

# Potential of reducing the electricity demand in private sector

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**Abstract:** During the last decades the amount of electricity demand increased continuously. The major driver is the residential sector with about 30% of the total energy consumption. In this paper the electricity consumption of household appliance in Austria investigated and potential for reduction of demand by substitution of old equipment by new technology and reduction of the number of appliance which is used has been studied.

**Key Words:** house hold appliance, standby power consumption, energy efficiency

## 1. Introduction

During the last decade the amount of energy consumption in comparison with 2000 is approximately 16% increased. Among this amount of total energy consumption in Austria (Fig. 1), it is about 20 % related to electrical energy consumption.

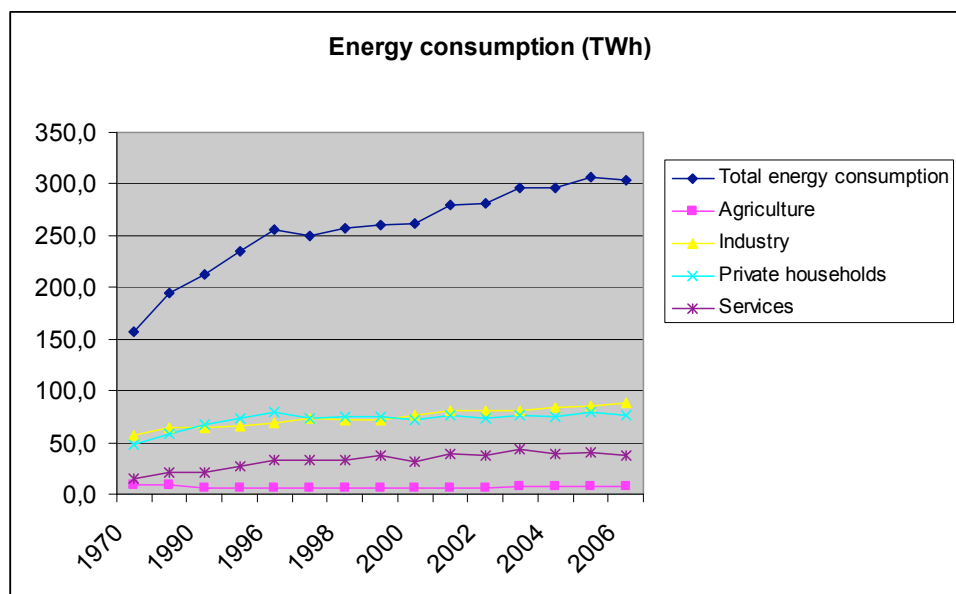
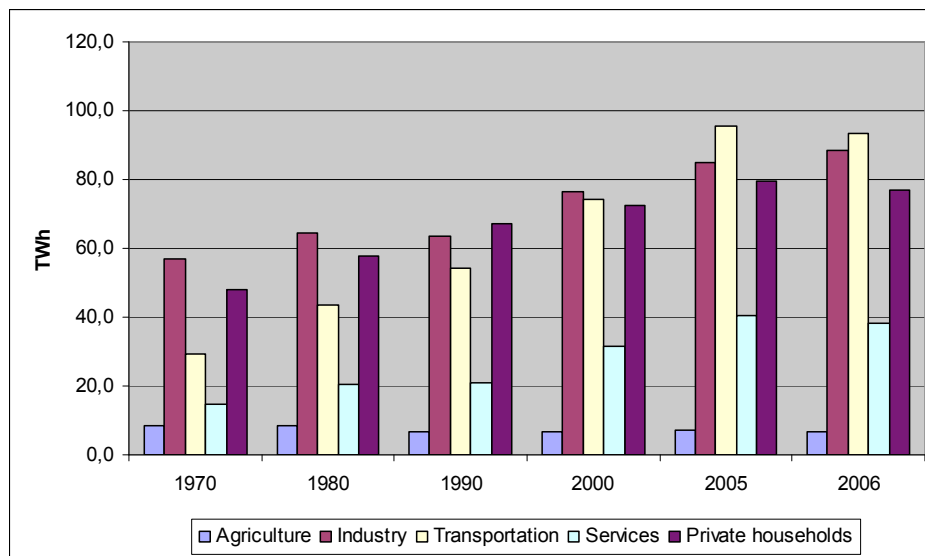


Fig. 1: total energy consumption in Austria <sup>[1]</sup>

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The main causes are the mobility sector, households and industries which account for 86% of the total energy consumption in Austria (Fig.2).



**Fig. 2:** Energy consumption in different sector

Household electrical appliance standards have more than three decade's history. The efficiency improvement in the last 30 years has reduced the energy demand to 25-30% energy consumption compared to 1970.

It is expected that by using the efficient appliance the rate of energy consumption would reduce but practically not only there isn't any decrease but also the demand of electricity is still growing by 2 to 3 % per year.

In this paper the various parameters which have affected the load profile in a house hold sector is investigated.

## 2. Penetration rate in Austria

In this section development of electrical appliances over 1998 to 2007 are studied. Fig. 3 The penetration rate of the house hold electrical appliance in Austria shows that the number of the appliance during the last years is increased.

In comparison with the year 2000, the number of the micro wave 18%, Dryer 53%, dishwasher 24% Electrical stove 5% increased while the number of the general wash machines and gas stove are decreased.

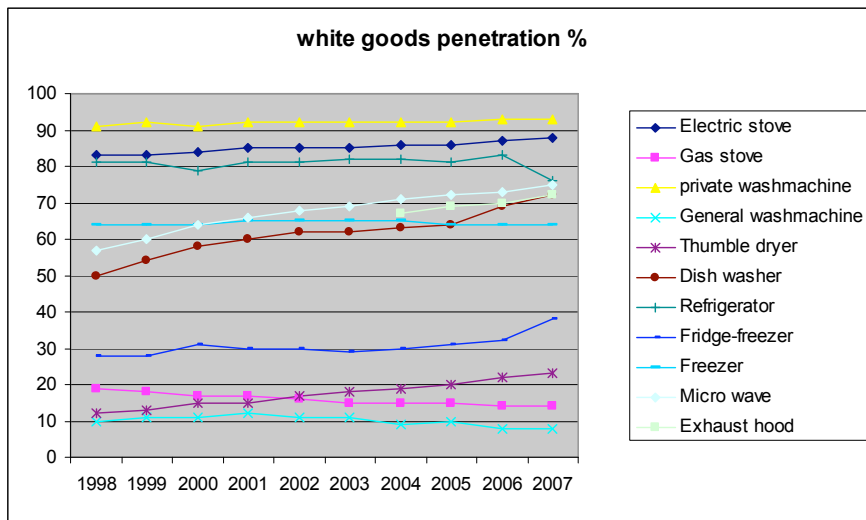


Fig. 3: White goods penetration rate in Austria [2]

Also in a brown goods sector, high increasing in the number of electrical kettle and coffee machine are noticeable (Fig. 4).

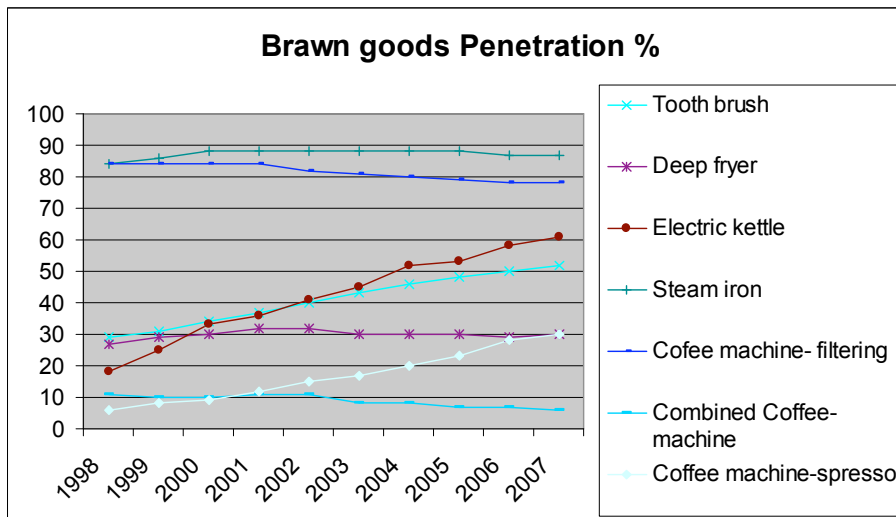


Fig. 4: Brown goods penetration rate in Austria

Among these appliance just a few of them has already reached their saturation point. It is shows that there is still ongoing increasing in the number of electrical appliance which is followed with energy demand increase.

### 3. Standby Power Consumption

During the last years technology development in a various industrial sectors caused that the number of appliances features increased. These additional features mostly work in a standby mode which the appliances don't perform their primary function. Although power consumption per appliances in this mode is low compared to the operational mode, it can be considerable in the total amount of energy consumption.

It can be seen from fig.5 that, about 10% in average of household electrical consumption is related to standby power consumption.

It is obvious that, although using the energy efficient appliance in households helped decreasing energy consumption, increasing the number of electric appliance and there for the amount of standby power consumption acts in contrast.

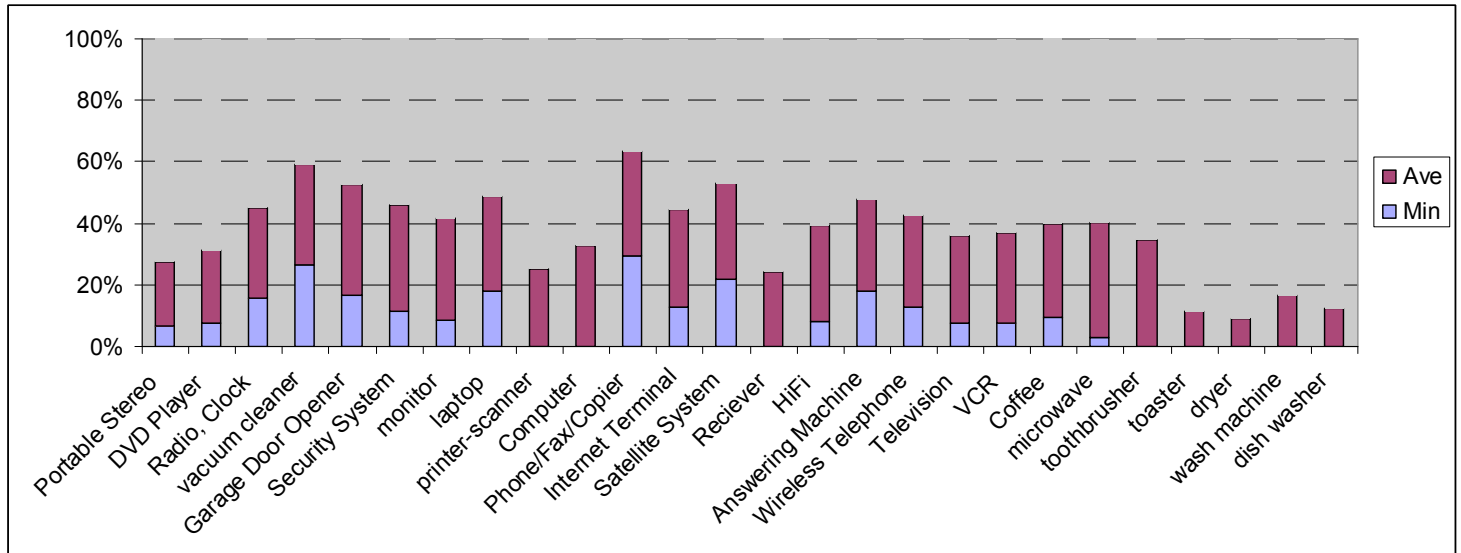
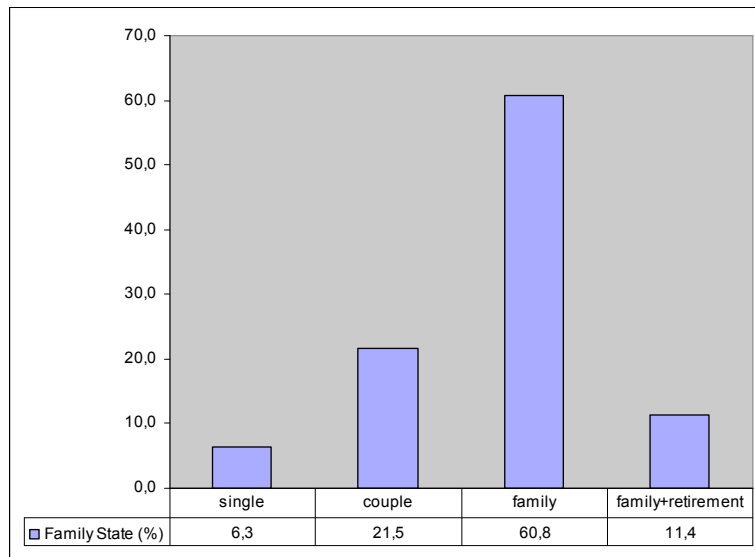


Fig. 5: Standby power consumption in various devices [3], [4]

#### 4. Questionnaire analysis

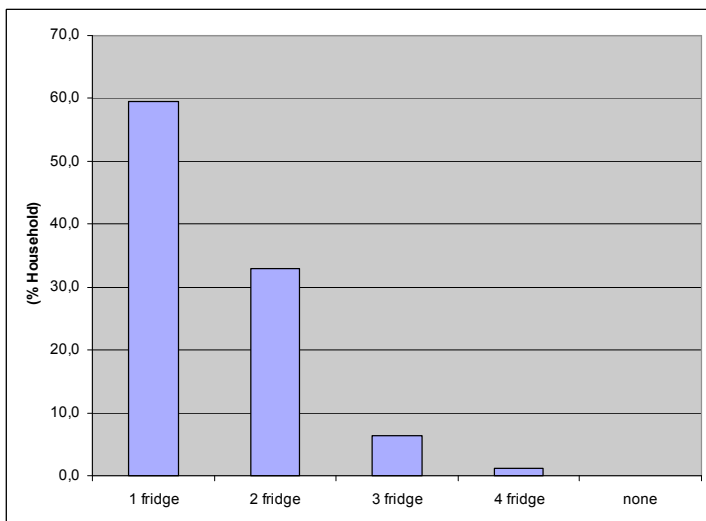
The data which electrical utility have on domestic electricity consumption don't contain much information about details, they are just simple aggregation of households power consumption. For saving potential investigation it is necessary to have detail information about individual household's energy consumption. For achieving this target a questionnaire was prepared and distributed between the random groups of people in Austria.

Questionnaire consisted of 7 main categories and required, on average, 15 min to complete. It was circulated among a sample of 180 people. A response rate as about 45% was returned and the fulfilled questionnaire were collected and responses analysed. Returned samples consist of 6.3% single, 21.5% couple, 60.8% family and 11.4% the family which live with retired people (Fig.6).

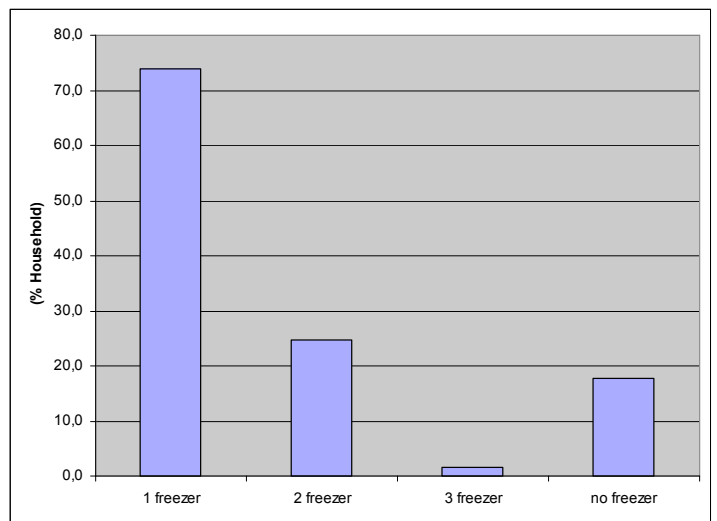


**Fig. 6:** distribution of different group of people in Questionnaire

Fig. 7 implies that there are some households with 3 or 4 refrigerators. On the whole 40.5% of households consume extra electrical energy for feeding their extra unnecessary refrigerators, which could be easily eliminated. There is the same problem with using the freezers in households (Fig. 8). Since freezer and refrigerator are taken as base loads in household and must use energy all the day during the year, even reducing a less amount of energy can affect the all amount of energy very much.



**Fig. 7:** penetration of refrigerators



**Fig. 8:** penetration of freezers

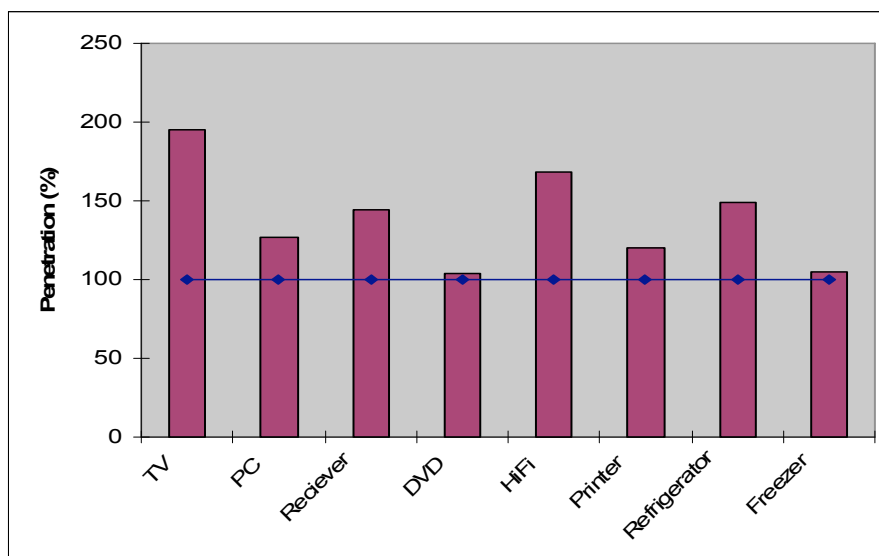
The average age of the electrical appliance which is used by this group of people is listed in the table. 1.

**Table- 1:** average age of appliance in households

Electrical Appliance		Average age	Percentage (%)
Freezer	No.1	10~20	41,5
	No.2	10~20	41,2
	No.3	>20	100
Refrigerator	No.1	10~20	40,6
	No.2	5~10	50
	No.3	5~10	34,2
	No.4	0~5	100
Micro wave		10~20	48,3
Stove		10~20	42,9
Dish washer		0~5	45,8

Also the questionnaire results in Fig. 9 shows that the penetrations of other devices like TV set, computer, receiver, printer, HiFi, Refrigerator and freezer are more that 100% per households.

Although these appliances don't use much more energy in comparison with other whit goods, decreasing the number of them could help us to decrease the amount of standby energy consumption.



**Fig. 9:** Saturation point of some household appliances

## 5. Saving Potential [5]

Fig. 10, 11 shows that after developing the technology for manufacturing the refrigerators and freezers there is a big gap in energy consumption between A energy class and A++. Nowadays freezers and refrigerators in A++ class consume about 48% less than the products with A class.

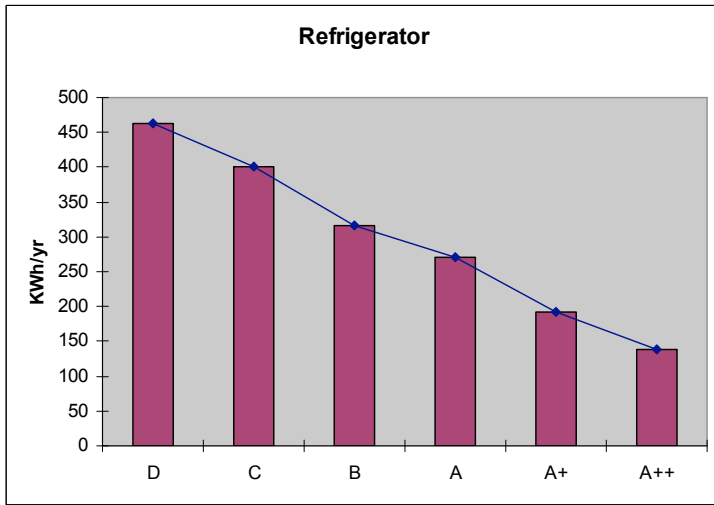


Fig. 10: Refrigerator energy consumption according to energy labelling

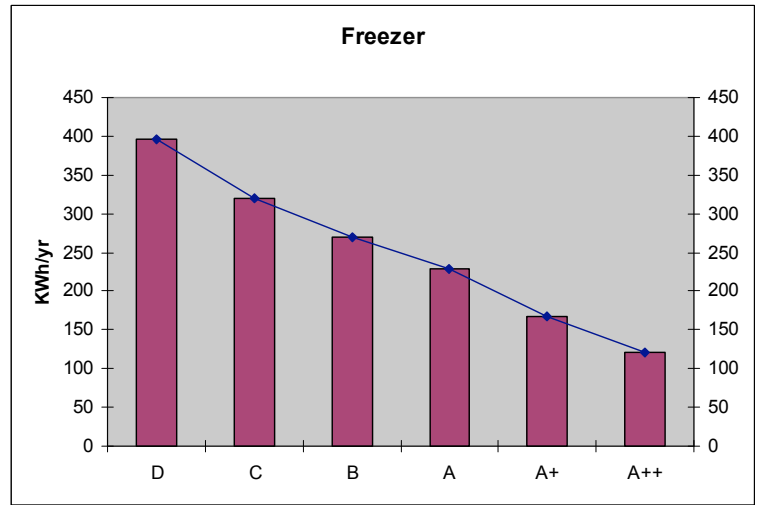


Fig. 11: Freezer energy consumption according to energy labelling

## 6. Consumers Behaviour

Studies shows that modifying the attitude of consumers also can be very helpful for reducing their demand. Fig. 12, 13 describes the variation of energy which dish washer and wash machine needs according to the energy class and number of wash per week.

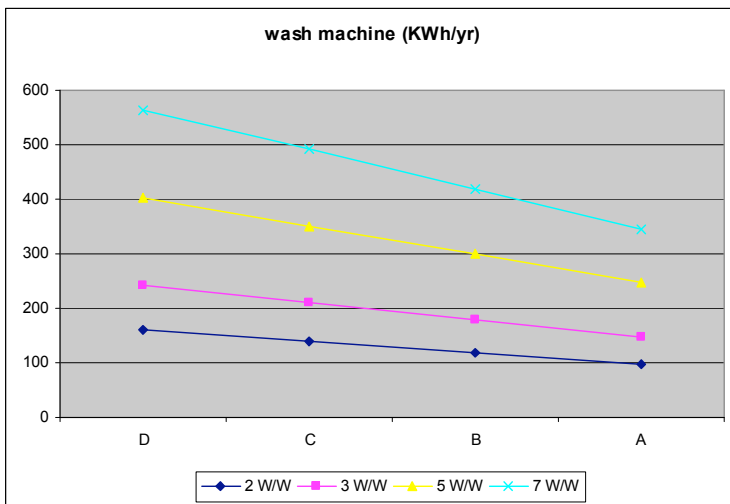


Fig. 12: wash machine energy consumption

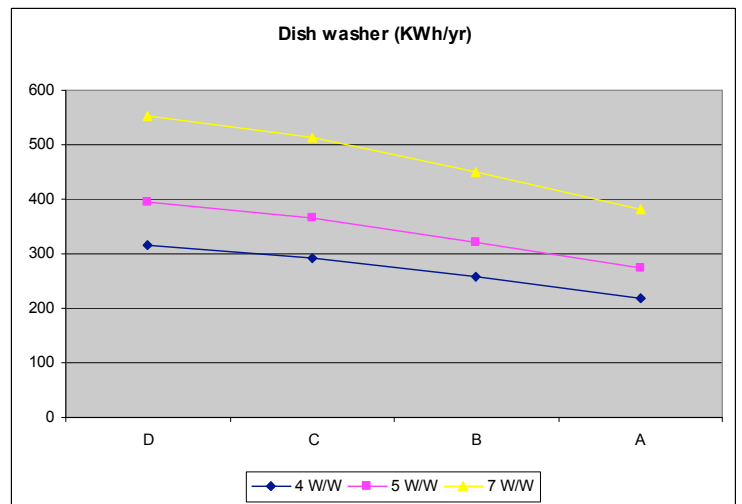


Fig. 13: dish washer energy consumption

If just change the old wash machine and dish washer with new one the amount of needed energy would decrease 39% and 31% respectively. Studies shows that 2 wash per week for wash machine and 4 wash per week for dishwasher are normal number of use of these appliance. So just by using the appliance in optimal way the amount of needed energy would decrease 71% and 43% for wash machine and dish washer respectively.

## 7. Conclusion

In household sector decreasing the demand without affecting the comfort of life of the people is possible. Following aspects could very helpful for reaching our object:

- Purchasing the electrical appliance conform with demand
- using the appliance in an efficient way
- changing the behaviour of consumer and conducting them to an optimal way of applying their electrical equipment
- throwing away the old inefficient appliance

Simulation result of a simple household represent that 10.7 % of electricity consumption is related to standby energy consumption which could be reduced to 2.9%. There is potential about 7.8% just by reducing the standby power consumption in the household sector. Also result of simulation shows that for making an economical family home, it is possible to reduce the demand from 4500 KWh/yr which is representative of conventional demand in Austria, to 3000 KWh/yr.

## Acknowledgment

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## 8. References

- [1]- [www.statistik.at](http://www.statistik.at), Overall energy balances 1970 to 2006
- [2]- [www.gfk.at](http://www.gfk.at)
- [3]- [www.topten.ch](http://www.topten.ch)
- [4]- [www.topprodukte.at](http://www.topprodukte.at)
- [5]- <http://db.eae-geraete.ch/>