



THE GREEN GRID ENERGY POLICY RESEARCH FOR DATA CENTRES

FRANCE, GERMANY, THE NETHERLANDS
AND THE UNITED KINGDOM

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CONTENTS



Aims and objectives.....	8
Methodology.....	8
Data centres and energy demand.....	8
The challenge.....	10
2.1 Energy Labelling – Demonstrating Energy Performance.....	10
Energy Performance of Buildings Directive (2002/91EC).....	10
Revisions to the Energy Performance of Buildings Directive.....	11
Environmental rating schemes of buildings.....	11
The Energy Labelling Directive (92/75/EEC).....	12
ENERGY STAR.....	13
EU Ecolabel/Flower.....	13
The European Commission Code of Conduct on Data Centres Energy Efficiency.....	13
2.2 Feed-in Tariffs—Generating New Revenue Streams.....	14
Feed-in tariffs.....	14
2.3 Financial Incentives—Tax reductions & Grant funding.....	15
Tax reductions.....	15
Climate Change Levy.....	16
Grants.....	16
Implications of grants.....	17
2.4 Driving Environmental Performance.....	17
Eco-Design Directive for Energy-Using Products (2005/32/EC).....	17
Implications of the Eco-Design Directive.....	17
Expansion to the Eco-Design Directive.....	17
Implications of revisions to the Eco-Design Directive.....	17
Certain Fluorinated Greenhouse Gases (EC Regulation 842/2006).....	17
Implications of the Fluorinated Greenhouse Gases Regulation.....	18
2.5 Delivering Sustainable Development.....	18
Building codes.....	18
Implications of building codes.....	19
Planning policies.....	19
Implications of planning policies.....	19
2.6 Carbon Trading—Putting a Price on Carbon.....	19
EU GHG Emission Trading Scheme (Directive 2003/87/EC).....	19
Implications of the EU ETS.....	20
National trading schemes.....	20
UK Carbon Reduction Commitment.....	20
Implications of UK Carbon Reduction Commitment.....	22
2.7 Monitoring, Measuring, and Reporting Energy Performance.....	25
2.8 Summary of Key Policies and Implications.....	27
2.9 Recommendations.....	27
APPENDICES.....	32
Kyoto Protocol & Copenhagen.....	32
Information and Communication Technologies (ICT) – EU consultation.....	32



EU energy-climate legislative package.....	32
Energy Performance of Buildings Directive (EPBD) (2002/91/EC).....	33
Certain Fluorinated Greenhouse Gases (EC Regulation 842/2006).....	34
Directive on the Promotion of the Use of Energy from Renewable Sources in the Internal Electricity Market (2001/77/EC).....	35
Forthcoming 'Energy' Directives.....	35
The Energy Labelling Directive (92/75/EEC).....	35
Eco-design Directive for Energy Using Products (2005/32/EC).....	36
Voluntary Codes.....	36
Voluntary Code of Conduct on Data Centres Efficiency.....	36
Performance Labels.....	38
France.....	39
French Grenelle Environment Agreement.....	39
Legislation.....	39
Energy Act 2005.....	39
EPBD translation into Le Diagnostic de Performance Energétique (DPE).....	41
The Building Code.....	41
National French Planning Regulations.....	41
Economic incentives.....	42
Advanced Renewable Tariffs (Tarife Equitable) in 2006.....	42
Tax credit.....	42
Voluntary standards.....	42
HQE.....	42
HQE & BREEAM in France.....	42
EFFINERGIE.....	42
Germany.....	42
National Target.....	42
Legislation.....	43
Implementing the EPBD.....	43
Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG).....	44
Pending legislation.....	46
Emissions Ordinance (Emissionshandels-Versteigerungsverordnung, EHV 2012).....	46
Incentives.....	46
Feed in Tariffs.....	46
Grants.....	46
Climate Protection Initiative.....	46
Voluntary.....	46
Sustainable Building Seal/DNGB certifications	46
The Netherlands.....	47
Legislation.....	47
Spatial Planning Act.....	47
Building Code (Bouwbesluit).....	47
Decree Energy Performance of Buildings (BEG).....	47
Environmental Management Act (2004).....	48
Emissions Trading Programmes: CO ₂ and NO _x	48
Voluntary/Incentives.....	48



Tax regime: EIA (Energy Investment Allowance).....	48
Feed in Tariffs.....	48
Grants.....	48
Research.....	49
Project Subsidies.....	49
Labels.....	49
The United Kingdom.....	49
Energy Performance of Buildings Directive (2002/91/EC).....	49
Environmental Protection (Control of Substances that Deplete the Ozone Layer).....	50
Building Regulations.....	51
Planning Policy.....	52
Forthcoming Legislation.....	53
Carbon Reduction Commitment (CRC).....	53
Voluntary Incentives.....	55
Climate Change Levy.....	55
Enhanced Capital Allowance.....	56
Feed in Tariffs.....	56
REFERENCES.....	57



EXECUTIVE SUMMARY

On behalf of The Green Grid, CB Richard Ellis has identified existing and emerging energy policies affecting the data centre industry in France, Germany, the Netherlands, and the United Kingdom.

Climate change and fuel security have dramatically risen up the policy agenda, resulting in a comprehensive policy framework at both the European Union (EU) and national levels. The growth of data centres, and their energy intensity, means the industry will be particularly affected by the drive for energy efficiency of product design and building services.

The following summarises just some of the key policies affecting data centres:

- The UK's Carbon Reduction Commitment will establish a new carbon market from April 2010 and could present the most significant financial risk to the data centre sector.
- European directives for products and buildings are pursuing reductions in greenhouse gases emissions, efficient use of energy, and energy performance labelling.
- There are evolving building codes for energy performance of new and refurbished data centres.
- Evolving planning instruments are requiring greenhouse gases reductions and increases in renewable energy provision.
- Voluntary best practice guidance and monitoring initiatives—led by or with close industry involvement—advocate energy management, reductions, and performance monitoring.

The overall finding and message is that legislation is tightening, and therefore it is advisable to innovate now and seek out opportunities to manage future implications.

The key recommendations identified in this energy policy report are as follows:

- All stakeholders should prepare for and manage risks associated with the (UK) Carbon Reduction Commitment.
 - Confirm eligibility for the scheme and legal compliance requirements.
 - Assess the financial implications associated with the scheme.
 - Develop carbon management and carbon trading strategies.
 - Manage and mitigate liabilities between data centre providers and users.
- Product and building designers must continually innovate to deliver data centre services with reduced demand for fossil fuel-based energy.
- Data centre operators should proactively measure and report their energy consumption and drive continuous improvements in hardware, software, and building services.
- Data centre operators should make full use of available energy efficiency incentives, such as tax reductions and capital allowances.
- Data centre operators should review their portfolios to identify opportunities for installing renewable energy technologies that would deliver carbon reductions as well as new revenues, such as those from feed-in tariffs.

- All stakeholders should embrace voluntary codes and initiatives to demonstrate that the sector can self-regulate in terms of energy efficiency and is doing so.

Trade bodies are advised to continue engagement and interaction with the European Commission (EC) and governments to inform policy makers on the sector as well as on carbon dioxide (CO₂) and renewable energy policies. This is particularly important for the:



- Evolving European Commission definition of “zero energy buildings” under the recasting of the Energy Performance of Buildings Directive
- UK government’s response to the Carbon Reduction Commitment (CRC) public consultation due autumn 2009
- French “Green IT” working group recommendations, also due this autumn

1. INTRODUCTION

On behalf of The Green Grid and its members, CBRE researched energy policy in Western Europe, identifying existing and forthcoming legislation, incentives, and voluntary initiatives. The Green Grid requested a policy and implications study; this report is not intended as a critique or endorsement of the policies herein. It includes key policy implications for the data centre sector and provides a suite of recommendations for consideration and action.



AIMS AND OBJECTIVES

The aim of this report is to support The Green Grid's aspiration to dramatically raise the energy efficiency of data centres in both the short and long term. Its objectives were to:

- Identify the key energy policies and emerging policies affecting the design, construction, and operation of data centres at the EU and national levels in the UK, France, Germany, and the Netherlands.
- Explore the implications for data centres of the identified energy policies, specifically opportunities and threats.
- Recommend actions that The Green Grid and its members can take to:
 - Meet existing legislation effectively and efficiently
 - Shape and prepare for forthcoming legislation
 - Inform and embrace voluntary codes
 - Leverage commercial opportunities

Note: This is not an exhaustive or exclusive study and should be used as a basis for further research of the implications of each of the legislative and proposed legislative items.

METHODOLOGY

CBRE's Energy and Sustainability (E&S) Group led the research, which included:

- Desk-based policy research for EU, UK, France, Germany, and the Netherlands
- Interviews with data centre professionals and members of The Green Grid
- Conversations with CBRE's project management and engineering colleagues in the UK, France, Germany, and the Netherlands
- A workshop with CBRE's Technology Practice Group to inform the content and recommendations of this report

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- Jim Hearnden, Dell
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DATA CENTRES AND ENERGY DEMAND

As those in the industry are all too aware, there has been an extraordinary boom in data centre demand as the use of information and communication technologies (ICT) by commerce, industry, and the wider population has grown.

As this growth continues, so does the demand for energy, particularly for electricity to power IT and cooling equipment. According to Dr. Kevin Aylin¹ in September 2008, data centres consume up to 50 times as much power as equivalent regular office space. Jonathan G. Koomey² predicts that, from 2005 to 2010, server consumption across the world will require additional capacity equal to more than 10 additional 1,000 MW power plants.

Electricity consumption (as a whole) in Western Europe is estimated to increase from a level of 56 terawatt hours (TWh) per year in 2007 to 104 TWh per year by 2020³, with data centre power consumption playing a major part in this increase.

Coupled with the increasing demand for energy, particularly fossil fuel-based electricity, are the greenhouse gas (GHG) emissions associated with producing that energy. Of these gases, CO₂ concentrations in the atmosphere are a key indicator of climate change and are measured by global scientists.

According to an estimate by Gartner, Inc., in April 2007⁴, the global ICT industry accounted for approximately 2% of global CO₂ emissions, a figure equivalent to the aviation industry's emissions. Despite the help ICT offers other sectors in terms of supporting energy efficiency, Gartner believes this is unsustainable.

The phenomenon of climate change is now accepted by world leaders, as confirmed at the 2009 Major Economies Forum (involving the G8). There, leaders declared that climate change is "*one of the greatest challenges of our time*," and they reaffirmed the objective, provisions, and principles of the United Nations Framework Convention on Climate Change (UNFCCC).⁵ This landmark international agreement has the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."⁶

Atmospheric concentrations of CO₂ (379ppm) and methane (1774ppb) in 2005 far exceed the natural range over the last 650,000 years.

Global increases in CO₂ are due primarily to fossil fuel use.
(Intergovernmental Panel on Climate Change, 2007)

The Kyoto Protocol to the UNFCCC established legally binding commitments for industrialized countries to reduce their GHG emissions to levels below those generated in 1990 by the period of 2008 to 2012.

In December 2009, world leaders will again meet in Copenhagen to agree on GHG emission reduction targets and mechanisms beyond 2012.

CO₂ emissions are particularly important in the UK, the Netherlands, and Germany. They are less so in France, where electricity supplies include higher proportions of nuclear power, approximately 39%, and hydroelectricity, approximately 5%.⁷

In Western Europe, there are additional important concerns to consider, including the increasing reliance on imported energy as local reserves decline, security of supply, and the related rising costs of fuel. The above



supports the need for increased attention on efficient energy generation, transportation, and consumption as well as on the employment of alternative energy sources.

THE CHALLENGE

The challenge today is to make energy efficiency and the transition from a carbon-based economy to a low-carbon economy economically viable and profitable. Where business and economics fail to deliver the desired results and behaviors, government policy and intervention usually follow. The research undertaken for The Green Grid identified a wide range of policies in response to the different challenges and "market failures." Therefore, this report focuses on the current and pending energy policy responses that are of importance to the data centre sector.

The following table is a summary of the key policies identified and applicable countries. The European flag and national flags for France, Germany, the Netherlands, and the United Kingdom have been used in this report to highlight relevance.



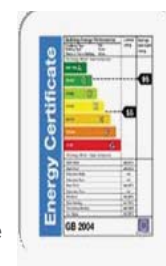
				
Energy Performance of Buildings Directive & Revisions	✓	✓	✓	✓
Energy Labelling Directive & Revisions	✓	✓	✓	✓
Eco-Design Directive & Expansion	✓	✓	✓	✓
Data Centre Environmental Certification	✓	✓	✓	✓
Energy and Environmental Product Labels	✓	✓	✓	✓
EU Code of Conduct: Energy Efficiency for Data Centres	✓	✓	✓	✓
The Fluorinated Greenhouse Gases (F Gas) Regulation	✓	✓	✓	✓
Feed-In Tariffs	✓	✓	✓	✓
Tax Reductions			✓	✓
Grants & Funding		✓		✓
Carbon Trading				✓
Increasing Buildings Codes		✓	✓	✓
Evolving Planning Policies				✓
Voluntary Monitoring & Reporting Initiatives	✓	✓	✓	✓

2. ENERGY POLICIES AND IMPLICATIONS

2.1 ENERGY LABELLING – DEMONSTRATING ENERGY PERFORMANCE

ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE (2002/91/EC)

At the EU level, the Energy Performance of Buildings Directive (2002/91/EC)—also known as the EPBD—introduced several legal requirements for non-domestic buildings regarding energy efficiency. Since December 2006, an Energy Performance Certificate (EPC) that shows a building's theoretical energy efficiency has been issued at the point of a building's completion, sale, or lease. The certificate is usually valid for 10 years and must be generated by an accredited assessor.



The Netherlands has had such a requirement as part of its Energy Performance Standard (EPN) since 1995. The UK, France, and Germany also have translated the EPBD into national law, albeit with their own



approaches and timeframes. For example, as of July 2009,⁸ Germany requires EPCs for all buildings and stipulates that the certificate be on display for buildings larger than 1,000m², while the UK only requires certificates to be on display in buildings visited by members of the general public.

The EPBD also introduced requirements for annual boiler and air conditioning system inspections to be undertaken by accredited assessors. In Germany and the Netherlands, annual boiler checks had already been required under the Small & Medium Combustion Plant Ordinance and Environmental Law, respectively. The air conditioning system inspections have necessitated new methodologies, assessor training, and legal amendments in all four countries. The trigger for air conditioning system inspections is the size (effective rated output) of the system; the EPBD requires inspections of air conditioning systems above 12 kW rated output.⁹ In England and Wales, the Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007 requires all air conditioning systems over 250 kW to have had their first inspection completed by 4 January 2009, and those over 12 kW to get their first inspection by 4 January 2011.¹⁰

IMPLICATIONS OF THE EPBD

To date, the EPBD has had minor implications for the data centre sector, with the landlord paying a small amount for:

- The EPC for the building (or part of the building) that is being completed, sold, or leased.
- The annual boiler and air conditioning system inspection.

REVISIONS TO THE ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE

In November 2008, the European Commission proposed a revision to the EPBD that, among other proposals, would:

- Reinforce provisions of EPCs and inspections of heating and air conditioning systems
- Provide a benchmarking calculation instrument
- Stimulate frameworks for higher market uptake of low- or zero-energy & carbon buildings¹¹

At the end of March 2009, Members of the European Parliament's (MEPs) industry committee adopted further amendments that pushed more ambitious proposals. These included calls for all new buildings to be zero energy by the end of 2018, a definition of zero-energy buildings to be established by the end of 2010, and Member States to set minimum percentages for a share of existing buildings to be energy neutral in 2015 and 2020. The committee also called for new financing instruments to promote energy efficiency, such as the creation of an energy efficiency fund and tax reductions.

IMPLICATIONS OF REVISIONS TO THE EPBD

The main implications of the evolving EPBD are:

- Potentially very significant impacts on data centre design in terms of the recent amendments regarding net zero carbon buildings by 2019. The extent to which this policy will apply to data centres (within buildings or stand alone) and their CO₂ emissions is unclear and requires clarification in due course.
- More transparency in the real estate market for tenants/lessees, investors, and owners.
- Likely offering of financial incentives at the design and refurbishment stage, although no details are as yet available.

ENVIRONMENTAL RATING SCHEMES OF BUILDINGS

There are environmentally focused assessment schemes and awards/labels available for commercial buildings, which usually are employed at the design stage result in a rating. At the international level, the

US Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system for commercial buildings provides assessment criteria for specific stages of construction, including "New Construction," "Core and Shell Construction," and "Existing Buildings."¹² Data centres with LEED certification are rare.

In 2007, Digital Realty Trust completed the world's first LEED Gold data centre in the United States. In Europe, the first LEED certified data centre was Citibank's Frankfurt data centre, which gained the LEED Platinum rating in 2008.¹³

In the UK, the Building Research Establishment (BRE) and Digital Realty Trust have developed a new **BRE Environmental Assessment Method; BREEAM Datacentres**¹⁴ scheme for the design, construction, and operation of data centres.¹⁵ Both the LEED and BREEAM schemes focus on a breadth of environmental issues and impacts, including energy, water, materials, ecology, transport, and management impacts.

France has had its own green building standard, known as High Quality Environmental (**HQE**), for a number of years, with a series of human health and environmental criteria applicable to commercial buildings. In June 2009, BRE Global agreed to a memorandum of understanding to work with the French CSTB¹⁷ to **align HQE and BREEAM in France**, aiming to improve the sustainability of buildings.

In the Netherlands, the Dutch Green Building Council (DGBC) is developing NL-BREEAM, which will initially cover offices, retail, industrial, residential, and educational building types.¹⁸

In January 2009, Germany adopted its own Sustainable Building Seal (**DNGB certifications**¹⁹) tool for offices and administration properties. This tool evaluates all aspects of sustainable buildings—ecological, economic, and sociocultural, plus technology, processes, and location quality.

IMPLICATIONS OF ENVIRONMENTAL RATING SCHEMES FOR DATA CENTRES

On the whole, the rating schemes described above are voluntary; however, certain UK Local Planning Authorities have introduced these schemes and minimum ratings in their planning policy requirements.

If those seeking to develop land in the UK are required to design and build to such a scheme, the implications for those developers include:

- An increase in time and financial resources at the design stage to attain the certification. This can be reduced when an experienced assessor and design team are employed, although given that both of these schemes are currently new, there will be limited availability.
- Energy/resource savings during operation and therefore associated running cost savings.

For those proactively seeking LEED or BREEAM certification, there is more to consider than just the financial implications. Certification presents an opportunity for positive press/PR and enhanced reputation, especially when the energy efficiency of the building and appliances specified are also high.

THE ENERGY LABELLING DIRECTIVE (92/75/EEC)

EU legislation is evolving in terms of energy labels for IT and electronic appliances. The Energy Labelling Directive (92/75/EEC) has proved to be very effective for household appliances, and the EC is proposing to extend the scope to include both energy-using products and those in the commercial sectors.



IMPLICATIONS OF THE ENERGY LABELLING DIRECTIVE

Currently, this directive does not have an impact on products in data centres; however, there is potential that equipment will be subject to energy labelling in the future. Although at this time the extension is not imminent or confirmed:

- Those interviewed generally welcomed the idea of using the A to G label for appliances with all energy-using products as a communications tool to increase awareness and knowledge.
- Product designers and manufacturers should prepare to respond to the labelling proposals and related customer requests.



ENERGY STAR

Another energy label being used is the voluntary ENERGY STAR label, which is awarded to qualifying energy-efficient electronic equipment. The EU recently signed an agreement to use the US ENERGY STAR database in Europe.²⁰ Since May 2009, this database has included Tier 1 servers in “idle mode,” with Tier 2 due to be included in October 2010.²¹ Tier 1 currently excludes blade servers and chassis, systems with greater than four sockets, and others.



The U.S. Environmental Protection Agency (EPA) intends to investigate future specifications for storage and networking equipment.

In addition, ENERGY STAR is currently collecting energy data from data centres to inform a future “ENERGY STAR for Data Centres” rating .

EU ECOLABEL/FLOWER

The EU Ecolabel Flower labelling is a voluntary system across Europe designed to encourage businesses to market products and services that are kinder to the environment.²² The system began in 1992. However, in terms of electronic products, to date the Ecolabel Flower only covers laptop and desktop computers, lighting, washing machines, and refrigerators.



IMPLICATIONS OF EXISTING ENERGY LABELS

The US ENERGY STAR database provides data centre operators and those specifying equipment with energy labels for a limited number of appliances, while the forthcoming EU Energy Label will be required for all products. It is currently unclear how the EC will reconcile proposals to extend the Energy Labeling Directive with the ENERGY STAR database.

THE EUROPEAN COMMISSION CODE OF CONDUCT ON DATA CENTRES ENERGY EFFICIENCY

The European Commission’s voluntary **Code of Conduct on Data Centres Energy Efficiency**²³ was launched in November 2008, following input from the data centre industry, to provide education and guidance for stakeholders. It is European focused and the “aim is to inform and stimulate data centre operators to reduce energy consumption in a cost effective manner without hampering the critical function...”²⁴ The European Commission Code of Conduct on Data Centres Energy Efficiency is often referred to as the European Union Code of Conduct or EU CoC.



The main guide is supported by a Technical Guide²⁵ that provides essential and technical advice related to energy-efficient design, specification, technologies, and management of data centres. The Code responds to an earlier European Commission recommendation “to inform relevant organizations about energy consumption by IT and to stimulate its reduction by spreading awareness of energy-efficient best practices.” There are indications that, following the UK government’s launch of the Cabinet Office “Greening Government ICT”²⁶ strategy in spring 2009, the UK government is seeking to mandate the adoption of the EU CoC in central government and public-sector procurement policy. If this is the approach adopted in the UK, it may well be the case that other European governments follow suit by adopting the EU CoC.

IMPLICATIONS OF THE THE EUROPEAN COMMISSION CODE OF CONDUCT ON DATA CENTRES ENERGY EFFICIENCY

The new EU CoC provides stakeholders with essential energy efficiency and technical guidance. The key implications are:

- A little additional time associated with employing and advocating the guide
- Opportunity to increase relationships with clients and therefore enhance reputation
- Opportunity for the industry to self-regulate and reduce the risk of future legislation

ENERGY-EFFICIENT DATA CENTRES—BEST PRACTICE EXAMPLES FROM EUROPE, THE USA AND ASIA

In Germany, on behalf of the Federal Ministry of the Environment, the Borderstep Institute has undertaken Green IT research and published best practice guides, including “Energy-Efficient Data Centres—Best Practice Examples from Europe, the USA and Asia.”²⁷

2.2 FEED-IN TARIFFS—GENERATING NEW REVENUE STREAMS

In response to traditional investment horizons and procurement approaches, fiscal instruments can be adopted to stimulate a response, such as increased mitigation of and adaptation to climate change.

In 2006, Sir Nicholas Stern²⁸ was the head of the UK Government Economic Service and a former World Bank chief economist. He called for an additional investment of 1% to 2% of the UK’s gross domestic product (GDP) to be spent immediately to mitigate and adapt to climate change rather than pay a much heavier price later, on the basis that the benefits of strong, early action on climate change outweigh the costs.

FEED-IN TARIFFS

A feed-in tariff (FIT) is the main fiscal instrument in operation that is designed to encourage investment in renewable energy technologies and reduce GHG emissions.

Renewable Energy FiTs guarantee a minimum price (above-market rates) per kWh of electricity generated via renewable energy technologies and supplied to the national grid. The guaranteed price is fixed for 15 to 20 years (as is the case in Germany) and legislation is changed to require the utility companies to buy renewable electricity. Electricity generated from renewable sources includes solar photovoltaics, wind power, biomass, hydropower, and geothermal power. The FIT price differs for each source due to a number of considerations, including the level of market penetration associated with the technology.

In 1990, Germany instituted a FiT under “Stromeinspeisungsgesetz” and has had one under “Erneuerbare-Energien-Gesetz” (EEG) legislation since January 2009. Eligible renewable energy sources include wind (in specific locations), biomass (biogas), solar, geothermal, hydropower, landfill gas, sewerage treatment gas, mine gas, and biodegradable waste. German FIT 2009 prices for energy generated by biomass sources are

listed below; prices for solar, wind, and geothermal energy are included in the Germany section of this report's appendix.

Biomass energy

Output	Basic fees (Euros)
Up to 150 kW of output	11.67 cents/kWh
Output between 150 kW & 500 kW	9.18 cents/kWh
Output between 500 kW & 5 MW	8.25 cents/kWh
Output between 5 & 20 MW	7.79 cents/kWh

Source: <http://www.klgates.com/newsstand/Detail.aspx?publication=5668>

The French **Advanced Renewable Tariffs (Tarife Equitable)** was introduced in 2006. In November 2008, the Sarkozy government announced a solar FIT for commercial buildings of €0.45/kWh (US \$0.57/kWh)—a rate above Germany's—until 2012.

In March 2009, the Dutch Cabinet agreed to implement feed-in tariffs, replacing an existing quota system, and the UK has followed suit with implementation proposed for April 2010.

IMPLICATIONS OF FEED-IN TARIFFS

These financial instruments offer a fixed additional payment per unit of renewable electricity generated on-site and/or sold to the national electricity grid, usually at a guaranteed price for 10 to 20 years. FITs provide additional financial support that may enable investments in renewable energy technologies to become viable.

FITs offer:

- Moderate levels of financial support and benefit, both for those developing new data centre capacity and for existing sites where renewable energy technologies can be installed/retro-fitted
- Moderate financial opportunities for specialist renewable energy investors to partner with data centre providers to generate an additional revenue stream

2.3 FINANCIAL INCENTIVES—TAX REDUCTIONS & GRANT FUNDING

The relatively high capital cost associated with investment in efficient and renewable energy technologies has been a challenge experienced for some time, especially when the developer/data centre owner will not pay the energy bills during operation because the lessee will inherit the overhead.

There are a small number of mechanisms that have been put in place to encourage more investment, as introduced below.

TAX REDUCTIONS

To overcome the high capital cost barrier, reductions in the amount of taxes paid by companies investing in energy-efficient equipment are available in the UK and the Netherlands. The UK scheme is called the **Enhanced Capital Allowance** (ECA) and in the Netherlands, the scheme is the **Energy Investment Allowance** (EIA). Both schemes are supported by a list of approved/qualifying energy-efficient equipment.

In the Netherlands, companies investing a minimum of €450 in approved efficient equipment and renewable energy technologies can deduct 44% of the investment amount from their pre-tax profits in the calendar year in which the equipment was procured.²⁹ To be eligible, Bureau Investeringsregelingen en Willekeurige Afschrijving (IRWA) forms must be completed within three months of the investment.



An Energy List determines which types of equipment qualify for the IRWA programme. The programme includes the cost of obtaining energy advice, provided that the advice results in an investment in energy-saving equipment.³⁰

IMPLICATIONS OF TAXES & LEVIES

The UK ECA offers a small financial incentive, and the Dutch EIA tax relief approach offers an attractive tax reduction for investing in energy-efficient equipment. The key implications are:

- Financial incentives are provided after the initial investment has been made, thereby only rewarding those who have made such a financial investment and not those seeking additional finances to invest in energy-efficient products.
- The list does not necessarily reflect the quality of the equipment.



CLIMATE CHANGE LEVY

In the UK, the Climate Change Levy (CCL) is paid by the non-domestic sector per unit of fossil fuel purchased. This levy was introduced in April 2001 to encourage users to improve energy efficiency and reduce emissions of greenhouse gases. The CCL rates for fuels, as of April 2008, are shown below.

Electricity	£0.00456/kWh
Gas supplied (in a gaseous state)	£0.00159/kWh
Any petroleum gas (or other gaseous hydrocarbon, supplied in a liquid state)	£0.01018/kilogram
Any other taxable commodity	£0.01242/kilogram

The UK government returns the levy revenues to the non-domestic sector, principally through a cut in the rate of employers' National Insurance Contributions of 0.3%. In addition, those energy-intensive sectors with **Climate Change Agreements** (CCAs)³¹—the mechanism for government and industry to agree on GHG emission reduction targets—companies can claim 80% of the CCL. Currently, the ICT sector does not have a CCA with the UK government.

IMPLICATIONS OF THE UK CCL AND CCAS

As of September 2009, the CCL has limited financial impact per unit of energy consumed, and there is no CCA with this sector or anecdotal evidence of such a proposal.

GRANTS

Those interviewed indicated that certain regions in Germany periodically offer grants, usually to attract certain types of business or to support innovation. Funding is often provided on a "match funding" basis in which half of the funding is made available, although often demand exceeds supply.

In the UK, the Carbon Trust offers interest-free loans for energy-efficient equipment upgrades between £3,000 and £400,000 to help reduce costs and associated CO₂ emissions.³² Currently, it is understood that the loans do not apply to IT equipment such as servers, yet they are available to larger companies that are not Carbon Reduction Commitment (CRC) participants, as well as to small and medium-sized businesses. Traditionally, the time between making an application and gaining a response has been lengthy; however, the Carbon Trust aims to address this by reducing its 4-to-6-week administration time to 10 days.

IMPLICATIONS OF GRANTS

There are a limited number of funding and loan opportunities available, in certain locations, for those seeking new manufacturing locations for equipment, research and development plants, and/or specification of new equipment. However, the timeframes involved and risk of not gaining the financial assistance can hinder business planning.

2.4 DRIVING ENVIRONMENTAL PERFORMANCE



ECO-DESIGN DIRECTIVE FOR ENERGY-USING PRODUCTS (2005/32/EC)

The Eco-Design Directive for Energy-Using Products (2005/32/EC) established a framework under which manufacturers of energy-using products are obliged, at the design stage, to reduce the energy consumption and other negative environmental impacts occurring throughout the product's life cycle. This directive currently requires domestic and some industrial energy-using products (EUPs)³³ to conform to energy consumption requirements before they can be sold in the EU.

On 21 October 2008, the EC adopted a working plan for 2009-2011, setting out an indicative list of priority EUP groups, including air conditioning and ventilation systems; network, data processing, and data storage equipment; transformers; and water-using equipment.

IMPLICATIONS OF THE ECO-DESIGN DIRECTIVE

By setting minimum energy efficiency standards for domestic and some industrial products, this directive has begun to increase the quality and environmental performance of products and had financial and product design impacts upon the sector.

EXPANSION TO THE ECO-DESIGN DIRECTIVE

On 16 July 2008, the European Commission proposed a recast of the Eco-Design Directive to amend the directive's scope in order to extend it from EUPs to include energy-related products (ERPs), which it described as "any good having an impact on energy consumption during use."³⁴

IMPLICATIONS OF REVISIONS TO THE ECO-DESIGN DIRECTIVE

The EC's desire to extend the scope to all energy-related products in the industrial and commercial sectors follows the domestic appliance success story. Key implications include:

- Financial impacts for product designers and manufacturers as the minimum standards increase
- A small risk for those product suppliers who invest ahead of legislation, although that does encourage innovation through research and development
- Financial impacts for customers who inherit additional purchase costs, although these should be offset by the energy savings realised during product use

CERTAIN FLUORINATED GREENHOUSE GASES (EC REGULATION 842/2006)

A number of ozone-depleting substances that were used in the manufacture of cooling equipment are now banned in most instances under this directive, known as the F Gas Regulation . These substances, often referred to as F gases, include:

1. Chlorofluorocarbons (CFCs)
2. Hydrochlorofluorocarbons (HCFCs)
3. Halons³⁵

Clearly, most stand-alone data centres were built after 2000. However, older data centres with air conditioning systems installed in 1999 or before may rely on these substances to operate

In the UK, there will be a ban on the use of virgin HCFCs for the maintenance and servicing of refrigeration and air conditioning systems from 1 January 2010 and a ban on the use of all HCFCs from 1 January 2015.³⁶ In practice, this means that the gases will need to be replaced with less-harmful alternatives or, potentially, that equipment will need to be upgraded and/or replaced.



Article 3 of the Fluorinated Greenhouse Gases Regulation also requires operators to use all available measures—those that are technically feasible and that do not entail disproportionate cost—to prevent leakage of F gases and to repair any detected leakage (as soon as possible) from the following applications: refrigeration, air conditioning, and heat pump equipment, including their circuits, and fire protection systems.³⁷

IMPLICATIONS OF THE FLUORINATED GREENHOUSE GASES REGULATION

There are potential operational and financial risks for older data centres operating with air conditioning plants that use F gases that need to be maintained, topped up, and potentially replaced.

2.5 DELIVERING SUSTAINABLE DEVELOPMENT

BUILDING CODES

Two national-level tools—**building codes** and **planning policies**—have been adopted to increase the energy performance of buildings and infrastructure.

The **Bouwbesluit**³⁸ are the technical building regulations in the Netherlands, laid down in the Building Decree to unify performance. Performance relates to a breadth of issues, including building occupants' health (e.g., ventilation, sound insulation) and energy-saving measures (e.g., thermal insulation, energy performance, air tightness).

The **Building Regulations in England and Wales**³⁹ set minimum performance levels for energy efficiency and ventilation. These have been set since 2006, in technical documents known as Part L and Part F, with revisions proposed every three years. The UK government has committed to increase the energy performance of buildings every 3 years, via the Building Regulations, to meet the objective for all new buildings to be net zero carbon by 2019. This is obviously a very challenging goal and, despite the economic downturn, an area of increasing investment by property developers.

In France, the Building/Construction Code (Code de l'Urbanisme) and Certificat d'Urbanisme (CDU), a certificate of town planning or urban development, are required prior to any building, construction, renovation, or development of a property.

In Germany, the **Energy Savings Ordinance (EnEV 2007/2008)** implemented the EPBD requirements and will tighten energy performance requirements for buildings in Germany over time. According to an article by *InBuilt*,⁴⁰ in March 2009 the German federal government accepted proposed amendments to this energy-saving ordinance, which will come into force during autumn 2009. The amendments include:

- The maximum allowed primary energy demand for new buildings will be reduced by 30% on average.

- The requirements for thermal insulation of new buildings will be tightened by 15% on average.
- The requirements for renewed building elements in retrofitted buildings with major renovations will be tightened by 30% on average.

IMPLICATIONS OF BUILDING CODES

The key implications for the data centre sector are the increasing financial burden associated with building and technical designs that comply with each country's increasing number of energy efficiency requirements. In Germany and the UK, this is indeed a growing challenge for data centre providers and developers.

PLANNING POLICIES

In addition to the building codes and regulations, there are spatial planning systems across Western Europe, setting policies at the national, regional, and local levels. For example, France has two regulations that govern planning permission: national town planning regulations, the Code de l'Urbanisme, and local rules contained in local schemes. It also has the Le Plan d'Occupation des Sols (POS) or the Plan Local d'Urbanisme (PLU).

Where other regulations have not promoted or required best practices for renewable energy and/or environmental certifications, certain UK local planning authorities (e.g., the Greater London Authority) have taken the lead by introducing policies for new developments, especially commercial development over 1,000m². For example, the London Borough of Merton requires new developments to generate at least 10% of their energy needs from on-site renewable energy equipment for non-residential developments over 1,000m². This policy approach has become known as "The Merton Rule."⁴¹

Planning policies in many authorities in England and Wales now require a percentage, from 10% to 20%, of a development's energy to be provided by on-site renewable energy technologies and/or a minimum BREEAM rating to be gained prior to receiving planning permission.

IMPLICATIONS OF PLANNING POLICIES

With such a high number of local planning authorities in each country, there is currently an uneven planning policy field. Schemes submitted to local planning authorities in the UK, which do not meet their energy efficiency, renewable energy and/or environmental certification policies, increasingly risk planning refusal and the associated financial and time penalties associated with redesigning and reapplying for planning permission.

This inconsistency may lead to "preferred area" status for new data centre developments where planning policies are less stringent and avoidance of land for data centre development in authorities and municipalities with Merton Rule-style policies.

2.6 CARBON TRADING—PUTTING A PRICE ON CARBON

EU GHG EMISSION TRADING SCHEME (DIRECTIVE 2003/87/EC)

In January 2005, the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) commenced operation as the largest multi-country, multi-sector greenhouse gas emission trading Scheme.⁴²

The EU ETS covers large combustion installations (larger than 20 MW thermal) within EU member states. Sectors covered by the system include power generation, cement, glass, ceramics, the steel industry, and so forth, with the aviation industry included from 2013.





Operators of installations that are covered by the EU ETS are obliged to monitor and report emissions of greenhouse gases from that installation and to surrender allowances equivalent to those GHG emissions.

The EU ETS has evolved and is now in its second phase of operation, which runs to 2013. It is also now a "regional scheme," which operates under the Kyoto Protocol worldwide umbrella of GHG trading schemes. The EU ETS is complex and, due to the ICT and data centre sectors not included in the scheme, is not explained further in this report. The European Environmental Protection Agency⁴³ website explains more on how the scheme currently works.

IMPLICATIONS OF THE EU ETS

To date, the ICT and data centre sectors have not been included in the EU ETS and no literature or anecdotal evidence has been found to indicate that a change may be considered.

However, given that it is estimated that the ICT sector is responsible for around 2% of global CO₂ emissions—approximately the same as the airline industry—the wider industry would be wise to keep an eye on this scheme.

In addition, the forthcoming UK carbon cap and trade scheme (see explanation below) will have a limited interaction with the EU ETS because the "carbon trading" option will make it possible for participants to buy carbon allowances from (but not sell them to) the EU ETS.

NATIONAL TRADING SCHEMES

Trading mechanisms are increasingly generating interest at the national level across the globe, with Australia, the US, and South Africa all active in this regard.

In Western Europe, the UK is forging ahead, as explained below, with a new carbon cap and trade scheme known as the Carbon Reduction Commitment.

In France, the Grenelle Agreement of 2007 is being supported by working groups that include a "Green IT" working group known as DETIC, which is due to publish its recommendations in autumn 2009. Anecdotal evidence indicates that emission trading options are being reviewed; however, the extent will not be clear until later in 2009 .

UK CARBON REDUCTION COMMITMENT

The Carbon Reduction Commitment (CRC) is a UK mandatory carbon trading scheme, expected to begin in April 2010. It aims to support the UK government's legally binding target of an 80% cut in greenhouse gas emissions by 2050.

The following provides an overview of how the scheme works:

- The Carbon Reduction Commitment is mandatory for data centres that consumed more than 6,000 MWh through half-hourly metering in 2008. Organisations consuming more than 3,000 MWh electricity through half-hourly metering also will have a degree of reporting requirements.
- CRC participants must establish auditable systems to report carbon emissions by April 2010.
- Daily penalties for non-compliance will apply.

- A league table of performance will be established, affecting reputation.
- Organisations must buy carbon allowances based on their energy consumption.
- The money is “recycled” back, with penalty or bonus payments dependent on position on the league table.
- From April 2013, a carbon market will be established, introducing significant price uncertainty.

Under the CRC, the organisation that holds the direct contract with an energy supplier will be responsible for GHG emissions—be it the data centre provider or lessee.

The highest parent organisation will be responsible for reporting its total energy use and emissions, including those of subsidiaries or joint ventures in which it has a share greater than 50%.



Timeline

The following table introduces some of the CRC's key dates in a timeline to illustrate the rollout:

Date	Action
2009	Organisations determine if they are participants and establish their CRC strategies
2010	April Participants register for the first phase of the scheme, which runs from April 2010 to March 2013
2011	April Participants purchase allowances for 2011/12 forecast emissions (at ~£12/tCO ₂)
	July Participants submit a footprint report and an annual report and then surrender allowances equivalent to the emissions reported in the annual report
	Oct Participants receive recycling payments with a bonus or penalty
2012	Apr Participants purchase allowances for 2012/13 forecast emissions (at ~£12/tCO ₂)
	July Participants submit annual report detailing emissions in previous year, then surrender allowances equivalent to the emissions reported in the annual report
	Oct League table based on 2011/12 reports will be produced and recycling payments received
2013	Apr Second (capped) phase begins

LEAGUE TABLE AND RECYCLING PAYMENTS

The performance league table introduced by the government will have implications not only on participants' reputation, but also on the amount of revenue they receive each year from recycling payments.

The revenue generated from selling allowances will be returned to participants based on their position in the league table. Overall, the scheme will be revenue neutral for the government; however, by year five, the best performers will receive bonuses of up to 50%, while the worst performers will be penalised 50%.

League table metrics

CRC participants' energy management and emissions reduction performance is measured against three metrics. The results against these metrics are then collated to enable the ranking of CRC participants' performance. The positions are then published annually in the league table. The following weightings will be applied over the first four years of the scheme.

CRC Metrics & Weightings	Introductory/1st Phase		2nd Phase
	2010/11	2011/12 & 2012/13	2013/14+
1. Early action metric	100%	40% then 20%	N/A
2. Absolute metric	0%	60%	75%
3. Growth metric	0%	20%	25%

1. Early action metric:

Used for the first and second year only, this metric recognises voluntary good energy management and gives equal weighting to:

- The extent of installation of automatic meter reading before 31 March 2011
- The percentage of an organisation's emissions covered by a valid energy efficiency accreditation scheme or Carbon Trust Standard certificate on 31 March each year

2. Absolute metric:

This metric represents the total percentage change in annual carbon emissions, calculated by comparing annual emissions with the average emissions in the preceding years of the scheme. After the fifth year, annual emissions are compared with the average of the preceding five-year period.

3. Growth metric:

The growth metric aims to compensate for the fact that organizations may be growing or declining; it measures the percentage change in emissions per unit turnover for private companies.

IMPLICATIONS OF UK CARBON REDUCTION COMMITMENT

There are significant financial, operational, and reputation implications associated with this new piece of legislation.

FINANCIAL IMPLICATIONS AND UNCERTAINTY

Perhaps most significant for the data centre industry are the financial implications associated with the scheme. There are cash flow implications from April 2011, when participants must purchase carbon allowances to cover their predicted 2011 financial year CO₂ emissions. In October 2011, the government will pay a participant for the allowance along with a bonus or penalty of up to 10%. This action is then repeated but with the penalty or bonus percentage increasing by 10% each year, up to 50%.

REPUTATION

The league table has been established for two main reasons: first, to provide a mechanism for rewarding or penalising those organisations that contribute most to the reduction or growth in carbon emissions. Second, the government wants to affect change through publishing the participating organisations' performance with regard to carbon emissions. Indeed, this will be the first mandatory requirement to publish actual carbon emissions (and reductions of carbon emissions) through a standard process of reporting. It will, of course, have significant implications for those organisations concerned about perceptions, in particular those that have made significant claims about their environmental practices.

COMPLIANCE WITH AND MANAGEMENT OF THE CRC

The CRC will place a number of operational burdens on data centre providers and users. The following summarises the key administrative requirements that will need to be addressed:

- Reporting accurately on carbon emissions
- Forecasting energy consumption and purchasing carbon allowances, with the potential need to trade those allowances



- Establishing treasury and accounting systems to manage carbon trading activities
- Developing systems for allocating associated costs and potential revenues to specific cost centres within the organisations, and potentially to their clients, where possible and appropriate

ILLUSTRATIVE FINANCIAL IMPLICATIONS FOR DATA CENTRES

Different data centres with different energy consumption profiles and growth rates will experience different financial impacts. In fact, a range of potential outcomes could result, depending upon the participant's league table position. The range of potential financial implications is therefore provided in the graphs below.

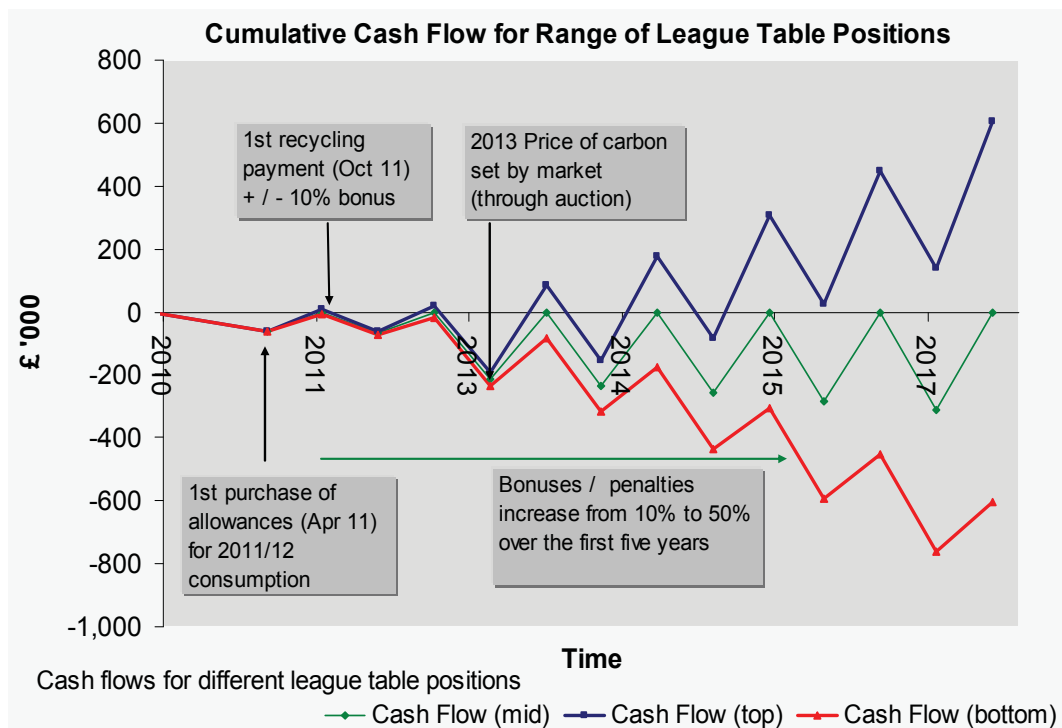


Due to the uncertainties associated with carbon trading, a number of assumptions have been made and should be noted:

- The price of carbon allowances in the first phase will be £12/tonne of CO₂ equivalent
- The price of carbon allowances in the second phase (from April 2013) is £35/tonne of CO₂ equivalent

It should also be remembered that a CRC participant organization will purchase allowances for the total amount of CO₂ emissions associated with all its property needs, not just those related to a data centre.

The following graph illustrates the range of cash flows that may occur for a data centre with 1 MW capacity, drawing 8,560 MWh of electricity in 2010, with a growth rate of 10% when allowances are i) purchased, and ii) when the recycling payments with bonus or penalty are received.



The following table illustrates the range of cash flows that may occur for the above and other scenarios.



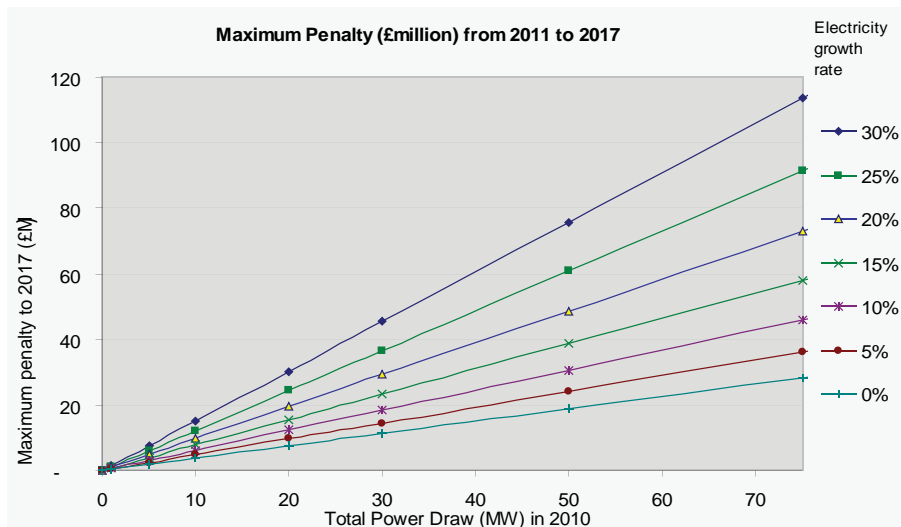
Data centre scenarios		Cumulative cash flows dependent upon best (top) and worst (bottom) positions					
Capacity in 2010	Growth rate	April 2011	October 2011		October 2017		Difference £'000
		£'000	Min £'000	Max £'000	Min £'000	Max £'000	
1 MW capacity drawing 8,560 MWh	10%	-£61	-£6	+£6	-£607	+£607	£1,213
1 MW capacity data centre, drawing 8,560 MWh	20%	-£66	-£7	+£7	-£968	+£968	£1,936
5 MW capacity, drawing 42,800 MWh	10%	-£303	-£30	+£30	-£3,034	+£3,034	£6,067
5 MW capacity, drawing 42,800 MWh	20%	-£331	-£61	+£61	-£4,840	+£4,850	£9,680

For more details on the forthcoming UK CRC, see this report's appendix and the Department of Energy and Climate Change web site: www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/crc/crc.aspx.

The following graph illustrates the range of potential penalties that may be applied to organisations with different electricity consumption in 2010 and with different growth profiles.

Again, a number of assumptions have been made and should be noted:

- The price of carbon allowances for the first three years will be £12/tonne of CO₂e
- The price of carbon allowances in the following years is £35/tonne of CO₂e
- Annual growth rates are from 2010 to 2017 for different sized data centres/organisations
- Data centres are utilized at full capacity all year; the X axis in the graph below refers to data centre capacity in MW
- Gas consumption has been ignored because it is typically negligible within data centres



A SIGNIFICANT AND UNCERTAIN LIABILITY

There are significant financial uncertainties associated with the CRC scheme, with the key sensitivities being:

- Total energy consumption in 2010
- Growth in energy consumption over time
- The price of carbon allowances
- Penalties for fraud



With the average value of a single carbon trade of £50,000 (about US\$81,000), there is ample opportunity for fraud, an example of which the UK's HM Revenue & Customs (HMRC) uncovered in January. A "carousel fraud" involves carbon offsets that are imported into Britain without paying value added taxes (VAT). They are then sold to companies, each of which is liable to pay the standard rate of VAT on the purchase, which, as of last year, was 17.5% according to the *Sunday Times*.

The potential liability for businesses is significant because the government has the right to reclaim the VAT on any carbon trade it thinks is suspicious, and companies also can be penalised retroactively for three years, reports the UK newspaper.

Businesses that unknowingly participated in a suspected carbon trading scam could face millions of dollars in legal fees and penalties. Any company involved in the scheme may be subject to an audit.

HMRC's advice to businesses is to know your customer, supplier, and products, but business groups said this was not good enough because anyone can register as a carbon trader, according to the *Sunday Times*.

Other countries expect to face similar challenges. For example, Australia recently gave its federal police the ability to enter company premises and request paperwork in order to prosecute a new range of climate offenses, including bogus carbon offset schemes and under-reporting of carbon emissions.

2.7 MONITORING, MEASURING, AND REPORTING ENERGY PERFORMANCE

One challenge for many industries is the practice of monitoring, measuring, and reporting environmental performance. This has been acknowledged by a number of organizations interested in this area, from IPD⁴⁴, which launched a standard for measuring property environmental performance in 2008, to The Green Grid, through its development of the Power Usage Efficiency metric.

To support monitoring, there are computerized metering systems for buildings known as building management systems (BMS) and utility meters, which provide automatic feedback every 30 minutes (often called "Half Hourly Metering" or HHM meters). It is the meter-reading data that enables organizations to calculate/measure their total and relative energy performance.

The Green Grid has responded to the measurement gap by working with the data centre industry to create performance metrics such as :

- The **Power Usage Efficiency (PUE) ratio**⁴⁵ for data centre IT/server appliances, which is calculated for a data centre running at full capacity. PUE is defined as:

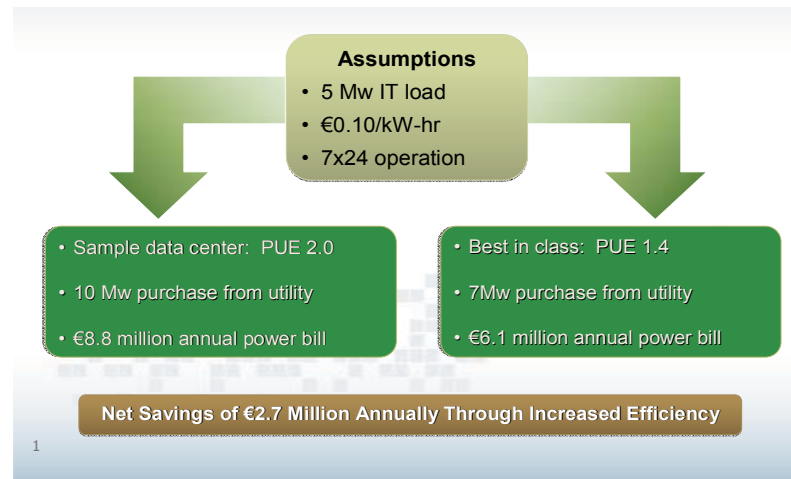
- Total Facility Power/IT Equipment Power

- Its reciprocal, **Data Center Infrastructure Efficiency (DCiE)**, is an easily understandable figure that provides an indication of efficiency for a particular facility. DCiE is defined as:

- $1/\text{PUE}$ or Equipment Power/Total Facility Power x 100%



As the following diagram shows, a sample data centre applying the PUE metric before and after employing energy efficiency measures and management was able to reduce its PUE from 2.0 to 1.4 (best in class) and achieve significant financial savings.



Those interviewed pointed out that the PUE is a very useful measurement for a specific data centre, enabling its operators to benchmark changes in energy performance, but it is not suitable for benchmarking data centres against each other, especially those in different climates. Further work is being undertaken by The Green Grid members on benchmarking data centres' energy performance in different locations and climates.

Complementing The Green Grid's work is the **EC Code of Conduct as introduced in Section 2**, which is concerned both with the efficiency of the data centre as a whole and with its appliances; therefore, it provides a "facility efficiency rating" and an "asset efficiency rating." In terms of reporting, the EU COC also advocates periodic reporting of performance against these metrics.

To help measure server energy efficiency, members of The Green Grid along with other market participants are working within the non-profit Standard Performance Evaluation Corporation (**SPEC**)⁴⁶ to develop **power-performance benchmarks**.

The forthcoming **UK CRC** is another mechanism requiring performance reporting, this time at the organizational level, for total energy consumption and relative CO₂ emissions. The results of this reporting will be publicly available and disclosed annually via the performance league table.

IMPLICATIONS

With increasing attention on monitoring, measuring, and reporting on the energy performance of assets and equipment, the implications for the data centre industry may include:

- Initial moderate demands on facility and data centre managers—becoming a small resource requirement once monitoring, measuring, and reporting is established—with the added advantage of being able to track changes over time and show others how certain actions have affected consumption
- Moderate changes to energy management and financial procedures for UK CRC participants
- Small demands on company time and resources through representation on industry working groups to inform the adoption and refinement of metrics and approaches to benchmarking energy performance



2.8 SUMMARY OF KEY POLICIES AND IMPLICATIONS

This table indicates the level of significance associated with key policy instruments.

Policy	Financial	Operational	Reputation
Revisions to Energy Performance of Buildings Directive (EPBD)	Significant (but uncertain)	Low	Low
Revisions to Energy Labelling Directive	Moderate	Moderate	Moderate
Environmental certification	Moderate	Low	Moderate
EC Code of Conduct	Low	Moderate	Moderate
Feed-in tariffs	Moderate	Low	Low
Tax reductions	Low	Low	Low
Forthcoming CRC (carbon trading)	Significant	Significant	Significant
Expansion of Eco-Design Directive	Moderate	Moderate	Low
F Gas Directive	Moderate	Moderate	Moderate
Increasing building codes	Significant	Moderate	Moderate
Evolving planning policies	Moderate	Moderate	Moderate
Voluntary monitoring & reporting initiatives	Low	Low	Moderate

Policy instruments found to be insignificant for the data centre industry include the current EU EPBD, current EU Energy Labelling Directive, current Eco-Design Directive, EU Renewables Directive, the German DGNB certification for office buildings, and grants.

3. RECOMMENDATIONS

2.9 RECOMMENDATIONS

This section draws on the aforementioned implications and findings to provide a set of recommendations for data centre managers and other stakeholders to consider and act upon, as appropriate.

As the European Commission and Western European governments increase their attention on the ICT industry, specifically on data centres due to their energy demands and sector growth, the industry needs to continually innovate to deliver data centre services more efficiently.

The following recommendations affect all stakeholders involved with data centres in Western Europe and relate to life-cycle stages from design and specification to build and fit through to operation and leasing.

ALL STAKEHOLDERS

All stakeholders are strongly encouraged to enhance their understanding of the reasons for the increasing EU- and government-level interest in energy efficiency, GHG reduction, and renewable energy technologies, and to identify opportunities to respond proactively.

All stakeholders are strongly encouraged to take steps to improve their energy efficiency, such as embracing the European Commission's voluntary Code of Conduct on Energy Efficiency Data Centres and technical guidance. Actions such as these show regulators that the sector is proactively responding to their concerns and has a working system of self-regulation. In addition:

- Specific feedback on the EU COC guides should be provided to the European Commission (DG JRC) to shape revisions and versions.
- The voluntary guide and approach should be advocated to educate the supply chain and encourage implementation.
- Stakeholders should get involved with The Green Grid.

The Green Grid is working closely with end users, technology providers, and governments around the world to create standards for more efficient use of energy in data centres. Through data collection and analysis, assessment of emerging technologies, and development of best practices for data centre operators, The Green Grid is creating industry-leading metrics and measurements for executives and end users anywhere in the world to determine the efficiency of their specific data centres.

Regardless of the nature of your organization or your role in it, The Green Grid offers a place for you in the dialog. According to a recent study by Emerson Network Power, 72% of companies surveyed do not have a documented strategy for reducing energy use in the data centre, although most agree that data centre energy consumption is a real issue of concern. The Green Grid provides a forum where IT, facilities, and other C-level executives come together to discuss different options that exist for improving energy efficiency. Findings and recommendations from these forums are published on a regular basis, and metrics have been established and are now industry standards.

The Green Grid Membership

Membership in The Green Grid offers benefits to individual organizations as well as to the industry. Data centres vary considerably—from the age of the facility to its location to its infrastructure to the work it supports. By participating in a variety of working groups and user forums, you will be able to add your company's voice to the hundreds of others that are developing the next wave of globally adopted metrics and measurements that will help you achieve efficiency in your data centres.

There are three ways to join: as a Contributor Member, General Member, or an Associate Member. Which level



of membership is right for you will depend on how much influence your organization wants to have in driving the mission of The Green Grid.

TRADE & INDUSTRY BODIES

Trade bodies are advised to continue engagement and interaction with the EC and national governments to inform policy makers on the sector and on CO₂ and renewable energy policies. This is important with regard to:

- The recasting of the EPBD (specifically the desire for net zero carbon buildings by 2019), the extent to which the EPBD will apply to data centres (within buildings or stand alone), and associated CO₂ emission calculations
- Evolving Eco-Design and Energy Labelling Directives
- Evolving building codes and planning policies
- The UK government's response to the CRC public consultation
- The French Green IT working group recommendations

Industry bodies should unite in the development of energy efficiency metrics for data centre asset and IT consumption—which often is fragmented by the number of ICT-focused industry bodies—to provide customers with clarity and greater industry transparency.

DESIGNING AND MANUFACTURING IT APPLIANCES

Given the increasing scope of the Energy Labelling Directive and Eco-Design Directive to capture all energy-using products during manufacturing and the EC's priority list of appliances, product design companies are advised to:

- Ensure that each innovation and product development fully embraces:
 - The life-cycle environmental impacts (from raw material sourcing to manufacturing) during its use and end of life
 - Energy efficiency and reduced heat outputs
- Gain third-party certification for energy efficiency of products (e.g., Energy Star certification) to support effective communication with key stakeholders

LOCATING AND DESIGNING DATA CENTRE BUILDINGS

In light of evolving policy and legislation, increasing energy costs, and the ability to employ sustainable/intelligent design options in Western Europe, stakeholders are advised to:

- Stay abreast of technological developments such as virtualisation, which will increasingly support locating data centres further away from customers, in cooler climates, and on less expensive sites.
- Work with data centre design team members to ensure that the design brief includes energy efficiency targets and confirms the desire for renewable energy. Specific opportunities and approaches advocated include:
 - Adopting the “energy hierarchy”⁴⁷
 - Undertaking a renewable energy feasibility study to inform financial appraisals and decisions regarding both the main and backup/secondary energy supplies
 - Including renewable feed-in tariffs and tax deductions in financial appraisals
- Keep abreast of and respond accordingly to national building codes
- Review the local planning policies, particularly in the UK, regarding operational CO₂ emissions and on-



site renewable energy to minimise delays in gaining planning permissions

SPECIFYING IT APPLIANCES

Those specifying equipment and servers, from data centre managers to consultants, are strongly encouraged to ensure that energy efficiency is equally as important as price, reliability, processing power, memory access times, and so on—even in the credit crunch—in light of the UK's forthcoming CRC and increasing government interest in "placing a price" on CO₂ emissions associated with energy consumed during use/operation.

For those investing in energy-efficient equipment listed on the UK and Netherlands product list, ensure that your company claims the tax deductions available.



MANAGING DATA CENTRES

It is important for data centre managers to be:

- At a minimum, periodically monitoring and measuring energy performance against industry-accepted metrics (e.g., The Green Grid's Power Usage Efficiency metric and the EU COC's facility efficiency and asset efficiency ratings).
- Proactively managing and saving energy. A suggested approach is to:
 - Review and find additional efficiencies in the data centre associated with i. hardware components (e.g., UPS), ii. building services (including air conditioning plant), and iii. software on servers, which is often unnecessary or can be rewritten to increase energy efficiency.
 - Exploit the existing and emerging renewable feed-in tariffs by i. reviewing portfolio suitability for renewable energy technologies, ii. assessing the financial impacts of investing in renewables and selling electricity to the grid to gain the FiTs, and then iii. identifying the best opportunities available and creating a business plan.
- Complying with the F Gas Directive requirements, such as preventing leaks, and ensuring that the phasing out of F gas use is not mission critical for air cooling equipment.
- Informing and implementing appropriate aspects of an organisation's energy/carbon management/CRC strategy.

PREPARING FOR CARBON TRADING

As explained earlier in this report, the UK is just months away from introducing a new carbon cap and trade scheme that will capture non-energy intensive organisations. At this time, only the proposals for the UK CRC scheme are known, and these may change in light of the public consultation that closed in early June 2009. The UK government has been the vanguard with the CRC legislation; however, other European governments and that of the United States are closely monitoring the CRC's implications and effectiveness.

As the scheme stands currently, the UK CRC presents significant risks for the data centre sector due to energy demands and growth rates.

Data centre providers and lessees should take the following actions to ensure compliance and limit liabilities:

- **Compliance:** Compare your 2008 electricity consumption against the threshold to establish if your organisation is a CRC participant. If so, establish your CRC strategy.
- **Measurement and monitoring:** Establish or formalise energy measurement, monitoring, and reporting systems that are in line with CRC requirements.
- **Reporting:** Keep records of energy use and supportive information in an "evidence pack" to support information disclosure to the regulator and future third-party auditors.

- **Cash flow:** Forecast cash flows to inform business decisions and ensure you have budgeted for CRC payments from April 2011 onwards. Remember, the "double payment" is due in April 2011.
- **Carbon management:** Develop your carbon management and carbon trading strategies, and establish appropriate accounting, treasury, and decision-making systems.
- **Early actions:** Determine the cost/benefit of taking "Early Action" and implement if required.
- **Liability management:** Confirm and formalise how CRC liabilities will be managed between the data centre provider and lessees. (See the text box on this page for further discussion of this complex issue.)



Managing Liabilities between Data Centre Providers and Lessees

A key challenge for the data centre industry is to establish how liabilities are allocated between a data centre provider and its lessees. Should a data centre provider absorb the risk, as the scheme applies to the organisation as a whole? Or should lessees accept the liability? After all, their energy consumption results in the CO₂ emissions associated with the scheme.

Deconstructing the cash flows associated with energy consumption (and its resultant CO₂ emissions) and the league table position (and its bonus and penalty payments) is key to understanding the contribution that each party makes to the cash flows associated with participation in the scheme.

It is through analysing and understanding these contributions, and then allocating liabilities fairly, that landlords and lessees will be incentivised to meet their responsibilities for effective carbon management.

In doing so, the cost of the scheme could be limited and potential revenues captured, benefiting landlord and tenant as well as the environment through CO₂ reductions.

APPENDICES

KYOTO PROTOCOL & COPENHAGEN

Internationally, the Kyoto Protocol targets for 2008-2012 have been set and ratified by the four countries of focus in this report, with:

- France to stabilise GHG emissions at their 1990 level
- Germany to reduce GHG emissions by 21% compared with 1990
- Netherlands to reduce GHG by 6% compared with 1990
- United Kingdom to reduce GHG emissions by 12.5% compared with 1990.



These national targets have been translated into National Strategies and through a variety of mechanisms, as introduced in this report.

As explained earlier, targets for 2012 and beyond are being discussed by the international community currently, with a view to adopting new GHG reduction targets in Copenhagen this December.

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) – EU CONSULTATION

On March 12, 2009, the EC adopted a Communication on mobilising Information and Communication Technologies (ICTs) to facilitate the transition to an energy-efficient, low-carbon economy. The Communication announces the planned adoption of a Commission Recommendation setting out specific actions to make the best use of ICTs in improving energy efficiency and reducing carbon emissions.

Servers & Data centres are a significant part of the wider ICT sector and are therefore critical given the demand on servers and data storage capacity is estimated to drastically increase due to the extensive utilisation of ICT user end-user devices.

Consultation: http://ec.europa.eu/information_society/activities/sustainable_growth/energy_efficiency/consultations/index_en.htm

The EU has funded several studies, including “Impacts of Information and Communication Technologies on Energy Efficiency” by Bio Intelligence Service, September 2008. ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/sustainable-growth/ict4ee-summary_en.pdf

EU ENERGY-CLIMATE LEGISLATIVE PACKAGE

On 6th April 2009, the EC adopted the climate-energy legislative package containing measures to fight climate change and promote renewable energy.

This package is designed to achieve the EU's overall environmental target of a 20% reduction in greenhouse gases and a 20% share of renewable energy in the EU's total energy consumption by 2020. http://ec.europa.eu/environment/climat/emission/ets_post2012_en.htm

The legislative package includes:

- Revisions to the UE ETS.

- Promoting the use of energy from renewable sources.
- Share the effort to make carbon emissions reductions.
- Promoting the use of energy from renewable sources.

ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE (EPBD) (2002/91/EC)

The EU Directive on the Energy Performance of Buildings (EPBD) entered into EU law in 2003 and was transposed into domestic building codes gradually over the coming years. The Directive's principal objectives are:

- To promote the improvement of the energy performance of buildings within the EU through cost effective measures;
- To promote the convergence of building standards towards those of Member States which already have ambitious levels.



MEASURES INCLUDE:

- Methodology for calculating the energy performance of buildings;
- Application of performance standards on new and existing buildings;
- Certification schemes for all buildings; Energy Performance Certificates and Operational Certificates
- Regular inspection and assessment of boilers/heating and cooling installations.

NB: The EPBD Buildings Platform was created by the European Commission as the central resource of information on the EPBD, under the Intelligent Energy – Europe, 2003-2006 programme. <http://www.buildingsplatform.eu/cms/index.php?id=7>

RECASTING OF THE EPBD

Despite the actions already undertaken under the EPBD, the EC believe that very large cost-efficient energy saving potential remains unexploited.

In November 2008, the Commission adopted the proposal for a recast of the Energy Performance of Buildings Directive. This is being seen as a “golden opportunity” to promote very low energy design.

The recasting proposes to clarify, strengthen and extend the scope of the current EPBD provisions by:

- Introducing clarification of the wording of certain provisions;
- Extending the scope of the provision requiring Member States to set up minimum energy performance requirements when a major renovation is to be carried out;
- Reinforcing the provisions on energy performance certificates, inspections of heating and air-conditioning systems, energy performance requirements, information, and independent experts;
- Providing Member States and interested parties with a benchmarking calculation instrument, which allows the nationally/regionally determined minimum energy performance requirements ambition to cost-optimal levels to be compared;
- Stimulating Member States to develop frameworks for higher market uptake of low or zero energy and carbon buildings;
- Encouraging a more active involvement of the public sector to provide a leading example. http://ec.europa.eu/energy/strategies/2008/doc/2008_11_ser2/buildings_directive_proposal.pdf

At the end of March 2009, Members of the European parliament's (MEPs) industry committee adopted

amendments to the Commission's draft EPBD revision, pushing more ambitious proposals. MEPs supported applying minimum national energy efficiency standards to all EU buildings undergoing a major renovation, though this should be set using a common EU methodology to be established by 2010 rather than by individual governments.

They also added that smart meters be installed in all buildings undergoing major renovation and all new buildings.



It called for new financing instruments to promote energy efficiency, calling for measures such as the creation of an energy efficiency fund, increasing the share of European Regional Development Fund available for energy efficiency investments, and using tax measures such as VAT reductions.

Member States would need to draw up national action plans that set out established financing instruments for energy efficiency improvements by 30 June 2011. Finally, MEPs called for all new buildings to be zero energy by the end of 2018, and that States set minimum targets for the share of zero energy buildings for 2015 and 2020. They said a detailed EU definition of zero energy buildings should be established by the end of 2010, while using the following definition: "where, as a result of the very high level of energy efficiency of the building, the overall annual primary energy consumption is equal to or less than the energy production from renewable energy sources on site".

<http://www.iea.org/textbase/pm/?mode=pm&action=detail&id=2614>

European parliament industry committee:

http://www.europarl.europa.eu/committees/itre_home_en.htm ,

Press release http://www.europarl.europa.eu/news/expert/infopress_page/051-52894-089-03-14-909-20090330IPR52892-30-03-2009-2009-false/default_en.htm

CERTAIN FLUORINATED GREENHOUSE GASES (EC REGULATION 842/2006)

Fluorinated greenhouse gases are among the Kyoto Protocol groups of gases for which the EU has committed itself to reduce emissions. EC Regulation 842/2006 on certain fluorinated greenhouse gases (the F gas Regulation) is the legal instrument by which emissions reductions are to be delivered. The Regulation requires leakage checks to be carried out, repairs to be completed, gases to be recovered so that they do not escape to the atmosphere, certified personnel and companies to be used, labels to be used on some equipment, information to be reported to the Commission, and bans some F gas products. Further European Community regulations have fleshed out many of these requirements.

Article 3 of the F gas Regulation introduces a requirement for operators to use all available measures which are technically feasible and that do not entail disproportionate cost in order to prevent leakage of F gases and to repair any detected leakage (as soon as possible) from the following list of stationary applications: refrigeration, air conditioning and heat pump equipment, including their circuits, and fire protection systems.

For the purposes of this requirement "checked for leakage" means that the equipment or system is examined primarily for leakage using direct or indirect measuring methods, focusing on those parts of the equipment most likely to leak.

The Regulation also provides a timetable for the checking of leakage of these stationary applications. The operators of these applications have to ensure that they are checked for leakage in line with the timetable set out in the Regulation. The checking for leakage timetable is graduated in line with the amount of F gas contained in the application as follows:

- At least once every twelve months for applications containing 3kg or more of F gases (this shall not apply to equipment with hermetically sealed systems, which are labelled as such and contain less than 6kg of F gases)
- At least once every six months for applications containing 30kg or more of F gases
- At least once every 3 months for applications containing 300kg or more of F gases.

These applications must also be checked for leakage within one month.



References:

Department for Local Government & Communities 'Improving the energy efficiency of our buildings A guide to air-conditioning inspections for buildings' (July 2008)

EC F gas Regulation text <http://europa.eu.int/eur-lex/lex/JOhtml.do?uri=OJ:L:2006:161:SOM:EN:HTML>

DIRECTIVE ON THE PROMOTION OF THE USE OF ENERGY FROM RENEWABLE SOURCES IN THE INTERNAL ELECTRICITY MARKET (2001/77/EC)

This Directive is also called the 'Renewables Directive', which requires each country to commit to specific targets for renewable energy and that the targets are consistent with reaching the Commission's target of 22% of electricity from renewables by 2010.

On 30th June 2009 the Commission adopted a decision establishing a template for National Renewable Energy Action Plans (NREAPs) under this Directive to guide Member States in the elaboration of their Renewable Energy Action Plan and detail their strategies for reaching their 2020 renewable energy targets. Each Member State must submit a NREAP to the Commission by 30 June 2010 at the latest.

Background:

The Directive follows on from the European Union White Paper, 'Energy for the Future: Renewable Sources of Energy 1997'.

The promotion of electricity from renewable sources of energy is a high priority in the EU for several reasons in addition to combating climate change. These include security and diversification of energy supply, environmental protection, and social and economic development. <http://www.berr.gov.uk/energy/sources/renewables/policy/european/directive/page23710.html>

FORTHCOMING 'ENERGY' DIRECTIVES

THE ENERGY LABELLING DIRECTIVE (92/75/EEC)

The EC would like to extend the scope of the Energy Labelling Directive to include energy-using products used in the industrial and commercial sectors, as well as to other energy-related products that have an impact on

energy consumption during use, such as insulated windows.

Energy labels are intended to provide consumers with energy and environmental information on which they can base a choice between products on the market. The Energy Labelling Directive has proved to be very effective, leading to significant improvements in the energy efficiency of household appliances in the European Union (EU).

The “A-G” label displayed on appliances, such as washing machines, dishwashers, has permitted consumers to be informed, at the point of sale, about the energy consumption - and hence the operating costs - of a product, thereby driving demand for the best performers.



<http://energy.ihs.com/News/efficiency/2008/eu-en-energy-labeling-11-08.htm>

For more information, see the EC's web sites on Second Strategic Energy Review - Securing our Energy Future and on Energy Policy for a Competitive Europe.

ECO-DESIGN DIRECTIVE FOR ENERGY USING PRODUCTS (2005/32/EC)

The regulations currently require energy-using products (EUPs) to conform to certain requirements for efficiency and electrical consumption, before they can be sold in the EU.

EUPs are products which use, generate, transfer or measure energy (such as electricity, gas, fossil fuel). This includes consumer goods such as boilers, water heaters, computers, televisions, but also industrial products such as transformers, industrial fans and industrial furnaces.

RECAST THE ECO-DESIGN DIRECTIVE

On 16 July 2008, the Commission proposed a recast of the Eco-design Directive to amend the scope of the Eco-design Directive, in order to extend it from EUP to include energy-related product (ERP) that is “any good having an impact on energy consumption during use”. http://ec.europa.eu/enterprise/environment/sip/sip_a2_ecodesign_en.htm

On 21 October 2008, the EC adopted a working plan for 2009-2011, setting out an indicative list of energy-using product groups which will be considered priorities for the adoption of implementing measures. The priority 10 product groups for this working plan include:

- Air-conditioning and ventilation systems;
- Network, data processing and data storing equipment;
- Transformers;
- Water-using equipment.

VOLUNTARY CODES

VOLUNTARY CODE OF CONDUCT ON DATA CENTRES EFFICIENCY

This new Code was issued on 30th October 2008 by the EC along with an introductory guide and best practice guidelines for the industry to follow.

The Code is a first step by the EC to focus attention on the inefficiently run data centres, both from a

business perspective and the environmental costs. The hope is that the Code is adopted by 'Participants' and 'endorsers' alike and becomes the standard – before the situation becomes as serious as to require mandatory regulation, reporting and targets!

CONTEXT

- Electricity consumption in Western Europe is expected to double between 2007 and 2020; from 56 Terawatt hours (TWh) / year to 104 TWh, with data centre power consumption playing a major role in the increase
- In Germany, servers are now the 2nd largest user of electricity with consumption from servers predicted to double.



THE CODE

Will initially use the ratio of IT Load to Facilities Load as the key metric in assessing infrastructure efficiency; to be known as 'facility efficiency', focussing on:

- IT Load – which looks at the consumption efficiency of the IT equipment in the data centre and can be described as 'the IT work capacity available for a given IT power consumption'. An example of this could be Mips1 per watt.
- Facilities Load – which looks at mechanical and electrical systems that support the IT infrastructure and includes such things as cooling systems (chiller plants, fans and pumps), air conditioning units, Uninterruptible Power Supplies and Power Distribution Racks.

The Code of Conduct will also be concerned with the efficiency with which the IT equipment utilises the power delivered, this will be known as 'asset efficiency'. As efficiency metrics for data centres are further developed and agreed, it is expected that the Code of Conduct will adopt more comprehensive metrics which may also cover the IT system design, the IT hardware asset utilisation, and the IT hardware efficiency.

This analysis feeds into The Green Grid's Data Centre Infrastructure Efficiency ("DCiE") measurement, which is the main reporting metric, which will show the percentage of power consumed by a data centre in producing useful IT services – with a higher figure providing an indication of better efficiency for that particular facility. This is expressed in the following calculation:

$$DCiE = \frac{\text{main IT equipment energy consumption}}{\text{total facility energy consumption}^2} \times 100\%$$

A Best Practice document has also been published; a companion to the EU Code of Conduct on Data Centres, providing a full list of identified best practices for data centre operators and also provides an education and reference document for interested parties. Best practices are suggested for existing data centres, those with new software, new IT equipment and during retrofit.

REFERENCES

Introductory Guide for applicants: http://re.jrc.ec.europa.eu/energyefficiency/pdf/DataCenter_CodeOfConduct_Introductory_Guide.pdf

Best Practice <http://re.jrc.ec.europa.eu/energyefficiency/pdf/CoC%20data%20centres%20nov2008/Best%20Practices%20v1.0.0%20-%20Release.pdf>

Code of Conduct on Data Centres Energy Efficiency - Version 1.0, 30 October 2008: <http://www.inst-informatica.pt/legislacao-e-directivas/identidade-e-seguranca-informatica/Code-of-Conduct-on-Data-Centres->

Energy-Efficiency.2008

Data Centres and the new Code of Conduct for Energy Efficiency' article from Bird & Bird written by Chris Holder & Karl Delport. <http://mail.twobirds.com/ve/ZZ940079737571xx31I923/VT=0/page=13>

<http://www.datacenterdynamics.com/ME2/dirmod.asp?sid=&nm=&type=news&mod=News&mid=9A02E3B96F2A415ABC72CB5F516B4C10&tier=3&nid=1DECF95DA28F4115989C7CA62BFE930E>

PERFORMANCE LABELS



US ENERGY STAR LABEL FOR PRODUCTS AND BUILDINGS

The Energy Star voluntary labeling program was created in 1992 by the United States Environmental Protection Agency in an attempt to reduce energy consumption and greenhouse gas emission.

Energy Star began with labels for computer products. In 1995 the program was significantly expanded, introducing labels for residential heating and cooling systems and new homes.[2] As of 2006, more than 40,000 Energy Star products are available in a wide range of items including major appliances, office equipment, lighting, home electronics, and in addition, the label can also be found on new homes and commercial and industrial buildings.

The ratings, on a scale of 1 to 100, provide a means for benchmarking the energy efficiency of specific buildings and industrial plants against the energy performance of similar facilities. Commercial and institutional buildings rating have been developed for the following common building types, such as office, hospitals with data centres in development and launched for Tier 1 servers in 'idle model' since May 2009 with Tier 2 implementation date set for October 2010⁴⁸. The U.S. Environmental Protection Agency (EPA) EPA does intend to investigate covering storage equipment and networking equipment under separate future specifications.

Energy Star energy performance ratings have been incorporated into some green buildings standards, such as LEED for Existing Buildings.

http://en.wikipedia.org/wiki/Energy_Star

EU ENERGY STAR

The EU has an agreement with the US for office equipment labelling, a database is available with the most recent models of Energy Star qualified equipment listed on http://www.eu-energystar.org/en/en_database.htm including computers, photo copiers, scanners, and servers.

TCO CERTIFICATION

TCO Certification, a combined energy usage and ergonomics rating from the Swedish Confederation of Professional Employees (TCO) instead of Energy Star.

LEED

Leadership in Energy and Environmental Design (LEED) scheme is the US Green Building's Council's environmental assessment scheme for commercial buildings including:

- LEED for New Construction
- LEED for Core and Shell Construction
- LEED for Commercial Interiors
- LEED for Existing Buildings

For data centre design Digital Realty Trust made green datacenter history in 2007 with the completion of the world's first LEED Gold-certified datacenter in the United States.

Ref: <http://www.infoworld.com/d/green-it/digital-realty-trust-sets-new-standard-green-datacenter-design-243>

BREEAM SCHEMES

Building Research Establishment Environmental Assessment Method (BREEAM) schemes in the UK focus on new design and refurbishments of commercial property types including:

- BREEAM offices
- BREEAM industrial
- BREEAM datacentres
- BREEAM International which is use in Western Europe and beyond.

BREEAM datacentres is new and was designed with Digital Realty Trust for the design, construction and operation of its datacentres in the UK.

Refs: <http://www.breeam.org/page.jsp?id=157> & <http://www.infoworld.com/d/green-it/digital-realty-trust-sets-new-standard-green-datacenter-design-243>

FRANCE

FRENCH GRENELLE ENVIRONMENT AGREEMENT

The 'Grenelle of the Environment' was the forum of French environmentalists, business representatives and trade unions convened by French President Nicolas Sarkozy, with the aim of reaching agreement on ways of combating climate change which published its conclusions in October 2007. In December 2007, President Nicolas Sarkozy spoke on the Grenelle Environment Agreement explaining that France will take a new approach to environmental protection and confirming desire to reduce GHGs, increase renewable energy but not at the expense of business and commerce through taxation.

Since 2007, a 'Green IT' working party (DETIC) has been focusing on options and proposals on reducing energy consumption and on the re-use of heat produced by data centers⁴⁹ with their recommendations and conclusion due around September 2009.

LEGISLATION

ENERGY ACT 2005

French energy policy is defined by the Energy Act of 13th July 2005 defining energy policy priorities:

4. To contribute to national energy independence and guarantee security of supply
5. To ensure competitive energy prices
6. To protect human health and the environment, in particular by fighting against climate change
7. To guarantee social and territorial cohesion by ensuring access to energy for all

Quantitative objectives were laid down by the Energy Act of 13th July 2005 defining energy policy guidelines:



- **A quartering** of CO₂ emissions by 2050,
- **average reduction of final energy intensity** of at least 2% per year from 2015 and of 2.5% from 2015 to 2030,
- **production of 10% of energy needs** from renewable energy sources by 2010,
- incorporation of **bio-fuels and other fuels** of renewable origin to a level of 2% in 2006, 5.75% by the end of 2008 and 7% in 2010.

FRAMEWORK: RT2000 & THERMAL REGULATION RT2005

RT2005 introduced stringent regulations for thermal heating insulation and heating systems from September 2006. New construction must now demonstrate an improvement in building energy performance over this regulation of at least 15%, rising every 5 years, to 40% by 2020.

The regulation also aims to reduce the use of air-conditioning and limit the use of electricity for heating, cooling, domestic hot water, lighting and ventilation.

- Energy performance diagnostics are now a requirement at construction, sale and/or rental stages.
- Since January 2008, designers have also been obliged to carry out efficiency feasibility studies to evaluate the various possibilities of energy supply, particularly renewables prior to the planning application submission.

MEASURING ENERGY PERFORMANCE

RT2005 focuses on energy used at primary production stage, unlike the UK, where energy performance is assessed according to direct energy usage and associated CO₂ emissions within buildings because of the low CO₂ emissions from electricity production in France – 85-90% comes from nuclear and large hydro plants, producing 0.09kg CO₂/kWh – which under the direct energy method of assessment would not give a clear measure of a building's actual performance in emissions terms. For this reason, under RT2005, calculations are based on the amount of energy consumed by the power stations in producing each unit of final energy billed to the occupier/owner.

For each type of building and climatic zone, RT2005 sets out a maximum consumption in kWh/m² of primary energy. To comply, building energy consumption must be lower than the reference (CEP ref) and lower than the maximum value (CEP max).

HOW DOES THIS WORK IN PRACTICE?

Designed to encourage the application of renewable energy, the RT2005 model offers reference values for a typical or "notional" building to assist with calculation, covering the range of energy source options. Take as an example an electrically heated residential building in Paris: energy consumption must not exceed 250kWhpe/m² a year. For gas heating, the target is 130kWhpe/m² a year. In Toulouse, which has a warmer climate and therefore reduced heating energy demand, energy consumption is limited at 190kWhpe/m² annually for electric heating and 110kWhpe/m² for gas heating.

Clients and design teams have freedom and flexibility in deciding how to hit the targets. They may choose to strengthen insulation, for example, or opt to use renewable energy sources. Air-conditioning could still be an option but will require compensation in other areas. It should be noted, however, that there are some minimum requirements on materials performance and equipment efficiencies that must be observed.





Buildings complying with the RT2005 regulations could also be awarded with one of five additional classifications:

8. High energy performance (HPE) awarded to buildings showing at least a 10% improvement in energy consumption compared with the RT2005 notional building;
9. HPE EnR2005 compliance additionally requires that 50% of the energy used for heating is derived from biomass plant or powered by a network where 60% of the energy is generated from renewable sources;
10. THPE: very high energy performance certification, equivalent to an improvement of at least 20% in consumption over and above the specified RT2005 standards;
11. THPE EnR2005: for buildings demonstrating improvements of 30% compared with the RT2005 notional building (to qualify, buildings must also use renewable energy sources including biomass, heat pumps and solar, thermal and photovoltaic technologies);
12. BBC2005: typically awarded to low energy consumption buildings meeting the higher targets set by Effinergie (a non-profit advisory organisation). This accreditation may go to non-residential buildings demonstrating a 50% reduction in consumption against RT2005 reference standards.

<http://www.bsdlive.co.uk/story.asp?storycode=3126094>

EPBD TRANSLATION INTO LE DIAGNOSTIC DE PERFORMANCE ENERGÉTIQUE (DPE)

To complement implementation of the EPBD, France has created two building energy efficiency labels respectively “High Energy Performance” (HPE ou Haute Performance énergétique) and “Very High Energy Performance” (THPE ou Très Haute Performance Energétique). A consumer education campaign to publicize both.

<http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=15028>

Refer to The EU EPBD Building Platform (Feb 2007) for details at that time.

THE BUILDING CODE

The Code de l’Urbanisme is the law which controls all construction in France. The Certificat d’Urbanisme (CDU) is a certificate of town planning or urban development in France, required to undertake any building, construction, renovation or development on a property.

The Code de l’Urbanisme requires an EPC when buildings are sold or rented.

NATIONAL FRENCH PLANNING REGULATIONS

- Règlement Nationale d’Urbanisme (RNU) - national rules governing new development and changes to existing buildings are called Les dispositions imperatives du règlement nationale d’urbanisme (RNU).
- Les directives territoriales d’aménagement (DTA) - incontestable regional directives are more often determined by central government.
- Les directives paysages or Directives de protection et de mise en valeur des paysages - regulations concern mainly planting requirements, the volume and height of buildings and external aspects of the development. <http://www.french-property.com/guides/france/building/planning/framework/>

There are two series of regulations that govern planning permission in France:

- National town planning regulations. These are contained in the French “Code de l’Urbanisme”,
- Local rules contained in local schemes (you may have heard of the “POS – Le plan d’occupation des

sols” or the “PLU – Plan Local d’Urbanisme”). The rules contained in the French Civil Code governing relations between neighbours, for example about rights of way, etc.

ECONOMIC INCENTIVES

ADVANCED RENEWABLE TARIFFS (TARIFE EQUITABLE) IN 2006

In November 2008 the Sarkozy government announced 50 actions it would take to substantially increase the role of renewable energy in France. The creation of a solar tariff for commercial buildings of €0.45/kWh (US \$0.57/kWh) is intended to aid businesses, factories and farmers to take profitable advantage of their large rooftops. As a measure of the government’s seriousness, there will be no limit on the size of commercial rooftop projects that qualify for the tariff. For comparison, the French commercial tariff for 2009 is higher than that for Germany, the current world leader in solar PV development.

<http://www.renewableenergyworld.com/rea/news/article/2008/11/france-raises-solar-feed-in-tariffs-new-york-seia-calls-for-fits-54119>

TAX CREDIT

A tax credit for energy saving and renewable energies was introduced on 1st January 2005 and reinforced in 2006. The tax credit rate has been increased:

- from 40% to 50% for energy production equipment using a renewable energy source and certain types of heat pump

- from 25% to 40% for condensing boilers and thermal insulation materials under certain conditions.

<http://www.industrie.gouv.fr/energie/anglais/politique-energetique.htm>

VOLUNTARY STANDARDS

HQE

“High Environmental Quality” focuses on reducing consumption of natural resources and discharge of pollutants, as well as for enhancing the comfort and the health conditions of buildings.

It is concerned with the design and the construction of both refurbishment and new building projects.

HQE & BREEAM IN FRANCE

In June 2009, BRE Global agreed a memorandum of understanding to work with the CSTB to align HQE and BREEAM in France⁵⁰, aiming to improve the sustainability of buildings throughout Europe and beyond.

EFFINERGIE

Effinergie is a registered quality label for new and refurbished low-energy-consumption buildings in France (www.effinergie.org)

Major construction group “Fondation Bâtiment-Energie” <http://www.batiment-energie.org/>

GERMANY

NATIONAL TARGET



In Germany, a 40% reduction in greenhouse gas emissions is being aimed for by 2020 (compared with 1990).

RENEWABLES STATISTICS FOR GERMANY

The expansion of renewable energies in Germany is a success story. This is confirmed by a recent report by the Federal Environment Ministry: within the last five years, the share of renewables in final energy consumption in Germany has doubled to 8.6%. Their share in gross electricity consumption now stands at 14.2% - twice as high as six years ago. In 2007, renewable energies contributed to climate protection with a CO₂ saving of around 115 million tonnes. <http://www.erneuerbare-energien.de/inhalt/42210/>



LEGISLATION

IMPLEMENTING THE EPBD

Responsible Government Departments include both Federal Ministry of Transport, Building & Urban Development and the Ministry of Economics & Technology.

ENERGY SAVING ORDINANCE (ENEV 2007/08)

Energy Saving Ordinance (EnEV 2002) introduced Energy Performance Certificate ((Energiebedarfsausweis) for new buildings in 2002. Amendment to Energy Saving Ordinance (EnEV) 2007/2008 was adopted by the Federal German Government in July 2007 and came into force on 1 October 2007. Air conditioning is included under the amended EnEV.

EnEV 2008 requires EPCs for all buildings by July 2009, including non-residential buildings. <http://www.dena.de/en/topics/buildings/projects/projekt/energy-performance-certificate/>

Official texts are available at <http://www.bbr.bund.de>

Main arrangements for existing buildings:

- An energy certificate required from July 2009 and has to be displayed at the building's entrance when the surface exceeds 1,000m².
- There are 2 types of certificates depending on the detail level of the audit. Both types are valid for 10 years. However, after 1 October 2008 type 1 (inexpensive & less detailed) may only be used for buildings comprising of five or more units regardless of the age of the building.
- The recommended improvements resulting from the certification don't have to be implemented.
- The rules regarding the experts allow to carry out the inspections of buildings differ per *Bundesland*.

Forthcoming changes to Ordinance will tighten energy performance requirements for buildings in Germany

According to InBuilt, In mid March 2009, *the Federal Government accepted several changes to the proposed amended energy saving ordinance, which were required by the Federal Council of Germany. The amended ordinance will immediately be published in the Federal Law Gazette and will go into force in autumn 2009. The essential modifications of the ordinance are:*

- *The maximum allowed primary energy demand for new buildings will be reduced by 30% on average.*
- *The requirements on the thermal insulation of new buildings will be tightened by 15% on average.*
- *The requirements for renewed building elements in retrofitted buildings with major renovations will be*

tightened by 30% on average.

- Accessible top floor ceilings in existing buildings have to be insulated before the end of 2011.
- Off-peak electrical storage heating systems, older than 30 years, in larger buildings have to be replaced with efficient heating systems by 2020.

The German Government plans to have the next revision of the ordinance in 2012. It will include another tightening of the energy performance requirements by about 30%.

<http://www.buildup.eu/news/1882>



RENEWABLE ENERGY SOURCES ACT (ERNEUERBARE-ENERGIEN-GESETZ, EEG)

The new Renewable Energy Sources Act became law in January 2009, replacing the 1991 Stromeinspeisungsgesetz, StrEG (Electricity Feed Act) that supported the expansion of renewable energy sources, especially wind power. Then in April 2000 it was replaced by the Renewable Energy Sources Act, amended on July 21st, 2004.

The Renewable Energy Sources Act (EEG) draws on more than 16 years of experience. The electricity feed-in from renewable energies to the grid was legally regulated for the first time in Germany with the adoption of legislation by the German Bundestag on a consensus basis in 1990.

As a result of the Act, the share of electricity produced from renewable energy sources has almost doubled from 6.3 % in 2000 to 12.0 % in 2006. The EEG introduced a fundamental change in energy supply: now any citizen can become an energy producer.

German FiT 2009 prices for certain renewable sources are listed below for information.

SOLAR

OUTPUT	INSTALLATIONS ATTACHED TO OR ON THE TOP OF BUILDINGS	FREESTANDING INSTALLATIONS
Up to 30 kW of output	43.01 Cent / kWh	31.94 Cent / kWh
Output between 30 kW & 100 kW	40.91 Cent / kWh	31.94 Cent / kWh
Output between 100 kW - 1 MW	39.58 Cent / kWh	31.94 Cent / kWh
Output over 1 MW	33.00 Cent / kWh	31.94 Cent / kWh

Source: <http://www.kl gates.com/newsstand/Detail.aspx?publication=5668>

WIND

OUTPUT	ONSHORE INSTALLATIONS	OFFSHORE INSTALLATIONS
First 5 Years after Installation	9.20 Cents / kWh	
First 12 years after installation		First 12 years after installation (for installations erected prior 1 January 2016 compensation will be 15.00 Cents / kWh)
After 5 years	5.02 Cents / kWh	
After 12 years		3.50 Cents / kWh

Source: <http://www.kl gates.com/newsstand/Detail.aspx?publication=5668>

BIOMASS ENERGY

OUTPUT	BASIC FEES
Up to 150 kW of output	11.67 Cents / kWh
Output between 150 kW & 500 kW	9.18 Cents / kWh
Output between 500 kW & 5 MW	8.25 Cents / kWh
Output between 5 & 20 MW	7.79 Cents / kWh

Source: <http://www.klgates.com/newsstand/Detail.aspx?publication=5668>

**GEOHERMAL ENERGY**

OUTPUT	BASIC FEES
Up to 10 MW of output	16.00 Cents / kWh
Output 10 MW	10.50 Cents / kWh

Source: <http://www.klgates.com/newsstand/Detail.aspx?publication=5668>

New renewable energies heat (EEWärmeG);

The Heat Act stipulates that by 2020 14 percent of Germany's heat must come from renewable energies. The Act is intended to protect the environment and help reduce emissions of harmful greenhouse gases. Its aim is both to conserve resources and to ensure a secure and sustainable energy supply. There are three aspects to the Act:

13. The obligation to use renewables: From 1 January 2009 owners of newly erected buildings must use renewable energies for their heat requirements. All owners are subject to this obligation, whether private individuals, the state or businesses. All forms of renewables, or combinations of them, can be used. Renewable energies include solar radiation, geothermal energy, ambient heat and biomass. Those who do not wish to use renewable energies can take other climate protection measures: improve the insulation of their buildings, obtain heat from district heating systems or use heat from combined heat and power generation (CHP).

14. Financial support: The use of renewable energies will continue to be financially supported. The government will inject more money into the existing market incentive programme, increasing funding for this support instrument to as much as 500 million Euro per year. This means better planning certainty for investors.

15. Heat grids: The Act makes it easier for heat grids to be extended. It makes provision for local authorities to prescribe connection to and use of such a grid in the interests of climate protection.

http://www.bmu.de/english/renewable_energy/downloads/doc/42193.php

PENDING LEGISLATION**EMISSIONS ORDINANCE (EMISSIONSHANDELS-VERSTEIGERUNGSVERORDNUNG, EHV 2012)**

Emissions trading: auctioning of allowances to be launched in 2010 according to the Federal Ministry of Environment, Nature Conservation and Nuclear Safety, at the end of May 2009, the Federal Cabinet passed a decision paving the way for the auction of emission allowances. With the Auctioning Ordinance

the Federation is taking up a proven concept which enables emission allowances to be sold in the simplest and securest way, in the place where allocated allowances are also traded: an existing European emissions trading exchange.

http://www.bmu.de/english/current_press_releases/pm/44147.php

INCENTIVES

FEED IN TARIFFS

See Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) above.

GRANTS

Grants are periodically offered by certain regions in Germany, usually to attract certain types of business or to support innovation. Funding is often provided on a 'match funding' basis where half of the funding is made available.

CLIMATE PROTECTION INITIATIVE

In June 2008, the Federal Environment Ministry launched a comprehensive Climate Protection Initiative.

With four new programmes, support is given for investments in energy efficiency and renewable energies by industry, municipalities and consumers.

The Climate Protection Initiative promotes:

- A programme for commercial refrigeration plants promotes highly efficient and climate-friendly refrigeration technology by providing grants for consultation (status check) and investments (existing and new plants).
- Installation of mini-CHP plants (CHP: combined heat and power). These mini-CHP plants generate both electricity and heat and therefore use energy very efficiently.
- Biomass research and pilot projects in order to develop solutions to unresolved questions and to advance a sustainable biomass strategy.

http://www.bmu.de/english/current_press_releases/pm/41999.php

VOLUNTARY

SUSTAINABLE BUILDING SEAL / DGNB CERTIFICATIONS

The German 'Sustainable Building Seal' (DGNB) certification⁵¹ was developed jointly by the German Green Building Council (DGNB) and the Federal Ministry of Transport, Construction & Urban Development, for offices and administration properties, to be used as a tool for the planning and evaluation of buildings in this comprehensive perspective on quality.

The scheme evaluates all aspects of sustainable building - ecological, economic and sociocultural. Technology, processes and location quality are also taken into consideration. Sociocultural is defined as a requirement for the building to fit in with its socio-cultural environment. Economic is defined as economic efficiency and long term value preservation.

On January 12, 2009 the certification was officially launched with the first awards, of a pilot version, made at



the BAU exhibition in Munich, marking the end of the pilot phase of DGNB certifications. A 2009 version is in development, flexible enough for other building types.

That is the German Sustainable Building Seal Version 2008 for new office and administration buildings. Four public and twelve private buildings received the award. The awards included three 'Bronze', seven 'Silver' and six 'Gold'.



THE NETHERLANDS

LEGISLATION

SPATIAL PLANNING ACT

The Spatial Planning Act of 1965 is based on the premise that the principles of spatial planning policy find their way into the physical plans of local authorities more or less automatically. Latest Spatial Planning Act updated July 2008.

Since 1965 a large number of amendments have been passed. The last major alteration involved changing Section 19 to include an independent project procedure for local authorities. This has led to the establishment of a law that provides for many eventualities but has also become extremely complicated and confusing in practice. The Council of State has even compared it to a 'patchwork quilt'; the Second Chamber of the Netherlands parliament concurs with this opinion and because of this the government has decided to fundamentally revise the act. <http://www.vrom.nl/pagina.html?id=37427>

BUILDING CODE (BOUWBESLUIT)

The technical building regulations in the Netherlands are laid down in the Building Decree (or Building Code; Dutch: Bouwbesluit). These are uniform and performance based regulations on the national level, which all structures must comply with. These requirements concern:

- safety (e.g. the mechanical strength, fire safety, user safety like requirements for stairs, availability of emergency appliances)
- health (e.g. ventilation, sound insulation)
- usefulness (e.g. accessibility for disabled people, habitable space toilet compartment, communal store for domestic waste)
- energy-saving (e.g. thermal insulation, energy performance, air tightness).

<http://www.vrom.nl/pagina.html?id=37435>

DECREE ENERGY PERFORMANCE OF BUILDINGS (BEG)

This decree and Regulations on Energy Performance of Buildings' (REG) were issued in December 2006 according to the EPBD Building Platform. Article 3 of the EPBD, adoption of a methodology, was already complied with under the Energy Performance Standard (EPN) since 1995 and the Energy Performance Advice (EPA) methodology was simplified.

The Dutch sustainable building policy, according to Luciana Melchert in 2005⁵², has transitioned from the 1970s attempt to improve the environmental performance of building stocks by means of self-sufficient technologies, to adopting a framework of 'ecological modernization', with integrative approaches seeking to

improve the environmental performance of building stocks through more efficient—rather than self-sufficient—technologies.

ENVIRONMENTAL MANAGEMENT ACT (2004)

Replaced Environmental Protection (General Provisions) Act 1986 to incorporate the EIA legal requirements to ensure that environmental concerns are accounted for in planning and decision-making processes.

In order to implement the CO₂ & NO_x emission trading schemes, a new chapter on emissions trading was added to this Act: EMA Chapter 16 CO₂ emissions trading act.

[http://www.acdi-cida.gc.ca/INET/IMAGES.NSF/vLUIImages/ea%20summaries/\\$file/Net.pdf](http://www.acdi-cida.gc.ca/INET/IMAGES.NSF/vLUIImages/ea%20summaries/$file/Net.pdf)

EMISSIONS TRADING PROGRAMMES; CO₂ AND NO_x

There are two emissions trading programmes in the Netherlands, a European system for greenhouse gas emissions and a Dutch system for NO_x emissions.

CO₂ emissions trading

Implementation of the European Directive on the European Emission Trading Scheme (EU-ETS) in the Netherlands,

NO_x emissions trading

The Dutch emissions trading program for NO_x was developed as part of national policy to comply with the EU directive on National Emission Ceilings (NEC Directive).

<http://climate.bna.com/Climapedia.html?d=A0B5R5Q6U6%20WCC%5C3000%5C3190>

VOLUNTARY / INCENTIVES

TAX REGIME: EIA (ENERGY INVESTMENT ALLOWANCE)

Since 1997 the energy investment deduction tax rule allows Dutch companies additional tax reductions after investment in energy efficiency and renewable energy has been made. 44% of the investment costs for approved equipment are deductible from pre-tax profits for To be eligible, Bureau Investeringsregelingen en Willekeurige Afschrijving (IRWA) forms must be completed within three months of the investment⁵³.

An Energy List determines which types of equipment qualify for this programme. The programme includes the cost of obtaining energy advice, provided that the advice results in an investment in energy-saving equipment.

http://www.senternovem.nl/english/products_services/towards_sustainable_energy/eia_energy_investment_allowance.asp

FEED IN TARIFFS

The Dutch Cabinet has agreed to implement a feed-in tariff on 27 March 2009, during a renegotiation of the government agenda in response to the global financial crisis.[35]. The proposed regulation replaces a quota incentive system. http://en.wikipedia.org/wiki/Feed-in_Tariff#cite_note-3

GRANTS - Carboncredits.nl

Grant for international companies investing in renewable energy projects in Central and Eastern Europe and



other emerging markets.

Investments in developing countries and in Central and Eastern Europe in renewable energy, energy conservation and waste have a higher efficiency by CO₂ emission reductions to sell.

RESEARCH

PROJECT SUBSIDIES

Certain Regional Government offers a percentage of funding to support innovative R&D projects promoting energy efficiency (i.e. gained by Evoswitch in Amsterdam to reduce PUE in Data centres).

Energy Research Centre is financed by the Dutch Ministry of Economic Affairs, through the EOS (Energie Onderzoek Subsidie) programme.

Feb 2009: energy research has stronger focus on transition, for example through *NWO Division for the Social Sciences and SenterNovem* are already setting up a new joint programme about energy transition. This new programme focuses on fundamental research in the social and natural sciences with concrete applications for the Energy Innovation Agenda of the Dutch government. The programme is a tangible expression of the NWO theme Sustainable Earth and compliments the EOS programme of the Ministry of Economic Affairs, implemented by SenterNovem.

http://www.nwo.nl/nwohome.nsf/Pages/NWOA_7P5C2Z_Eng

LABELS

NL-BREEAM

The Dutch Green Building Council (DGBC) reported in October 2008 that '*BREEAM-NL is under development and will initially cover offices, retail, industrial, residential and education building types. Once launched DGBC will manage the scheme, train and licence assessors and carry out the certification.*'⁵⁴

Green Fan – an Evoswitch initiative is advertised on their website, which states: '*Companies displaying The Green Fan logo demonstrate that they are actively making a positive contribution to reducing CO₂ emissions.*'

The Green Fan is a partner programme. Together with our partners, we provide end-users with a guarantee

that our collective IT infrastructure is supplied in an efficient and environmentally friendly manner. This is based on the philosophy that only a reduction in CO₂ emissions and the use of sustainable energy can solve the greenhouse effect.

THE UNITED KINGDOM

EPBD

The UK Government has been slow to respond to the EPBD, however Regulations were laid before Parliament in March 2006 and 2007 to implement the articles 3-6 and 7-10 respectively.

The UK has devolved responsibility from one central Government Department to those Department of Local



Government & Communities for England & Wales, Scottish Building Standards Agency in Scotland and Department of Finance and Personnel in Northern Ireland.

In England & Wales, the **Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007** required:

- From 6 April 2008 those buildings with a total useful floor area greater than 10,000m² to have an Energy Performance Certificate on construction, sale or let.⁵⁵
- From 1 July 2008 those buildings with a total useful floor area greater than 2,500m² to have an Energy Performance Certificate on construction, sale or let.
- From 1 October 2008 large public buildings to display a 'Display Energy Certificate' (DEC) showing the building's energy efficiency rating.⁵⁶



A DEC shows an operational rating which conveys the actual energy used by the building as opposed to an EPC which conveys an asset rating showing the intrinsic performance of the building.

EPCs for the sale or letting of buildings other than dwellings will be valid for 10 years.

Approved Assessors undertake building assessments and produce the certificates.

In Scotland and Northern Ireland the rules are similar yet the dates differ slightly.

The boiler and air conditioning inspections are also required under this legislation.

All air-conditioning systems with an effective rated output of more than 12kw must be regularly inspected by an appropriately qualified Energy Assessor. The inspections must be a maximum of five years apart.

The regulations require the first inspection to be carried out for air-conditioning systems, where the effective rated output is more than 250kW by 4th January 2009.

ENVIRONMENTAL PROTECTION (CONTROL OF SUBSTANCES THAT DEplete THE OZONE LAYER)

A number of ozone depleting substances that were used in the manufacture of cooling equipment are now banned in most instances. These include:

1. chlorofluorocarbons (CFCs)
2. hydrochlorofluorocarbons (HCFCs)
3. halons

There will be a ban on the use of virgin HCFCs for the maintenance and servicing of refrigeration and air-conditioning systems from 1 January 2010 and a ban on the use of all HCFCs from 1 January 2015. <http://www.netregs.gov.uk/netregs/businesses/62291.aspx>

Paul Finch, Director, Building Consultancy, CB Richard Ellis reports:

Some refrigerants used to provide cooling in commercial air conditioning systems and industrial processes are prohibited from use under the latest stage of the Environmental Protection (Controls on Substances the

Deplete the Ozone Layer) Regulations which comes into effect at the end of 2009, placing a legal duty on business owners and occupiers to comply with these requirements.

THE ISSUE: Until the end of 1999, air condition plant and machinery using hydrochlorofluorocarbon (HCFC) refrigerants (such as R22) were still being installed throughout the UK, particularly on contractor led 'design and build' projects. Although this plant is now 10 years old, its life-expectancy would have been between 20 – 25 years, depending on the system. Under the changes in legislation, HCFC refrigerants are no longer manufactured so that reclaimed stocks are expected to be in high demand, driving up maintenance and operating costs, until such time as they are fully depleted. The use of any remaining reclaimed refrigerant available on the market after 2010 will be banned from 2015, although current guidance given by DEFRA indicates this deadline is likely to be brought forward. After this time any remaining operational plant will be rendered effectively non-maintainable.



THE IMPACT: The loss of air conditioning would be 'mission critical' for environments relying on cooling systems, such as data centres..., with the impact of failure resulting in severe consequential losses and reputational damage.

THE OPTIONS: A number of solutions are available although many are technically complex. Wholesale replacement options involve the installation of environmentally friendly refrigerants, but some of these are highly flammable and toxic. Other lesser radical 'drop in' solutions can impact on the building's electrical power systems and the cooling output of the refrigeration plant.

<http://www.defra.gov.uk/environment/air-atmos/ozone/protection/gb-legislation.htm>

BUILDING REGULATIONS

Building Regulations 2000 sets the legal framework for Building standards and has a suit of supportive technical guides documents, known as 'Approved Documents' implementing the Regulations sup, including for energy and ventilation performance.

Specific documents titles are:

- Approved Document L2A: Conservation of fuel and power (New buildings other than dwellings) (2006 edition)
- Approved Document L2B: Conservation of fuel and power (Existing buildings other than dwellings) (2006 edition).
- Approved Document F - Ventilation (2006 edition).

The Government Department 'Communities & Local Government' CLG proposes to update the energy performance requirements in Approved documents L2A and L2B in 2010, 2013 and 2016 to drive efficiency.⁵⁷ In the 2008 Budget, the UK Government also announced an ambition for all new non-domestic development to be net zero carbon from 2019.

Until September 2009, CLG is consulting on proposal to improved energy efficiency standards for new non-domestic buildings under Building Regulations. The proposal is for phased improvement beginning with 25 per cent in 2010 and then a plan to consult on the further trajectory towards zero carbon new non-domestic buildings later in 2009.

In recognition that when the proposed energy efficiency standards in Part L are strengthened in 2010 there is likely to be a tendency to more airtight buildings, changes to Part F of the Building Regulations are also proposed to ensure adequate means of ventilation is provided.

Ref: Proposed Changes to Part L and Part F of the Building Regulations <http://www.planningportal.gov.uk/england/professionals/en/1115314110382.html>



the green grid™

PLANNING POLICY

The UK now has devolved planning responsibility from one central Government Department to the Welsh Assembly Government, Scottish Government & Northern Ireland Planning Service.

In England, national Planning Policy Statements (PPS) sets the National Policy Framework for planning in England under the Department for Communities & Local Government (CLG).

'Planning Policy Statement 1: Delivering Sustainable Development' (PPS1) sets out the overarching planning policies on the delivery of sustainable development through the planning system.

'Planning Policy Statement: Planning and Climate Change - Supplement to Planning Policy Statement 1' sets out how planning, in providing for the new homes, jobs and infrastructure needed by communities, should help shape places with lower carbon emissions and resilient to the climate change now accepted as inevitable.

The Planning and Compulsory Purchase Act of 2004 introduced a new two tiered planning system in England operating at regional level Regional Spatial Strategies and at local level Local Development Frameworks.

The regional plans, e.g. The South East Plan, sets out a vision for the future of the region for the coming 20 years, outlining how the Regional needs to respond to challenges facing the region such as housing, the economy, transport and protecting the environment. The plans often include a section on Sustainable Development with policies related to climate change mitigation and adaptation, sustainable design, pollution prevention, sustainable travel and so on.

Local Development Frameworks (LDFs) are replacing land use plans in England, known as Urban Development Plans and Local Plans. Again there are planning policies within the documentation focussing on delivering sustainable development in their local borough.

In Scotland, the National Planning Framework is supported by the Scottish Planning Policy (SPP) and Planning Advice Notes (PAN) which are being consolidated into one document. At the local government level, development plans lie at the heart of the planning system.

In Wales, the Planning Inspectorate for Wales, under the Welsh Assembly Government is responsible for planning matters. Planning Policy Wales (PPW) documents contain the development plans and advice on development control and are supplemented by a series of topic-based Technical Advice Notes (TANs).

In addition there are Ministerial Interim Planning Policy Statements e.g. (MIPPS) 01/2009 – Planning for Sustainable Buildings and on Good Design where changes or additions to policy are agreed before a revised

version of Planning Policy Wales is issued will be notified by Ministerial statement and will subsequently be published as numbered Interim Planning Statements.

In Northern Ireland, the Regional Development Strategy for Northern Ireland 2025 (RDS) sets out the future development of Northern Ireland to 2025. <http://www.planningni.gov.uk/index/policy.htm>



FORTHCOMING LEGISLATION

CARBON REDUCTION COMMITMENT (CRC)

Background

The CRC is a forthcoming UK carbon trading scheme for non-energy intense industry. The CRC was first announced by the UK Government in May 2007, since then three rounds of consultation have taken place with the third round of consultation completed in early June 2009. At the national level, the Department for Environment and Rural Affairs (DEFRA) is handing responsibility for the CRC over to the new Department for Climate Change (DECC) with the scheme set to become law in April 2010.

Introduction

The CRC is designed to reduce carbon dioxide (CO₂) emissions associated with real estate within both the public and private sectors. Through the carbon trading requirement and a league table that will be established, organisations will be given financial incentives to effectively manage their carbon emissions, with significant financial penalties and reputation risks for those who do not.

How do you know if the CRC affects you?

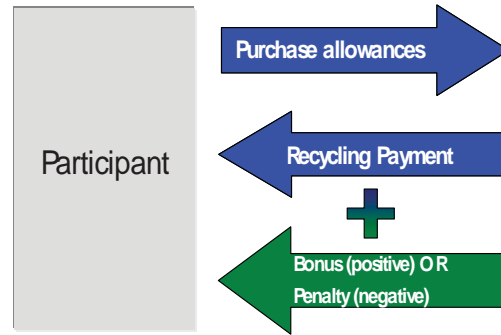
The UK Government (DEFRA) has written to organisations which it believes to be eligible (known as CRC Participants) and qualification packs are due to be received summer 2009. As stated above, organisations will qualify if they exceeded the 2008 electricity consumption threshold.

The organisation with the direct contract with an energy supplier will be responsible for the emissions under the CRC, be it the data centre provider or lessee. It is the highest parent organisation that is ultimately responsible under the CRC and also responsible for annual reporting of the total energy use and associated CO₂ emissions.

Buying carbon allowances

In the first phase, carbon allowances will be sold at a fixed price, which is expected to be £12 per tonne of carbon dioxide. The first sale will take place during April 2011 and, on that occasion only; organisations will be able to buy allowances to cover their actual emissions in 2010/11 as well as their forecasted emissions for the following year. From 2012 organisations will need to forecast the number of carbon allowances required then purchase the appropriate number.

The following diagram illustrates how the scheme works, with purchases, recycling payments and bonuses / penalties.



However it is not quite that simple because there is a 'carbon trading' option whereby it is possible to trade allowances on a secondary market throughout the year, and to buy from (but not sell to) the EU Emissions Trading Scheme.

From 2011, organisations will be required to calculate their energy use and surrender carbon allowances each July to cover their emissions for the compliance year that ended the previous March.

LEAGUE TABLE AND RECYCLING PAYMENTS

The annual Performance League Table will rank CRC participants (organisations) according to their emissions reduction performance. With over 5,000 CRC participants (organizations) expected to participate, only one will be the best and one be the worst with the rest in between.

Naturally the ranking will have reputation implications – as the UK Government intends – but also on the amount of revenue participants receive from the 'recycling' payments each year.

The revenue generated from selling allowances will be returned to participants, based on their position in the League Table. Initially the 'recycling' payment is a 10% bonus or penalty, increasing by 10% per year, to 50% in 2015/16 when the best performers will receive substantially more than they have paid for their carbon allowances, while the worst will get substantially less.

Further information available from:

BPF: www.bpf.org.uk/topics/document/23589/bpf-guide-to-the-carbon-reduction-commitment

DEFRA: www.defra.gov.uk/Environment/climatechange/uk/business/crc/index.htm
(Note: CRC responsibility lies with the Department for Energy & Climate Change)

The Carbon Trust: www.carbontrust.co.uk/climatechange/policy/CRC.htm & www.carbontruststandard.com/

Worth bearing in mind that the USA is soon to follow:

Obama presumes in his 2010 budget proposal that by 2012, there would be a nationwide cap on CO₂ emissions. The vision is to reduce said emissions to 14 percent below 2005 levels by 2020 and to 83 percent below 2005 levels by 2050.

Under such a system, businesses would face limits on how much CO₂ they could emit. Those caps could come in the form of permits, where each permit would equal, say, a ton of CO₂. Companies that are able to produce fewer emissions than they're allowed would be able to sell their extra permits to companies that can't keep their emissions within bounds.

In this scenario, companies will need to do two things: measure their carbon footprints and reduce their emissions. In both cases, IT will play an integral role.

<http://www.infoworld.com/d/green-it/it-versus-global-climate-change-913?page=0,0&source=fssr>



VOLUNTARY INCENTIVES

CLIMATE CHANGE LEVY

The Climate Change Levy (CCL) is a tax on the use of energy in industry, commerce and the public sector. The levy was introduced on 1st April 2001.

The aim of the levy is to encourage users to improve energy efficiency and reduce emissions of greenhouse gases.

The Government is returning the revenues from the levy to the non-domestic sector, principally through a cut in the rate of employers' National Insurance Contributions of 0.3 percentage points. <http://www.defra.gov.uk/environment/climatechange/uk/business/cca/levy.htm>

Levy rates are generally increased annually in line with inflation, current rates are shown on HM Custom & Revenue site. The rates as of 1 April 2008:

Taxable commodity	Rate
Electricity	£0.00456 per kilowatt hour
Gas supplied by a gas utility or any gas supplied in a gaseous state that is of a kind supplied by a gas utility	£0.00159 per kilowatt hour
Any petroleum gas, or other gaseous hydrocarbon, supplied in a liquid state	£0.01018 per kilogram
Any other taxable commodity	£0.01242 per kilogram

http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&pageLabel=pageExcise_InfoGuides&propertyType=document&id=HMCE_PROD1_027235

CLIMATE CHANGE AGREEMENTS

The Government has recognised the need for special consideration to be given to the energy intensive industries given their energy usage and their exposure to international competition.

Consequently, the Government has provided an 80% discount from the Climate Change Levy for those industry sectors that agree challenging targets for improving their energy efficiency or reducing carbon emissions.

The mechanism for Government and industry to agree targets, and for companies to claim the levy reduction are Climate Change Agreements (CCAs).

CCAs have a two-tier structure:

- A sector-level agreement between DEFRA and the sector or trade association (known as an umbrella agreement). Those sectors included are brewing, chemicals, dairy, foundries, glass, metal forming, paper, textiles, etc
- Individual agreements between DEFRA and the operator of the facility (known as underlying agreements).



The energy intensive industries were initially defined as industries that are covered by Part A1 or A2, in Part 1 of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 (as amended). In 2006 the definition of energy intensity expanded to include that set out in the Energy Products Directive (which came into force on 1 January 2004). The extended criteria relates to:

- Energy Intensity (EI) must be 3% or more (i.e. energy costs must be 3% or more of production value for the sector)
- The industry import penetration ratio must be 50% or more. This ratio is calculated for the sector as a whole to determine its exposure to international competition. (The import penetration ratio is the total value of imports for the sector divided by the total value of all UK sales for the sector, plus the sales value of imports, minus the total value of exports for the sector.)

Sectors that do not meet the international competitiveness requirement must have an EI of 10% or more. The eligibility test is based on the average energy cost and production values for three consecutive years. It is only applied at sector level and only at the beginning of the agreement so as not to disincentivise energy efficiency. Sectors that have negotiated EI agreements include industrial gases, cold storage and glass manipulators.

ENHANCED CAPITAL ALLOWANCE

Where capital investment in energy efficient plant and appliances is made, Enhanced Capital Allowances (ECAs) are often available. ECAs enable a business to claim 100% first-year capital allowances on their spending on qualifying efficient plant and machinery. There are three schemes for ECAs:

- Energy-saving plant and machinery
- Low carbon dioxide emission cars and natural gas and hydrogen refuelling infrastructure
- Water conservation plant and machinery⁵⁹.

FEED IN TARIFFS

The UK Secretary of State for Energy and Climate Change announced in October 2008 that the UK would implement a feed-in tariff by 2010 in addition to its current renewable energy quota scheme (see ROCS).

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³ Paolo Bertoldi, European Commission DG JRC, presentation in London (November 2008) <http://re.jrc.ec.europa.eu/energyefficiency/pdf/Meeting%20CoC%20DC%2019112008/Paolo%20Bertoldi-EC%20JRC.pdf>

⁴ Gartner, Inc. <http://www.gartner.com/it/page.jsp?id=503867>

⁵ Declaration of the leaders of the major economies forum on energy and climate (9 July, 2009)

⁶ The United Nations Framework Convention on Climate Change. Article 2. (15 November 2005). http://unfccc.int/essential_background/convention/background/items/1353.php.

⁷ International Energy Agency Primary Energy Mix Table (2006)

⁸ Deutsche Energie-Agentur (the German Energy Agency) <http://www.dena.de/en/topics/buildings/projects/projekt/energy-performance-certificate/>

⁹ BUILD UP website: <http://www.buildup.eu/publications/1656>

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¹¹ Europa Recasting of the EPBD http://ec.europa.eu/energy/strategies/2008/doc/2008_11_ser2/buildings_directive_proposal.pdf

¹² US Green Building Council LEED Rating Systems <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222>

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¹⁵ Ted Samson, InfoWorld (22 April 2009) <http://www.infoworld.com/d/green-it/digital-realty-trust-sets-new-standard-green-datacenter-design-243>

¹⁶ HQE http://www.assohqe.org/documents_certifications_hqe.php





- ¹⁷ CSTB is the French approval body for the construction sector. It is a state-owned industrial and commercial cooperative, placed under the administrative supervision of the French Ministry of Housing. <http://www.breeam.org/newsdetails.jsp?id=574>
- ¹⁸ Building Journal News (28 October 2008) <http://www.building.co.uk/story.asp?storycode=3126140>
- ¹⁹ DGNB certification http://www.dgnb.de/en/certification/the-german-sustainable-building-certification/index.php?edit_document=1
- ²⁰ EU Energy Star database list <http://www.eu-energystar.org/en/database.htm>
- ²¹ Energy Star Enterprise Server and Data Center Energy Efficiency Initiatives http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency
- ²² EU Ecolabel <http://ec.europa.eu/environment/ecolabel/>
- ²³ EU COC Voluntary Code, Guide Version 1 (30th October 2008) http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative_data%20centers.htm
- ²⁴ Paolo Bertoldi, European Commission DG JRC presentation in London (November 2008) <http://re.jrc.ec.europa.eu/energyefficiency/pdf/Meeting%20CoC%20DC%2019112008/Paolo%20Bertoldi-EC%20JRC.pdf>
- ²⁵ EU COC Best Practice Guide (October 2008) <http://re.jrc.ec.europa.eu/energyefficiency/pdf/CoC%20data%20centres%20nov2008/Best%20Practices%20v1.0.0%20-%20Release.pdf>
- ²⁶ Cabinet Office Greening Government ICT website http://www.cabinetoffice.gov.uk/cio/greening_government_ict.aspx
- ²⁷ Federal Ministry of the Environment "Energy-Efficient Data Centres - Best Practice Examples from Europe, the USA and Asia" (2008) <http://borderstep.de/details.php?menu=70&subid=103&le=en#>
- ²⁸ The Economics of Climate Change: The Stern Review (2006) <http://www.occ.gov.uk/activities/stern.htm>
- ²⁹ SenterNovem (Dutch Agency responsible for Subsidy Programme) "Energy Investment Allowance (EIA) 2009" leaflet http://www.senternovem.nl/mmfiles/Leaflet%20EIA%202009%20-%20eng_tcm24-292675.pdf
- ³⁰ SenterNovem (Dutch Agency responsible for Subsidy Programme) http://www.senternovem.nl/english/products_services/towards_sustainable_energy/eia_energy_investment_allowance.asp
- ³¹ Climate Change Agreements <http://www.defra.gov.uk/environment/climatechange/uk/business/cca/agreements.htm>
- ³² Carbon Trust Loans <http://www.carbontrust.co.uk/energy/takingaction/about-loans.htm>



³³ EUPs are products that use, generate, transfer, or measure energy (such as electricity and gas), including consumer goods and industrial products such as transformers, industrial fans, and industrial furnaces.

³⁴ EUROPA http://ec.europa.eu/enterprise/environment/sip/sip_a2_ecodesign_en.htm

³⁵ Department for Local Government & Communities "Improving the energy efficiency of our buildings A guide to air-conditioning inspections for buildings" (July 2008) <http://www.communities.gov.uk/publications/planningandbuilding/airconditioning>

³⁶ NETREGS <http://www.netregs.gov.uk/netregs/businesses/62291.aspx>

³⁷ Fluorinated Greenhouse Gases Regulation text http://members.wto.org/crnattachments/2008/tbt/EEC/08_0033_00_e.pdf

³⁸ Dutch Building Code <http://www.vrom.nl/pagina.html?id=37435>

³⁹ Building Regulations in England & Wales <http://www.planningportal.gov.uk/england/professionals/en/1115314110382.html>

⁴⁰ InBuilt, "Tightening of energy performance requirements for buildings in Germany" (30th April 2009)

⁴¹ The Merton Rule http://www.merton.gov.uk/living/planning/planningpolicy/mertonrule/what_is_the_merton_rule.htm

⁴² Europa http://ec.europa.eu/environment/climat/emission/index_en.htm

⁴³ European Environmental Protection Agency <http://www.epa.ie/whatwedo/climate/overviewofkyotoprotocolandtheeuemissionstradingscheme/>

⁴⁴ Environment Code www.ipdoccupiers.com/environmentcode

⁴⁵ The Green Grid Data Center Power Efficiency Metrics: PUE and DCiE, www.thegreengrid.com/en/Global/Content/white-papers/The-Green-Grid-Data-Center-Power-Efficiency-Metrics-PUE-and-DCiE

⁴⁶ Premises & Facilities Management, "How to reduce data centre energy consumption, environmental impact and power costs" <http://www.fmlink.com/ProfResources/Magazines/article.cgi?Premises%20%26%20Facilities%20Management:pfm101508-6.html>

⁴⁷ Introduction to the 'energy hierarchy' <http://www.imeche.org/about/keythemes/energy/About/>

⁴⁸ Energy Star Enterprise Server and Data Center Energy Efficiency Initiatives http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency

⁴⁹ Press Release December 2008 <http://semiconductor.vipress.net/?id=tutpaibhx1007ihnq>

⁵⁰ BRE Global news (30th July 2009) <http://www.breeam.org/newsdetails.jsp?id=574>



⁵¹ German Green Building Certification http://www.dgnb.de/en/certification/the-german-sustainable-building-certification/index.php?edit_document=1

⁵² Luciana Melchert, a Faculty of Architecture and Urbanism, University of São Paulo, Rua do Lago, 876, CEP 05508.900, São Paulo SP, Brazil (September 2005).

⁵³ SenterNovem (Dutch Agency responsible for Subsidy Programme) Energy Investment Allowance (EIA) 2009 Leaflet http://www.senternovem.nl/mmfiles/Leaflet%20EIA%202009%20-%20eng_tcm24-292675.pdf

⁵⁴ Building Journal News (28 October 2008) <http://www.building.co.uk/story.asp?storycode=3126140>

⁵⁵ Department for Communities and Local Government 'Improving the energy efficiency of our buildings A guide to energy performance certificates for the construction, sale and let of non-dwellings' (January 2008)

⁵⁶ Planning Portal EPC page <http://www.planningportal.gov.uk/england/professionals/en/1115315386289.html>

⁵⁷ Ecobuild 2009 'The Code for Sustainable Homes' presentation (4 March 2009) by Jeannette Henderson from Sustainable Buildings Division

⁵⁸ <http://www.defra.gov.uk/environment/climatechange/uk/business/cca/umbrella.htm>

⁵⁹ Enhance Capital Allowances homepage <http://www.eca.gov.uk/>