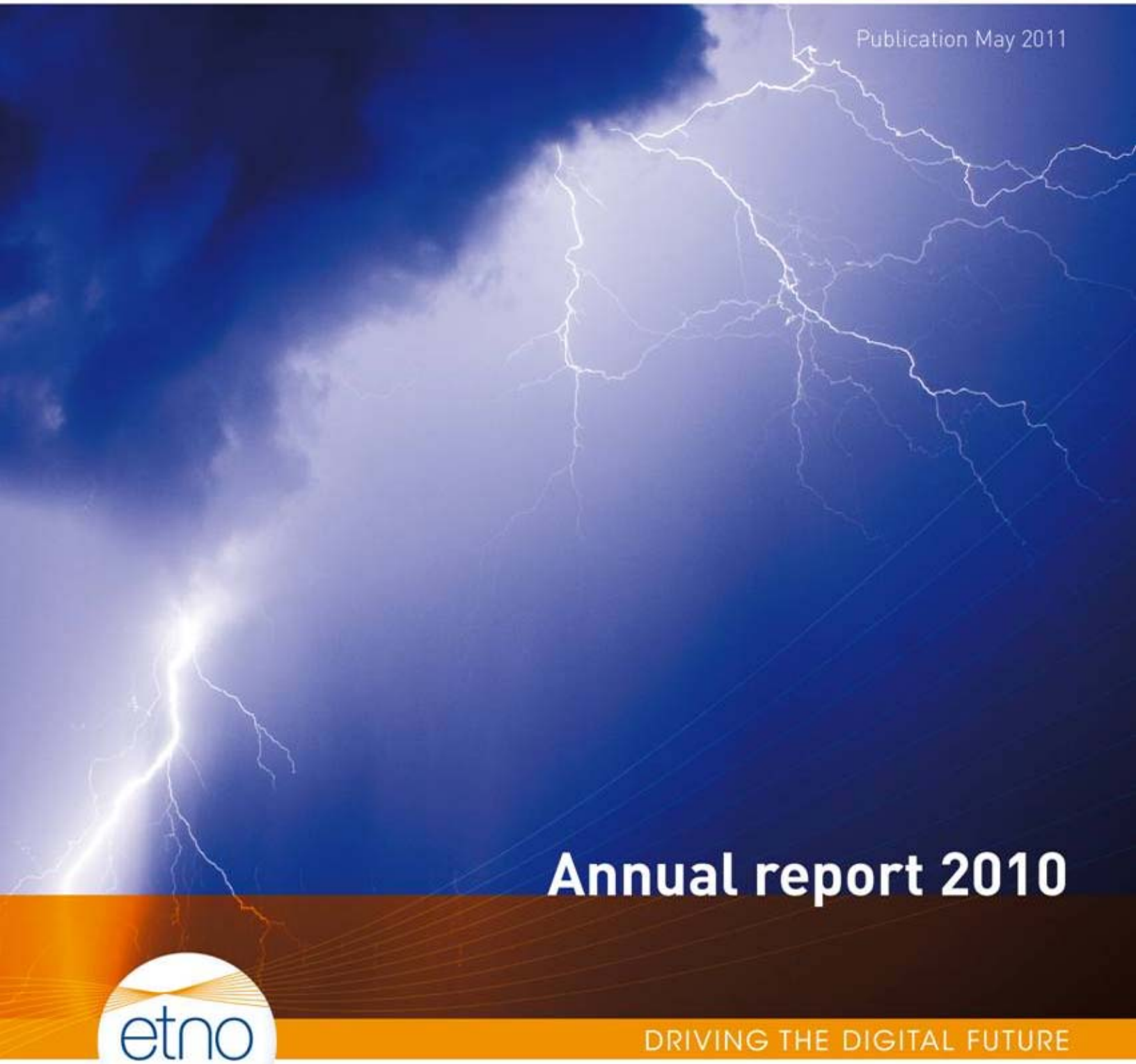
Energy Task Force



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Annual report 2010

DRIVING THE DIGITAL FUTURE

etno

European Telecommunications Network Operators → committed to energy efficiency

Content:

Foreword

The ETNO Energy Task Force was established back in 2004 by visionary members of the European Telecom Operators realizing that energy consumption and handling of CO_2 would have become an essential skill in the telecom industry.
Having arrived at the 12th meeting of the Energy Task Force the importance of the energy topic has even increased in the meantime for several reasons:

- energy supply and energy efficiency are even more on the agenda of the public and of cost-conscious companies as energy prices rise and more natural and technical breakdowns have happened.
- Europe has set an ambitious set of targets known as the "3x20"-target (20% less CO_2, 20% more energy efficiency, 20% share of renewable energy) until 2020
- The ICT branch has been found to be a key for modern climate protection offering a whole range of possibilities to reduce energy consumption and CO_2-emissions.

Because of this last point the focus of the ETNO Energy Task Force is now on three topics:

1. decrease further the energy consumption of the ICT branch by pushing engineering excellence for more efficient networks, data centres and end user equipment. The greatest part of the articles in our report deal with this topic such as the benchmarks on the efficiency of broadband routers, data centres, energy management systems and the most important KPIs.
2. motivate society to make use of the existing potential of Green ICT like reducing business travel and commuting, increasing the energy efficiency of logistics and buildings and offering efficient IT Services from the cloud. You can find a number of contributions on this topic such as the new way of working from Telia Sonera and the customer experience chain on Green ICT from Swisscom.
3. develop new solutions to increase the energy saving impact of ICT. The most recent developments in collaboration and videoconference tools are one example. Nowadays many of the operators prepare to contribute with their communication and IT skills towards smarter electricity grids allowing "presumes" to store and produce energy. You can find an article on the implementation of telematic systems on fleet by Cyta or the internal use of smart metering by Telefonica Ireland.

Please find some of these examples in this report. Feel free to learn from them and ask their authors about more information. This is what the ETNO Energy Task force is about and will continue to work on: to push energy efficiency with an open exchange on best practice.

Yours sincerely

Res Witschi,
Swisscom, Manager Sustainability & Environmental Affairs and Chairman of the ETNO Task Force

Gianluca Griffa,
Telecom Italia, Project Manager and Co-Chairman of the ETNO Energy Task Force

Introduction

The Energy Task Force is a sub-group of the ETNO working group on sustainability, the members of which have each signed the ETNO Sustainability Charter. By signing up to the Sustainability Charter each Signatory has freely accepted a number of commitments, recognising the importance and the value of doing business in a sustainable way.
Each signatory is aware that signing should not be taken light-heartedly, and that deeds must follow words. The task team initiative is one such demonstration of this commitment.

The Task Force was established during a meeting of the ETNO WG on Sustainability June 2004. Initially the purpose of the task team, membership, etc, was determined by the chairman and secretary and this was confirmed at a meeting comprising of a small team of people from KPN and BT. At this inaugural meeting formal objectives were set out, a working methodology determined, the first meeting organised and speakers and guests invited.

Objectives:

1. To ensure efficient energy utilisation and the reduction of environmental impacts through improved energy management.
2. To contribute to national and global efforts to reduce GHG emissions.
3. To provide opportunities to market environmental practice and demonstrate the viability of voluntary actions.
4. To share knowledge and best practice among all the Association's members.
5. To benchmark among the members and look for best practice
6. To provide all members with a recommended Energy policy
7. To put pressure on suppliers with a Code of Conduct
8. To carry out innovative pilots

Methodology:

1 To maintain a network of energy experts committed to the use of benchmarking as a means of driving energy efficiency
2 To meet 2 times per year to exchange views, share knowledge, discuss solutions, work collaboratively, etc.
3 To hold 2 telephone conference calls between meetings to track on progress and ensure completion of action points
4 To deliver continuous improvement

Meetings:

Meetings (locations, dates and hosts) held since the formation of the Task Force are:

01 - Amsterdam, Netherlands	20th - 21st April 2005	KPN
02 - London, United Kingdom	8th - 9th December 2005	BT
03 - Stockholm, Sweden	17th - 18th May 2006	TeliaSonera
04 - Paris, France	13th -14th December 2006	Orange-FT
05 - Sophia Antipolis, France	23rd - 24th May 2007	Orange-FT
06 - München, Germany	12th -13th December 2007	Deutsche Telekom
07 - Reykjavik, Iceland	16th - 17th April 2008	Mila
08 - Wien, Austria	3rd - 4th December 2008	A1-Telekom Austria
09 - Venice, Italy	22nd - 23rd April 2009	Telecom Italia
10 - Dublin, Ireland	26th - 27th November 2009	Eircom
11 - Limassol, Cyprus	17th - 18th June 2010	Cyta
12 – Bern, Switzerland	9th - 10th December 2010	Swisscom

Nevertheless, the physical meetings are just a small part of the ETNO ETF activities: rather, the Group widely uses and encourages audio and video conference services

Example of topics covered at meets to date:

- **Powering**
    - Installation of combined solar panel and wind generator
    - DC and High Voltage DC Power Systems
    - Technology for Fuel cells
    - Use of Bio-Fuel
    - Power Saver Plugs
    - Purchase of renewable/green energy
- **Cooling**
    - Kyoto cooling for Data Centres
    - Underground Cooling with heat exchanger (air or liquid)
    - Use of Fresh Air Cooling in Central Offices, RBS and Data Centres
    - Air Conditioning System Electrically Commutated Fans
- **Innovative solutions for energy efficiency**
    - Definition of ratio/efficiency metrics and energy conversion factors
    - Energy Monitoring/Management System
    - Use of frequency converters
    - Increasing the temperature in equipment rooms
    - Liquid Pressure Amplification
    - Energy optimisation using switchable connector strips
    - Inclusion of power management requirements in RFQ/RFP

All the network segments (Fixed, Mobile, Data Centre, Office, Customer equipment) have been covered so far; moreover, the analysis and the solution discussed are often not limited to the technical point of view, but rather include economic (ROI, PBT) evaluations.

Looking Forward:

The Task Force has grown rapidly in size and reputation. Its success was also communicated to Intelec, a worldwide telecommunications energy conference and exhibition that embraced the idea of a more sustainable way of working, using less and greener energy. This initiative has generated significant interest, so much so, that it has been copied by operators in the United States.
But new challenges must be found and this report is a result. This will help companies determine their position and hopefully, ensure that resources are allocated in order to live up to their obligations as determined in the ETNO Sustainability Charter.

Members and references:

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PART 1

ETNO ETF MAIN ACTIVITIES AND INITIATIVES

1. G.R.E.E.N Benchmarking

Deployment of power efficient implementation of ADSL and VDSL networking equipment could lead to a reduction of up to 60% of their power consumption as demonstrated by the results of the first phase of the home gateway energy consumption Benchmark called "G.R.E.E.N" (Green Router for Energy Efficient home Networking).

G.R.E.E.N has been developed with the support of the Home Gateway Initiative (HGI) and provides a snapshot of current state of the art in energy efficiency of Home Gateways, showing the advantages of power consumption optimisation when the HG is supporting services or is performing a low level of operation. ETNO's G.R.E.E.N benchmark highlights the current best practice in meeting the power targets for Home Gateways set out by the European Code of Conduct on Broadband Equipment for the various power modes.

Tests included a variety of HGs representing actual deployments as well and non-deployed configurations using a variety of chipset technology generations and processing power, all influencing power consumption performance results. In particular, G.R.E.E.N benchmark focused on three different categories of products.

- First, Home Gateways already massively deployed in the market before the publication of the latest version of the EU Code of Conduct (CoC) tested, directly provided by the ETNO operators joining the activity: Belgacom, Deutsche Telekom, Swisscom, TDC, Telecom Italia;

Then, alternative solutions aiming at demonstrating improvements of the overall efficiency were considered, in particular:

- Reference designs from chipset vendors specifically optimized for reduced power consumption levels; and
- Reference designs from chipset vendors that did not include enhancements to reduced power consumption levels.

Chipset vendors participating in this event included Broadcom Corporation, Ikanos Communications and Lantiq in cooperation with equipment manufacturers including AVM and Sagemcom. Depending on type and number of functionalities implemented, the measured values have been compared with different targets, directly derived from the European Code of Conduct limits. The test results show a clear improvement trend, in all the specific power modes supported. The power consumption of the "best in class" ADSL HG is limited to 8,1W in full power mode and 5 W in low power mode, well below the EU CoC target values. Considering the yearly total energy consumption (TEC) of these ADSL tested products, the maximum difference between the best and the worst measurement is equal to 41,6 kWh/year, or a decrease of 45,7% of the power consumption.

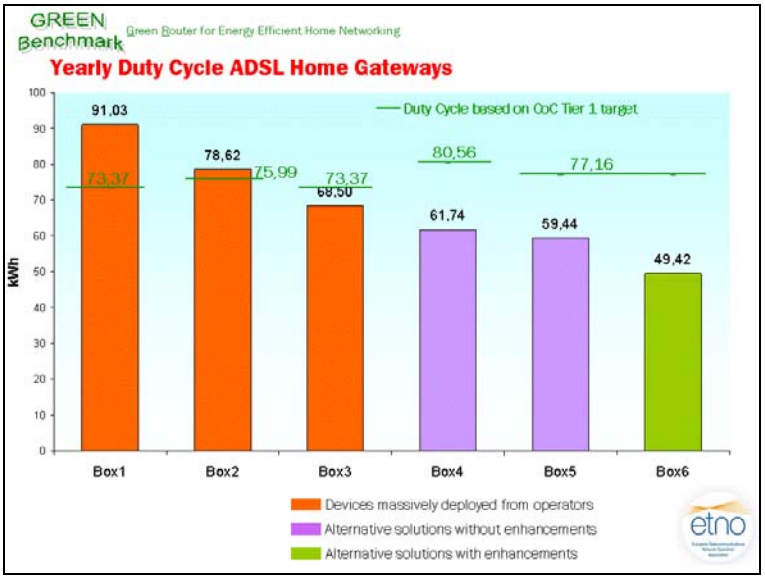


Figure 1: ADSL HG results compared with EU CoC energy targets

For VDSL HG the best results achieved are 7,6 W in full power mode and 5,3 W in low power mode. The difference between the best and the worst in class measurement results in 75,6 kWh/year, or a decrease of 59,9% of the power consumption.

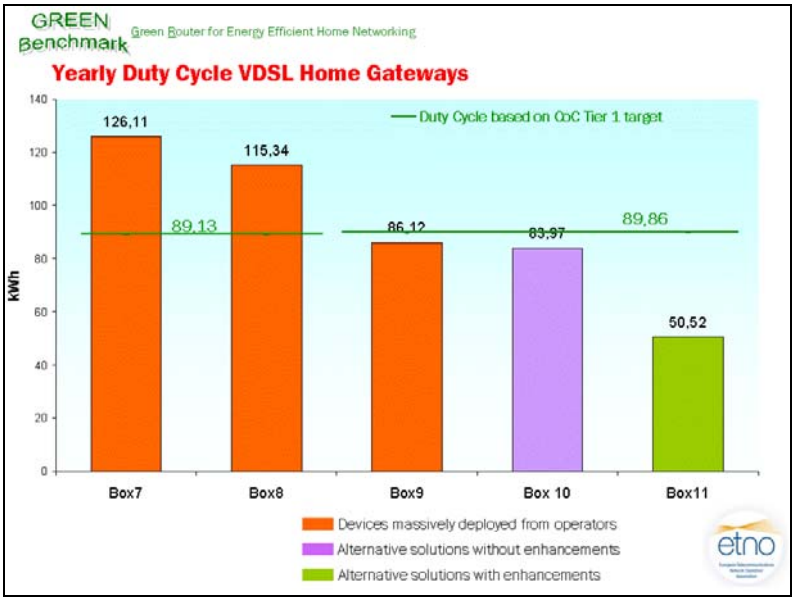


Figure 2: VDSL HG results compared with EU CoC energy targets

Reporting the potential energy consumption difference between the best and the worst in class to the corresponding savings of CO_2 emissions we can estimate that, on a basis of 20 millions of deployed ADSL HGs, the efficiency improvements would result in a yearly reduction of CO_2 emissions around 568000 tons; that is equivalent to the emissions produced by more than 312000 cars during a year or the CO_2 captured in 568000 adult trees. For VDSL, assuming 5 millions of deployed HGs, the yearly reduction of CO_2 emissions close to 257000 tons, corresponding to emissions of more than 142000 cars or the CO_2 captured in 257000 trees.

It is worth to note that continued advancements in ADSL and VDSL technologies allowed already to reduce noticeably the differences in the power consumption between ADSL and VDSL products enabling deployment of higher performance HG without power consumption penalties.

Given the success of the initiative, a second phase of the G.R.E.E.N benchmark is foreseen: the aim is, again, to stimulate the market to provide solutions for optimising the energy efficiency of the home gateways. This second phase of test measurements is planned for the fourth quarter of 2010.

2. Benchmarking on most relevant EE KPIs

This activity has been set up with the aim to have an overview of the most important KPIs on Energy Efficiency and climate protection from European Operators. To this end, the following targets/KPIs have been taken into account:

1) CO_2eq reduction
2) reduction of Electrical Energy consumption
3) CO_2 emission factor from average used electricity (g CO2/kWh)
4) Purchasing of renewable electricity
5) Targets for Scope 3
6) Signatures of EU CoCs
7) Energy Efficiency factors (e.g. Bits/Joule , Bits/kWh, Bits/kg CO2)
8) Plans for the EU-Target to ICT-industry (CO_2 reduction of 20% from 2011 to 2015)

This benchmarking has involved 10 Operators on the whole, and provided the opportunity to identify different Best Practices. In particular, the activity highlighted the great difference between the targets set by the various Operators involved. In the following the tables containing the main targets/KPIs are reported and commented

Target/KPI	A1 Telekom Austria	C&W	Magyar Telecom	Swisscom	TDC	Deutsche Telekom	Telenor	Telia Sonera	Telekom Slovenije
CO_2eq reduction targets (% and time interval, Scope1/2/3)	A reduction of 40% of the CO_2 emissions compared to 2008 could be achieved in 2009. Aim is to keep this standard	Reduce CO_2 emissions per unit of network traffic and data storage by 20% by April 2015 (from a 2010 baseline) (scope 2)	10% 2008-2011	Reduction of 60% from 1990 until 2015	Reduce CO_2 of 40% by 2020 (baseline 2010)	Reduce CO_2 of 30% by 2020 (baseline 2008)	-40% measured as CO_2 emission intensity by 2017 compared to 2008, includes scope 1&2, and parts of scope 3 (flights and outsourced elements of the core business)	CO_2 targets are set on country level. Sweden: -4%/annually (Scope 1/2/3)	To be in line with EU - ICT target of -20% by 2015 (separation by scope 1/2/3 not in current Business Plan)
CO_2eq reduction per year for the time defined	-40% ("one shot")	-4%	-2.5%	-2.4%	-4%	-2,5%	-4.4%	-4%	-4%
Scope 1/2/3	1+2	1+2	1	-1	1+2+3	1?	1+2+ partly 3	1+2+3	1

Table 1: CO_2eq reduction targets

Table 1 contains the main targets concerning the CO_2eq reduction. In particular, some Operators (in particular Swisscom and Telenor) have set quite challenging values (up to -60%). The average rate per year is mostly between -2.5% and -4%. Furthermore, most targets are referred to Scope 1, while very few include Scope 2 or even Scope 3. In the future a common way of reporting could be evaluated among the various Companies.

Table 2 contains the main targets concerning the electrical energy consumption reduction. As it can be noticed, the different scopes (datacenters, fixed network, office buildings) make comparison quite difficult. Nevertheless, the table highlights that further savings concerning data centers and fixed network are certainly possible.

Table 3 reports the CO2-emission factor from average used electricity (g CO2/kWh). In particular, the table highlights a range between 14 g CO2/kWh (Swisscom, best in class) and 537 g CO2/kWh (Cable&Wireless). Most Operators make the calculation taking as a reference the national CO_2 mix (and this of course has a huge impact on the final result, especially as far as the scope 2 is concerned)

Table 4 highlights the different percentages concerning the purchasing of electricity from renewable sources. The range is really wide, and goes from 0% to 100%! Of course it strongly depends on the energy mix of the Country where the Operator is based.

Table 5 contains some targets concerning Scope 3. In particular, the main areas for such Scope 3 are: waste recycling, logistics, flights, use of Green ICT internally and from customers (videoconferencing, online billing). Moreover, the benchmark has highlighted that Scope 3 definition is quite different from Company to Company.

Target/KPI	A1 Telekom Austria	C&W	KPN	Magyar Telecom	Swisscom	TDC	Telenor	PASM	Telekom Slovenije
Target for reduction of Electricity consumption	Increasing the energy efficiency in ICT-locations by 10% in the period 01/2008 to 12/2012 (starting with a DCE of 42%)	Implement energy savings initiatives to deliver 200 GWh of savings between April 2010 and 2020 (scope includes all technical and office electricity)	1. 30% energy eff improvement 2005-2020 for Data Centers (based on PUE) 2. 20% reduction electricity consumption network and offices 2005-2020	4% office buildings 2008-2011	20% improvement of energy efficiency between 2009-2015	Not defined - related to CO2 target	Not defined; CO2 target captures all	Improvement of the PUE-factor in the fixed network of DT until 2020 up to 1.40	- 5% by December 31st, 2012 (base year 2009, whole fixed net operations; set previously as part of ISO 14001/EMS long term goal setting)
Scope	Data Centers	All electricity	Data Centers / network& offices	Office buildings	All electricity	Only CO_2	Only CO_2	Fixed network	Fixed network operations

Table 2: targets for electrical energy consumption reduction

Target/KPI	A1 Telekom Austria	C&W	KPN	Magyar Telecom	Swisscom	TDC	Telecom Italia	Telenor	Telekom Slovenije
CO2-emission factor from average used electricity (g CO2/kWh) and source of the information	190 gCO2/kWh (for year 2009)	537gCO_2/kWh. Used from carbon reporting guidelines as per UK government calculated national grid mix. Our own supplier has a different fuel mix.	based on energy mix supplier (better than average grid mix)	338,5 gCO2/kWh calculated from our sustainability report 2009	13,7 gCO_2/kWh from Ecoinvent database for LCAs	455 gCO2/kWh from national energy authorities	403 gCO_2/kWh in Italy and 0.025 kg CO_2/kWh in Brazil. Source: GHG Protocol Initiative	National values on annual basis for each of 13 countries; figures according to IEA-data or national energy authorities (DK)	470 gCO2/kWh (for year 2009)
National mix	No	Yes	No	?	No	Yes	Yes	Yes	Yes?

Table 3: CO_2-emission factor from average used electricity (g CO2/kWh)

Target/KPI	A1 Telekom Austria	C&W	KPN	Magyar Telecom	Swisscom	TDC	Telecom Italia	Telenor	Telia Sonera	Telekom Slovenije
Purchasing of renewable electricity (% of each kind: wind, water, Solar, Biomass, Geothermal..) and kind of purchasing (RECS, CER, direct contract with power producer, own power plant..)	TA-Figures for 2009: roughly 8% green electricity (small-scale hydropower +green energy), roughly 62% electricity from hydroelectric power. Aim is to keep this standard	0% at present, looking at various options however	100% green electricity by end 2011 from NL wind and RECs	15% contract with power supplier	Purchasing of 100% renewable energy (99.7% Hydro, 0.2%Wind, 0.1%Solar)	0%	1.70%	20% Hydro in Sweden, in Norway the main electricity source is hydropower and there is no scheme regulating the use of guartantees of origin	100% in Sweden (environmental labelled/externally verified: hydropower + wind), Ca 80% in Finland (hydro power certified by producer), 30% in Denmark (Wind - national energy certification system+imported hydropower (origin source=Sweden), Norway (hydropower). For the whole Nordic sector the electricity is purchased on the Nordic power exchange	37% (2010 data; almost all hydroelectric power, rest is very minor)

Table 4: purchasing of electricity from renewable sources

Target/KPI	A1 Telekom Austria	C&W	KPN	Magyar Telecom	Swisscom	TDC	Telenor	Telekom Slovenije
Targets for Scope 3 (e.g. use of Green ICT services, logistics,..)	Saving 150t CO2 p.a. by emphasizing video conferences, modernising the car fleet till 12/2011. Consolidation of server, serverfarms ongoing.	a) Increase the proportion of UK facilities waste that is recycled to 54% by April 2010 and 65% by April 2011 b) Review company wide business travel and identify opportunities to reduce carbon footprint of travel by 10% by April 2011	Starting reduction target on energy consumption CPE's	Scopes (no target numbers) videoconf hybrid cars less paper e-invoice less waste recycling more green articles & logistics & contracts	Start of calculating effect of Green ICT services at the customer. Increased use of video-/teleconferencing. Collect CO2-emissions from inland transports. Saving 2300 tons internally	Partly in progress	Emission from flights of own employees, energy related to operation of core services, e.g. purchase of services from tower companies. Consideration also of inclusion of more elements of scope 3 such as transport of large subcontractors	Green articles in all purchasing/ logistics contracts, increased use of video/tele-conferencing as substitute for travels planned etc.

Table 5: targets for Scope 3

Table 6 contains the current state of the art concerning the signatures of the Codes of Conduct released by the European Commission. As it can be noticed, lots of Companies have recently joined such CoCs, with special regards to the one on Broadband Equipment. To this end, it must be highlighted that such (excellent) situation is mainly due to the "Signatory Event of the Codes of Conduct on Broadband Equipment and Data Centres", organized by GeSI (Global E-Sustainability Initiative) on September, 28th 2010 in Brussels. During such Event, the following new signatories to the Codes have been finalized: A1 Telekom Austria, Belgacom, BT, KPN, Orange/France Telecom, OTE, Portugal Telecom, TDC, Telecom Italia, Telefónica, Telenor, and Turk Telekom. The signing, in the presence of Commissioner Neelie Kroes, have brought these new signings together with existing signatories Alcatel-Lucent, Cisco, Deutsche Telekom, HP, Huawei, Microsoft, Nokia Siemens Networks, Swisscom, and TeliaSonera. The addition of the new signatories to the Codes of Conduct greatly increases the scope of the Codes, which, for broadband, will increase from up to 32% to cover up to 75% of the EU broadband market (analysis by Arthur D. Little). The inclusion of non-EU companies in the list of signatories also gives the Codes of Conduct a push towards becoming global standards for energy efficiency.

Target/KPI	A1 Telekom Austria	C&W	KPN	Magyar Telecom	Swisscom	TDC	Telecom Italia	Telenor	Telia Sonera	Telefonica
Signatures of EC Codes of Conduct	CoC DC (2009) CoC BB equipment (2010)	None at present. Seeking to sign the EU DC CoC	CoC BB equipment (2010)	None at present	CoC BB equipment (2009)	CoC BB equipment (2009) CoC DC (2010)	CoC BB equipment (2009) CoC DC (2010)	CoC BB (2010)	CoC BB equipment (2010)	CoC BB equipment (2010) CoC DC (2010)

Table 6: signatures of EC Codes of Conduct

Table 7 reports some Energy Efficiency factors used by the Operators. Also in this case, there isn't a "universal" indicator, even if the form "Bit/Joule" is going to predominate. To this end, it must be highlighted that such numbers can have quite different assumptions behind: therefore, a punctual direct comparison could be misleading.

Finally, Table 8 contains the plans of some Companies towards the EU-Target to ICT-industry (that is CO_2 reduction of 20% from 2011 to 2015). As it can be noticed, only one Company (Telekom Slovenije) is currently focusing on such EU target

Target/KPI	KPN	Magyar Telecom	Swisscom	TDC	Telecom Italia	Telenor	Telia Sonera
Energy Efficiency factor (e.g. Bits/Joule , Bits/kWh, Bits/kg CO2)	PUE factor for network will be published in CSR-report 2010	11,883 Gbit/kWh (2009)	1046 Bit/Joule (2009) 3.76 Gbit/kWh (2009)	1036 Bit/Joule (2009)	1699 Bit/Joule (2010)	3 Specific benchmark values currently considered are : 1/ kWh/FTE building energy, 2/ CO_2/FTE related to travelling (road and flights) 3/ kWh/MB of network traffic	Sweden and Finland: Energy efficiency model based on performed work (functional unit) related to electricity consumption. Model in use since 2001. Denmark: TBD

Table 7: Energy Efficiency factors

Target/KPI	A1 Telekom Austria	C&W	KPN	Magyar Telecom	Swisscom	TDC	Telecom Italia	Telenor	Telia Sonera	Telekom Slovenije
What are the plans of your company for the EU-Target to ICT-industry (CO_2-Reduction of 20% from 2011 to 2015)?	CO_2 targets reported in table 1	None at present - seeking to learn more about this	See table 2	Now no target defined but green electricity project running	No plans, target above, 2009-2015 only -10%	Refer to the above CO_2 target in table 2	No plans available	Refer the above target for 2008-2017 in table 1	No decided corporate targets other then already decided targets (se table 2). TBN Reductions achieved in Sweden 2001-2009= -76% CO_2). Participate in ICT4EE	To be inline with the EU-target - 20% by 2015

Table 8: Companies' plans for the EU-Target to ICT-industry (CO2-Reduction of 20% from 2011 to 2015)

3. Benchmark on STB

After the G.R.E.E.N Benchmark on Home Gateway devices ETNO ENGY TF is now focusing on Set Top Boxes (STBs).This category of equipment includes a range of products that, though not always-on, consume up to 20 W in the most complex version.

A STB is defined to be complex when it implements a CA (Conditional Access) system or contains a CAM module. In addition standby modes often do not provide substantial power saving: standby power consumption in many cases is almost the same as in the "On" mode.

In this unclear situation ETNO ENGY TT is launching a benchmark among Telecommunications operators to understand the current state of the art of Set Top Boxes' power consumptions. This report kicks off the first step of the process, consisting in the specification of the measurement procedure aimed at ensuring repeatability and comparability of measurement results.

The measurement results will be used to build a shared set of ecoefficiency measurements for STBs in use. In addition, information collected during the measurements could be used to build an ecoefficiency ranking for the STB involved. Measurements will be carried out independently by each interested operator within its specific IPTV Service delivery platform.

This document also contains a proposal for partitioning the great deal of products that includes different items, in some cases with striking differences to one another, into a number of clearly defined classed that contain homogeneous products. Comparison of power consumption should be this way both simpler and more meaningful.

Architecture, requirements and methodology have been elaborated taking in account the EU CoC (the Code of Conduct for Digital TV Service System Version 8 **Error! Reference source not found.**) and the European Regulation ER 1275/2008 **Error! Reference source not found.**. The added value of this document with respect to the EU standards is that it provides the definition of STB classes and their operational states. The document lists the following classes at the moment:

1) "**Basic STB**", including hybrid IPTV/DTT Standard Definition operation, no PVR
2) "**Enhanced STB**", including DTT decoder, Web TV interface, PVR, a SD card slot, a number of home network interfaces (Bluetooth, WiFi, USB), and the UPnP AV (DLNA) software stack (note that no IPTV service platform is supported by this class; it nevertheless falls within the definition of a STB provided by CoC – Annex B). Operators interested in carrying out the measurements are kindly asked to revise and complete the current definitions or add new ones if necessary

4. Benchmark on Energy Management Systems

Systematic energy management is used in a great many companies worldwide. Good energy management identifies areas where energy savings can be made. This can result in reduced operating costs and improved competitiveness.
Telecommunications network operators and those in the ICT industry can also use systematic energy management to meet the European Commission's 2015 reduction targets.

In recent years, the EN 16001 – Energy Management Systems standard has come into being in Europe. In principle, this standard is also suitable for the introduction of systematic energy management in telecommunications companies. The special characteristic of ICT network operators is the structure of their energy consumption. Most have several thousand network nodes and data centers spread across the entire country. The majority of the energy consumed by these companies is made up of electricity for operating networks and cooling network nodes. Energy consumed for heating premises is of somewhat lesser significance.

One of the aims of the ETNO Energy Task Team is to develop a best practice for the roll-out and implementation of an efficient energy management system (EnMS) focusing on strategy & politics, planning, implementation, controlling, and monitoring & reviewing.

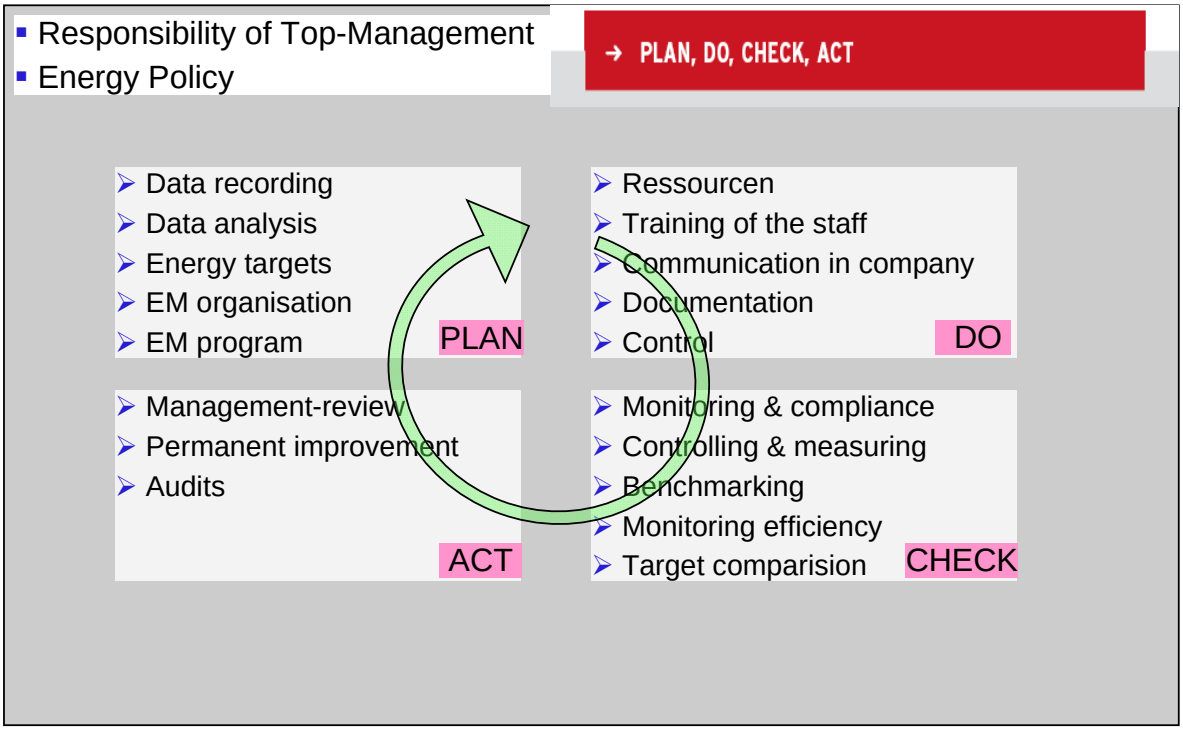
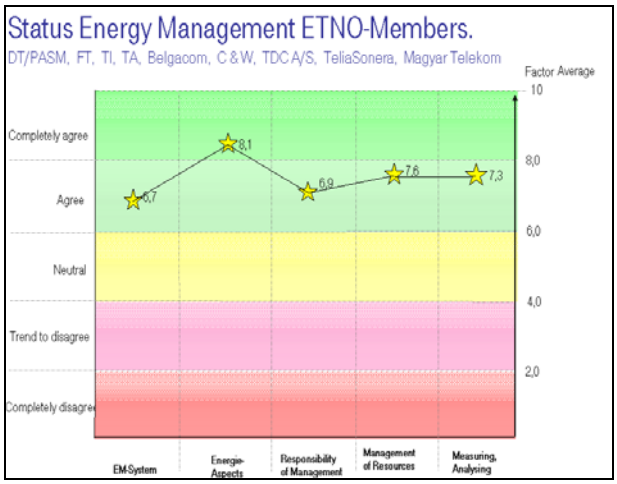
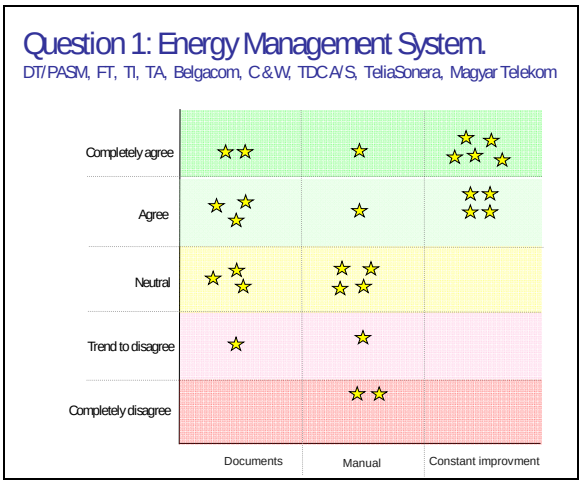
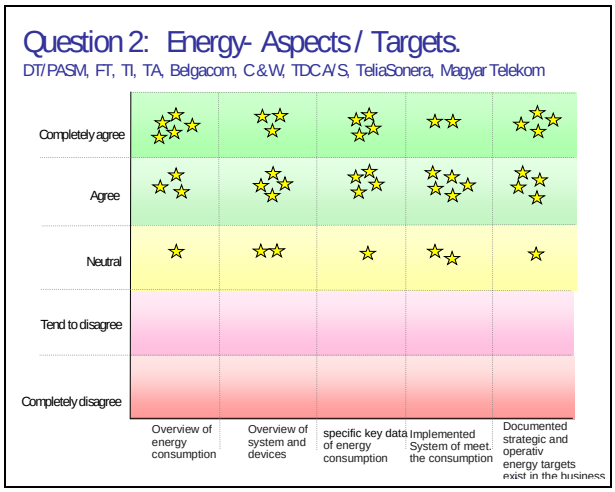


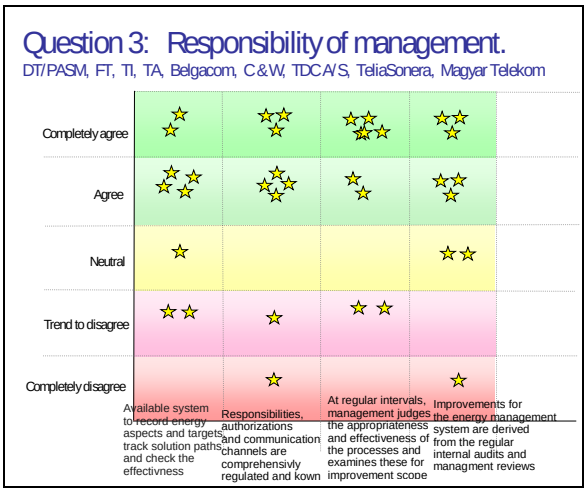
Figure 3: Systematic energy management processes

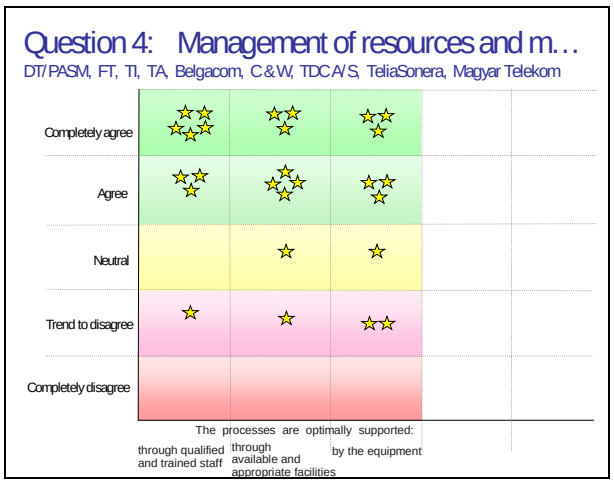
In 2010, the ETNO Energy Task Force made some first moves toward creating a best practice on the roll-out and implementation of energy management systems in ICT companies. The objective was to establish the as-is situation in the ETNO member companies.
Eight telecommunications companies took part in the research. The following charts show the results in both summarized and detailed form.

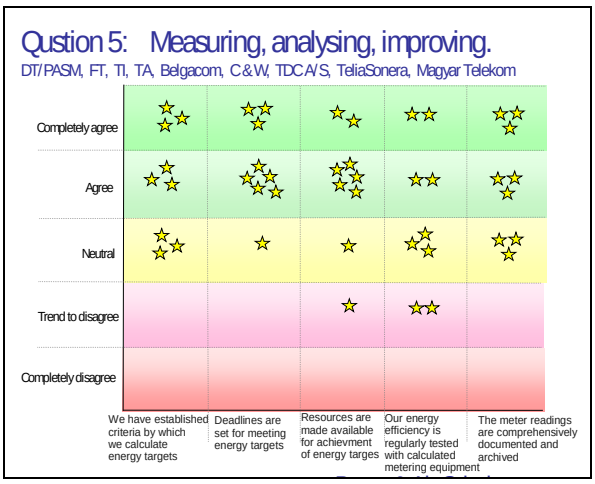












The next step is to draft a best practice on realizing an efficient energy management system specifically for ICT network operators, which will then be followed by benchmarking. The aim is to ensure the ICT networks of ETNO members are operated consistently at optimum efficiency in terms of energy consumption and to open up this know-how to the millions of customers of the various companies. This requires targeted company decisions, modified organizational platforms, EE KPIs, planning instruments for end-to-end views of energy and profitability, databases for energy-related data, lean processes and highly trained experts, as well as regular audits by top management.

5. Benchmark on Green Energy

To lower CO_2 emission telecom operators work on energy savings. The CO_2 of the remaining energy consumption can be reduced by the use of renewable or "Green energy". The aim of this benchmark is to better understand how ETNO ENGY TF members realise "green energy" projects. 13 Operators participated on this benchmark (of which one anonymous) in 2009. Following questions were benchmarked:

- List the renewable sources in use:
  - The type of technology
  - The number of installations
  - The total capacity of the installations and % ownership
- % of "green electricity" actually used

The aim of the benchmark was:

- To better understand:
  - What is the share of 'green' power?
  - What is the share of "self produced green power"
  - What is the aim for self or co-production in 2020?
- To evaluate the pros and cons experienced by Telco's on available technologies:
  - Solar Photo-Voltaic and Thermal panels
  - Wind Turbines
  - Cogeneration
  - Bio-mass
  - Hydroelectric Power (tidal movement, barrage)
- To determine which factors are affecting the choice of technology:
  - Location (urban or rural project)
  - Profitability / ROI
  - Own or external project (invest or buy-in)
- To determine which results are expected from the actions:
  - 'Green' image
  - Create new sources of revenues
  - Reduce carbon footprint
  - Generate savings
  - Which result is desired and what is the commitment of the management?

The results are quite different and reported in Table 9

	% Green				MWh Green production					# Installations Green production				
		Buy Green	Grid Green	RECS-Offset	Sun Photo-voltaic	Sun Boiler Hot water	Cogene-ration	Wind	Water	Sun Photo-voltaic	Sun Boiler Hot water	Cogene-ration	Wind	Water
Anonymous	0%													
Belgacom	100%	100%	4%	0%	3,9	70,0				2	9			
Deutche Telecom	100%		17%	83%	156,9		19.850,0			8		5		
Eircom	50%	50%												
France Telecom Group				66GWh	8.800,0					380				
KPN	39%	13%	8%	17%										
Magyar Telecom	15%	15%				100,0					1			
P&T Luxembourg	80%	80%			23,4		715,7			1		1		
Swisscom	100%				42,0					4				
Telecom Austria	55%		55%											
Telecom Italia	2%	1,7%			2,4		14.000,0			10		1		
Telia Sonera (Sweden, Finland, Norway)	100%		100%											
Telia Sonera Denmark	30%		30%											

Table 9: main results of the Green Energy Benchmark

Main findings:

- More than half of the operators use at least 50% renewable energy
- Half of the operators own photovoltaic installations
- Solar boilers and cogeneration are still at a starting point
- No operator uses Wind or Water as a renewable source of own production
- Heat recuperation was not mentioned by any operator during the benchmark though it's potential for important savings

6. Benchmark on Data Centres

One of the main drivers for increasing energy consumption with telecom operators is the growing data centre business. According to the Green Grid the global consumption of data centres increases by 50% each year. ETNO ENGY TF noticed this evolution in 2007 and decided to benchmark within members' data centres. In total 10 operators participated with data on 25 data centres. The main goal is not only to compare energy efficiency but equally important the used technologies. As the results of a benchmark can only be reliable when the compared situations are known the main technical data were inventoried. Thanks to these technical data the Benchmark results can be evaluated.

At that moment DCE (or DCiE) indicator (Data Center infrastructure Efficiency) was chosen as comparison. DCE is determined by dividing the power used to run the computer infrastructure by the total amount of power entering a data centre. In literature we noticed a competition to announce the highest efficiency or lowest possible PUE (PUE i.e. Power Usage Effectiveness is the reciprocal value of DCE), without mentioning the levels of back-up or technology used. Basically high modularity and building by stages should be considered by the design and operation of energy and cooling facilities at data centres, thus ensuring high energy efficiency even at reduced load.

The benchmark is based on a study of the Berkely Lab ordered by the US department of Energy http://hightech.lbl.gov/datacenters.html. Terminology was based on ANSI/TIA-942-2005, Approved: April 12, 2005, Telecommunications Infrastructure Standard for Data Centres. The following technical data were collected:

- UPS Redundancy: N, N+1, 2N
- UPS technology: Static or Rotative
- Cooling Production Redundancy: N, N+1, 2N
- Cooling Free air: Y/N
- Cooling technology: Ice Water circuit, Direct eXpansion, Ice Water + Direct expansion (as back-up)
- Humidification: Boiling pots, Central steam production, Evaporation (wet filter, spray...)
- Total In-Door surface (m²)
- Server Room Surface (m²)
- If available, detailed specific consumptions were measured:
    - Consumption Chillers & Pumps
    - Consumption Fans
    - Consumption Lighting
    - Consumption UPS Losses
    - Residual Consumption
    - Heat re-use (deducted from the total building consumption)

Main findings are that the average DCiE is 53% (PUE=1.89), as shown in Figure 4

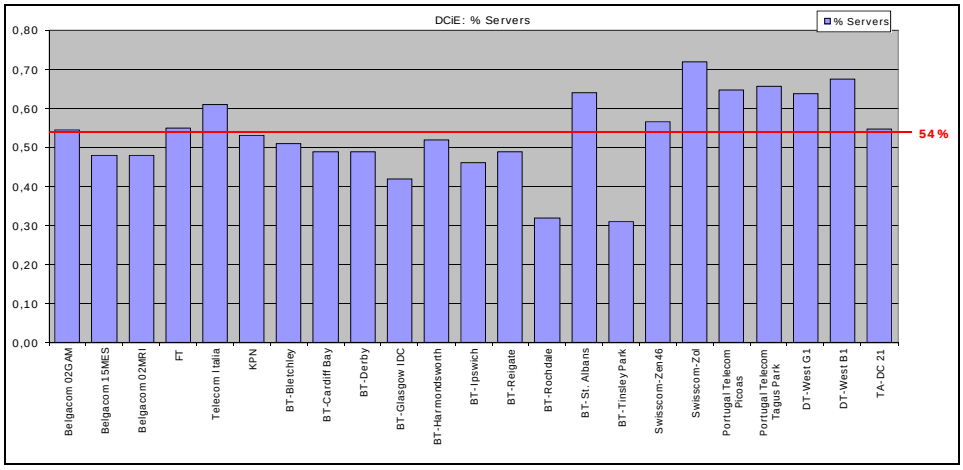


Figure 4: DCiE for some important Data Centres

Figure 5 reports the percentage of the total energy entering in the DC consumed for cooling of Data Centres (the average is 34%). The UPS losses are reported in Figure 6 (the average is 8%).

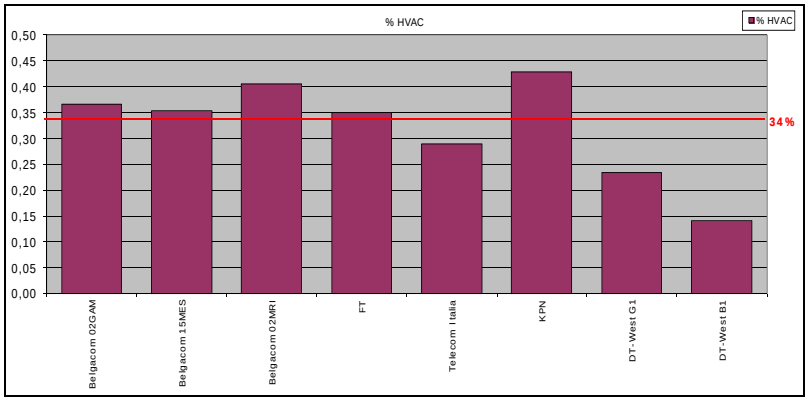


Figure 5: percentage of the energy consumed for cooling in Data Centres

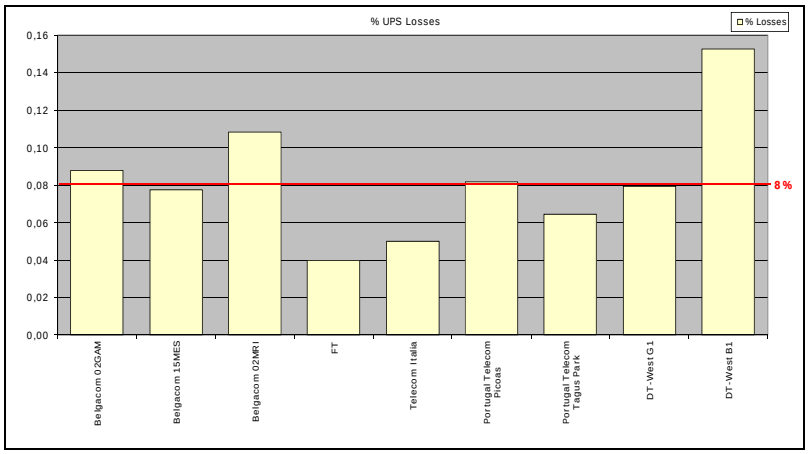


Figure 6: loss percentage of UPS

6.1 Example of energy efficient DC at Belgacom

Within Belgacom this benchmark was a start to measure on monthly base PUE. Belgacom improved the energy efficiency of Data Centres, by implementing closed cold corridors, free chilling (with dry coolers) and heat exchangers in order to heat the building with the heat produced by the IT equipment in the data rooms. As a consequence, the consumption of heating gas in our offices next to our main data centre dropped drastically. We also virtualised 461 servers, resulting in 1.6GWh savings. These investments allowed us to sign up to the EU Code of Conduct for Energy Efficiency in Data Centres (the first company in Belgium to sign), committing ourselves to making public the PUE (Power Usage Effectiveness), the standard unit of measurement for green data centres, and to constant improvements. In 2010 we reduced our PUE (1.88) by 4% vs. 2009 (1.96). Figure 7 reports the PUE of the Belgacom's Data Centres

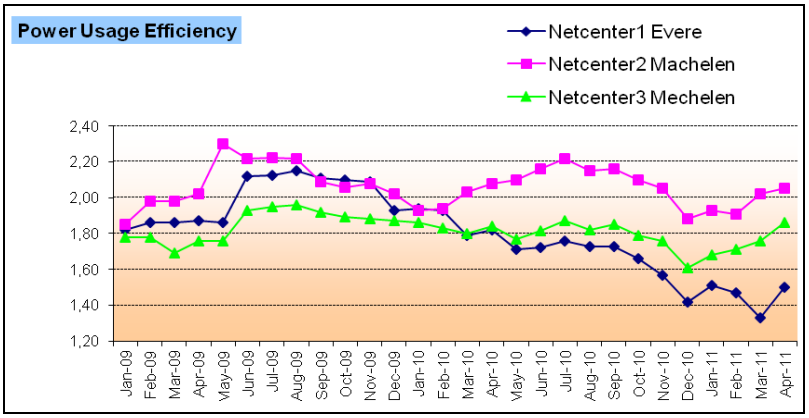


Figure 7: PUE of Belgacom's Data Centres

6.2 Example of energy efficient DC at Swisscom

Energy efficiency was a priority while designing and building the new data centre of Swisscom located in the canton of Berne (see picture in Figure 8). An energy share of less than 20% for the cooling as well as an energy efficiency of UPS above 90% (UPS power loss representing less than 8%) were set by the planning of this DC. These requirements correspond to a DCiE value above 72% or a reciprocal PUE value below 1.39.

To achieve these target values, energy efficiency has been included consistently. Chilled water temperature is supplied at 16°C which enables extended use of freecooling throughout year (mixed operating „chillers/freecooling"). Turbo chillers with high COP (coefficient of performance) even at reduced load have been selected. Room temperature is set at 25°C. Cold/warm aisle topology in the server rooms is applied systematically, thus preventing air mixing between cold and warm air. The use of air re-circulation units with variable air volume rate enables to better match the air volume rate to the effective needs, thus reducing energy consumption of fans. Power and IP cables are placed in well dedicated cable routes inside the raised floor, thus preventing unwanted obstacles for air flow. Heat recovery is currently used for internal purposes and remains also available for potential external recipients (district heating). Particular attention has been paid for the selection of UPS with energy efficiency above 90%.

Figure 8: New DC of Swisscom located in the canton of Berne (Switzerland)

The DCiE and the reciprocal PUE values are monitored on monthly base at this DC. The values for year 2010 are reported in Figure 9. It appears in this figure that, thanks to optimized cooling, the above-mentioned energy efficiency goals have already been reached after two years of operation. Thus, compared with a conventional data centre, Swisscom is currently saving 4'300'000 kWh per year with its modern infrastructure – equivalent to the electricity consumption of 800 Swiss households. The company received the Cisco's 2009 special "Green Award" for this particular data centre.

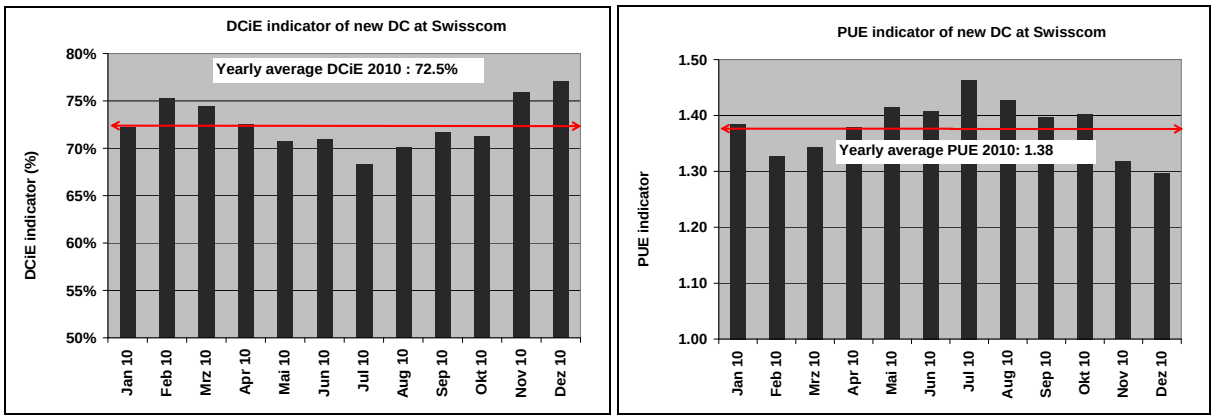


Figure 9: monthly DCiE (left) and reciprocal PUE values (right) of the new DC of Swisscom (canton of Berne) for the year 2010. The positive impact of freecooling is reflected by the higher DCiE values, respectively the lower reciprocal PUE values during most of the year.

6.3 Example of energy efficient DC at TeliaSonera

Haninge DC is one of the largest data centres in TeliaSonera's operations. It was established already in the end of 1980'th and contains today several thousands of servers, data storages, data robots as well as data arrays and network equipment. It was established in the 1980'th and at that time bills and invoices was printed at the same location. The site is constructed as a bunker and by that the level of resistance to intrusion and security and operational availability is high including full power back up capacity based on lead batteries, UPS and diesel generators.

Since then the cooling system has been rebuilt several times and in 2001 indirect free air cooling was introduced, operational up to an outdoor temperature of +7ºC.

In 2007 an increased need for additional cooling and power occurred and a major reconstruction of the sites infrastructure was decided with an estimated budget of 7M€. The power capacity exceeded 3 MW. Since TeliaSonera have had good experiences from direct and indirect free air cooling in combination with bed rock ground cooling a similar solution was designed. At the same time we identified that that there where a huge possibility increasing energy efficiency and lower the total energy consumption. An energy saving potential of ~20-30% was identified.

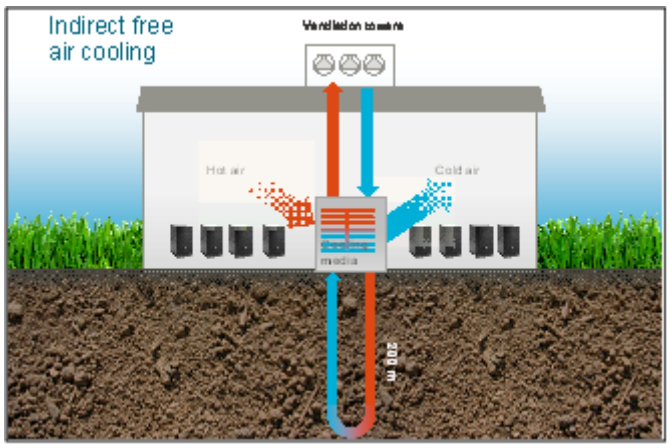


Figure 10: scheme of indirect free cooling for TeliaSonera

The following actions have been performed: two redundant cooling systems have been installed, working entirely independently assuring the cooling of the site. The system have now been up and running for approximately 2 years and covers 100% of the cooling needs up to 14 ºC outdoor temperature – that's equal to 8-10 months of operation in Sweden/year. Between 14 and 21 ºC the indirect free air cooling system is partly faced out. For temperatures above 21ºC the cooling is maintained by ordinary compressor cooling techniques.

The system is constructed in a way which limits the internal energy consumption to a fraction of the energy consumption of Data Centres in general. In combination with some new patented systems and technologies we have increase the cooling capacity with 100% and at the same time a 30% reduction of total energy consumption for the site. Compared to conventional sites Haninge DC is estimated to consume less than 80% of the energy used in a conventional cooling systems. Our opinion is that Haninge DC might be one of the most sustainable conventional Data Centres in the world.

Energy efficiency in Data centres are normally defined as sk PUE values i.e. Total consumed electricity (including Network equipment, cooling, rectifiers, UPS etc) / Electricity used by network equipment such as servers etc.

Globally data centres have an average PUE value of 1.92. Haninge DC had before the reconstruction an PUE value of approximately 1,9 and is expecting an yearly averages of approximately 1,3 – 1,4 after reconstruction. Compared to other data centres with the same equipment load this is extremely good. As a comparison Google data centres has an estimated PUE of approximately 1,2 but they are on the other hand using

standardized specially designed servers and they do not offer collocation possibilities for external customers .

As information it's worth mentioning that during February 2010 the PUE in Haninge DC was as low as 1,14. In addition to the work done in the cooling and ventilation systems a lot of efforts have been made on consolidating and replacing older server installations with virtual server solutions.

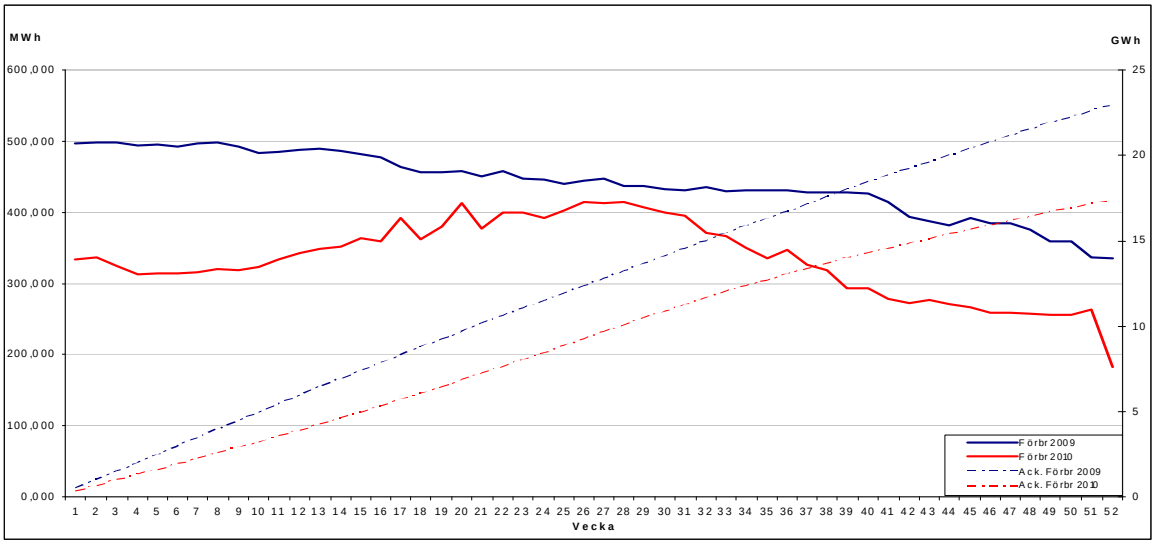


Figure 11: Electricity consumption peer week + annual consumption, 2009 - 2010, Haninge DC.

The results so far shows when comparing 2008 to 2010 electricity consumption has lowered from 26 GWh to 18 GWh on an annual base. And we are not finalized yet. There are still some additional work to be performed, adjustments and fine tuning etc so the final figure will be even lower. Not the least since there are some additional plans to rise the operational temperatures in the data server rooms in combination with a bed rock/ground cooling system to be used during the summer season to secure top cooling capacity.

The achieved results so far is the main reason why the reconstruction of Haninge DC was nominated as one of the most sustainable IT project of the year 2010 in Sweden.

Facts and figures - Haninge DC	
Total area	4200 square meter, 8 halls in secure shelt
Special:	Uses 100% green labelled non fossil based electricity
Cooling capacity:	Cooling production with independent indirect free air cooling 3 MW capacity, extendable to 4.5 MW. Excess heat feed able into district heating system if required
Power	Backup power 4 x 2 MW, N + 1. Yearly electricity consumption (2009): 23 000 MWh
Connectivity:	Offers access integrated with TeliaSonera Services
Project status:	Indirect free air cooling project (14-21ºC) finalized. Additional ground water cooling under planning/test
Expected energy saving:	Achieved energy saving: 7 GWh per year. Additional expected saving: ~1 GWh year (ground water cooling)
Expected PBT:	7 years

7. ETNO ENERGY TASK FORCE LETTERS

7.1 Letter to EC on CoC and VA

The ETNO Energy Task Force is not only focused on the reduction of energy consumption in the network, but also aims to reduce the energy consumption of telecom devices at the customers home. The main focus there is on broadband routers and settop boxes.

For settop boxes the Task Force has been recommending to support the European Code of Conduct for Digital TV Services. Over the past years the ambition level of this Code of Conduct has increased forcing suppliers to reduce the power consumption, especially in the standby mode.

As progress was not quick enough the EU started activites for regulation. Now a group of settop box suppliers and TV companies was preparing a voluntary agreement to avoid regulation. The voluntary agreement contains an target values with an ambition level to cover 90% of the products on the market. In contrast the Code of Conduct wants to set the ambition level such that only the best 10-20% of the market will reach the targets.

The ETNO Energy Task Force was fearing that the Voluntary Agreement (VA) could take away the pressure on industry again to build energy efficient settop boxes as the ambition levels are low. Today the first complex settop boxes e.g. for IP-TV are occurring on the market which allow really low standby power consumption of e.g. < 1 W.

Therefore the ETNO ENGY TF sent a letter to the EU asking to strengthen the role and ambition level of the Code of Conduct for Digital Services instead of the VA.

The EU in person of Mr. Jacek Truszczynski from the European Commission DG Energy took notice of our letter and is now considering to refer to both the Voluntary Agreement and the Code of Conduct as ambition levels the EU requires.

From: Res Witschi, Gianluca Griffa, chairman and co-chairman of Energy Efficiency Task Force, ETNO (European Telecom Network Operators)

etno

European Commission DG Energy
Mr. Jacek Truszczynski

Date	November 8th 2010	Page
Your contact	res.witschi@swisscom.com, gianluca.griffa@telecomitalia.it	1 of 2
Topic	Endorsement of the Voluntary Agreement (VA) on Complex Set Top Boxes	

Dear Mr. Truszczynski

We were noticed about the intention of the European Commission to officially endorse the Voluntary Agreement (VA) on Complex Set Top Boxes (http://www.difgroup.eu/).

ETNO – Energy Task Force would like to express a basic concern about the document, with specific reference to the target values indicated in the latest version of the Agreement.

The allowances for energy consumption indicated in the VA were in fact discussed at the beginning of 2009 in the group dealing with the definition of version 8 of the EU Code of Conduct for Digital TV systems. The two documents were then maintained aligned for the calculation method, but more challenging targets were defined for the Code of Conduct. Nowadays, we detect that the CoC targets are already aligned with the current market products, at least for IP set top boxes; furthermore, these values should be already revised for next Tiers in order to maintain the basic role of the CoC, that should stimulate the market for real improvements.

As a consequence, the higher values contained in the VA cannot act in any way as stimulus for the vendors as they are basically covering 90% of the available products.

ETNO – Energy Task Force would like to propose avoiding endorsing, as European Commission, a second document that is quite misaligned in comparison to the CoC in terms of targets, and not fully updated to the 2010 market reality, to prevent the market will be disoriented by the two parallel documents.

Since at least two years, most of the ETNO Operators have been using the CoC as tool for managing our procurement activities, setting up requirements in our RFIs, and we will keep this approach in the future. Nevertheless, we consider that keeping a unique reference on the European Commission side will be a good help for identifying the real improvement objectives without any misunderstanding.

In addition to the above considerations, ETNO – Energy Task Force would like to draw your attention to the fact that the VA statement that "Each signatory shall ensure compliance of >90% of its STBs, including units of existing models" might give overly weight to the existing models' performance in setting the

targets, could by no means provide any stimulus to the market and cannot qualify as a progress with respect to the present status, depicted by the CoC v8.

ETNO is seriously involved in reducing energy consumption by pursuing the CoC v8 targets and will not be interested in endorsing a specification that provides targets less challenging than the ones set by the CoC more than one year ago.

Kind regards

Res Witschi, Gianluca Griffa, chairman and co-chairman of ETNO Energy Task Force

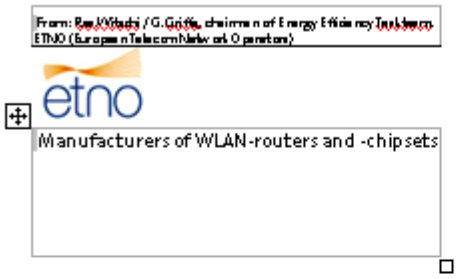
representing the following 15 Telecom Operators: Belgacom, Cable&Wireless, CYTA, Deutsche Telekom, Eircom, KPN, Magyar Telecom, Swisscom, TDC, Telefonica, Telecom Italia, Telenor, Telia Sonera, Telekom Austria, Telekom Slovenije

7.2 Letter to manufacturers of WLAN-routers and chipsets

A relevant part of the customers, consumer organisations and politicians worry about the power consumption and the radiation of WLAN-devices.

WLAN is a basic function of many of our services. However, we strictly aim at reducing its power consumption and radiation as much as technically feasible while not harming the customers experience.

The ETNO Energy Task Force request the suppliers of WLAN-routers and chipsets to implement features in order to address the customers need. In a letter some suggestions for measures to reduce both power consumption and radiation are proposed. But other approaches from the manufacturers allowing the customer to use WLAN with less radiation and energy consumption are very welcome:



Date	November 2010	Page
Your contact	res.wilschi@swisscom.com; gianluca.griffa@telecomitalia.it	1 of 2
Topic	Reduction of power consumption and radiation from WLAN devices	

Dear manufacturers of WLAN-routers and chipsets

A relevant part of the customers, consumer organisations and politicians worry about the power consumption and the radiation of WLAN-devices.
WLAN is a basic function of many of our services. However, we strictly aim at reducing its power consumption and radiation as much as technically feasible while not harming the customers experience.

We as Telecom operators united in the ETNO (European Telecom Network Operators Association) request you to implement features in order to address the customers need. Below some features that should be implemented are listed. But other approaches allowing the customer to use WLAN with less radiation and energy consumption are very welcome:

Features involving the customer:

a) WLAN-off-button: allowing the customer to switch off the WLAN with a button on the router whenever he doesn't need it
b) WLAN-scheduler: allowing the customer to define times with WLAN off in a Web-interface

Automatic features:

c) Disabling of redundant radio channels when they are not needed / when there is no traffic (e.g. in 80211n) without reducing the range
d) Disabling of radio channels in between beacons sent by access points
e) Increasing the beacon interval to a degree with which the establishement of a connection is not noticeable longer for the customer.

Development of new power- and radiation-saving features:

f) Adaption of transmitting power for established connections according to the need of this connection. The transmit power should not affect the time for transmission. If high bandwidth is needed the transmit power should be on the highest level to keep transmit times short.
This function does not affect the transmit power of the beacons which are needed to establish new connections.

g) Beam forming: aiming the beam in the direction of connected devices. This would mean that in certain directions there is lower radiation for the customer. This would also help to increase the range of transmission.

Of course any other approach to address this need of our customers is welcome.
We thank you for your effort towards more environmentally friendly solutions. We are convinced that suppliers addressing these issues early will have a competitive advantage on the telecom market.

Kind regards

Res Witschi, Gianluca Griffa, chairmen of ETNO Energy Task Team

representing the following European telecom operators:

Belgacom, Cable& Wireless, Deutsche Telekom, Eircom, KPN, Magyar Telecom, Swisscom, TDC, Telefonica, Telekom Austria, Telecom Italia, Telenor, Telekom Slovenije, Telia Sonera

7.3 Letter to Vendors to promote energy efficient and temperature-resistant servers

Manufacturers of Servers were asked in a letter to fulfil the most important criteria for servers to allow to run more energy efficient data centers in the future:

1) 80 PLUS Gold (http://www.80plus.org/) or equivalent certificates as ENERGY STAR® Program Requirements for Computer Servers (Version 2, Draft 1)**.** This specification guarantees high energy efficiency of internal energy conversion: >90% (@ power load of 50%).
2) Compliance to Standard ETSI EN 300 019-1-3, Class 3.1. This compliance enables use of fresh-air cooling over extended period of time or even year-round at DC.
3) Declaration of power consumption (W)**.** This declaration enables the inclusion of energy costs by assessment of new servers (TCO: Total cost of ownership), thus promoting servers with low energy consumption. The power consumption measurement and reporting shall be compliant to ENERGY STAR® Program Requirements for Computer Servers (Version 2, Draft 1)
4) Front to back airflow in servers with internal fans. This specification applies also to other devices deployed in Data Centres. Through this standardisation contra-productive air mixing between warm and cold air can be avoided, thus enabling energy efficient cooling.

From: Res Witschi, Gianluca Griffa, chairmen of Energy Efficiency Taskteam, ETNO (European Telecom Network Operators)

Manufacturers of servers

Date	September, 2010	Page
Your contact	res.witschi@swisscom.com, gianluca.griffa@telecomitalia.it	1 of 2
Topic	Promotion of energy efficient and temperature resistant servers	

Dear manufacturers of servers

Most manufacturers have for some years explained their "new" server power consumption is less than previous models and more recently they have claimed that power consumption will not increase beyond some historic preset value. However as form factors have decreased operators see an increase of power densities (W/m2). If no attention is paid on environment-friendly design of servers, a drastic increase of energy consumption at data centres (DC) is expected in the near future. Some figures show that the energy consumption in this area worldwide has doubled from 2000 to 2005 and that this trend continues.

In addition due to the increase of IT power densities optimisation of heat management is crucial for energy efficient and cost effective operation at data centres.

We as Telecom and IT operators united in the ETNO (European Telecom Network Operators Association) request you to apply the following specifications on servers in order to address our needs:

1. 80 PLUS Gold (http://www.80plus.org/) or equivalent certificates as ENERGY STAR® Program Requirements for Computer Servers (Version 2, Draft 1). This specification guarantees high energy efficiency of internal energy conversion: >90% (@ power load of 50%).
2. Compliance to Standard ETSI EN 300 019-1-3, Class 3.1. This compliance enables use of fresh-air cooling over extended period of time or even year-round at DC.
3. Declaration of power consumption (W). This declaration enables the inclusion of energy costs by assessment of new servers (TCO: Total cost of ownership), thus promoting servers with low energy consumption. The power consumption measurement and reporting shall be compliant to ENERGY STAR® Program Requirements for Computer Servers (Version 2, Draft 1)
4. Front to back airflow in servers with internal fans. This specification applies also to other devices deployed in Data Centres. Through this standardisation contra-productive air mixing between warm and cold air can be avoided, thus enabling energy efficient cooling.

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We thank you for your effort towards more environment-friendly servers. We are convinced that suppliers addressing these issues early will have a competitive advantage on the IT market.

Kind regards

Res Witschi, Gianluca Griffa, chairmen of ETNO Energy Task Team
representing the following European telecom operators:

Belgacom, Cable&Wireless, Deutsche Telekom, Eircom, KPN, Magyar Telecom, Orange France Telecom, TDC, Telefonica, Telekom Austria, Telecom Italia, Telenor, Telekom Slovenije, Telia Sonera

PART 2

MAIN ENERGY SAVING PROJECTS FROM SINGLE ETNO ETF MEMBERS

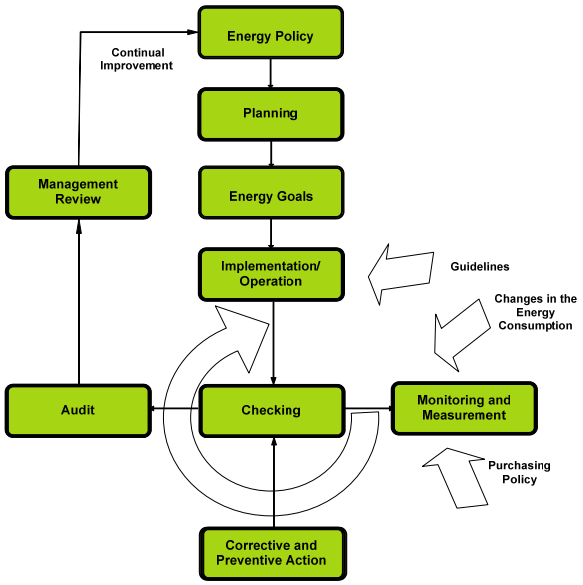
Operator	A1 Telekom Austria
Project / Initiative Name	**A1 Telekom Austria's EMS meeting the EN 16001**
Project Brief Description	Effective management is a crucial issue for the success of any business. For many an Energy Management System is one of the basis sine qua non. EN 16001 can be applied both independently or integrated with other management systems such as quality and environment management. This European Standard specifies the requirements for an Energy Management System to enable to develop and implement a policy, identify significant areas of energy consumption and target reductions. The Energy management system was implemented in A1TA in October 2009.
Project Status	**Energy management system was implemented in A1TA in the EOY 2009**
Expected Energy Saving	**EN 16001 represents the latest best practice in energy management based on standards and initiatives to improve energy efficiency**
Expected PBT	**Immediately**

The Board of the Telekom Austria TA AG had already introduced an Energy Policy in Juni 2008. This was an important step towards a consequent realization of energy efficiency in every primary process and field of the company. With that Energy Policy it was assured that new equipment and services should meet the criteria of energy efficiency. In the energy department the basis for an Energy Management System (EMS) was developed. Every relevant energy consumption was taken into account, the potential of improvements were identified and quantified.

In the next step the A1 Telekom Austria defined an Energy Program, in which the aims, measurements and responsibilities were fixed. The energy consumption is monitored according to the energy carriers, possible improvements and quantitative goals and aims were to be fixed.

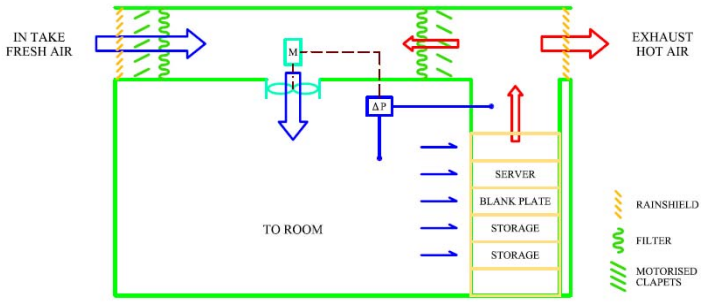
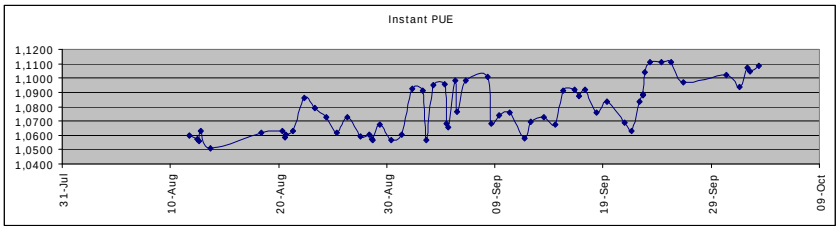
The limiting factor of a Telco is that there is a wide diversity of services and lots of new services to be realized permanently. Besides that the volume of the data and the service platforms are rapidly increasing. Without effective means energy demand would grow enormously and steadily.

So at the beginning you have to start with your home work analyzing the energy flows and the technologies deployed. In best practice examples you develop and scrutinize solutions with less energy demand.



From "Program to Practice", A1TA is committed to a sustainable energy policy. Already in 2007 we created a separate department for energy management. Here we permanently analyze the development of direct and indirect energy costs in the operational business and explore how we can further improve our energy efficiency, for example in our purchasing policy or by making use of innovative technologies. A sustainable concept for the efficient use of energy not only reduces emissions and is therefore climate-friendly, it also cuts costs, thus increasing your company's competitiveness.

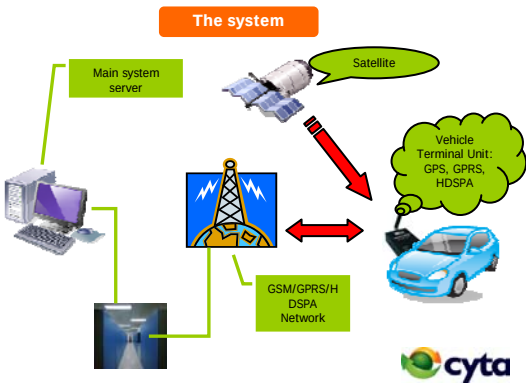
Operator	A1 Telekom Austria
Project / Initiative Name	**A1 Telekom Austria Code of Conduct on Data Centres**
Project Brief Description	The Code of Conduct has been launched as a voluntary initiative by JRC (EU Joint Research Center) for signing and implementation. Its aim was to bring interested stakeholders together, including the coordination of other similar activities by manufacturers, vendors, consultants and utilities. Parties signing up will expect to follow the intent of this Code of Conduct and abide by a set agreed commitments. This Code of Conduct on DC proposes general principals and practical actions to be followed by all parties involved in data centers, operating in the EU, to result in more efficient and economic use of energy, without jeopardizing the reliability and operational continuity of the services provided by data centers. Many data centers operators are simply not aware of the financial, environmental and infrastructure benefits to be gained from improving the energy efficiency of their facilities. **This Code of Conduct aims to:** ▪ develop and promote a set of easily understood metrics to measure the current efficiencies and improvement going forward in conjunction with other industry through leadership. ▪ produce a common set of principles to refer to and work in coordination with other international initiatives. ▪ raise awareness amongst managers, owners, investors,… ▪ create and provide an enabling tool for industry to implement cost-effective energy saving opportunities. ▪ develop practical voluntary commitments which when implemented improve the energy efficiency of data centers and in so doing minimize the TCO. ▪ set energy efficiency targets, for public and corporate data center owners and operators (targets are differentiated according to the size and status of existing data centers, the geographical location, the return of investments, etc). ▪ provides reference for other participants. The values of the Code of Conduct goes beyond the number companies that sign and commit themselves… Efforts to improve efficiency differ from simple energy management practice and low cost solutions, to exploring alternative, energy efficient opportunities before specifying or replacing IT equipment and supporting infrastructure, to designing new highly efficient data centers or upgrading existing ones to very high level of efficiency. **Data centers are designed** ▪ **so as to minimize energy consumption whilst not impacting business performance** ▪ **to allow the optimization of energy efficiency (meeting the operational/service targets)** ▪ **to allow regular and periodic energy monitoring.** **Total facility energy consumption is sum of** ▪ **Main IT equipment (Servers/Storage/Network equipment within the physical DC)** ▪ **Cooling system** ▪ **Miscellaneous infrastructure equipment**
Project Status	**Since EOY 2009 – first of the ETNO members (2010 was the first complete year)**
Expected Energy Saving	**Improve the energy efficiency in DC with the help of the CoC.**
Expected PBT	**Immediately**

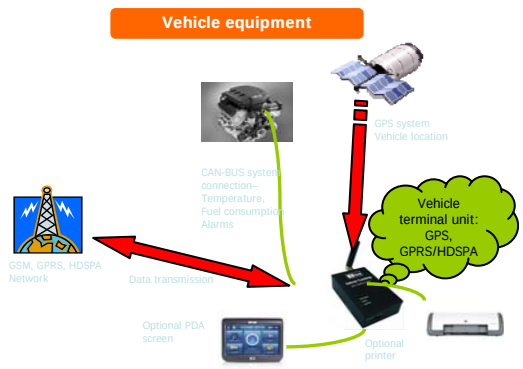
Operator	belgacom
Project / Initiative Name	**Belgacom Proof of Concept: Full Free Air Cooling of Data Centers**
Project Brief Description	This Proof Of Concept (POC) is realized in collaboration with Sun Microsystems and Cisco. It demonstrates that 40% overall data-center energy savings can be realized by introducing the concept of Full Free Air Cooling in combination with ETSI compliant servers, storage and switches. ETSI EN 300 019-1-3 V2.2.2 (2004-07) class 3.1 requires that the environment stays within 10-35 degrees for 90% of the time. During 10% of the time, 5-40 degrees are allowed, and during 1% of the time -5 to 45 degrees are tolerated. **Goals of the project:** 1. Facilitate the implementation of FFA Cooling as mentioned in the EU CoC for Data Centers 2. Urge IT-manufacturers to produce ETSI-NEBS-compliant equipment 3. Urge DC-operators to build ETSI-NEBS-compliant DC's. Thanks to this project FFAC for Datacenters is part of EU Code of Conduct (art 4.3) as best saving practice (5) applicable from 2012. Official launch CoC: 19/11/2008 **Description of the Proof of Concept (POC)** The POC is based on the experience of several European Telecom Operators (e.g. Swisscom, BT, Belgacom) using Full Free Air cooling to substantially reduce the energy consumption in the Telecom Network. A small scale datacenter has been designed and built by Belgacom & Sun Microsystems, and is constructed at the Sun Solution Center in Linlithgow (Scotland). Testing was done from August 11th until October 3rd 2008. During the POC the IT equipment is consuming 8240 Watts. Outside Air is filtered with G4 filters. These filters guarantee > 90% dust capturing. Experience proves that this keeps the environment within ETSI 300-019: art 5.4. (Sand < 30mg/m³, Dust (suspension) < 0.2 mg/m³, Dust (sedimentation) < 1.5 mg/m²h). Maximum pressure drop is 250 Pascal. Filters will have to be replaced approximately twice a year depending on outside conditions.   The regulation ensures a 20°C in the room unless outside temperature is higher or humidity exceeds 90% RH. The average PUE was 1.06 (UPS excluded), ETSI boundaries are respected with a large margin. The concept can be applied to any data-center load density.  The POC is documented on: http://wikis.sun.com/display/freeaircooling/Free+Air+Cooling+Proof+of+Concept
Project Status	**Test Project successful realized in 2008**
Expected Energy Saving	**-40% compared to the traditional cooled Data Centers**
Expected PBT	**Immediately**

Operator	Cable&Wireless Worldwide
Project / Initiative Name	**Cable&Wireless EC Plug Fan Installations**
Project Brief Description	Cable&Wireless Worldwide is a leading global telecoms company providing a wide range of high-quality managed voice, data, hosting and IP-based services and applications to public and private sector customers. It operates data centres and telecommunications network sites around the globe, and these secure technical sites are central to the services it provides Maintaining resilient cooling to the computer rooms to achieve the desired up time is a major contributor to operating costs and environmental impact arising from such facilities. As such, as part of its published environmental commitments, it implemented a programme to improve the energy efficiency of the cooling systems that improves the site's Power Usage Effectiveness (PuE). These mechanical cooling systems have cooling; generation, distribution and controls elements to their energy cycle. The project undertaken aimed specifically at reducing the absorbed fan power per unit of air moved predominately by replacing the fans with a more efficiency style. This is part of an ongoing optimisation programme in the business and future phases will ensure that the power per unit of air is further optimised through enhanced airflow improvements its seeking to implement. The project labelled *EC Plug Fans* retrofitted existing, less efficient AC induction motors with a direct drive EC Plug fan whose duty was better matched to the conditions. The main advantages of the EC Plug fans were; o Retrofitting a component part versus a complete unit results in high resilience during replacement o Has a quick lead time to installation Enables other energy efficiency measures with regards to; o Recalibrate the cooling infrastructure to the changing needs of the room, notably heat density and as such achieve efficiency gains through enhanced air distribution o Achieve mechanical refrigeration efficiencies through better knowledge of refrigeration cycles in equipment Overall, this programme presents attractive capital costs vs. operational benefits. Over 800 electronically commutated (EC) fans, capable of producing fan power equivalent to the old air conditioning equipment, at a reduced current flow. As a result, it has achieved energy savings of 8,221MWh per annum, which, at a current rate of £84 per MWh, saves £690,579 a year. These savings have been verified in a joint post-commissioning exercise. The new fans reduce carbon emissions by 4,415 tonnes per annum, which at £12/tonne of CO2 eligible in the CRC Energy Efficiency Scheme saves some £53,000 each year in the initial phase. There is also reduced operational expenditure on spares and maintenance by virtue this represents a shift towards direct drive technologies.
Project Status	**Deployed 801 fans during 2010**
Expected Energy Saving	**In absolute terms, a saving of 8,221 MWh. Over 80% of units on average delivered a saving of ≥40% with the highest saving individual unit delivering a staggering 72% reduction in power**
Expected PBT	**26 months**

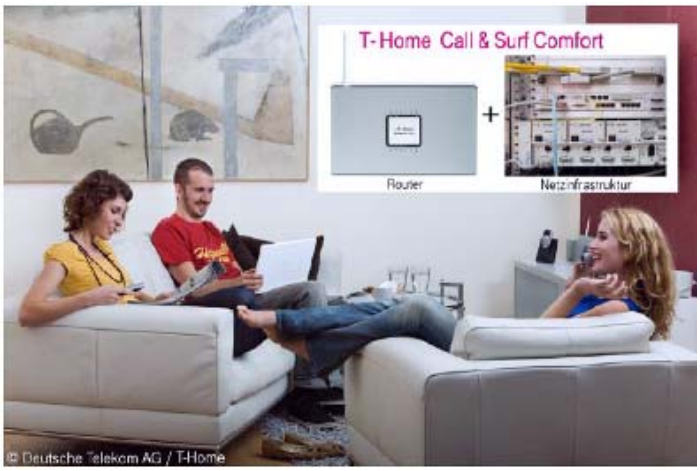
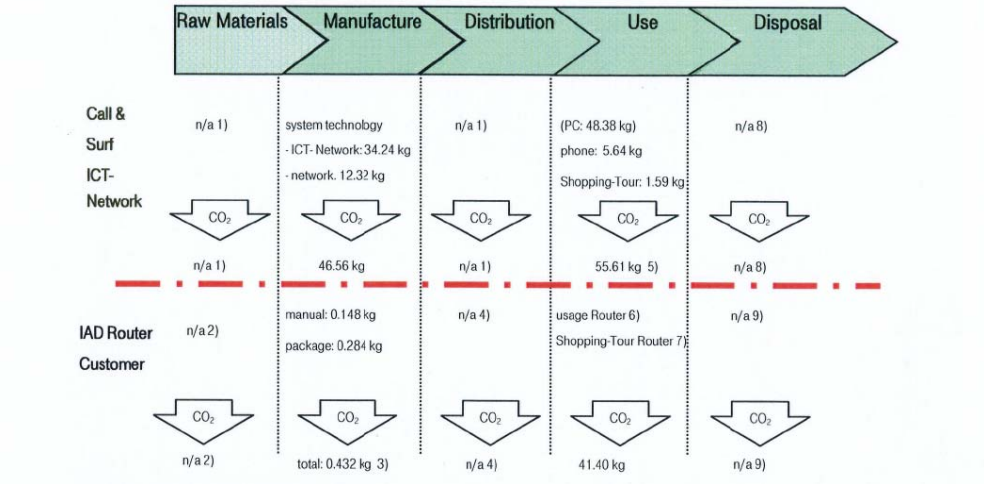
Operator	cyta
Project / Initiative Name	**Cyta Implementation of Vehicle Telematics System on Fleet**
Project Brief Description	**Telematics is** the science of sending, receiving and storing information via telecommunication devices via integrated use of telecommunications and informatics (also known as ICT -Information and Communications Technology).Telematics includes, but is not limited to, the Global Positioning System (GPS) technology integrated with computers and mobile communications technology in automotive navigation systems. Most narrowly, the term has evolved to refer to the use of such systems within road vehicles, in which case the term Vehicle Telematics (VT) may be used. Cyta decided to implement VT System to its fleet concerning the follows:

System Capabilities	**System Advantages**
➢ Navigation	➢ It is a progressive automation tool
➢ Customer mapping	➢ Increases productivity
➢ Driver interactive communication	➢ Improves response times
➢ Monitoring distance travelled and other vehicle parameters (temperature, fuel, velocity etc.)	➢ Improves customer support quality
➢ Emergency alarms	➢ Reduces dead time
➢ Maintenance logs and messages	➢ Capability to log-in/log-out from the vehicle
➢ Vehicle access control	➢ Fast vehicle location
➢ Time keeping	➢ Reduces fuel consumption
➢ Vehicle statistics: start-stop, residence times, open doors, vehicle data etc.	➢ Reduces overspeeding
➢ Vehicle distribution, pool formation and regrouping	➢ Reduces foul use
	➢ Comprises modular design features
	➢ Easily upgradable and expandable

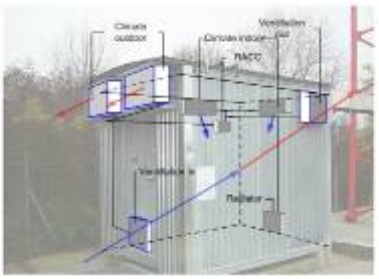




Project Status	**Implementation to 100% of our fleet by the end of 2011**
Expected Energy Saving	➢ **Fuel cost reduction by 10%** ➢ **Maintenance cost reduction by 10%** ➢ **Service team "Dead Time" reduction by 30 min/per day/per team**
Expected PBT	**1 year**

Operator	
Project / Initiative Name	**Deutsche Telekom Case Study for PCF Pilot Project Germany and CO2 balance for "Call & Surf**
Project Brief Description	 **Executive Summary** This case study assesses the carbon footprint for the Call & Surf all-inclusive offer on the T-Home Information and Telecommunications network, and the operation of the Integrated Access Device (IAD) Router Speedport W701V. A basic distinction was made between services generated in systems technology and services used on the customer end. To assess these two areas, both production and operating data was used. The carbon footprint assessment for T-Home's "Call & Surf comfort" all-inclusive offer and the Speedport W701V IAD router concluded that the usage phase of IT equipment is a determining factor in climate impact. While in use, the router's CO_2 emission (up to the LAN interconnection point) has a climate impact comparable with the operation of an ICT network. This calculation was based on the electrical energy factor required for both operating the hardware on the client side and as a production factor for the ICT infrastructure technology. Calculations were based on data from the year 2007. Results are documented below. **Overview and results:** 
Project Status	**Completed**
Expected Energy Saving	**N.A.**
Expected PBT	**N.A.**

Operator	kpn
Project / Initiative Name	**KPN Green ICT Services: The New Way of Working**
Project Brief Description	KPN observes an increasing need in society to be able to work irrespective of time and place. Greater flexibility in working hours has made it possible for many people either to participate, or participate more fully, in the labor market while combining this with personal obligations. Our "New Way of Working" theme targets three interconnected areas: - a new workspace concept - adjustments to the virtual workplace (laptops, conference cards, smart phones, facilities for collaboration and teamwork) - a new approach to working together in which employees are more measured by their results and not by their presence  The New Way of Working benefits the environment as well. Remote working, videoconferencing and other ICT solutions help tackle the (traffic) mobility and travelling problems. If you can choose where and when you work, you can avoid peak-hour traffic or even stay at home. That saves effort, travel time and CO_2 emissions. KPN's New Way of Working program rests on four building blocks: 1. Implementing the New Way of Working at KPN itself 2. Enabling and promoting the New Way of Working among customers 3. Participation in debate with society about the New Way of Working 4. Innovation The impacts and results of implementing the The New Way of Working within KPN in 2010 are: 1. By the end of 2009 KPN has installed 3,500 The New Way of Working working places. In 2010 this increased to 10,400 KPN staff (out of 20,500 in the Netherlands) who work according to The New Way of Working. 2. 15,500 videoconference meetings were held. 3. 74% of KPN staff in the Netherlands were given a personal teleconferencing card, suitable for audiocenferencing and webconferencing. http://www.kpnconferencing.nl/info/default_eng.asp 4. The New Way of Working allowed us to operate with 20,000 fewer square meters of office space. This generated an energy saving of almost 6 per cent for the entire Dutch offices assets. In 2010 KPN has expanded the services it provides by refining the commercial solutions allowing implementation of the New Way of Working. In 2010 Getronics (KPN's brand for the top 500 business clients in the Netherlands) continued its marketing campaign promoting its package of New Way of Working products and services. See http://www.getronics.com/web/show In our CSR report 2010 the approach and results of The New Way of Working program are described http://www.kpn.com/csrreport One of the targets for 2011 is to develop a measuring tool that will enable the measurement of the environmental impacts of services such as the New Way of Working and audio/videoconferencing. KPN will do this project in cooperation with ICT~Office, an industry-wide organization in the Netherlands.
Project Status	**Ongoing (targets 2011 specified in CSR report)**
Expected Energy Saving	**Calculations by measuring tool energy savings**
Expected PBT	**Calculations by measuring tool energy savings**

Operator	**Magyar Telekom**
Project / Initiative Name	**Magyar Telekom Container Fresh Air Cooling**
Project Brief Description	Innovative cooling of T-Mobile base stations with RACC-2 control unit . No. 3 151 Patent The essence of innovation, implemented developments : ➢ Modification of container base stations' split cooling system ➢ Supplementation with free air cooling, alternating operation ➢ Intelligent local software control with RACC 2 (Rubin Air Cooling Control) unit leaving the climate equipment's own control ➢ Applying optimum energy consumption, condition ➢ Automatic emergency ventillation mode ➢ Independent of line power, 48 V DC operation ➢ Standard connection to laptop and remote supervision ➢ Detailed report to NOC (Network Operation Center) on operation status and failures ➢ Remote operation mode, central setup and failure management possibility ➢ Flexible SW modification, firmware setting ➢ Receiving fire alarm, forbidding of air replacement Further developments: ➢ Cooperation with inverter type climate equipments ➢ Communication on IP  Green advantages - environment protection ▪ Less load on environment ▪ 6-8 kW climate equipment input, 0,3 kW ventilator input ▪ Decreased electricity consumption, CO2 release ▪ Longer lifetime – less waste ▪ operating time reduction 80%, 5 times longer lifetime ▪ Less repairs - less fuel consumption ▪ Less operating hours, needs less maintenance and repairs ▪ Visiting a station is approximately 100 km which is reduced by half due to less failure and repairs Failure management ▪ Handling of wrong setting and installation ▪ SW parameter error ▪ Error in permissioning, banning buttons setup ▪ Observation and upgrading obsolete firmware ▪ Error in positioning of temperature sensors ▪ Failure management on the basis of measured data ▪ Split failure ▪ Ventillator failure ▪ Failure of blind inlet opening/closing ▪ Container heat isolation failure, opened door, etc ▪ Failure prevention at extreme situations ▪ At dusty environment emergency ventilation mode is permitted only (over 30 C°) ▪ Extra parametering in noise-sensitive environment
Project Status	**Installed on 950 BTS and in 2011 250 planned**
Expected Energy Saving	**80% ÷compared to the traditional split cooling systems traditional cooling systems**
Expected PBT	**~ 2,5 Years**

Operator	**Magyar Telekom**
Project / Initiative Name	**Magyar Telekom PEM fuel cell application and H2 logistic**
Project Brief Description	What a PEM fuel cell application is doing in a BTS, in a container? Serves as a back up source on the 54V DC bus. No more neccessary for big lead-acid batteries (200-2000 kgs lead!). 35-40 celsius is possible inside the container instead of 25 celsius. Temperature range of Container Frech Air Cooling is much more wider. Only some conventional cooling is neccessary.. Using direct heat drain from radio frames, no convetional cooling is neccessary. To solve the H2 logistic, PEM engine operates as a diesel generator at the BTS. How works the H2 logistic? Some site has 3+3pcs of 200 bar changeable cylinders (4,8kgs H2). The first 3 are running out of H2. If they are out it is signalled at the Network Operation Center where the operator orders the H2 transporter to bring 3 filled cylinders to the site from a Depo. Further information is given about the time left for transportation and replacement. Or some site has 2pcs of 350bar fillable cylinders (2kgs H2). If they are on 60% hydrogen level, it is signalled at Network Operation Center where the operator orders to fill the cylinders from a mobil H2 filling station (a truck with 200bar and 430bar H2). And time informations also are given.  Changeable cylinders and H2 manipulator  Outdoor PEM and cylinders  PEM engine  Direct heat drain  H2 manipulator with filleable cylinders and refuelling joint
Project Status	**Installed on 5 sites with fillable cylinders, on 5 sites with changeable cylinders, on 1 site with changeable cylinders and with direct heat drain, all as pilots. Now no more in plans.**
Expected Energy Saving	**100% from cooling energy (+ no lead + no diesel)**
Expected PBT	**~ 4 Years**

Operator	**Magyar Telekom**
Project / Initiative Name	**Magyar Telekom Data Center Hybrid Fresh Air Cooling**
Project Brief Description	o A new application field of RACC2 (Rubin Air Cooling Control). It was successfully used in 950 container. Now we use in data centers. o It works from autumn to spring (when outside air is cool). o The conventional high power cooling systems remain on spot. But the full system is under the control of RACC2. o No new fans, we use the fans of existing cooling machines. o A lot of new piping, air volume controlling are necessary. o 5-10 Celsius is necessary between outside and inside. o We also use direct heat drain method. o All places are different from each other. o A lot of special situation have to solve o First financial results are very good, 400 € / month /data center less electric energy cost.  New role of RACC2 in data center  New pipeing  Controlling under the floor  New way for air
Project Status	**Installed in 1 Data Center and 2 places under construction and in 2011 20 planned**
Expected Energy Saving	**30% ÷compared to the traditional cooling systems**
Expected PBT	**~ 1-2 Years**

Operator

france telecom orange

Project / Initiative Name

Orange Green Datacenters: enlarging climatic ranges

Project Brief Description

Experience shows that as a result of lack of reliability data given by IT vendors to illustrate the differences of the preferred temperature range and the working temperature range, operators use to keep narrow temperature and humidity ranges: temperature: 19 – 21 °C; humidity: 45 – 55 %. In order to achieve such values, it is necessary to install very high power air conditioning systems, which leads to huge energy consumptions.
In order to change those requirements and look for power consumption improvement, a typical France Telecom datacenter has been studied during several months.
The experiment has been performed in several steps:

- current data collection, temperature and energy consumption measurements have been measured without modifying the existing settings
- maximum temperature and hygrometry in the room has been gradually increased. Temperature measurements, electrical consumption and equipment failure rates have been recorded during several months following these changes

- 1st new settings (modified values appeared in bold characters)

	Previous settings	*1st new settings*
Cooling unit start-up	*20-24°C*	***22-26°C***
Dehumidifier start-up	*50-65 %*	***60-75%***
Humidifier start-up	*45-50%*	***35-40%***
Winter/summer switching point	*17°C*	***19°C***

- 2nd new settings

	2nd new settings
Cooling unit start-up	***24-28°C***
Dehumidifier start-up	*60-75%*
Humidifier start-up	***30-35%***
Winter/summer switching point	*19°C*

These second settings have led to a reduction of energy consumption of 20% compared to the current settings.

Time to repair (MTTR)
The time to repair is defined as the interval between a total failure of the air conditioning system (with no redundancy) and the time at which the temperature in the room reaches a maximal functional limit (30°C in this case).

When a very high power is installed in a room, this time can be very short. Estimation (both based on computation and observation of real events) have been performed. The time to repair remains acceptable for the studied room but can be critical for other rooms. This shows that there are limits to extend climatic ranges due to operational requirements.

Temperature	***22°C (initial settings)***	***24°C (1st new settings)***	***26°C (2nd new settings***
MTTR in other room	*1 >>h*	*>1 h*	*> 30 min*
MTTR in room studied	*1>>h*	*>1 h*	*> 55 min*

The experience shows that it is possible and easy to operate at some wider temperature and relative humidity ranges without decreasing the reliability, and with an important reduction of the energy consumption.

Project Status

Progressive roll out in France Telecom datacenters

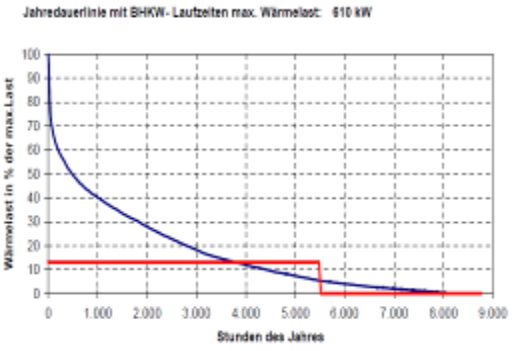
Expected Energy Saving

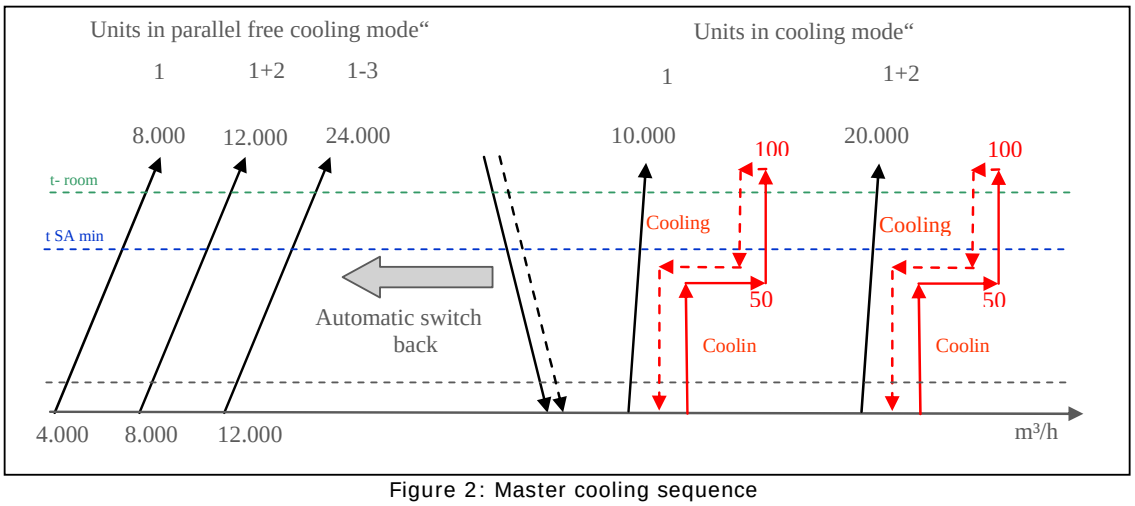
The total energy savings can reach 20% of power consumption due to cooling

Expected PBT

N.A. - No cost

Operator	france telecom / orange
Project / Initiative Name	**Orange ORYX project: sustainable solar base stations program**
Project Brief Description	The objective of the project is to design and deploy innovative engineering solutions in Africa, Middle East and Asia (AMEA) France Telecom Orange mobile network with three major objectives: • Reduce operating costs • Improve quality of service • Develop sustainable products with a preference to renewable energy To date, 1354 solar Base Transmission Stations (BTS) have been ordered and 1000 are operating across 16 countries in the AMEA region. The roll out of the solar BTS sites has reached around one-third of eligible sites in these regions, giving potential coverage to 2.2 million people. The sustainable benefits of the programme include: • Enhanced digital inclusion by extending mobile networks to rural areas via a low cost solution; stimulating local economies by providing jobs, allowing ecosystems of local vendors to develop and giving locals access to services such as mobile banking • Improved quality of the network service, eliminating the power cuts and air-conditioning failures associated with Genset • Notable environmental benefits tied to Orange's commitment to cut its CO2 footprint by 20 percent between 2006 and 2020; reduce FT Group's energy consumption by 15 percent between 2006 and 2020; and for 25 percent of AMEA energy to come from solar energy by 2015 (for new mobile sites). The programme started in Senegal in 2007 and now covers 16 countries. Orange aims to power 80 percent of the rural off-grid radio sites with solar solutions by 2015. Social aspects: for each BTS plant producing an average surplus of 25 percent, Orange will evaluate case by case uses for this energy to meet local needs, providing further benefits to communities. For example, in collaboration with the Orange Foundation, excess solar power has been used to launch a project to power a healthcare centre in Niger from a nearby solar plant. This project combines Orange's technology, Corporate Social Responsibility policy, and patronage to improve the living conditions of surrounding populations. The energy produced provides lighting, fans, electrical sockets and refrigerator power for vaccine storage. 
Project Status	**Operating and roll out on going**
Expected Energy Saving	**Total yearly results:** **- 6.6 GWh saving (solar energy production)** **- more than 30,000 tons of CO2 saving** **- 11 million litres of fuel saving**
Expected PBT	**<2 years, depending of countries and climate**

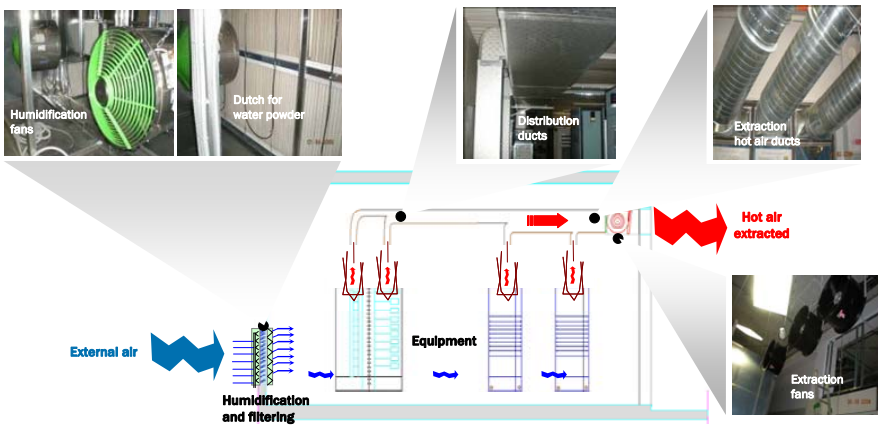
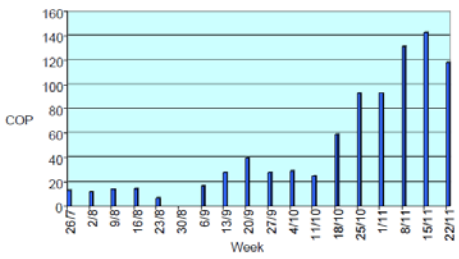
Operator	Power & Air — Deutsche Telekom Group
Project / Initiative Name	**PASM Cogeneration unit project**
Project Brief Description	At the DTAG group, PASM is responsible for providing energy-based products for safeguarding availability at reasonable prices. As a result, overall energy efficiency has improved considerably. At the same time, research is carried out on an ongoing basis in order to develop innovative solutions for supplying with energy. The use of cogeneration units is one such solution. **Basis:** Generally speaking, it can be assumed that the use of cogeneration units can achieve a 37% reduction in primary energy consumption. Concept studies carried out in conjunction with STRABAG-PFS showed that mixed-use buildings (offices and technical systems) can generate their own low-cost electricity using heat-controlled cogeneration units. The studies were produced for mini cogeneration units with a nominal electrical output <=50 kW and form the basis for this specification. According to the results, a total of 10 cogeneration units were installed as pilot systems. The outputs of the various units were as follows: 3 x 50 kW (el); 2 x 25 kW (el); 3 x 15 kW (el);2 x 5 kW (el) The systems were operated alongside the general electricity network. In this case, the basic electrical load in the building is so high that no electricity is fed back into the general electricity network. **Implementation:** In this particular pilot project, 100% of the waste heat from the cogeneration units is used for heating and producing hot water for the buildings. The units operate on a heat-controlled basis only, i.e. they are operational only if there is a need for heating energy. The following diagram shows how a cogeneration system works: Alternatively, a peak-load management system can be installed on two units to reduce sourcing peaks from the general electricity network. The waste heat generated outside the heating period can then be used for producing warm water. If there is no need for heating, the excess heat is dissipated with the help of an emergency cooling circuit with a plate heat exchanger which takes cooling water from the drinking water supply and then feeds it into the building's sewerage system.   Example: Cogeneration unit (50 kW el.) in Regensburg Cogeneration unit in Regensburg, Bajuwarenstr. 4 El. output: 50 kW Therm. output: 81 kW Make / type: ESS, Vitoblock 200, EM-50/81
Project Status	**Deployed on 10 Central Offices at the end of 2010**
Expected Energy Saving	**The ten cogeneration units supply 1,539 MWh of electricity per year. Their thermal energy output is 2,790 MWh per year. This results in a total annual CO2 reduction *) of approx. 959 t/a.**
Expected PBT	**~ 3-5 Years (if applied to CO with office to use waste heat)**

Operator	Power & Air — Deutsche Telekom Group
Project	**PASM ETS 300 project**
Project Brief Description	As part of the "ETS 300 ventilation and air-conditioning project", the Munich-based company "PASM Power and Air Condition Solution Management GmbH & Co. KG" optimized the energy consumption of the ventilation and air-conditioning systems used to cool Deutsche Telekom AG's telecommunications rooms. The aim of the project was to reduce the energy consumption of existing compact ventilation and air-conditioning units used for cooling and maintaining air flow to an economically feasible minimum within the threshold range of the ETS 300 climate model. **Basis:** Since the early 1990s, the telecommunications rooms concerned have been cooled with specially designed compact ventilation and air-conditioning units operating in mixed-air mode with a constant air quantity and a supply-air temperature of 18°C. Over the course of a year, they operate exclusively in free cooling mode for 95% percent of the time. When outdoor temperatures are above 21°C, an integrated cooling system ensured a constant supply-air temperature of 21°C.  Figure 1: Compact ventilation and air-conditioning units **Solution:** A new self optimizing control system was developed which automatically adjusts the required air quantity to the current cooling load and permanently maintains the technical rooms within the upper threshold range of the ETS 300 019-1-3 climate model, Figure 2: Master cooling sequence +33°C at the room measuring point. The distribution of air in the technical room was optimized to ensure that all technical communication systems were properly cooled. Following the optimization, the intention was for the temperature difference between the room measuring points to be approximately 2 Kelvin.  Figure 2: Master cooling sequence
Project Status	**Deployed on 2000 Central Offices at the end of 2010**
Expected Energy Saving	**The energy consumption of the ventilation and air-conditioning systems was reduced by an average of 67%. The COP of the compact units improved from 7.4 to 22.6. The optimization cost around € 2,800 per unit**
Expected PBT	**< 3 Years**

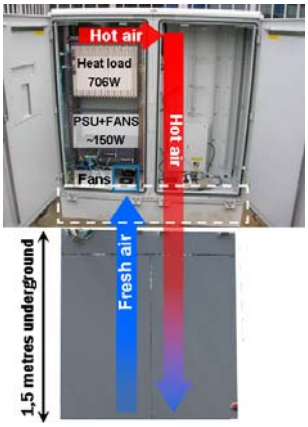
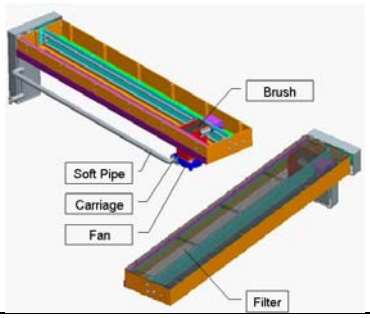
Operator	Power & Air — Deutsche Telekom Group
Project / Initiative Name	**PASM Innovation Program Project for FCs & H2 in DT fixed network**
Project Brief Description	Demonstration systems for availability assurance of the Telekom fixed network with integrated fuel cell systems will be set up and tested with this project. The objective is to increase efficiency and reduce costs and CO_2 emissions. The fuel cells will also be used in a virtual power plant for providing minute reserves and for internal peak load management. **Basis:** The FC system technology supplies (among others) the telecommunication system interruption-free with 48V/60 V output voltage. The compact system consisting of rectifiers, fuel cells, H_2 infrastructure and controllers can replace the existing rectifiers and batteries, while also ensuring load optimization. The integrated complete solution covers the following operational applications: **1. Normal operation** The consumers are supplied via the rectifiers. **2. Power failure** The FC assumes the power supply for the respective consumers. **3. Minutes reserve** The minutes reserve is requested by a power grid operator. The system's controller receives a signal from an external control cabinet with the request. The rectifiers subsequently reduce their voltage so that the FC assumes the power supply (full power). The controller sends information on the time, period of use and elec. power generated to the external control cabinet. **4. Peak load management system** A building's electricity rate very much depends on the maximum load peak. To reduce this peak load and therefore the electricity costs, the maximum load peaks must not exceed a specified value. The controller receives the following information from the electricity meter for this: ▪ Interval (synchronization pulse) ▪ Actual power consumption (meter pulses per kWh). In acc. with these signals the controller calculates the actual power and sends the power requirements to the FC. The FC therefore works parallel with the rectifiers and delivers a power level calculated by the controller.  Fig. 1: Compact outdoor fuel cell system with connection to building  Fig. 2: Modular setup fuel cells in outdoor container **Implementation:** In this pilot project a total of 12 compact fuel cell systems in different power groups (13 – 28 kW) will be installed by 2012. Both indoor and outdoor systems will be tested. **Results:** 5 systems are currently in operation. No faults worth mentioning have yet occurred. The 12 FC systems replace approx. 50 tons of lead batteries.
Project Status	**Deployed on 5 Central Offices at the end of 2010**
Expected Energy Saving	**The 12 FC systems replace approx. 50 tons of lead batteries.**
Expected PBT	**Not possible**

Operator	swisscom
Project / Initiative Name	**Swisscom Green ICT: Customer experience chain**
Project Brief Description	The climate protection potential of Green ICT is known to be approximately five times bigger than the carbon emissions from the ICT branch. This is one of the reasons why telecom operators should motivate their customers for the use of Green ICT services. Futher reasons are: o customers improve their efficiency and their way of collaboration o customers save costs o the work-life-balance of their employees are improved o customers improve their environmental image Therefore Swisscom has created a customer experience chain on Green ICT with 5 steps: 1. The sales person can check with the Green ICT affinity tool if a customer is qualified for Green ICT services. This depends e.g. if the customer has many different sites, if a huge part of the employees are mobile workers and if he runs many IT servers. 2. With the so called Green ICT Check (www.swisscom.ch/green-ict) the customer can check his potential for savings with few clicks. He receives a detailed report on his potential to save CO2, electricity, costs and travel time:  3. When the customer is interested he can receive consulting either from the sales person or from special consultants with the “Green ICT audit”. 4. The customer can then choose from a whole portfolio of climate friendly services. These services are marked with a label from the NGO mycliamte which is well trusted in the field of climate protection. So far approximately 15 services have been labeled with 10 different labels. The background of the labels is described on a public website www.swisscom.ch/myclimate .  5. Finally the customer can receive a certificate of his CO2- and electricity-savings which is based on a calculation tool validated by the NGO myclimate.
Project Status	**Created 163 Sales-Leads in the Corporate Business Unit in 2010**
Expected Energy Saving	**121 Mio Euro turnover on labelled climate-friendly services**
Expected PBT	**Not specified**

Operator	TDC
Project / Initiative Name	**TDC PSTN Defragmentation**
Project Brief Description	Depending on how the operator has handled the situation since customers began switching from PSTN to Broadband or Mobile, the power savings potential is often stuck in the remaining infrastructure. The reason for this lies in the way the exchange installation is constructed and the random way customers are switching to new technology. Often the equipment is powered in blocks of 128 customers and therefore you can't power down a section as long as one single customer is still there - unless you choose to proactively move the remaining customers to new PSTN equipment using less power and in a consolidated manner (defragmentation) or maybe to a completely new platform (Mobile, CoIP, BB PSTN or??). The best way forward is up to the individual operator to choose. The way to approach this task is the way to success and a good Business Case (BC). You must make a very thorough case study of the process and the time used to move the remaining customers. It is of the utmost importance that the allowed time used on moving a customer is as low as possible. And the way of achieving this is by addressing the task as if it was a factory line task. Since this is not rocket science and therefore demands no competences at all, you must use employees as low skilled as possible and with the greatest liking to the task. By doing so, you will have the fastest and cheapest labour. In TDC, using this strategy, we lowered this time by more than 200% and thereby improved the BC dramatically. Another important area is to calculate or measure the amount of power saved locally and to make the best BC overall. Positive aspects of this project: • No IT development and no reaction time in performing the task • No specific skills/training and no ordered equipment • Less cooling and ventilation and less equipment to operate afterwards • Power/money saved and less new power and cooling installations • Saves square feet in the exchange building • A clearer cross connector section and fewer errors 
Project Status	**Ongoing – mainly used as buffer work in 2010**
Expected Energy Saving	**Depending on local situation – in TDC up to 2/3 on the platform**
Expected PBT	**~12 month**

Operator	TELECOM ITALIA
Project / Initiative Name	**Telecom Italia EFFC (Extraction Full Free Cooling)**
Project Brief Description	Free-cooling consists in the direct use of external air to cool environment. Temperature of external air can be reduced by injecting water spray if the external humidity is lower than 100%. This is called the adiabatic free-cooling. The adiabatic free-cooling system (called in Telecom Italia as EFFC – Extraction Full Free Cooling) can therefore increase the number of days when the free cooling solution is used (it could even be all the year in the best case), further reducing the use of mechanical air conditioning. This helps to reduce the primary energy requirements as well as the electricity bills.  The system was realized in the Telecom Italia Test Plant that reproduce a TLC Central Office with around 120 kW power consumption, 300 mq, 150 racks and 200 systems The main advantages of the EFFC are the following: o room cooling without the use of traditional conditioning systems o no syntetic gas (that contribute to the “greenhouse effect”) o low energy consumption, no refrigerants o capital costs reduced by a factor 3 to 4 o extremely low maintenance OPEX (cleaning/change of filters, typically once a year, maximum two; control of the fans) o Improved comfort for maintenance staff members: o room temperature between 22 and 25°C for most of the year o during hot summer days room temperature comparable to outside temperature (feelings of improved comfort due to indoor air movement caused by fans). o lower failure rate of network equipment o yearly average room temperature (ca. 25°C) lower than today o the flexibility of the system allow the applicability to a large number of Central Offices (and, in the future, it can also be applied to Data Centres) • **COP = coefficient of performance** $$COP = \frac{E_{sys}}{E_{fan} + E_h + E_{cond} + E_{H2Oeq}}\Bigg|_{t_1}^{t_2}$$ • E_{sys} = energy consumption of the TLC systems • E_{fan} = energy consumption of extraction fans • E_h = energy consumption of humidifier • E_{cond} = energy consumption of supplementary traditional system • E_{H2Oeq} = energy equivalent of water consumption  On the other hand, the main attention points are the following: o noise level (in can of course be reduced through the adoption of noise reduction systems) o reduced air flow if filters are not maintained
Project Status	**Deployed on 400 Central Offices at the end of 2010**
Expected Energy Saving	**-80% ÷ -90% compared to the traditional cooling systems**
Expected PBT	**~ 3 Years (if applied to a CO with air conditioning only)**

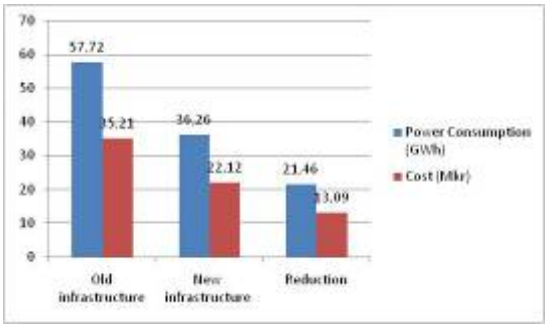
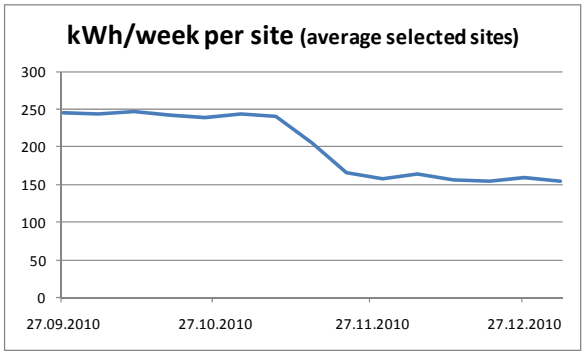
Operator	TELECOM ITALIA
Project / Initiative Name	**Telecom Italia Green (Ecolabel)**
Project Brief Description	After defining a Policy on “Green Procurement”, to purchase lower environmental impact goods and services , Telecom Italia realized its first line of environmentally friendly products. Telecom Italia’s new equipment, designed to limit the impact on the environment and which meet specific energy efficiency requirements, will be covered by the mark “Telecom Italia Green” and will be given, directly in the product package, by a special Environmental Statement.. The brand name “Telecom Italia Green” was thus designed to characterize the product as part of a line with lower environmental impact  The first product with the mark ”Telecom Italia Green” is the new “Access Gateway” for ADSL. The benefits in term of eco-efficiency are significant and the product will be installed in large quantities (over 500,000 pieces) from March 2011 at the homes of Customers of Telecom Italia. In the use phase the product allows mean savings of more than 40% of electrical energy, corresponding to the same amount of reduction of greenhouse gases (CO2 equivalent), in comparison to a previous generation product deployed by Telecom Italia and provided with the same functionalities As example, the calculated emissions savings referred to 500.000 pieces corresponds to keep 5700 cars inactive for one year, or create a wood composed by 14700 trees
Project Status	**Over 500,000 devices installed during 2011**
Expected Energy Saving	**-40% of electrical energy compared to previous generation product**
Expected PBT	**Not specified**

Operator	TELECOM ITALIA
Project / Initiative Name	**Telecom Italia Trial Cooling FTTCab**
Project Brief Description	Telecom Italia has started since 2008 a trial on innovative cooling solutions for Fiber To The Cabinet (FTTCab) deployments. The activity is performed in cooperation with Huawei in the Turin premises. The goal of the trial is to: o analyse the cooling efficiency of three innovative solutions for FTTCab architecture (with up to 400 VDSL2 lines) o Free Cooling with static filter o Free Cooling with self cleaning Cabinet o Underground Cooling o Monitor the state of the filters and the fan noise for the Free Cooling cabinets o Collect "field" experience about several topics (permissions, digging time, unforeseen difficulties, etc..)    Concerning the Underground Cooling Cabinet, the hot air coming from the heat load is brought underground at a depth of 1,5 meters. During its underground passage, the air progressively transfers its heat to the soil. The Underground Cooling Cabinet installation process requires a key preliminary activity, aimed at carefully analyzing the ground where the digging will be performed. In particular, it must be verified the absence of other services, such as waterworks, medium/high voltage cables or gas pipelines. The external Cabinet dimensions are: (W x H x D): 1400 x 1600 x 400 mm. The smart and easy cooling strategy of the system allows a resultant Coefficient Of Performance (COP, evaluated as the total power consumption of the Cabinet divided by the power consumption of the cooling system) of around 60. During the summer period, with a load of 820W, the internal temperature of the Cabinet has never exceeded 60°C. Concerning the two Free Cooling Cabinets, the internal power is dissipated with four fans that take away the hot air through the holes located in the upper side of the front door. The fresh air is instead taken by depression from the lower side of the front door (filters are used). The difference between such two Cabinets is that one has a "traditional" static filter, while the other (installed since 2010) has filter unit is composed by a filter, a carriage with a small centrifugal fan on its bottom and a brush on its top, a soft pipe connecting the end of centrifugal fan air outlet to a hole on the surface of the cabinet, and a driving motor. The brush softly touches the bottom surface of the filter.  When the external fresh air enters into the cabinet, the dirt is stopped by the filter and sticks on the lower surface of the filter. The driving motor periodically operates and moves the carriage forward and back along one axis. During the carriage moving forward and back, the brush on its top brushes the filter; at the same time the centrifugal fan on its bottom operates and drives dirt into the carriage and through the soft pipe blowing it away from the cabinet through the other end of the soft pipe. The COP of the two Free Cooling Cabinet is roughly 30. During the summer period, with a load of 820W, the internal temperature of the Cabinet with the self cleaning filter has never exceeded 60°C.
Project Status	**Trial with three cabinets started in 2008, currently ongoing**
Expected Energy Saving	**COP of 60 for the Underground Cooling Cabinet, 30 for the Free Cooling**
Expected PBT	**Not specified**

Operator	Telefónica
Project / Initiative Name	**Telefónica Green Datacentre Virtualization and equipment optimization**
Project Brief Description	Telefónica has several data centers in Europe and especially in Spain. This project consisted in an energy efficiency project for data centers leaded by the R&D team in Spain in one of the major major Data Centre in Spain (Emilio Vargas) in order to eliminate all the non-working servers and re-use sub-used equipment. There were analysed 860 equipment along 2010, removing 517 equipment. After this, subsequent virtualization of the required capacity was developed. The supplier of the new technology was DELL and eight (8) servers Dell Smart Energy were installed. The investment of the project including new servers, back up-hardware and software licenses was around 117.500 €. During 2010, this project generated savings of around 732.000 KWh/ year. This projects turned to be one of best practices in order to promote energy efficiency in data centres in Telefónica. This is part of our commitment in the signature of the Code Of Conduct for Energy Efficiency in Data Centres un Europe. Old Data-Centre equipment  New Data-Centre equipment 
Project Status	**Project completed**
Expected Energy Saving	**732.000 KWh/ year**
Expected PBT	**~ 1-2 Years**

Operator	Telefónica
Project / Initiative Name	**Telefónica Ireland Smart Metering in Mobile Networks**
Project Brief Description	Telefónica has an energy efficiency strategy which fosters the development of projects aiming to reduce energy consumption in networks in the Group. One of the major projects which have being developed in Europe is the smart metering program in UK in 2008 – 2009, with more than 2,3 million euros in investment in 7,000 electricity smart meters rolled out in company cell sites, offices and retail outlets over the last three years. During 2010, Ireland underpinned the complete energy strategy of the country with a Smart Metering project. This initiative can accurately measure electricity consumption in the network. It is anticipated an electricity consumption reduction by approx 7,500,000 kWh per annum when meters are rolled out across the complete network. During 2010, 900 cell sites were equipped by smart metering across the Irish mobile network. These devices remotely monitor and report on the electricity consumption at each site. This has allowed to identify sites where energy invoicing was higher that measured. This project consists on an important step towards a better energy management process in Ireland and Telefónica operations. “What can me measured can be managed”. The opex savings for Ireland in 2010 reached the 1,2 million euros.
Project Status	**900 cell sites in Ireland with Smart Metering**
Expected Energy Saving	**Annual savings of approx. 7,000.000 kWh per year**
Expected PBT	**~ 1-2 Years**

Operator	Telekom Slovenije
Project / Initiative Name	**Telekom Slovenije "URE" project (Efficient Use of Energy)**
Project Brief Description	**Project Brief Description**: Efficient Use of Energy is one of the key objectives of Telekom Slovenije, d.d. – both a business and an environmental one. It is our vision to (a) establish control over energy consumption (b) reduce energy consumption (c) start production of energy from renewable sources and (d) be in position to sell CO2 coupons in the future. Our key objectives are (a) reduction of energy consumption (b) reduction of CO_2 emissions and (c) energy cost savings. ETNO benchmarks showing space for improvement in energy efficiency were one of the key drivers for decision to start with the project. Possibility of co-funding of these activities from Slovenian and European Funds were an enabler for the decision as well. As we are an ISO 14001 certified company, more detailed goals, objectives, targets and programs are specified, progress is measured and results published in the CSR reports. Validity of the report is checked annually towards GRI guidelines. **Key measures in the "URE" project** ***a. Temperature range increase in the object where technology is placed*** Instructions have been given to increase temperature range of operations of the equipment, with separate temperature regimes for summer and winter and for key layers of the network. The upper limit has been set to 26 degrees, while the lower to 17 degrees. Field trails (in the hottest southwestern part of the country) did not show any decrease in equipment performances so far. ***b. Renewable sources of energy*** The decision is to start with photovoltaics. A trail installation will be an upgradeable 50.000 € power plant in the location with most hours of sun in the southwestern Slovenia. Due to subsidized selling of electrical energy to the grid for 15 years, a payback period of 8 years is planned. ***c. IR Energy Review*** Infrared /thermal/ energy review of large buildings started in the late 2010 to identify spots with highest loses of energy. Measures where determined and action plan how to lower the costs of heating has been prepared. Activities continue in 2011. ***d. Economical Lighting*** Some on-site analysis of the lighting in the buildings has been done. Decision is being finalized among T5 and LED lightning. ***e. Other energy savings*** 1) All PCs are now put into hibernation mode after shorter period of inactivity. 2) Streamlining of technical equipment (discarding mainly TDM equipment no longer in use) has started. 3) Smart metering of consumption on objects with technology is being installed on objects were reconstruction/renewal activities are underway since mid 2009 (project still running). 4) Plan for one object with passive cooling (as presented during ETNO meeting in Bern) was prepared – realization planed before end 2011. Not as part of this project: Workforce management project (phase 1: Mobile office; related to Fleet Management) with the result of less kilometers driven, less liters used and less emission made (oils consumption down 5% in 2010 compared to 2009). Not as part of this project: First totally energy independent GSM/UMTS base stations (wind plus solar panels) in regular use in Slovenia. As most of the project activities started only in Fall 2010, so most project results will fall into 2011. But an encouraging sign: Since the start of the systematic activities in September 2010 in all but one month consumption was lower than in the same month one year ago.
Project Status	**Ongoing (results reported in quarterly company & group reports and in the annual CSR report).**
Expected Energy Saving	**N.A.**
Expected PBT	**N.A.**

Operator	telenor
Project / Initiative Name	**Telenor Norway - The BRAIN Program** **Broadband All IP Network**
Project Brief Description	Telenor is now doing a major upgrade of its Norwegian mobile service infrastructure. All the equipment, including the PS Core network and the RAN with controllers, at around 6500 sites across Norway, including offshore installations in the North Sea and Svalbard, will be replaced before 2012. Through this project we are establishing a mobile network to meet the future needs of our customers with respect to coverage, high capacity and speed. Since the new equipment is much more energy efficient compared to the existing installations, we can benefit from huge energy consumption savings. In June 2010 we estimated our total potential reduction [1]to be in the range of 30 – 40 % as shown in the figure below.  ***Note 1**. Cost saving calculation based on an average cost pr kWh at NOK 0.61(average 2009 figure)* ***Note 2**. Estimated figures are based on simplified calculations, i.e. only 2G and 3G base stations are taken into considerations.* ***Note 3**. Calculations are based on average configurations of cabinets.* ***Note 4**. Changes in heating or cooling are not taken into consideration.* Based on actual measurements before and after the swap we have verified our initial estimates as shown below. This figure shows the average total reduction of power consumption, approximately 30 %, for a limited selection of various typical site configurations. All of these sites were swapped in middle of November 2011, with instant reduction on energy consumption. 
Project Status	**The BRAIN Program is in full operation and by May 1st 2011 we have swapped approx 50 % of all our sites in Norway.**
Expected Energy Saving	**Expected energy savings are expected to be approx 20 GWh/yr.**
Expected PBT	**N.A.**

[1] See Note 1 – 4.

Operator	TeliaSonera
Project / Initiative Name	**TeliaSonera in Sweden – Replacement of halogen lamps with LED as positioning lights in masts**
Project Brief Description	TeliaSonera in Sweden has a number of masts for fixed and mobile communication. The normal height for a mast can vary from some few meters up to 350 meters. In average a mast is approximately between 50-100 meters. As part of regulation we are obliged to have at least one lamp in each mast as a guide and warning for flights and helicopters. Previously the lamp type used has been of halogen type with an average energy consumption of approximately 115W. Each of these lamps has a life time of approximately 3-4 years and to verify that the lamps are working properly energy consumption are monitored remotely. Some years back we decided to start replacing the older lamp types with a more sustainable solution and a LED type was chosen. By replacing the internal lamp socket we were able to install a new LED type instead in the same cover. The replacement is ongoing and is performed when the old lamp breaks every 4th year or when maintenance personnel due to other reasons visit the site.  By this simple activity the energy consumption is reduced from 115W/lamp to 20W/lamp. The total energy saving cost is not that large, only equal to 100€/year and site but since the LED lamp has a longer life time there are large cost savings received by lowered need for maintenance in combination with energy savings. The only problem noted is that the LED lamps energy consumption is so low that the positioning lamp alarm sometimes is activated due to too low energy consumption.
Project Status	**Ongoing implementation in approximately 2 100 masts in Sweden**
Expected Energy Saving	**When installed expected annual saving of approximately 1 800 MWh**
Expected PBT	**2-5 years, mainly depending on reduced need for maintenance**