenums	Consider the use of return plenums to return heated air from the IT equipment to the air conditioning units	No	~~2~~3
Design – Hot / cold aisle	As the power densities and air flow volumes of IT equipment have increased it has become necessary to ensure that equipment shares an air flow direction, within the rack, in adjacent racks and across aisles. The hot / cold aisle concept aligns equipment air flow to create aisles between racks that are fed ~~chilled~~ cold air from which all of the equipment draws intake air, in conjunction with hot aisles with no ~~chilled~~ cold air feed to which all equipment exhausts air.	New IT Equipment During Retrofit	~~2~~ 3
Design – Raised floor or suspended ceiling height	It is common to use the voids in the raised floor, suspended ceiling or both in a data centre to feed ~~chilled~~ cold air to equipment or extract ~~heated~~ hot air from the equipment. Increasing the size of these spaces can significantly reduce ~~pumping~~ the fan losses in moving the air.	No	~~2~~ 3
Equipment segregation	Deploy groups of equipment with substantially different environmental requirements in separate areas of the data centre with separate air flow and cooling provision. This allows the environmental conditions and therefore efficiency to be optimised for each group.	No	~~3~~ 2
Provide adequate free area on rack doors	Solid doors can be replaced (where doors are necessary) with partially perforated doors to ensure adequate cooling airflow which often impede the cooling airflow and may promote recirculation within the enclosed cabinet further increasing the equipment intake temperature.	New IT Equipment During Retrofit	3~~2~~

4.2 Cooling Management

Type	Description	Expected	Value
Scalable / ~~M~~modular installation and use of cooling equipment	Cooling plant should be installed in a modular fashion allowing operators to shut down unnecessary equipment. This should then be part of the review at each cooling load change. Design to maximise the part load efficiency as described in 2.3	No	3
Shut down unnecessary cooling equipment	If the facility is not yet fully populated or space has been cleared through consolidation non variable plant such as fixed speed fan CRAC units can be turned off in the empty areas.	No	2~~3~~
Review CRAC Settings	Ensure that CRAC units in occupied areas have appropriate and consistent temperature and relative humidity settings to avoid controls fighting. ~~and are set to heat / cool and humidify / dehumidify at the same thresholds~~	No	3
~~Automatic control of cooling~~	~~Incorporate control systems that automatically adjust the cooling delivered to the data floor based~~	~~No~~	~~3~~

	~~on the thermal load presented by the IT equipment~~		
~~Dynamic control of building cooling~~	~~It is possible to implement control systems that take many factors including cooling load, data floor air temperature and external air temperature into account to optimise the cooling system, (e.g. chilled water loop temperature) in real time.~~	~~No~~	~~3~~
Effective regular maintenance of cooling plant	Effective regular maintenance of the cooling system is essential to maintain the design operating efficiency of the data centre e.g. belt tension, condenser coil fouling (water side / air side), chiller evaporator fouling, filter changes, ~~.~~	No	2

4.3 Temperature and Humidity Settings

Facilities are often overcooled with air temperatures (and hence chilled water temperatures, where used) colder than necessary resulting in an energy penalty. Increasing the set range for humidity can substantially reduce humidifier loads. Reviewing and addressing air management issues as described in sections 4.1 and 4.2, is required before set points can be changed in order to avoid risk to operational continuity, expert advice should be sought before changing the environmental range for the facility. An increase in chilled water ~~loop~~ temperature setpoints provides enhanced efficiency for economisers (free cooling) and reduction in compressor energy consumption ~~and can substantially reduce humidifier loads when raised above the dew point~~.

The specification of wider operating humidity and temperature ranges for the data floor should be performed in conjunction with changes in IT equipment procurement policy, over time narrow tolerance equipment will be naturally cycled out and replaced.

Review and if possible raise target IT equipment intake air temperature	Data Centres should be designed and operated *at their highest efficiency* within the current environmental range of 18-27C. The current, relevant standard is the ASHRAE *Recommended* range for Class 1 Data Centers, as described by ASHRAE in "2008 ASHRAE Environmental Guidelines for Datacom Equipment". Operations in this range will ensure data centres are not wasting energy through overcooling. This range applies to legacy data centres with existing equipment. Note that other best practices for airflow management (containment, hot aisle/cold aisle, blanking plates, and sealing leaks) may need to be implemented at the same time to ensure successful operations.	Yes	~~3~~ 4
Review set points of air and water temperatures	Once air management issues have been addressed and IT equipment target temperatures agreed these temperatures can be increased (using less energy) without increasing server inlet temperatures beyond acceptable levels. Note that some IT equipment may use more power under increased inlet temperatures.	Yes	~~3~~ 4
Review and raise chilled water loop temperature	~~Increase the chilled water loop temperature to above the dew point of the air within the facility.~~ Increase the chilled water ~~loop~~ temperature setpoints to maximise the use of economisers (free cooling) and / or reduce compressor energy.	~~No~~ Yes	~~3~~ 4

Formatted Table

4.4.1 Free and Economised Cooling

Direct water free cooling	~~Condenser~~ Chilled water is ~~chilled~~ cooled by the external ambient ~~conditions is circulated within the chilled water circuit~~air via a free cooling coil. This may be achieved by ~~radiators~~ dry coolers (/adiabatic coolers) or by evaporative assistance through spray onto the dry coolers (/adiabatic coolers)~~radiators~~.	No	4~~5~~
Indirect water free cooling	~~Condenser~~ Chilled water is ~~chilled~~ cooled by the external ambient conditions via~~.~~ ~~A~~a heat exchanger which is used between the condenser and chilled water circuits. This may be achieved by dry coolers (/adiabatic coolers)~~radiators~~, ~~evaporative assistance through spray onto the radiators or a evaporative cooling in a~~ or cooling towers.	No	~~5~~ 4
~~Adsorptive~~Sorption cooling (absorption / adsorption)	~~Waste h~~Heat produced as a byproduct from power generation or other processes close to the data centre is used to power the cooling system in place of electricity~~,~~ ~~reducing overall energy demand. In such deployments adsorptive cooling can be effectively free cooling~~. This is frequently part of a Tri Gen combined cooling heat and power system. The suitability of such a system should consider improved holistic carbon emissions over life time (including utility efficiency improvements) vs optimised grid powered system over realistic operating range (part loads + seasonal).~~.~~	No	~~5~~1

4.4.2 High Efficiency Cooling Plant

Chillers with high COP	Make the Coefficient Of Performance of chiller systems at average operating load a high priority decision factor during procurement of new plant.	During Retrofit	3
Efficient part load operation	Optimise the facility for the partial load it will experience for most of operational time rather than max load. e.g. sequence chillers, operate cooling towers with shared load for increased heat exchange area	During Retrofit	~~3~~2
Variable speed drives for compressors, pumps and fans	Reduced energy consumption for these components	No	2~~3~~

4.5 Computer Room Air Conditioners

Variable Speed Fans	Many old CRAC units operate fixed speed fans which consume substantial power and obstruct attempts to manage the data floor temperature. Variable speed fans are particularly effective where there is a high level of redundancy in the cooling system, low utilisation of the facility or highly variable IT electrical load. These fans may be controlled by factors such as the return air temperature or the chilled air plenum pressure.	During Retrofit	3~~4~~
Control on	Controlling on supply temperature ensures the server supply	No	2~~3~~

CRAC unit supply air temperature	air (key temperature to control) is satisfactory without possible over cooling of air which may result when controlling on return temperature (where sensor location may impact)		
Run variable speed CRAC units in parallel	It is possible to achieve efficiency gains by running CRAC units with variable speed fans in parallel to reduce the total electrical power necessary to achieve the required air movement as electrical power is not linear with air flow. Care should be taken to understand any new failure modes or single points of failure that may be introduced by any additional control system.	No	3~~4~~
Sequencing of CRAC units	In the absence of variable speed fans it is possible to turn entire CRAC units on and off to manage the overall air flow volumes. This can be effective where there is a high level of redundancy in the cooling system, low utilisation of the facility or highly variable IT electrical load.	No	~~3~~ 2

4.6 Reuse of Data Centre Waste Heat

Waste heat re-use	It ~~is frequently~~ may be possible to provide low grade heating to industrial space or to other targets such as swimming pools directly from the ~~waste side of the heat pumps~~heat rejected from the data centre. This can ameliorate an energy use elsewhere, reducing the total energy use of the data centre and the client of the waste heat.	No	~~4~~ 3
Heat pump assisted waste heat re-use	Where it is not possible to directly re use the waste heat from the data centre due to the temperature being too low it can still be economic to use additional heat pumps to raise the temperature to a useful point. This can supply office, district and other heating.	No	2~~3~~

5.2 Management of Existing Power Equipment

Reduce engine-generator heater temperature set-point	When using engine heaters to keep generators ready for rapid starts, consider reducing the engine heater set-point. Block heaters for the Standby Generators should be controlled to only operate when the temperature conditions warrant it	No	2~~1~~

6 Other Data Centre Equipment

~~There is discussion as to whether, to eliminate overlap this section should be removed and replaced with a pointer to BREEAM, LEED or EU standards for green buildings. These standards do not define the data centre part of the building.~~Energy efficiency in non-data centre areas can be optimised based on relevant standards, such as BREEAM, EU standards, LEED etc.

7.1 Building Physical Layout

Locate M&E plant outside the cooled area	Heat generating Mechanical and Electrical plant should be located outside the cooled areas of the data centre wherever possible to reduce the loading on the data centre cooling plant.	No	1~~3~~
Select a building with sufficient ceiling height	Insufficient raised floor or suspended ceiling height will obstruct the use of efficient air cooling technologies in the data centre.	No	3~~2~~
Optimise orientation of the data centre	Optimise the layout and orientation of the building to reduce the insolation heat loads and optimise the efficiency of heat transfer.	No	1~~2~~

7.1 Building Geographic Location

Type	Description	Expected	Value
Locate the Data Centre in an area of low ambient temperature	Free and heavily economised cooling technologies are more effective in areas of low ambient external temperature.	No	~~2~~3
Co-locate with power source	Locating the data centre close to the power generating plant can reduce transmission losses and provide the opportunity to operate ~~adsorptive~~ sorbtion chillers from power source waste heat.	No	1~~2~~

8.1 Energy Use and Environmental Measurement

Incoming energy consumption meter	Install metering equipment capable of measuring the total energy use of the data centre, including all power conditioning, distribution and cooling systems. Again, this should be separate from any non data centre building loads. Note that this is required for CoC reporting	Yes	~~2~~3
IT Energy consumption meter	Install metering equipment capable of measuring the total energy delivered to IT systems, including power distribution units. This may also include other power feeds where non UPS protected power is delivered to the racks. Note that this is required by for CoC reporting.	Yes	3~~2~~
CRAC unit level metering of ~~return~~ supply air temperature and humidity	Collect data from CRAC units on ~~return~~ supply air temperature and humidity.	No	3
PDU level metering of IT Energy consumption	Improve ~~granularity~~ visibility in IT energy consumption by metering at the Power Distribution Unit inputs or outputs.	No	3
~~PDU~~ Distribution board level metering of Mechanical and Electrical energy consumption e.g. MCCs	Improve ~~granularity~~ visibility in understanding data centre infrastructure overheads	No	3
Row or rack level metering of temperature ~~and humidity~~	Improve ~~granularity~~ visibility in understanding air supply temperature	No	3

8.2 Energy Use and Environmental Collection and Logging

Periodic manual readings	Entry level energy, temperature and humidity reporting can be performed with periodic manual readings of consumption meters, thermometers and hygrometers. This should occur at regular times, ideally at peak load. Note that energy reporting is required by the CoC reporting requirements.	Yes	~~2~~ 3

8.3 Energy Use and Environmental Reporting

Written report	Entry level reporting consists of periodic written reports on energy consumption and environmental ranges. This should include determining the averaged DCiE over the reporting period. Note that this is required by the CoC reporting requirements.	Yes	3~~2~~
Energy and environmental reporting console	An automated energy and environmental reporting console to allow M&E staff to monitor the energy use and efficiency of the facility provides enhanced capability. Averaged and instantaneous DCiE are reported. Supersedes Written report	No	3
Integrated IT energy and environmental reporting console	An integrated energy and environmental reporting capability in the main IT reporting console allows integrated management of energy use and comparison of IT workload with energy use. Averaged, instantaneous and working range DCiE are reported and related to IT workload. Supersedes Written report and Energy and environmental reporting console. This reporting may be enhanced by the integration of effective physical and logical asset and configuration data.	No	34