Off mode power consumption: the most hidden part of standby losses - An analysis of German households

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1. SYNOPSIS

In the study Germany's household energy consumption with focus on standby power consumption is analysed.

2. EXECUTIVE SUMMARY

Households are strongly affected by the rapid development of electrical equipment. Some of the new appliances will increase the variety like e.g. scanners, devices for power line communication or mobile phones. Others will step by step replace existing types of equipment. It is for example estimated that DVD-players will edge out VCRs in the coming decade. The influences of this development on the overall power use and on standby power use have been examined for households in Germany. In the existing works on standby power no detailed, commonly accepted definition of the occurring operation modes exists (ebök, 1997; IEA, 2000; Commission of the EU, 1999). In order to identify standby losses, a detailed definition of the different existing operation modes was carried out (see table 1), differentiating the off mode which was often included in the standby mode. This allowed to analyse exactly the power use in each operation mode.

Table 1. Operation modes of electrical equipment

Mode of operation	**Definition**	
Standard operation	The appliance fulfils it's main purpose	
Ready mode	The appliance fulfils at least one function but not the main purpose	The appliance waits for a task, minor reduction of energy consumption
Standby mode		Major reduction of energy consumption
Steep mode		Strongest reduction of energy consumption
Off mode	The appliance does not fulfil any task, seems to be switched of but still uses energy	
Off	The appliance does not fulfil any task and uses no energy	

The differentiation between standby mode and off mode is seen as important, as the off mode does not offer any advantages like more comfortable operation for the user but is mainly provoked by cheap and simple solutions in the design of the appliance. Omitting the off mode power consumption would not affect the comfort for the user. For 53 types of electrical appliances which have been grouped in seven classes the specific power use, the typical form of use and the holdings have been analysed. For an eighth group, consisting of centralised heating appliances and appliances without standby losses, only the overall power use was analysed. The seven classes with in depth analysis are: audio, video, communication, data processing, household appliances for kitchen, household appliances for washing and general household appliances. The year 1997 was used as base from which the development was estimated for the years 2000, 2005 and 2010.

Table 2. Overall and Standby Power Use in German Households and the related CO_2-Emisions

Year	Overall Power Use (TWh)	Resulting CO_2-Emissons (Mio. t of CO_2)	Standby Power Use (TWh)	Resulting CO_2-Emissons (Mio. t of CO_2)
1997	103,7	56,4	16,6	9,0
2000	109,5	58,1	19,7	10,5
2005	114,0	58,0	20,5	10,4
2010	114,5	54,5	20,4	9,7

Until 2005 the resulting data shows a growing standby power use (see table 2) corresponding to the rising number of electrical appliances. For the period from 2005 to 2010, the standby power use stagnates at the high level of 2005. The technical progress compensates the ongoing rise of holdings of electrical appliances. Some steps of this progress can already be observed as for example the specific standby power use of products in the

group data processing decreases or the specific power use of plug in charger for cellular phones will decrease as it is estimated that the copper coil transformer equipped devices will be replaced by electronically transforming devices in the future. The CO_2-emissions (see table 2) caused by standby power use does not rise at the same rate as the efficiency in power generation is increased (Ziesing *et al*, 1999). For the period 2005 to 2010 a reduction in standby related CO_2-emissions is anticipated, caused by decreasing specific standby power use and increasing efficiency in power generation.

Table 3. Standby Losses in German Households distributed among Operation Modes

Year	Ready Mode	Standby Mode	Sleep Mode	Off Mode	Standby Total
1997	0,8	11,8	0,1	4,0	16,6
2000	1,0	13,3	0,1	5,2	19,7
2005	1,5	13,1	0,1	5,8	20,5
2010	1,9	12,4	0,1	6,1	20,4

Analysing the different modes of operation (see table 3) showed that half of the examined types of appliances use power while being in the off mode (off mode losses). Looking at the development until 2010, it can be seen that the standby power use will decrease from the year 2000 on. The off mode power use however will rise continually until the year 2010 because of the low awareness about the widespread existence of appliances with this mode of operation.

Table 4. Standby Losses of innovative electrical equipment in German Households in GWh (Market Introduction of PLC-Devices not before end of 2001)

Year	DVD-Player	Set-Top-Box	Celular Phone	PLC Devices
1997	--	1104,2	154,0	--
2000	9,9	1428,8	759,6	--
2005	251,0	2009,1	531,7	66,3
2010	610,5	2189,1	292,4	258,0

Examining the standby losses of four appliances with a more innovative character (see table 4) shows some interesting differences. The set-top-boxes for tv-sets will have increasing standby losses over the whole analysed period. The cellular phones, although growing strongly in number (from 4.5 million in 1997 to an estimated number of almost 70 million in 2010) the standby power use will only increase until around the year 2000. Then the anticipated gradual introduction of electronic plug in chargers will reduce the standby power consumption of these appliances.

The growth of standby power consumption is considerably bigger than the growth of overall power consumption until 2005. After the standby power consumption even decreases slightly, a result of the technical progress in minimising the power need for the usual standby functions. The off mode power consumption however grows at constantly higher rates than the overall power consumption. This fact indicates the importance of measures to reduce this unnecessary power consumption. It could be imagined to increase the awareness by campaigns or by the use of labels on the products.

3. REFERENCES

ZIESING *ET AL.*: *"Politikszenarien für den Umweltschutz, Band5 Szenarien und Maßnahmen zur Minderung von CO_2-Emissionen in Deutschland bis 2020"*. Jülich 1999. *"Policy scenarios for the protection of the environment. Vol. 5 Scenarios and Measures for the mitigation of CO_2-emissions in Germany until 2020."*

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