TREN/D3/91-2007/Lot 26

Preparatory Studies for Eco-design Requirements of EuP

Study funded by the European Commission

EuP Preparatory Studies

Lot 26: Networked Standby Losses

Draft Task 5

Definition of Base Cases

Contractor: Fraunhofer Institute for Reliability and Microintegration, IZM, Berlin, Department Environmental Engineering

Dr.-Ing. Nils F. Nissen, Dr. Lutz Stobbe

Gustav-Meyer-Allee 25, 13355 Berlin, Germany

Contact: Tel.: +49-30-46403-132

Fax: +49-30-46403-131

Email: nils.nissen@izm.fraunhofer.de

Berlin, Paris 15th September 2010

Authors:

Dr. Nils F. Nissen, Fraunhofer IZM

Dr. Lutz Stobbe, Fraunhofer IZM

Dr. Andreas Middendorf, Technical University Berlin

Alexander Schlösser, Technical University Berlin

Sascha Scheiber, Fraunhofer IZM

Alexander Thornton, Bio Intelligence Service

Kurt Muehmel, Bio Intelligence Service

Shailendra Mudgal, Bio Intelligence Service

Disclaimer:

The findings presented in this document are results of the research conducted by the IZM consortium and are not to be perceived as the opinion of the European Commission.

Contents:

5 Task 5: Definition of Base Cases

5.1 Introduction

According to the MEEuP methodology, the objective of Task 5 is the environmental impact analysis of selected base cases applying the MEEuP EcoReport assessment tool. In the case of ENER Lot 26 Networked Standby this task requires modification in order to serve the horizontal purpose of the study. The modification concerns Subtasks 5.1 and 5.2, the product specific inputs and environmental impact assessments. With respect to the individual product inputs we selected and aggregated product groups that are typically used in European households (home) and business environments (office). The economical and use data for the eco-assessment derive from Tasks 2 (market analysis) and Task 3 (user behaviour). These input data have been further specified for certain product groups. The power consumption values of the selected products derive generally from open sources such as technical reviews (test magazines), product declarations, Energy Star and technical product specifications. Some assumptions are drawn from the results of the technical questionnaire and stakeholder interviews that preceded this analysis. Nevertheless, for the purpose of this study and due to the broad product spectrum it was necessary to average most values.

The methodical approach for the required environmental impact assessment was developed on the basis of the technical analysis in Task 4 and the observation that network availability is a general distinction or reference factor for a horizontal product assessment. In the first subtask we explain the intention, concept and structure of our Networked Standby Assessment Model. In the second subtask we present the input assumptions and assessment results for each product group. In the third subtask we aggregate the individual results and calculate EU-totals. We then selected plausible development scenarios and discussed the results of the calculated eco-impacts and financial implications. The assessment of life cycle costs (LCC) is limited to the monetary value of electricity consumption with respect to the (annual) use phase scenarios. In the final subtask we will summarize and discuss the results of the impact assessment. It is the intention of this analysis to identify the basic mechanisms for improvement.

5.2 Networked Standby Assessment Model

5.2.1 Objective and Concept

The assessment of the environmental impact and improvement options for networked standby deals with a high level of complexity. There are many variables to consider in such an assessment including:

- Various types of products and their typical use environment (e.g. Home Desktop PC or Office Workgroup Printer)
- The product's performance, network configurations, and mode options in conjunction with respective power consumption (e.g. power consumption in idle mode and availability of a low power mode that supports remote access and reactivation)
- Product utilization patterns according to different types of users or Quality of Service requirements (e.g. individual demand for remote access and reactivation)
- Technical progress in the next years with respect to all power modes (e.g. level of idle mode to the next possible low power mode)
- Product stock development (installed base in EU-27) and new products (e.g. multifunctional devices, convergence of functionality, standard network technologies)

Against this background we develop a simplified assessment model that supports a comparable analysis of networked standby aspects on the technical, user and market level. The basic concept of that model is a comparison of annual energy consumption development per mode and product group. We will introduce four development scenarios for each selected product group. These development scenarios reflect four different utilization options with respect to Network Availability. The development scenarios have a time horizon of ten years with the reference year 2010 and the forecast year 2020.

In the following text, we describe each input aspect of the assessment model and the excel sheets created for this purpose. Since the environmental impacts are limited to energy consumption in the use phase the MEEuP EcoReport is only used for interpreting the totals at the end of this task report.

5.2.2 Network Availability Concept

The Network Availability Concept reflects basically three aspects:

- The capability of a networked product for remote access and reactivation

- The response time of a networked product
- The actual resume time to application (this could include average booting time)

The Network Availability Concept recognizes Quality of Service (QoS) requirements or conditions, which are an important aspect in the design of telecommunication and computer networks. This concept reflects indirectly different utilization patterns e.g. in home and offices, technical options and configurations for networked standby (technical capabilities), and their respective power consumptions. For the purpose of this study we introduce four Network Availability Scenarios. The four scenarios are:

- High Network Availability (HiNA)
- Medium Network Availability (MeNA)
- Low Network Availability (LoNA)
- No Network Availability (NoNA)

Before we implemented this concept for all product groups, we discussed our model with industry stakeholders from DigitalEurope and modified various aspects. We tested the model mainly with the complex examples of Desktop and Notebook PCs. With these four Network Availability Scenarios we can now uniformly describe quite differentiated utilization cases across product groups in order to assess environmental impacts and eco-design options. The Network Availability Scenarios are one layer of the abstraction and simplification process to generate base cases.

5.2.2.1 High Network Availability (HiNA)

Specification of HiNA:

- Remote access and reactivation is available 24h/d (always available).
- Immediate resume time to application (in milliseconds).
- “Networked Standby” functionality would currently be supported by remaining in idle mode (constant idle mode can result in higher energy consumption).
- Typical products (applications) are networking-type customer premises equipment such as home gateways, telephone systems, complex set-top-boxes and server-type products.

Regarding the application of high network availability in the field we should consider some conditions such as the time expectations, randomness, and network distances. High network availability characterizes a product and use environment where the wake-up signal occurs

randomly (e.g. unexpected incoming telephone call), the initiator expects a full functionality of the receiving product (e.g. the telephone will ring, although nobody is in the room), and in the case of a networking device an immediate transmission of the signal to the addressed client.

5.2.2.2 Medium Network Availability (MeNA)

Specification of MeNA:

- Remote access and reactivation is available 24h/d (always available).
- Resume time to application varies between periods of immediate (in milliseconds) and fast reaction (<<10 seconds).
- Networked Standby is currently supported by idle mode and Wake-on-LAN-type sleep modes.
- Products featuring medium network availability are typically of server-type such as Desktop PCs and to some extent of client-type such as office workgroup printers or DVD/BluRay player with fast play/quick start function (active standby high).

Medium network availability characterizes products and applications for which remote access and reactivation is less random, can be planned or at least delays can be taken into consideration by the initiator of the trigger signal. As an example, take a home server from which the user intends to retrieve a file or media content. In this case the user might expect some delay (10 to 20 seconds) until the request is fulfilled and the upload occurs. Under other conditions, where a private user, corporate administrator or external service provider (e.g. TV broadcasting provider) triggers a wake-up, it is more important that the signal receiving product is capable to react and confirm the wake-up signal, rather than running the required task immediately.

5.2.2.3 Low Network Availability (LoNA)

Specification of LoNA:

- Remote access and reactivation is available 24h/d (always available).
- Resume time to application varies between periods of fast (<<10 seconds) and longer reaction (>>10 seconds).
- Networked Standby is currently supported by Wake-on-LAN-type sleep, hibernate, and off modes.
- Products featuring low network availability are typically client-type and to some extent of server-type products (at the presented time this scenario is limited to PCs and PC peripheral devices).

Low Network Availability characterizes the general capability of the product to reactivate and resume an application. The resume time requirement (speed) is of less concern for the customer or user.

5.2.2.4 No network availability (NoNA)

Specification of NoNA:

- Remote access and reactivation is not available 24h/d (periods of unavailability).
- Resume time to application varies between periods of unavailability and low availability with reaction times of >>10 seconds.
- Networked Standby is currently supported by Wake-on-LAN-type sleep, hibernate, and off modes.
- Products, which do not feature WOL, or users that switch off products when not in use.

The concept of NoNA has been introduced in order to show product and user behavior that still prevails today.

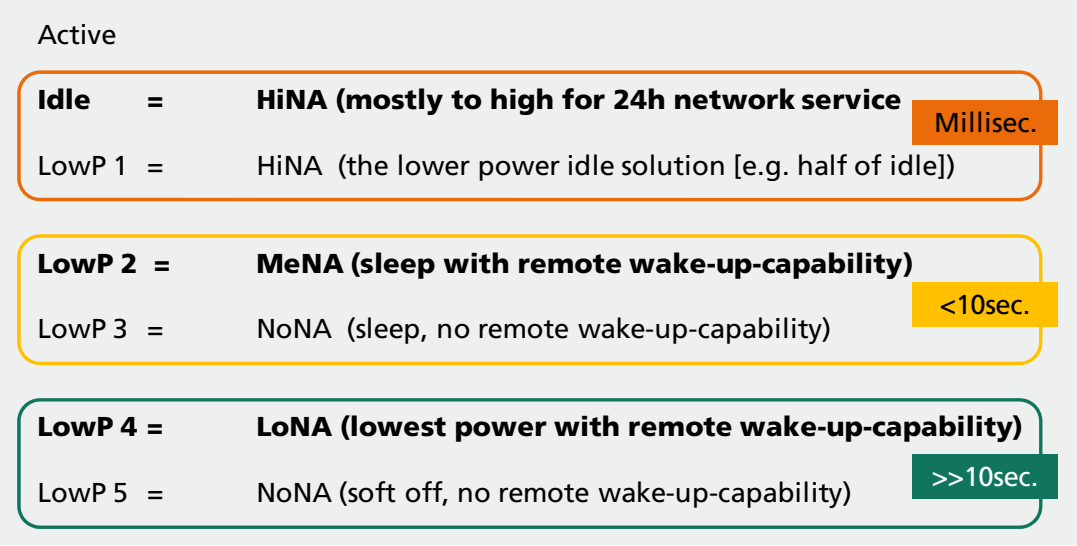


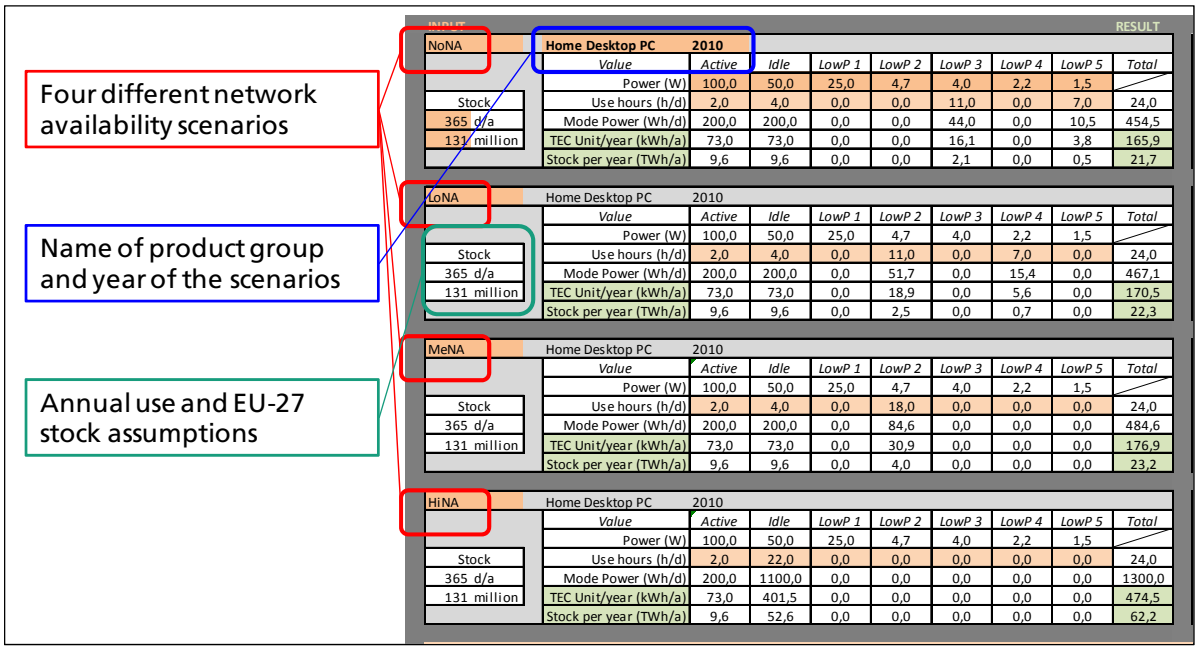
Figure 1: Overview of network availability concept

For the assessments the four availability scenarios correspond to six potential power modes indicated in Figure 1. The usefulness of these abstracted modes will be explained in the next sections.

5.2.3 Description of Assessment Spreadsheets

5.2.3.1 Basic input data

Before we provide the data input for the individual product group assessments it is necessary to shortly explain the spreadsheets we created for this purpose.



	Value	Active	Idle	LowP 1	LowP 2	LowP 3	LowP 4	LowP 5	Total
NoNA	Power (W)	100,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	2,0	4,0	0,0	0,0	11,0	0,0	7,0	24,0
365 d/a	Mode Power (Wh/d)	200,0	200,0	0,0	0,0	44,0	0,0	10,5	454,5
131 million	TEC Unit/year (kWh/a)	73,0	73,0	0,0	0,0	16,1	0,0	3,8	165,9
	Stock per year (TWh/a)	9,6	9,6	0,0	0,0	2,1	0,0	0,5	21,7
LoNA	Power (W)	100,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	2,0	4,0	0,0	11,0	0,0	7,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	200,0	200,0	0,0	51,7	0,0	15,4	0,0	467,1
131 million	TEC Unit/year (kWh/a)	73,0	73,0	0,0	18,9	0,0	5,6	0,0	170,5
	Stock per year (TWh/a)	9,6	9,6	0,0	2,5	0,0	0,7	0,0	22,3
MeNA	Power (W)	100,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	2,0	4,0	0,0	18,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	200,0	200,0	0,0	84,6	0,0	0,0	0,0	484,6
131 million	TEC Unit/year (kWh/a)	73,0	73,0	0,0	30,9	0,0	0,0	0,0	176,9
	Stock per year (TWh/a)	9,6	9,6	0,0	4,0	0,0	0,0	0,0	23,2
HiNA	Power (W)	100,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	200,0	1100,0	0,0	0,0	0,0	0,0	0,0	1300,0
131 million	TEC Unit/year (kWh/a)	73,0	401,5	0,0	0,0	0,0	0,0	0,0	474,5
	Stock per year (TWh/a)	9,6	52,6	0,0	0,0	0,0	0,0	0,0	62,2

Figure 2: Assessment spreadsheets showing different scenarios in spreadsheets

Figure 2 above shows the assessment spreadsheet on the example of home desktop PCs (framed in blue). There are four tables for the reference year 2010, one for each Network Availability Scenario (framed in red). In the table, you find the basic assumptions for the annual use and the EU-27 Stock (framed in green).

Figure 3 below shows the individual data inputs for the daily use including the type of mode, power consumption per mode in Watt, and use duration in hours.

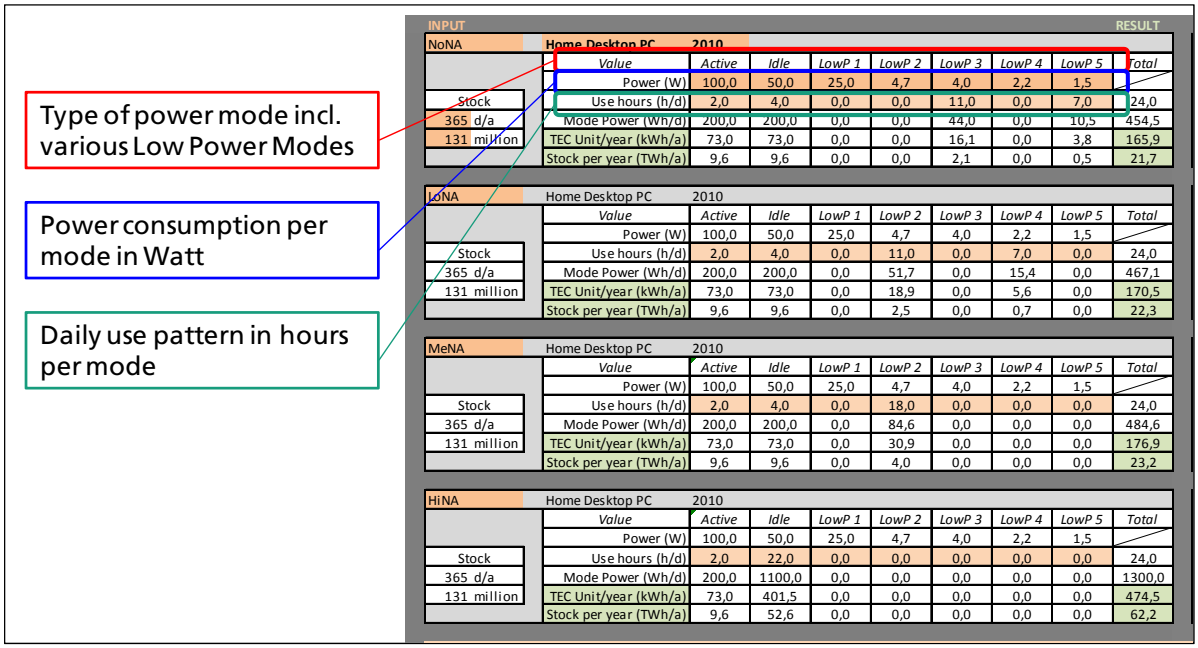


Figure 3: Assessment spreadsheet with main data inputs

5.2.3.2 Distinction of Power Modes

In order to cover the wide product spectrum of this study and provide flexibility for the development scenarios we distinguish not only active and idle modes but a total of five low power modes (LowP). Regarding these modes we make the following basic assumptions:

- Active: This is the mode where the system executes the main applications or services. In the development scenarios we keep the duration of active mode constant in order to simplify the scenarios for the evaluation of networked standby.
- Idle: This is the mode where the system is fully operational and ready to execute the main applications or services immediately (in milliseconds). This mode is utilized to indicate high network availability at the current stage.
- LowP 1: This is a low power mode where the system is fully operational and ready to execute the main applications or services immediately (in milliseconds). *Note: This is a fictional mode that provides idle functionality with about half the energy consumption. This mode will be utilized in later improvement scenarios.*
- LowP 2: This is a low power mode equivalent to sleep with WOL (APCI G1/$S3_{WOL}$) or active standby that provides a resume time to application of <<10 seconds (typically 2-5 sec.). This mode is utilized to indicate medium network availability.

- LowP 3: This is a low power mode equivalent to sleep (APCI G1/S3) or “passive” standby (EC 1275/2008) that provides no remote access and reactivation. This mode is utilized to indicate no network availability.
- LowP 4: This is a low power mode equivalent to hibernate or soft-off with WOL (APCI $G1/S4_{WOL}$ or $G2/S5_{WOL}$) or active standby low (IEC 62087) that provides a resume time to application of >>10 seconds (typically 25+ sec.). This mode is utilized to indicate low network availability.
- LowP 5: This is a low power mode equivalent to soft-off (APCI G2/S5) or off-mode (EC 1275/2008) that provides no remote access and reactivation. This mode is utilized to indicate no network availability.

The assumed power consumption levels for each mode are based on averaged data for products that are currently in the market. In the development scenarios for the year 2020 we generally consider an improvement of single mode power consumption by about 20%. This assumption reflects to some extent the increasing energy efficiency of electronic components, higher system integration and power management. In order to calculate the annual electricity consumption we made assumptions for daily use patterns by defining time durations (hr) per mode per day. If possible we would consider existing power management requirements in the assumptions. Figure 4 below shows the principle use patterns for the four Home Desktop PC scenarios. We use this method to check the plausibility of our assumption.

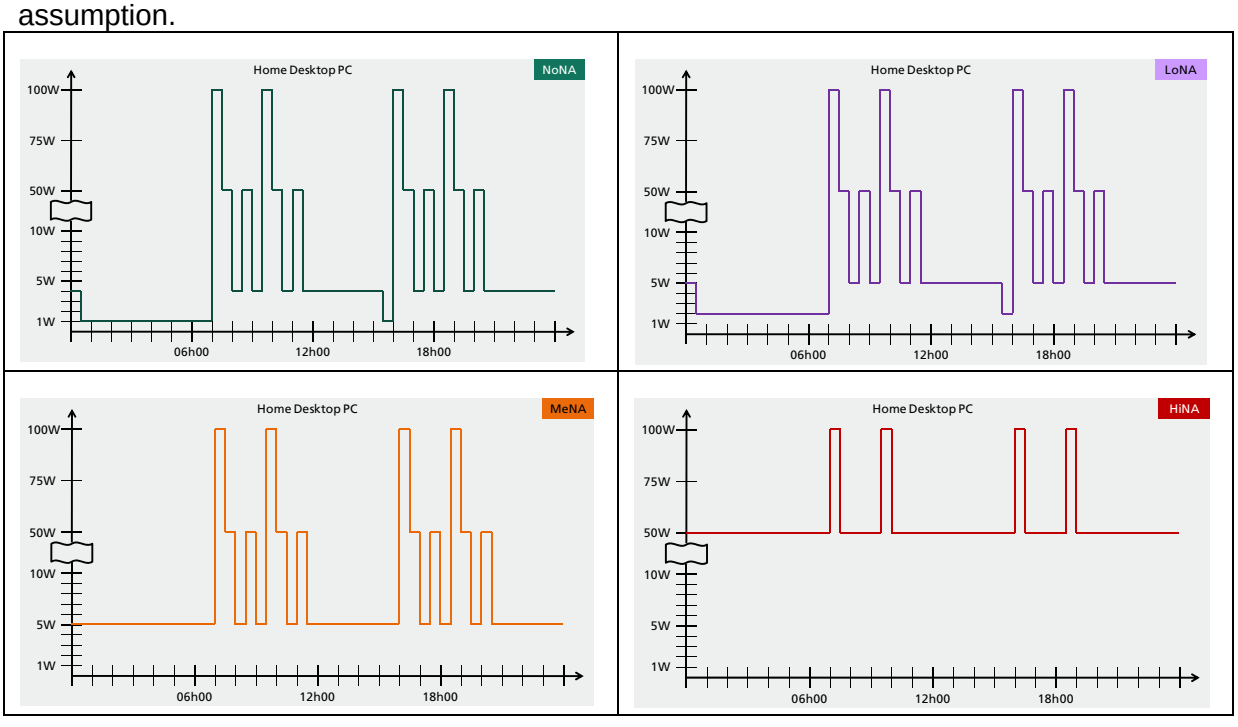
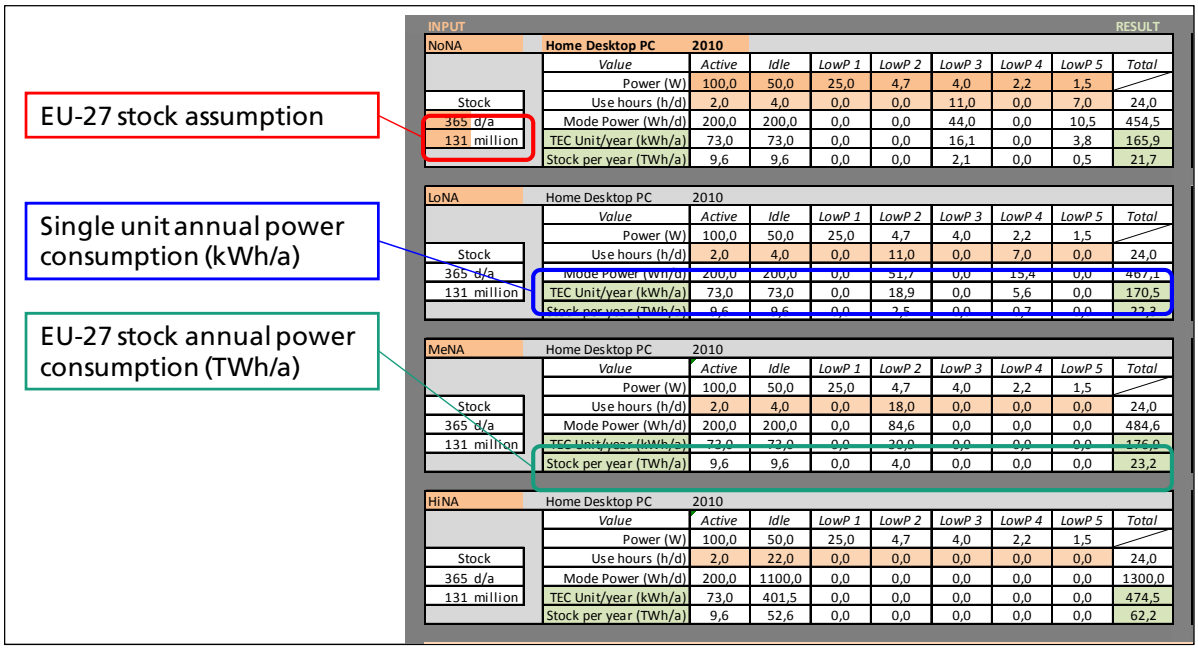


Figure 4: Daily use pattern assumptions for the Desktop PC scenarios

5.2.3.3 Annual Electricity Consumption Assessment

The primary objective of the spreadsheet is the calculation of the annual electricity consumption. We calculate the annual electricity consumption of each product group both per single unit and per the EU-27 installed base (see Figure 5 below).



NoNA	Home Desktop PC	2010							
	Value	Active	Idle	LowP 1	LowP 2	LowP 3	LowP 4	LowP 5	Total
	Power (W)	100,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	2,0	4,0	0,0	0,0	11,0	0,0	7,0	24,0
365 d/a	Mode Power (Wh/d)	200,0	200,0	0,0	0,0	44,0	0,0	10,5	454,5
131 million	TEC Unit/year (kWh/a)	73,0	73,0	0,0	0,0	16,1	0,0	3,8	165,9
	Stock per year (TWh/a)	9,6	9,6	0,0	0,0	2,1	0,0	0,5	21,7

LoNA	Home Desktop PC	2010							
	Value	Active	Idle	LowP 1	LowP 2	LowP 3	LowP 4	LowP 5	Total
	Power (W)	100,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	2,0	4,0	0,0	11,0	0,0	7,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	200,0	200,0	0,0	51,7	0,0	15,4	0,0	467,1
131 million	TEC Unit/year (kWh/a)	73,0	73,0	0,0	18,9	0,0	5,6	0,0	170,5
	Stock per year (TWh/a)	9,6	9,6	0,0	2,5	0,0	0,7	0,0	22,2

MeNA	Home Desktop PC	2010							
	Value	Active	Idle	LowP 1	LowP 2	LowP 3	LowP 4	LowP 5	Total
	Power (W)	100,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	2,0	4,0	0,0	18,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	200,0	200,0	0,0	84,6	0,0	0,0	0,0	484,6
131 million	TEC Unit/year (kWh/a)	73,0	73,0	0,0	30,9	0,0	0,0	0,0	176,9
	Stock per year (TWh/a)	9,6	9,6	0,0	4,0	0,0	0,0	0,0	23,2

HiNA	Home Desktop PC	2010							
	Value	Active	Idle	LowP 1	LowP 2	LowP 3	LowP 4	LowP 5	Total
	Power (W)	100,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	200,0	1100,0	0,0	0,0	0,0	0,0	0,0	1300,0
131 million	TEC Unit/year (kWh/a)	73,0	401,5	0,0	0,0	0,0	0,0	0,0	474,5
	Stock per year (TWh/a)	9,6	52,6	0,0	0,0	0,0	0,0	0,0	62,2

Figure 5: Assessment spreadsheet showing results

The single unit annual energy consumption is given in kWh/a, and indicates a value that can be compared to the Typical Electricity Consumption (TEC) method of the Energy Star Program, for example. For some products we used the TEC values as an orientation for an appropriate correlation of the selected use pattern and power consumption level per mode.

The EU-27 annual energy consumption is given in TWh/a. This value is strongly influenced by the available stock data. We cross check the stock assumptions with the household and office penetration rates in order to verify their plausibility. We conclude that this method can only indicate the order of magnitude of networked standby related energy consumption.

5.3 Product-specific Inputs and Environmental Impact Assessments

5.3.1 Home Gateway

Table 1: Home Gateway - Input data for scenarios of reference year 2010

NoNA	Home Gateway	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	12,0	10,0	0,0	6,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	6,0	6,0	0,0	6,0	0,0	0,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	72,0	60,0	0,0	36,0	0,0	0,0	1,8	169,8
136 million	TEC Unit/year (kWh/a)	26,3	21,9	0,0	13,1	0,0	0,0	0,7	62,0
	Stock per year (TWh/a)	3,6	3,0	0,0	1,8	0,0	0,0	0,1	8,4

LoNA	Home Gateway	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	12,0	10,0	0,0	6,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	6,0	6,0	0,0	12,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	72,0	60,0	0,0	72,0	0,0	0,0	0,0	204,0
136 million	TEC Unit/year (kWh/a)	26,3	21,9	0,0	26,3	0,0	0,0	0,0	74,5
	Stock per year (TWh/a)	3,6	3,0	0,0	3,6	0,0	0,0	0,0	10,1

MeNA	Home Gateway	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	12,0	10,0	0,0	6,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	6,0	12,0	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	72,0	120,0	0,0	36,0	0,0	0,0	0,0	228,0
136 million	TEC Unit/year (kWh/a)	26,3	43,8	0,0	13,1	0,0	0,0	0,0	83,2
	Stock per year (TWh/a)	3,6	6,0	0,0	1,8	0,0	0,0	0,0	11,3

HiNA	Home Gateway	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	12,0	10,0	0,0	6,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	6,0	18,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	72,0	180,0	0,0	0,0	0,0	0,0	0,0	252,0
136 million	TEC Unit/year (kWh/a)	26,3	65,7	0,0	0,0	0,0	0,0	0,0	92,0
	Stock per year (TWh/a)	3,6	8,9	0,0	0,0	0,0	0,0	0,0	12,5

Explanatory notes:

Power consumption in active and idle mode correlates with an average ADSL modem/router with LAN, WLAN, and USB ports. We distinguish an active and idle power state. Idle is the product when full on but not transmitting or processing a signal or data.

LowP-2 indicates an optional sleep mode (e.g. WLAN powered down). LowP 5 is an off-mode with losses.

Most realistic use pattern is the HiNA scenario which assumes high network availability for telephone and internet utilization. For some energy conscious users MeNA or even LoNA could be assumed

Table 2: Home Gateway - Input data for scenarios of forecast year 2020

NoNA	**Home Gateway**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	9,6	8,0	0,0	4,8	0,0	0,0	0,2	
Stock	Use hours (h/d)	6,0	6,0	0,0	6,0	0,0	0,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	57,6	48,0	0,0	28,8	0,0	0,0	1,4	135,8
225 million	TEC Unit/year (kWh/a)	21,0	17,5	0,0	10,5	0,0	0,0	0,5	49,6
	Stock per year (TWh/a)	4,7	3,9	0,0	2,4	0,0	0,0	0,1	11,2

LoNA	Home Gateway	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	9,6	8,0	0,0	4,8	0,0	0,0	0,2	
Stock	Use hours (h/d)	6,0	6,0	0,0	12,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	57,6	48,0	0,0	57,6	0,0	0,0	0,0	163,2
225 million	TEC Unit/year (kWh/a)	21,0	17,5	0,0	21,0	0,0	0,0	0,0	59,6
	Stock per year (TWh/a)	4,7	3,9	0,0	4,7	0,0	0,0	0,0	13,4

MeNA	Home Gateway	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	9,6	8,0	0,0	4,8	0,0	0,0	0,2	
Stock	Use hours (h/d)	6,0	12,0	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	57,6	96,0	0,0	28,8	0,0	0,0	0,0	182,4
225 million	TEC Unit/year (kWh/a)	21,0	35,0	0,0	10,5	0,0	0,0	0,0	66,6
	Stock per year (TWh/a)	4,7	7,9	0,0	2,4	0,0	0,0	0,0	15,0

HiNA	Home Gateway	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	9,6	8,0	0,0	4,8	0,0	0,0	0,2	
Stock	Use hours (h/d)	6,0	18,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	57,6	144,0	0,0	0,0	0,0	0,0	0,0	201,6
225 million	TEC Unit/year (kWh/a)	21,0	52,6	0,0	0,0	0,0	0,0	0,0	73,6
	Stock per year (TWh/a)	4,7	11,8	0,0	0,0	0,0	0,0	0,0	16,6

Explanatory notes:

Mode and use assumptions are similar to the 2010 scenarios. We assume a general improvement of 20% in power consumption per mode. However it is also feasible to assume that active and idle power consumption could increase due to increasing bandwidth and number of integrated network ports. Further consideration has to be given to the integration of data storage capacity (e.g. HDD, SSD) and the utilization of the device as a home server.

Most realistic use pattern is the HiNA scenario which assumes high network availability for telephone and internet utilization. MeNA or even LoNA seems less and less likely to be utilized.

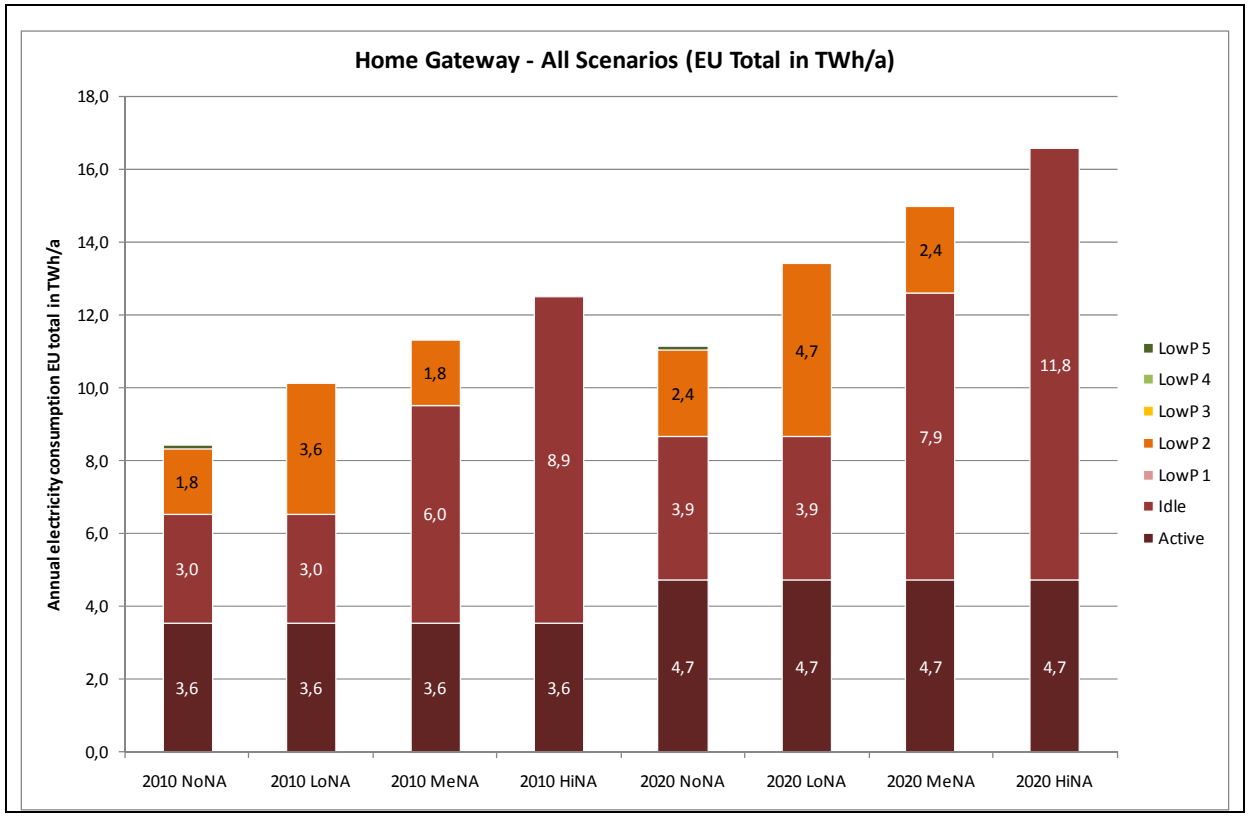


Figure 6: Home Gateway – Comparison of all scenarios (EU total)

Discussion of results:

All 2020 scenarios show increasing overall energy consumption due to growing number of devices. HiNA seems to be the most realistic scenario. The idle mode energy consumption which indicates “high network availability” is with 11 TWh/a (HiNA 2020) considerable. The MeNA scenario is less likely, but it indicates an improvement potential. Overall energy consumption could further increase, if:

- The active utilization grows,
- The home gateway functions as a home server,
- More complex wired and wireless networks are supported.

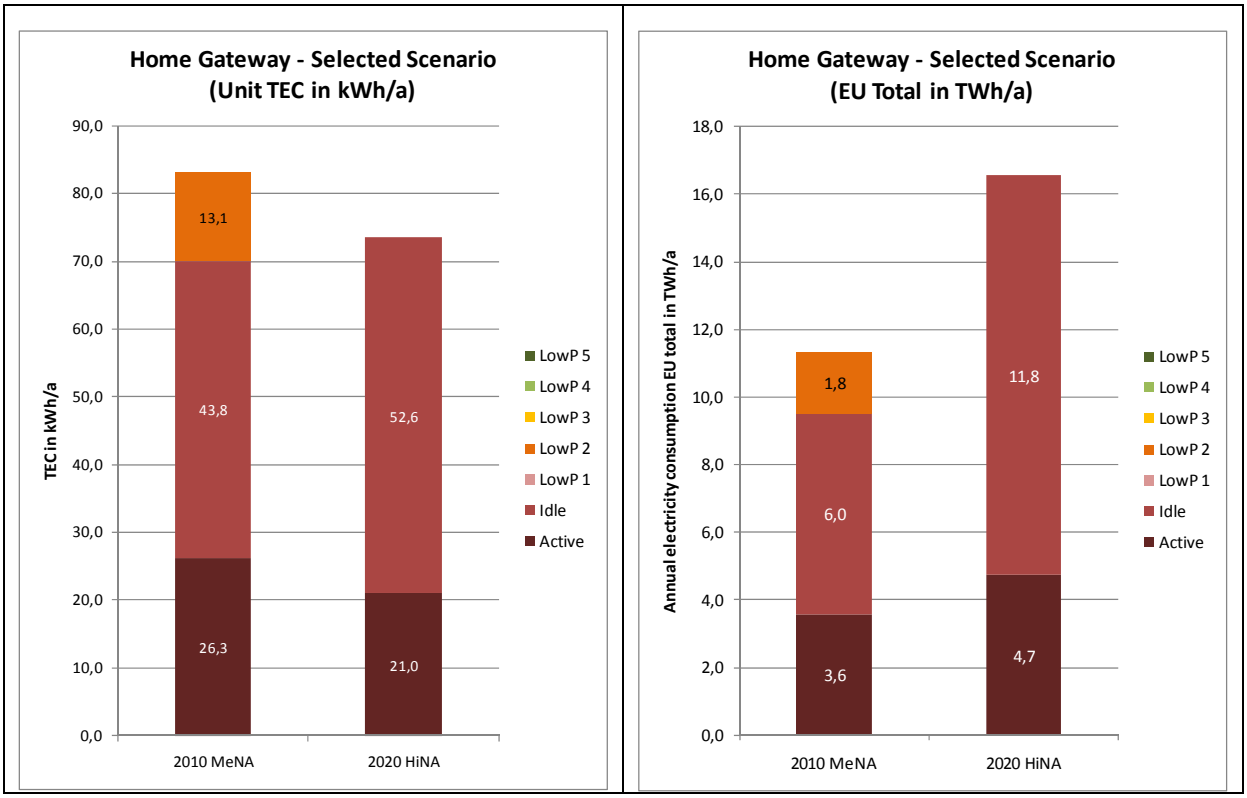


Figure 7: Home Gateway – Comparison of selected scenarios TEC and EU total

The selected scenario for this product group is MeNA 2010 to HiNA 2020.

5.3.2 Home Phone

Table 3: Home Phone - Input data for scenarios of reference year 2010

NoNA	**Phones**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	4,5	3,5	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	9,0	77,0	0,0	0,0	0,0	0,0	0,0	86,0
141 million	TEC Unit/year (kWh/a)	3,3	28,1	0,0	0,0	0,0	0,0	0,0	31,4
	Stock per year (TWh/a)	0,5	4,0	0,0	0,0	0,0	0,0	0,0	4,4

LoNA	Phones	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	4,5	3,5	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	9,0	77,0	0,0	0,0	0,0	0,0	0,0	86,0
141 million	TEC Unit/year (kWh/a)	3,3	28,1	0,0	0,0	0,0	0,0	0,0	31,4
	Stock per year (TWh/a)	0,5	4,0	0,0	0,0	0,0	0,0	0,0	4,4

MeNA	Phones	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	4,5	3,5	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	9,0	77,0	0,0	0,0	0,0	0,0	0,0	86,0
141 million	TEC Unit/year (kWh/a)	3,3	28,1	0,0	0,0	0,0	0,0	0,0	31,4
	Stock per year (TWh/a)	0,5	4,0	0,0	0,0	0,0	0,0	0,0	4,4

HiNA	Phones	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	4,5	3,5	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	9,0	77,0	0,0	0,0	0,0	0,0	0,0	86,0
141 million	TEC Unit/year (kWh/a)	3,3	28,1	0,0	0,0	0,0	0,0	0,0	31,4
	Stock per year (TWh/a)	0,5	4,0	0,0	0,0	0,0	0,0	0,0	4,4

Explanatory notes:

The product group is represented by an average DECT telephone. The telephone is ether active or idle. Own measurements indicate that some telephones actually consume more power in idle, because the display is on when the device is in the cradle.

Product is always online (HiNA). We therefore made no use distinction in the scenarios.

Table 4: Home Phone - Input data for scenarios of forecast year 2020

NoNA	**Phones**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	3,6	2,8	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	7,2	61,6	0,0	0,0	0,0	0,0	0,0	68,8
205 million	TEC Unit/year (kWh/a)	2,6	22,5	0,0	0,0	0,0	0,0	0,0	25,1
	Stock per year (TWh/a)	0,5	4,6	0,0	0,0	0,0	0,0	0,0	5,1

LoNA	Phones	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	3,6	2,8	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	7,2	61,6	0,0	0,0	0,0	0,0	0,0	68,8
205 million	TEC Unit/year (kWh/a)	2,6	22,5	0,0	0,0	0,0	0,0	0,0	25,1
	Stock per year (TWh/a)	0,5	4,6	0,0	0,0	0,0	0,0	0,0	5,1

MeNA	Phones	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	3,6	2,8	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	7,2	61,6	0,0	0,0	0,0	0,0	0,0	68,8
205 million	TEC Unit/year (kWh/a)	2,6	22,5	0,0	0,0	0,0	0,0	0,0	25,1
	Stock per year (TWh/a)	0,5	4,6	0,0	0,0	0,0	0,0	0,0	5,1

HiNA	Phones	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	3,6	2,8	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	2,0	22,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	7,2	61,6	0,0	0,0	0,0	0,0	0,0	68,8
205 million	TEC Unit/year (kWh/a)	2,6	22,5	0,0	0,0	0,0	0,0	0,0	25,1
	Stock per year (TWh/a)	0,5	4,6	0,0	0,0	0,0	0,0	0,0	5,1

Explanatory notes:

Mode and use assumptions are similar to the reference scenarios 2010.

Improvement of power consumption per mode: 20%

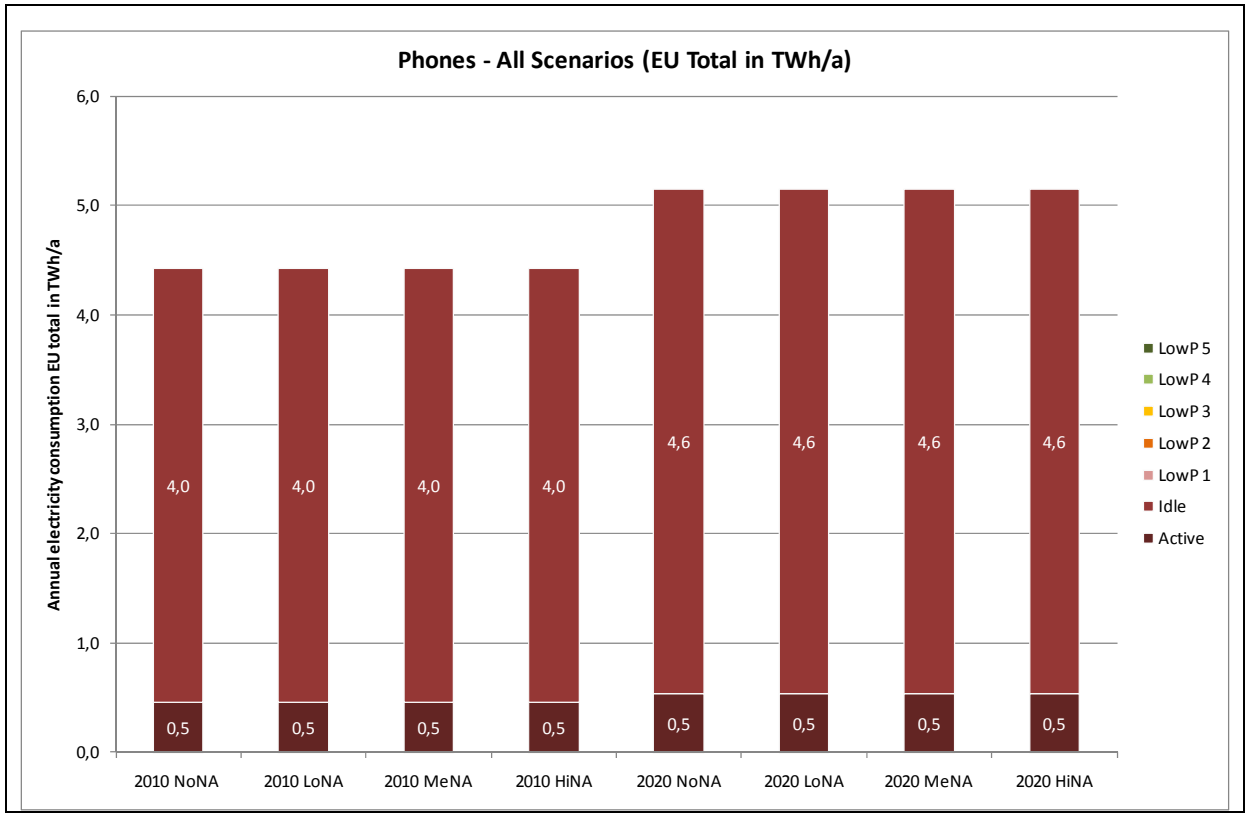


Figure 8: Home Phones – Comparison of all scenarios (EU total)

Discussion of results:

EU-27 total annual electricity consumption remains the same in all scenarios due to always online use pattern.

Idle mode is highly considerable and dominates overall energy consumption.

2020 scenarios show slightly increasing overall energy consumption due to growing number of devices.

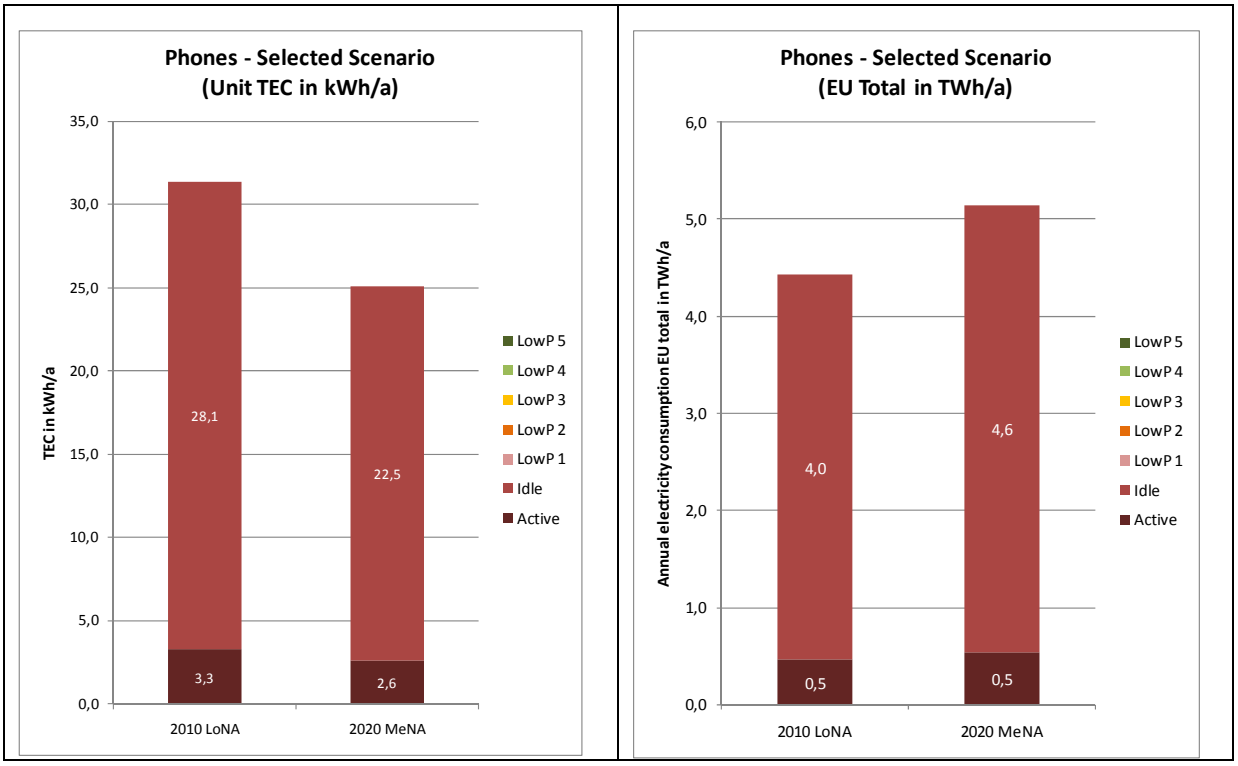


Figure 9: Home Phone – Comparison of selected scenarios TEC and EU total

5.3.3 Home Desktop PC

Table 5: Home Desktop - Input data for scenarios of reference year 2010

NoNA	**Home Desktop PC**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	60,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	5,0	2,0	0,0	0,0	5,0	0,0	12,0	24,0
365 d/a	Mode Power (Wh/d)	300,0	100,0	0,0	0,0	20,0	0,0	18,0	438,0
131 million	TEC Unit/year (kWh/a)	109,5	36,5	0,0	0,0	7,3	0,0	6,6	159,9
	Stock per year (TWh/a)	14,3	4,8	0,0	0,0	1,0	0,0	0,9	20,9

LoNA	Home Desktop PC	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	60,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	5,0	2,0	0,0	5,0	0,0	12,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	300,0	100,0	0,0	23,5	0,0	26,4	0,0	449,9
131 million	TEC Unit/year (kWh/a)	109,5	36,5	0,0	8,6	0,0	9,6	0,0	164,2
	Stock per year (TWh/a)	14,3	4,8	0,0	1,1	0,0	1,3	0,0	21,5

MeNA	Home Desktop PC	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	60,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	5,0	2,0	0,0	17,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	300,0	100,0	0,0	79,9	0,0	0,0	0,0	479,9
131 million	TEC Unit/year (kWh/a)	109,5	36,5	0,0	29,2	0,0	0,0	0,0	175,2
	Stock per year (TWh/a)	14,3	4,8	0,0	3,8	0,0	0,0	0,0	22,9

HiNA	Home Desktop PC	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	60,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	5,0	13,0	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	300,0	650,0	0,0	28,2	0,0	0,0	0,0	978,2
131 million	TEC Unit/year (kWh/a)	109,5	237,3	0,0	10,3	0,0	0,0	0,0	357,0
	Stock per year (TWh/a)	14,3	31,1	0,0	1,3	0,0	0,0	0,0	46,8

Explanatory notes:

Active mode is equivalent to G0/S0 (applications are running). According to industry sources average active mode power consumption that is approx. factor 1.2 of idle power.

Idle mode is equivalent to G0/S0 (no application running).

LowP 1 not yet existent (low power idle, power about 50% of G0/S0 idle)

LowP 2 is equivalent to G1/S3 (sleep with WOL), power value oriented on Energy Star

LowP 3 is equivalent to G1/S3 (sleep)

LowP 4 is equivalent to G2/S5 (soft off with WOL)

LowP 5 is equivalent to G2/S5 (soft off)

Table 6: Home Desktop PC - Input data for scenarios of forecast year 2020

NoNA	**Home Desktop PC**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	48,0	40,0	20,0	3,8	3,2	1,8	1,2	
Stock	Use hours (h/d)	5,0	2,0	0,0	0,0	5,0	0,0	12,0	24,0
365 d/a	Mode Power (Wh/d)	240,0	80,0	0,0	0,0	16,0	0,0	14,4	350,4
143 million	TEC Unit/year (kWh/a)	87,6	29,2	0,0	0,0	5,8	0,0	5,3	127,9
	Stock per year (TWh/a)	12,5	4,2	0,0	0,0	0,8	0,0	0,8	18,3

LoNA	Home Desktop PC	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	48,0	40,0	20,0	3,8	3,2	1,8	1,2	
Stock	Use hours (h/d)	5,0	2,0	0,0	5,0	0,0	12,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	240,0	80,0	0,0	18,8	0,0	21,1	0,0	359,9
143 million	TEC Unit/year (kWh/a)	87,6	29,2	0,0	6,9	0,0	7,7	0,0	131,4
	Stock per year (TWh/a)	12,5	4,2	0,0	1,0	0,0	1,1	0,0	18,8

MeNA	Home Desktop PC	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	48,0	40,0	20,0	3,8	3,2	1,8	1,2	
Stock	Use hours (h/d)	5,0	2,0	0,0	17,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	240,0	80,0	0,0	63,9	0,0	0,0	0,0	383,9
143 million	TEC Unit/year (kWh/a)	87,6	29,2	0,0	23,3	0,0	0,0	0,0	140,1
	Stock per year (TWh/a)	12,5	4,2	0,0	3,3	0,0	0,0	0,0	20,0

HiNA	Home Desktop PC	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	48,0	40,0	20,0	3,8	3,2	1,8	1,2	
Stock	Use hours (h/d)	5,0	13,0	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	240,0	520,0	0,0	22,6	0,0	0,0	0,0	782,6
143 million	TEC Unit/year (kWh/a)	87,6	189,8	0,0	8,2	0,0	0,0	0,0	285,6
	Stock per year (TWh/a)	12,5	27,1	0,0	1,2	0,0	0,0	0,0	40,8

Explanatory notes:

Mode and use assumptions are similar to the reference scenarios 2010.

Improvement of power consumption per mode: 20%

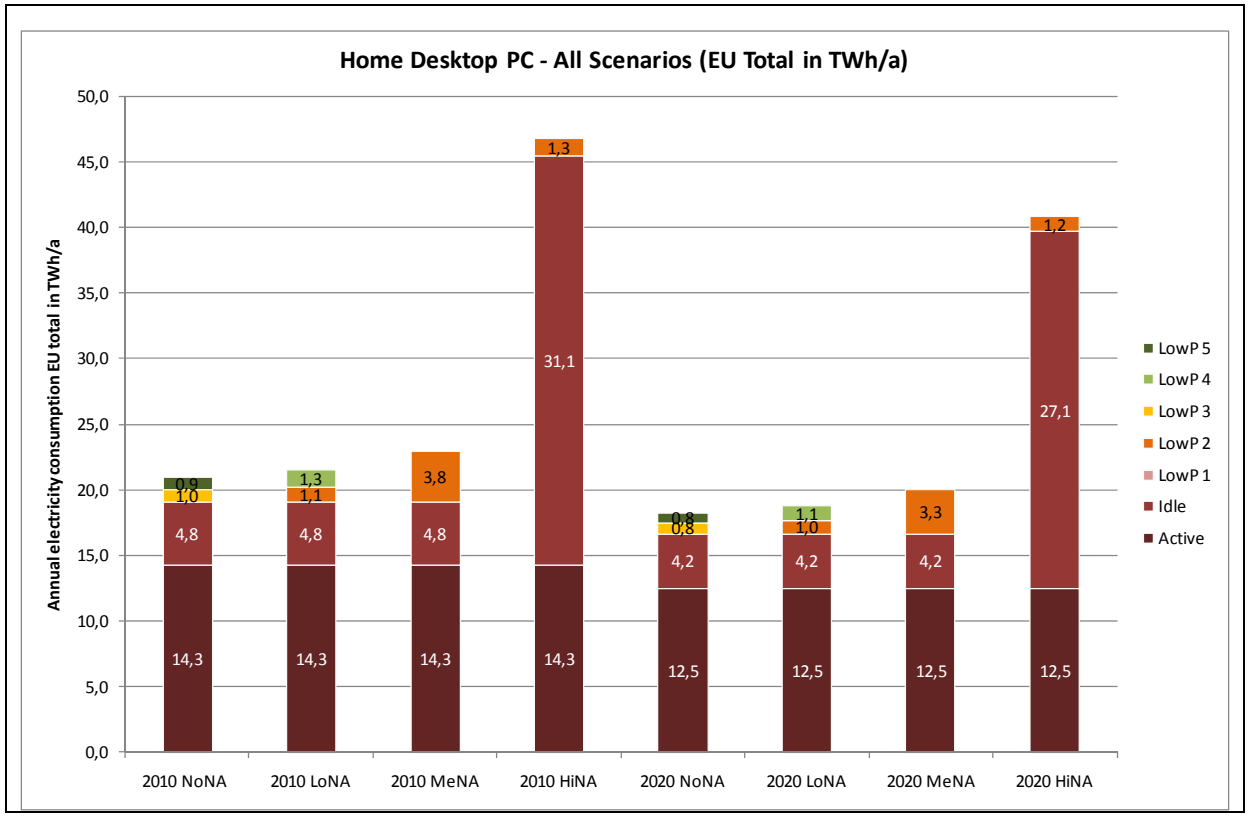


Figure 10: Home Desktop PC – Comparison of all scenarios (EU total)

Discussion of results:

Use patter for NoNA and LoNA simulates requirements outlined in TREN Lot 3 computer study. MeNA resembles always online with longest resume time of <10 seconds. A mix of LoNA and MeNA seems to be the most realistic scenario. HiNA assumption is unrealistic but included due to the formal logic of the assessment model.

The overall energy consumption is decreasing over time despite a slightly growing product stock. The reason for this development is our general assumption that power consumption per mode has improved by 20% in 2020. The difference in power consumption between LoNA and MeNA is less significant. Energy impact of networked standby (indicated to some extent by the amount of idle and the low power modes) in these two scenarios is about 3 to 6 TWh per year. Improvement potential is obviously related to a further reduction of idle power level or idle time duration. The HiNA – although unrealistic – shows the impact of such long idle periods.

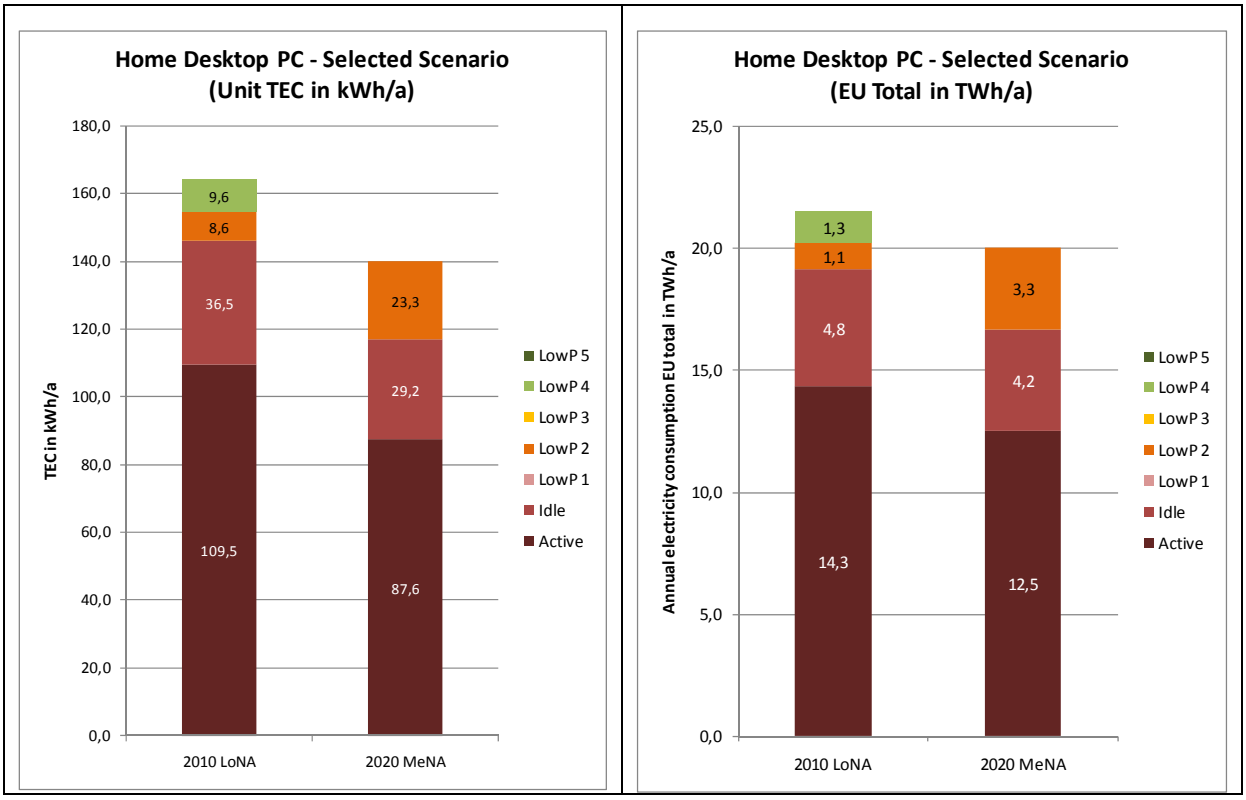


Figure 11: Home Desktop PC – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.4 Home Notebook PC

Table 7: Home Notebook PC - Input data for scenarios of reference year 2010

NoNA	**Home Notebook**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	20,0	10,0	2,7	2,0	1,5	0,8	
Stock	Use hours (h/d)	5,0	2,0	0,0	2,0	0,0	0,0	15,0	24,0
365 d/a	Mode Power (Wh/d)	150,0	40,0	0,0	5,4	0,0	0,0	12,0	207,4
63 million	TEC Unit/year (kWh/a)	54,8	14,6	0,0	2,0	0,0	0,0	4,4	75,7
	Stock per year (TWh/a)	3,4	0,9	0,0	0,1	0,0	0,0	0,3	4,8

LoNA	Home Notebook	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	20,0	10,0	2,7	2,0	1,5	0,8	
Stock	Use hours (h/d)	5,0	2,0	0,0	2,0	0,0	15,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	150,0	40,0	0,0	5,4	0,0	22,5	0,0	217,9
63 million	TEC Unit/year (kWh/a)	54,8	14,6	0,0	2,0	0,0	8,2	0,0	79,5
	Stock per year (TWh/a)	3,4	0,9	0,0	0,1	0,0	0,5	0,0	5,0

MeNA	Home Notebook	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	20,0	10,0	2,7	2,0	1,5	0,8	
Stock	Use hours (h/d)	5,0	2,0	0,0	17,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	150,0	40,0	0,0	45,9	0,0	0,0	0,0	235,9
63 million	TEC Unit/year (kWh/a)	54,8	14,6	0,0	16,8	0,0	0,0	0,0	86,1
	Stock per year (TWh/a)	3,4	0,9	0,0	1,1	0,0	0,0	0,0	5,4

HiNA	Home Notebook	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	20,0	10,0	2,7	2,0	1,5	0,8	
Stock	Use hours (h/d)	5,0	13,0	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	150,0	260,0	0,0	16,2	0,0	0,0	0,0	426,2
63 million	TEC Unit/year (kWh/a)	54,8	94,9	0,0	5,9	0,0	0,0	0,0	155,6
	Stock per year (TWh/a)	3,4	6,0	0,0	0,4	0,0	0,0	0,0	9,8

Explanatory notes:

Notebook PCs feature already very good power management. They are optimized for mobile (battery) use and therefore reduce power (e.g. display dimming, drivers) whenever possible. Mode assumptions are the similar to Desktop PCs.

LowP 2 is equivalent to G1/S3 sleep with WOL,

LowP 4 is equivalent to G1/S4 hibernate with WOL

LowP 5 is equivalent to G2/S5 soft off

LoNA is the most realistic scenario for 2010. HiNA assumption is unrealistic but included due to the formal logic of the assessment model.

Table 8: Home Notebook PC - Input data for scenarios of forecast year 2020

NoNA	**Home Notebook**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	16,0	8,0	2,2	1,6	1,2	0,6	
Stock	Use hours (h/d)	5,0	2,0	0,0	2,0	0,0	0,0	15,0	24,0
365 d/a	Mode Power (Wh/d)	120,0	32,0	0,0	4,3	0,0	0,0	9,6	165,9
123 million	TEC Unit/year (kWh/a)	43,8	11,7	0,0	1,6	0,0	0,0	3,5	60,6
	Stock per year (TWh/a)	5,4	1,4	0,0	0,2	0,0	0,0	0,4	7,4

LoNA	Home Notebook	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	16,0	8,0	2,2	1,6	1,2	0,6	
Stock	Use hours (h/d)	5,0	2,0	0,0	2,0	0,0	15,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	120,0	32,0	0,0	4,3	0,0	18,0	0,0	174,3
123 million	TEC Unit/year (kWh/a)	43,8	11,7	0,0	1,6	0,0	6,6	0,0	63,6
	Stock per year (TWh/a)	5,4	1,4	0,0	0,2	0,0	0,8	0,0	7,8

MeNA	Home Notebook	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	16,0	8,0	2,2	1,6	1,2	0,6	
Stock	Use hours (h/d)	5,0	2,0	0,0	17,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	120,0	32,0	0,0	36,7	0,0	0,0	0,0	188,7
123 million	TEC Unit/year (kWh/a)	43,8	11,7	0,0	13,4	0,0	0,0	0,0	68,9
	Stock per year (TWh/a)	5,4	1,4	0,0	1,6	0,0	0,0	0,0	8,5

HiNA	Home Notebook	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	16,0	8,0	2,2	1,6	1,2	0,6	
Stock	Use hours (h/d)	5,0	13,0	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	120,0	208,0	0,0	13,0	0,0	0,0	0,0	341,0
123 million	TEC Unit/year (kWh/a)	43,8	75,9	0,0	4,7	0,0	0,0	0,0	124,5
	Stock per year (TWh/a)	5,4	9,3	0,0	0,6	0,0	0,0	0,0	15,3

Explanatory notes:

General improvement of power consumption per mode: 20%

Recent data suggest that power consumption might further improve depending on the performance, configuration and selected technologies (component level) of an individual product. It is feasible to assume that a combination of LoNA and MeNA is the most realistic real life scenario.

Regarding the stock assumption one might argue that because of the introduction of increasing number of fair priced Subnotebooks, Netbooks, and Tablet-PCs the market could develop much more dynamically and that the numbers of user drastically increase. The sensitivity analysis should consider this notion.

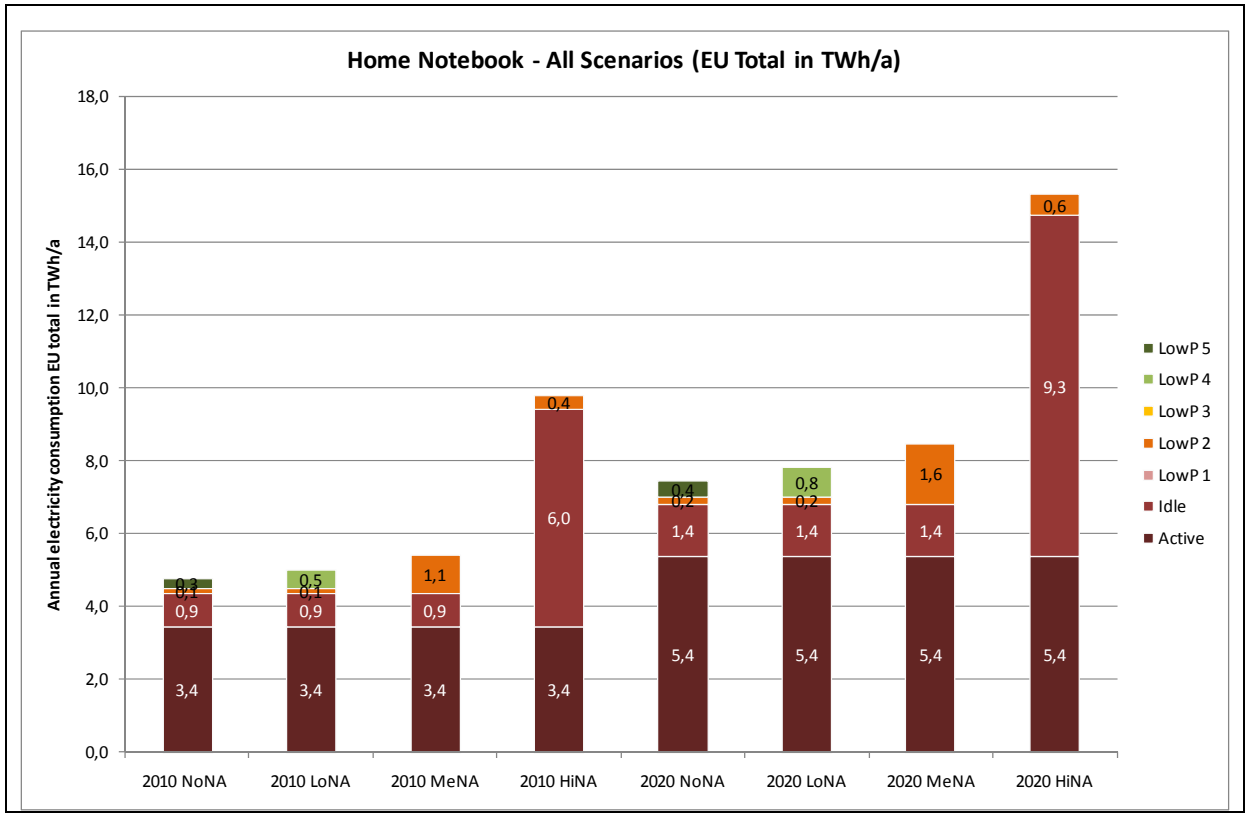


Figure 12: Home Notebook – Comparison of all scenarios (EU total)

Discussion of results:

The 2020 scenarios show an overall increase in energy consumption. The main reason is the growing product stock in Europe (the stock basically doubles). A combination of LoNA and MeNA seems to be the most realistic development scenario. HiNA is not realistic but shows the impact of prolonged idle mode. Energy impact of networked standby (indicated to some extent by the amount of idle and the low power modes) is about 2 TWh per year.

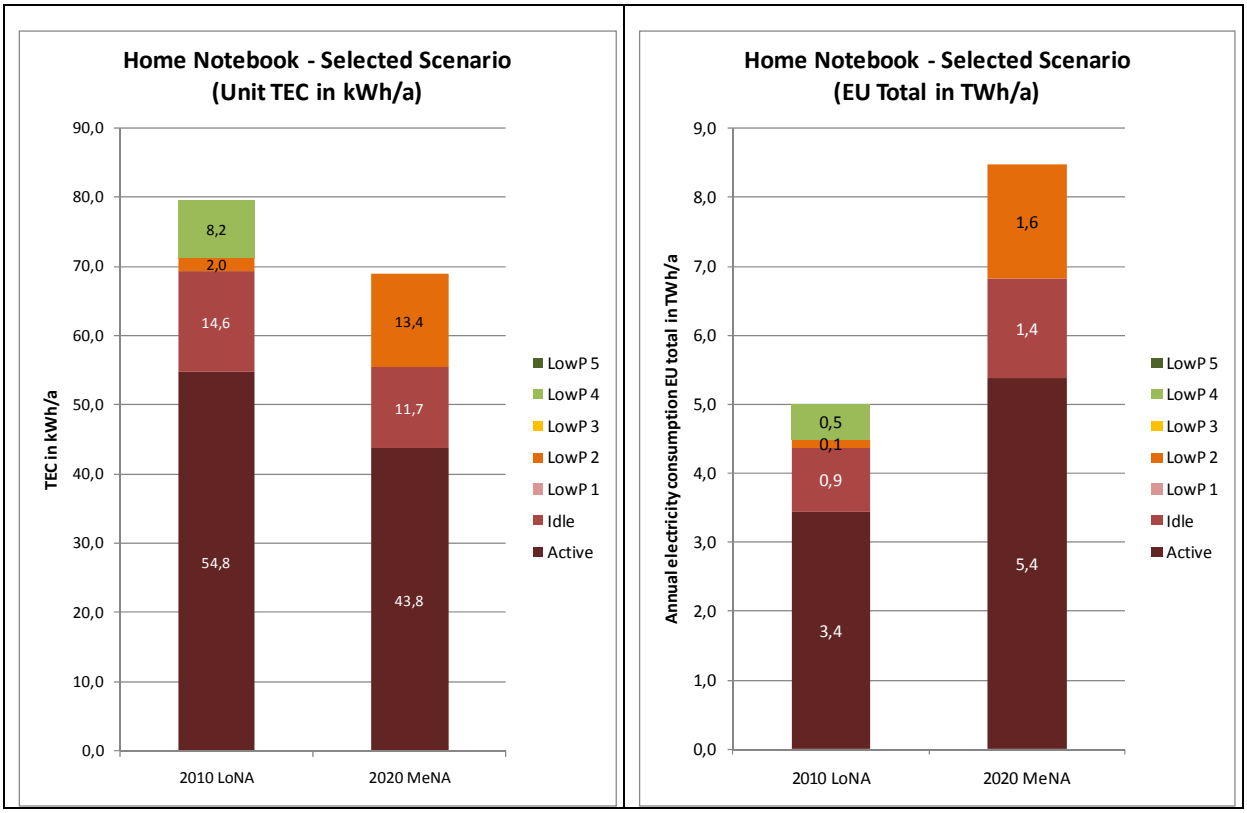


Figure 13: Home Notebook PC – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.5 Home Networked Attached Storage

Table 9: Home NAS - Input data for scenarios of reference year 2010

NoNA	**Home NAS**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	15,0	0,0	8,0	0,0	0,0	0,2	
Stock	Use hours (h/d)	1,0	0,0	0,0	0,0	0,0	0,0	23,0	24,0
365 d/a	Mode Power (Wh/d)	20,0	0,0	0,0	0,0	0,0	0,0	4,6	24,6
20 million	TEC Unit/year (kWh/a)	7,3	0,0	0,0	0,0	0,0	0,0	1,7	9,0
	Stock per year (TWh/a)	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,2

LoNA	Home NAS	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	15,0	0,0	8,0	0,0	0,0	0,2	
Stock	Use hours (h/d)	1,0	4,0	0,0	0,0	0,0	0,0	19,0	24,0
365 d/a	Mode Power (Wh/d)	20,0	60,0	0,0	0,0	0,0	0,0	3,8	83,8
20 million	TEC Unit/year (kWh/a)	7,3	21,9	0,0	0,0	0,0	0,0	1,4	30,6
	Stock per year (TWh/a)	0,1	0,4	0,0	0,0	0,0	0,0	0,0	0,6

MeNA	Home NAS	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	15,0	0,0	8,0	0,0	0,0	0,2	
Stock	Use hours (h/d)	1,0	4,0	0,0	19,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	20,0	60,0	0,0	152,0	0,0	0,0	0,0	232,0
20 million	TEC Unit/year (kWh/a)	7,3	21,9	0,0	55,5	0,0	0,0	0,0	84,7
	Stock per year (TWh/a)	0,1	0,4	0,0	1,1	0,0	0,0	0,0	1,7

HiNA	Home NAS	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	15,0	0,0	8,0	0,0	0,0	0,2	
Stock	Use hours (h/d)	1,0	23,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	20,0	345,0	0,0	0,0	0,0	0,0	0,0	365,0
20 million	TEC Unit/year (kWh/a)	7,3	125,9	0,0	0,0	0,0	0,0	0,0	133,2
	Stock per year (TWh/a)	0,1	2,5	0,0	0,0	0,0	0,0	0,0	2,7

Explanatory notes:

External storage or network attached storage devices are typically LAN or USB connected and provide file based data storage services to other devices (e.g. PC). NAS systems contain one or more hard disks, often arranged into logical, redundant storage containers or RAID arrays. Wireless access is likely in future.

The product has an active and idle state. LowP 2 is equivalent to a sleep mode with WOL. LowP 5 is off-mode with losses.

Higher network availability has been indicated in scenarios through longer durations of the idle mode. .

Table 10: Home NAS - Input data for scenarios of forecast year 2020

NoNA	**Home NAS**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	12,0	0,0	6,4	0,0	0,0	0,1	
Stock	Use hours (h/d)	1,0	0,0	0,0	0,0	0,0	0,0	23,0	24,0
365 d/a	Mode Power (Wh/d)	16,0	0,0	0,0	0,0	0,0	0,0	3,2	19,2
61 million	TEC Unit/year (kWh/a)	5,8	0,0	0,0	0,0	0,0	0,0	1,2	7,0
	Stock per year (TWh/a)	0,4	0,0	0,0	0,0	0,0	0,0	0,1	0,4

LoNA	Home NAS	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	12,0	0,0	6,4	0,0	0,0	0,1	
Stock	Use hours (h/d)	1,0	4,0	0,0	0,0	0,0	0,0	19,0	24,0
365 d/a	Mode Power (Wh/d)	16,0	48,0	0,0	0,0	0,0	0,0	2,7	66,7
61 million	TEC Unit/year (kWh/a)	5,8	17,5	0,0	0,0	0,0	0,0	1,0	24,3
	Stock per year (TWh/a)	0,4	1,1	0,0	0,0	0,0	0,0	0,1	1,5

MeNA	Home NAS	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	12,0	0,0	6,4	0,0	0,0	0,1	
Stock	Use hours (h/d)	1,0	4,0	0,0	19,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	16,0	48,0	0,0	121,6	0,0	0,0	0,0	185,6
61 million	TEC Unit/year (kWh/a)	5,8	17,5	0,0	44,4	0,0	0,0	0,0	67,7
	Stock per year (TWh/a)	0,4	1,1	0,0	2,7	0,0	0,0	0,0	4,1

HiNA	Home NAS	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	12,0	0,0	6,4	0,0	0,0	0,1	
Stock	Use hours (h/d)	1,0	23,0	0,0	0,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	16,0	276,0	0,0	0,0	0,0	0,0	0,0	292,0
61 million	TEC Unit/year (kWh/a)	5,8	100,7	0,0	0,0	0,0	0,0	0,0	106,6
	Stock per year (TWh/a)	0,4	6,1	0,0	0,0	0,0	0,0	0,0	6,5

Explanatory notes:

Mode and use assumptions are similar to the reference scenarios 2010. General improvement of power consumption per mode is 20%.

Stock is increasingly growing due to the understanding, that external or networked attached storage devices are used in conjunction with media servers.

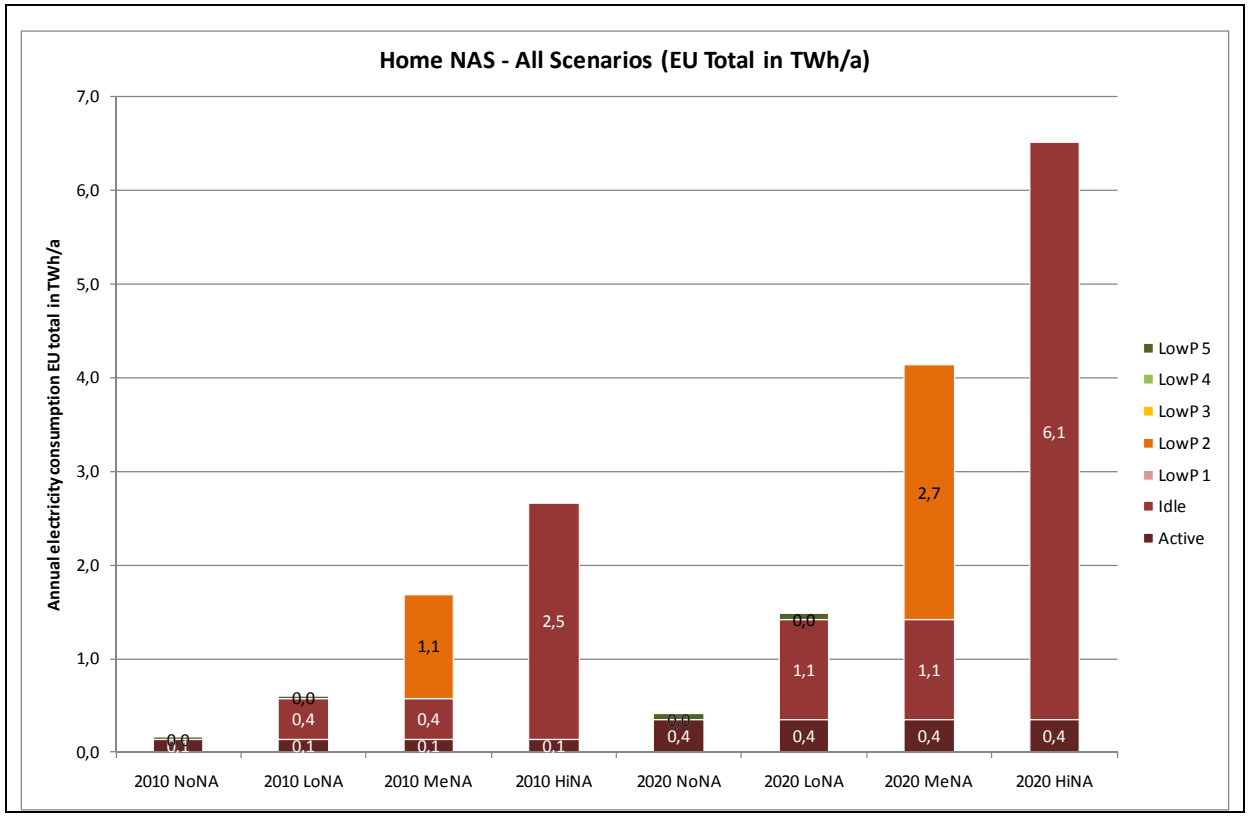


Figure 14: Home NAS – Comparison of all scenarios (EU total)

Discussion of results:

The overall energy consumption related to external or network attached storage devices are increasing due to the growing installed base. Energy impact of networked standby (indicated to some extent by the amount of idle and the low power modes) is in the MeNA 2020 scenario about 3 TWh per year.

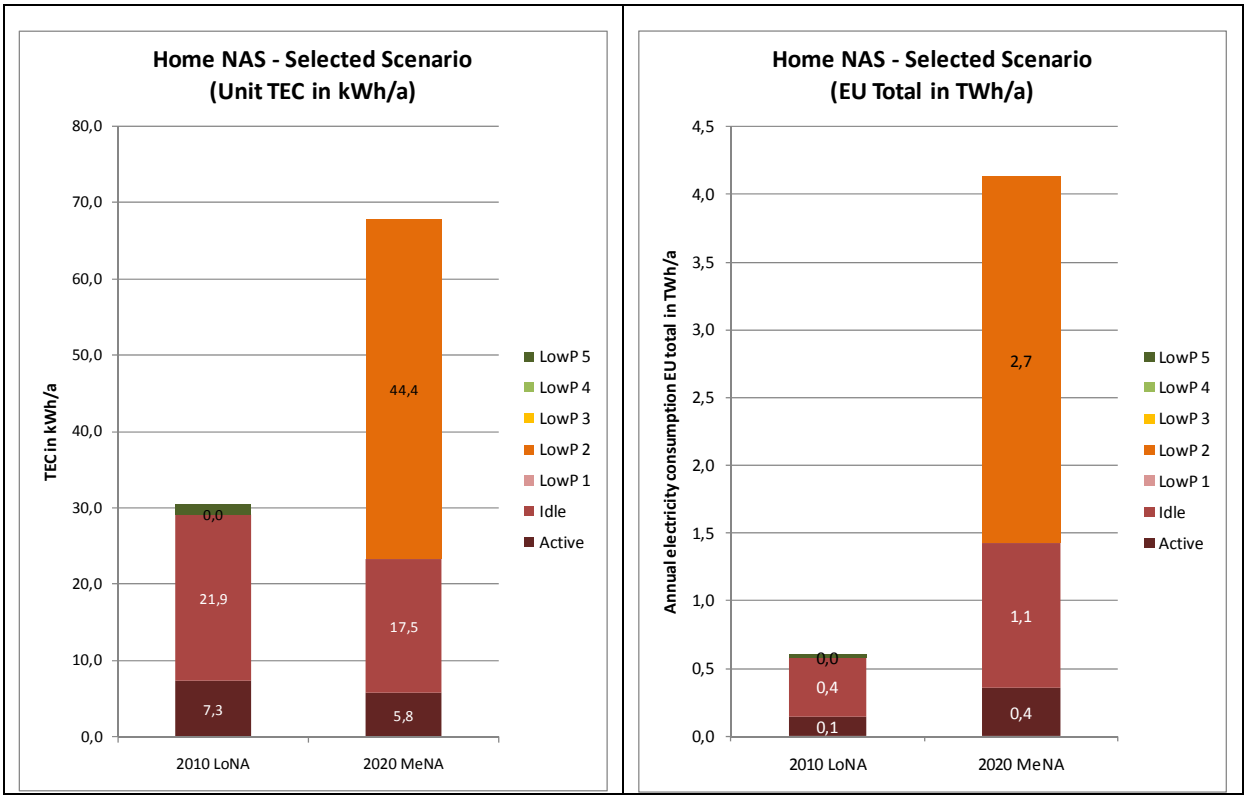


Figure 15: Home NAS – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.6 Game Console

Table 11: Game Console - Input data for scenarios of reference year 2010

NoNA	Game Console	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	155,0	135,0	0,0	0,0	0,0	2,0	0,0	
Stock	Use hours (h/d)	2,0	0,0	0,0	0,0	0,0	22,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	310,0	0,0	0,0	0,0	0,0	44,0	0,0	354,0
25 million	TEC Unit/year (kWh/a)	113,2	0,0	0,0	0,0	0,0	16,1	0,0	129,2
	Stock per year (TWh/a)	2,8	0,0	0,0	0,0	0,0	0,4	0,0	3,2

LoNA	Game Console	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	155,0	135,0	0,0	0,0	0,0	2,0	0,0	
Stock	Use hours (h/d)	2,0	2,0	0,0	0,0	0,0	20,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	310,0	270,0	0,0	0,0	0,0	40,0	0,0	620,0
25 million	TEC Unit/year (kWh/a)	113,2	98,6	0,0	0,0	0,0	14,6	0,0	226,3
	Stock per year (TWh/a)	2,8	2,5	0,0	0,0	0,0	0,4	0,0	5,7

MeNA	Game Console	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	155,0	135,0	0,0	0,0	0,0	2,0	0,0	
Stock	Use hours (h/d)	2,0	6,0	0,0	0,0	0,0	16,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	310,0	810,0	0,0	0,0	0,0	32,0	0,0	1152,0
25 million	TEC Unit/year (kWh/a)	113,2	295,7	0,0	0,0	0,0	11,7	0,0	420,5
	Stock per year (TWh/a)	2,8	7,4	0,0	0,0	0,0	0,3	0,0	10,5

HiNA	Game Console	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	155,0	135,0	0,0	0,0	0,0	2,0	0,0	
Stock	Use hours (h/d)	2,0	10,0	0,0	0,0	0,0	12,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	310,0	1350,0	0,0	0,0	0,0	24,0	0,0	1684,0
25 million	TEC Unit/year (kWh/a)	113,2	492,8	0,0	0,0	0,0	8,8	0,0	614,7
	Stock per year (TWh/a)	2,8	12,3	0,0	0,0	0,0	0,2	0,0	15,4

Explanatory notes:

Game Consoles are not standardized products. They are rich in performance diversity and utilization. Change in performance increase power consumption while technology improvements reduce power consumption from one generation to the next. For the purpose of this study we assume a highly average product which represents a mixture of the XBOX 360 and PS3.

We are under-representing smaller systems such as the PS2 (about 25 Watt active), PS3 slim (about 90 W active) and the Nintendo Wii (about 20 Watt active).

Based on the market data available from the new ENTR Lot 3 study on audio and video equipment, the XBOX 360 and PS3 account 2010 for about 25 million units in the European market.

The game consoles feature effectively only two modes – active and off. Power consumption in active is not constant. It varies according to the technical (chip) generation and supported applications. Video games consume more power than watching a movie on DVD. The selected power consumption values are based on the results on the NRDC issue paper (2008): “Lowering the cost of play – Improving the Energy Efficiency of Video Game Consoles”. There are also individual measurements available on Tech Blog pages on the internet.

Active mode is assume to be on average 155 W (190 W to 120 W) for playing 2h per day video games or watching movies.

Idle mode is an active mode while the device ready but not running an application (e.g. games or movie). Power consumption is on average 135 W (110 W to 160 W).

LowP 4 is a low power standby/soft-off mode with an average power consumption of 2 W. We assume that devices have a programmable auto-power-down (APD). Our network availability scenarios reflect different type of settings for fast reactivation.

Table 12: Game Console - Input data for scenarios of forecast year 2020

NoNA	**Game Console**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	124,0	108,0	0,0	0,0	0,0	1,6	0,0	
Stock	Use hours (h/d)	2,0	0,0	0,0	0,0	0,0	22,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	248,0	0,0	0,0	0,0	0,0	35,2	0,0	283,2
34 million	TEC Unit/year (kWh/a)	90,5	0,0	0,0	0,0	0,0	12,8	0,0	103,4
	Stock per year (TWh/a)	3,1	0,0	0,0	0,0	0,0	0,4	0,0	3,5

LoNA	Game Console	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	124,0	108,0	0,0	0,0	0,0	1,6	0,0	
Stock	Use hours (h/d)	2,0	2,0	0,0	0,0	0,0	20,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	248,0	216,0	0,0	0,0	0,0	32,0	0,0	496,0
34 million	TEC Unit/year (kWh/a)	90,5	78,8	0,0	0,0	0,0	11,7	0,0	181,0
	Stock per year (TWh/a)	3,1	2,7	0,0	0,0	0,0	0,4	0,0	6,2

MeNA	Game Console	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	124,0	108,0	0,0	0,0	0,0	1,6	0,0	
Stock	Use hours (h/d)	2,0	6,0	0,0	0,0	0,0	16,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	248,0	648,0	0,0	0,0	0,0	25,6	0,0	921,6
34 million	TEC Unit/year (kWh/a)	90,5	236,5	0,0	0,0	0,0	9,3	0,0	336,4
	Stock per year (TWh/a)	3,1	8,0	0,0	0,0	0,0	0,3	0,0	11,4

HiNA	Game Console	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	124,0	108,0	0,0	0,0	0,0	1,6	0,0	
Stock	Use hours (h/d)	2,0	10,0	0,0	0,0	0,0	12,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	248,0	1080,0	0,0	0,0	0,0	19,2	0,0	1347,2
34 million	TEC Unit/year (kWh/a)	90,5	394,2	0,0	0,0	0,0	7,0	0,0	491,7
	Stock per year (TWh/a)	3,1	13,4	0,0	0,0	0,0	0,2	0,0	16,7

Explanatory notes:

The general mode and use assumption is similar to the reference year 2010.

The stock data is based on ENTR Lot 3 study in combination with the pragmatic assumption that half of the product stock consists of products similar to the current XBOX 360 and PS3.

We are also assuming a general improvement of power consumption per mode by 20%. We have based this general improvement on the – in the past displayed – potential of the semiconductor industry as well as the potential for system integration. As long as the game consoles do not feature displays (integrated or as a dedicated component unit) the 20% improvement in average power seems to be a feasible scenario.

Regarding network availability, it is very difficult to assess the network integration of game consoles. If game consoles are used as media server it is possible that there is a demand for remote activation.

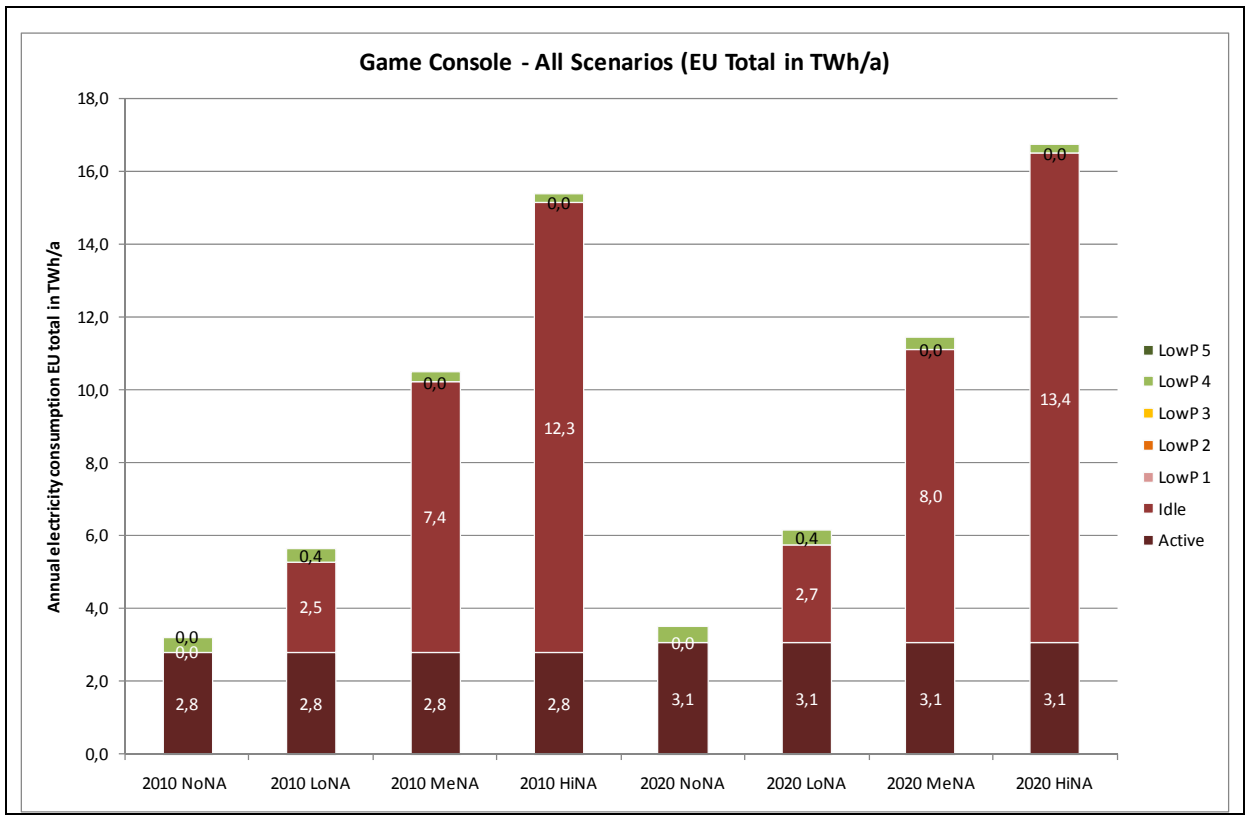


Figure 16: Game Console – Comparison of all scenarios (EU total)

Discussion of results:

The energy consumption of game consoles is considerable due to the performance in active and therefore also in mode. In comparison to computers, current game consoles do not feature much scaled power management. The devices are active/idle or standby/off. If the products are kept active for faster reactivation then improvement potential is clearly in the reduction of idle mode duration or an advanced power management. According to the assumptions made in the scenarios networked standby represents about 2 to 8 TWh per year.

If we take the whole spectrum of game consoles – the smaller products such as Nintendo Wii – the standby power consumption will increase in total. The “WiiConnect24” standby mode indicates a higher level of network availability and consumes about 9.5 Watts in comparison to regular standby of about 1.3 Watts. Let’s assume in a worst case scenario that the 22.5

million Wii consoles in the European market would be in WiiConnect24 standby for 24/7/365. The resulting annual energy consumption would be 1.8 TWh.

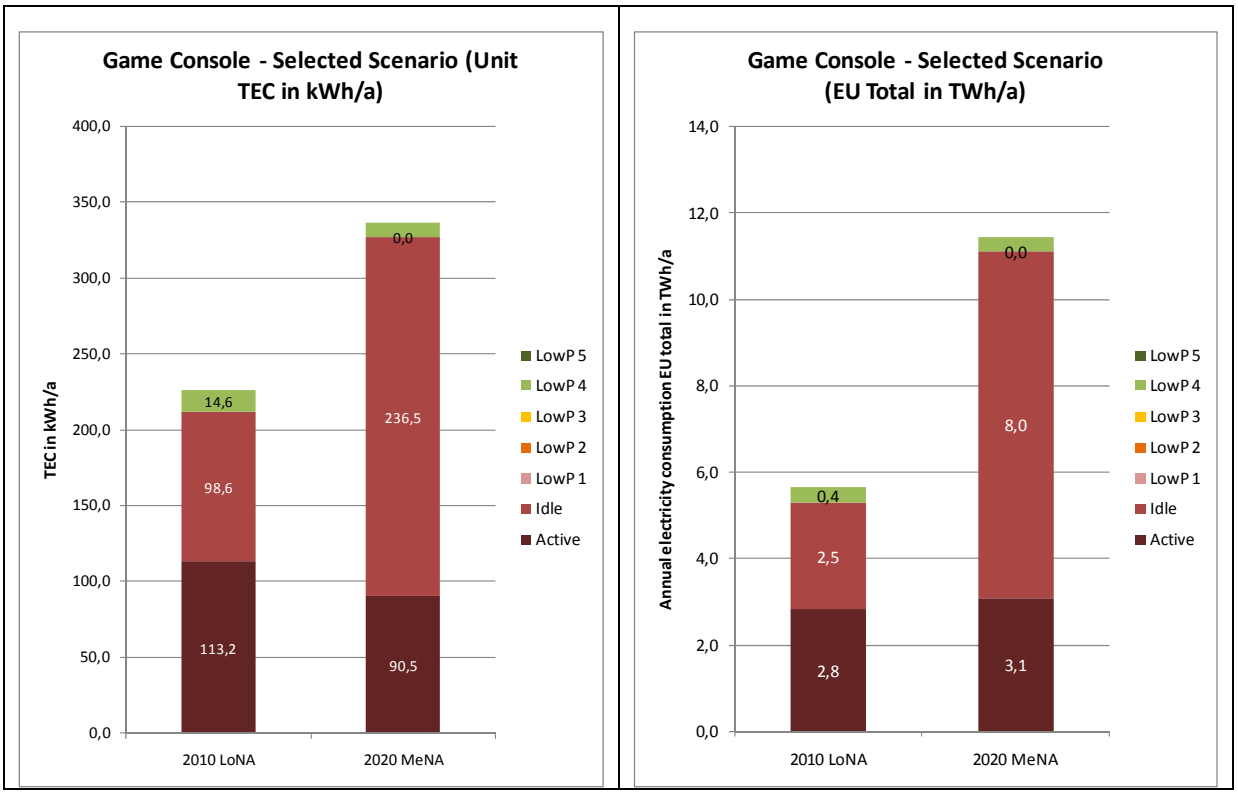


Figure 17: Game Console – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.7 Home Computer Display

Table 13: Home Computer Display - Input data for scenarios of reference year 2010

NoNA	**Home Display 22"**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	25,0	0,0	0,0	1,2	0,0	0,0	0,4	
Stock	Use hours (h/d)	5,0	0,0	0,0	2,0	0,0	0,0	17,0	24,0
365 d/a	Mode Power (Wh/d)	125,0	0,0	0,0	2,4	0,0	0,0	6,8	134,2
141 million	TEC Unit/year (kWh/a)	45,6	0,0	0,0	0,9	0,0	0,0	2,5	49,0
	Stock per year (TWh/a)	6,4	0,0	0,0	0,1	0,0	0,0	0,3	6,9

LoNA	Home Display 22"	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	25,0	0,0	0,0	1,2	0,0	0,0	0,4	
Stock	Use hours (h/d)	5,0	0,0	0,0	7,0	0,0	0,0	12,0	24,0
365 d/a	Mode Power (Wh/d)	125,0	0,0	0,0	8,4	0,0	0,0	4,8	138,2
141 million	TEC Unit/year (kWh/a)	45,6	0,0	0,0	3,1	0,0	0,0	1,8	50,4
	Stock per year (TWh/a)	6,4	0,0	0,0	0,4	0,0	0,0	0,2	7,1

MeNA	Home Display 22"	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	25,0	0,0	0,0	1,2	0,0	0,0	0,4	
Stock	Use hours (h/d)	5,0	0,0	0,0	19,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	125,0	0,0	0,0	22,8	0,0	0,0	0,0	147,8
141 million	TEC Unit/year (kWh/a)	45,6	0,0	0,0	8,3	0,0	0,0	0,0	53,9
	Stock per year (TWh/a)	6,4	0,0	0,0	1,2	0,0	0,0	0,0	7,6

HiNA	Home Display 22"	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	25,0	0,0	0,0	1,2	0,0	0,0	0,4	
Stock	Use hours (h/d)	5,0	0,0	0,0	19,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	125,0	0,0	0,0	22,8	0,0	0,0	0,0	147,8
141 million	TEC Unit/year (kWh/a)	45,6	0,0	0,0	8,3	0,0	0,0	0,0	53,9
	Stock per year (TWh/a)	6,4	0,0	0,0	1,2	0,0	0,0	0,0	7,6

Explanatory notes:

The use pattern of the display has been aligned to the use of the home desktop PC.

The product features an active mode and two low power modes.

LowP 2 is equivalent to sleep with wake-up over network.

LowP 5 is equivalent to soft off.

Table 14: Home Computer Display - Input data for scenarios of forecast year 2020

NoNA	**Home Display 22"**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	0,0	0,0	1,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	5,0	0,0	0,0	2,0	0,0	0,0	17,0	24,0
365 d/a	Mode Power (Wh/d)	100,0	0,0	0,0	1,9	0,0	0,0	5,4	107,4
164 million	TEC Unit/year (kWh/a)	36,5	0,0	0,0	0,7	0,0	0,0	2,0	39,2
	Stock per year (TWh/a)	6,0	0,0	0,0	0,1	0,0	0,0	0,3	6,4

LoNA	Home Display 22"	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	0,0	0,0	1,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	5,0	0,0	0,0	7,0	0,0	0,0	12,0	24,0
365 d/a	Mode Power (Wh/d)	100,0	0,0	0,0	6,7	0,0	0,0	3,8	110,6
164 million	TEC Unit/year (kWh/a)	36,5	0,0	0,0	2,5	0,0	0,0	1,4	40,4
	Stock per year (TWh/a)	6,0	0,0	0,0	0,4	0,0	0,0	0,2	6,6

MeNA	Home Display 22"	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	0,0	0,0	1,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	5,0	0,0	0,0	19,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	100,0	0,0	0,0	18,2	0,0	0,0	0,0	118,2
164 million	TEC Unit/year (kWh/a)	36,5	0,0	0,0	6,7	0,0	0,0	0,0	43,2
	Stock per year (TWh/a)	6,0	0,0	0,0	1,1	0,0	0,0	0,0	7,1

HiNA	Home Display 22"	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	0,0	0,0	1,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	5,0	0,0	0,0	19,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	100,0	0,0	0,0	18,2	0,0	0,0	0,0	118,2
164 million	TEC Unit/year (kWh/a)	36,5	0,0	0,0	6,7	0,0	0,0	0,0	43,2
	Stock per year (TWh/a)	6,0	0,0	0,0	1,1	0,0	0,0	0,0	7,1

Explanatory notes:

The general mode and use assumption is similar to the reference year 2010.

General improvement of power consumption per mode: 20%

Further reduction in on-mode power (W/cm²) is feasible. However, we assume that the average screen size will increase over time and compensate the improvement to some extent.

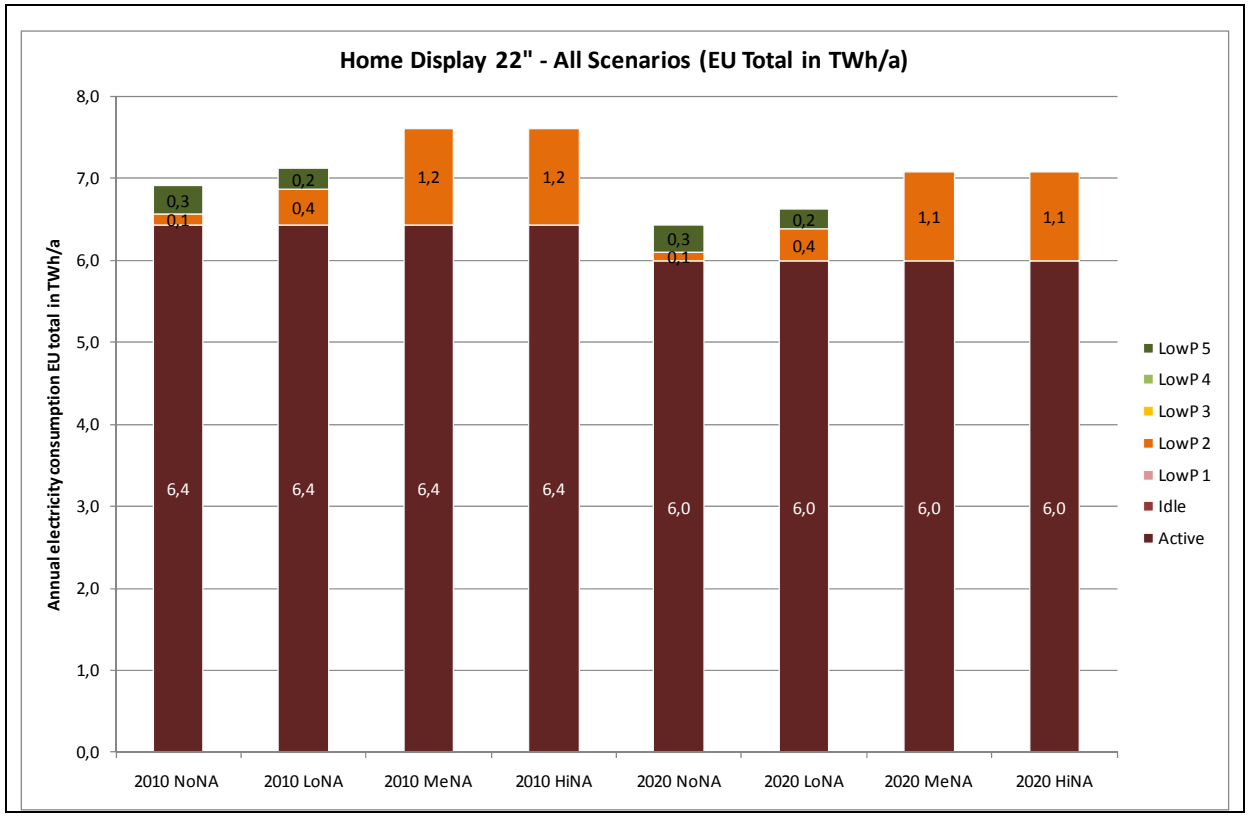


Figure 18: Home Computer Display – Comparison of all scenarios (EU total)

Discussion of results:

The overall energy consumption decreases by 2020 due to the general improvement of power consumption per mode. Networked standby power accounts for about 1 TWh per year. Further improvement potential is related to active power management in conjunction with the PC use.

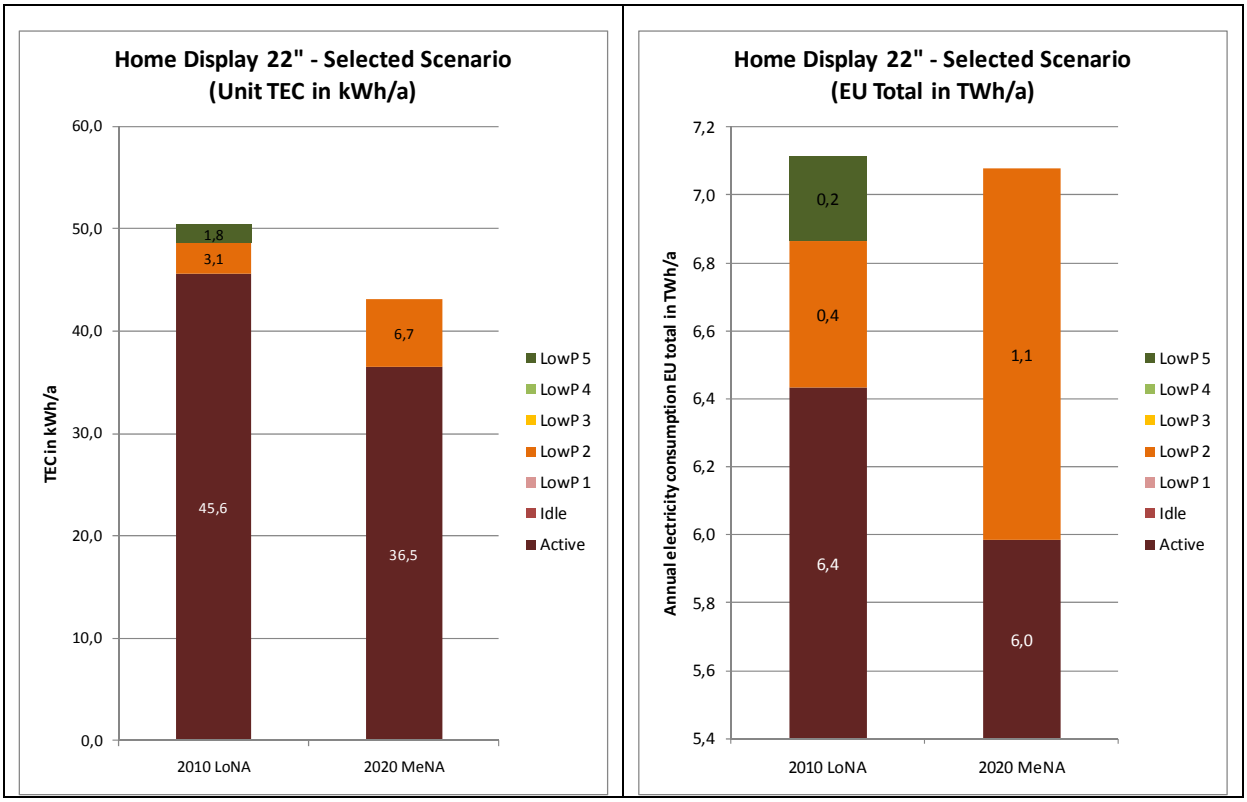


Figure 19: Home Computer Display – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.8 Home IJ Printer/MFD

Table 15: Home IJ Printer/MFD - Input data for scenarios of reference year 2010

NoNA	**Home IJ Printer**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	34,0	17,0	0,0	4,0	0,0	1,5	0,5	
Stock	Use hours (h/d)	0,1	0,9	0,0	6,0	0,0	0,0	17,0	24,0
365 d/a	Mode Power (Wh/d)	3,4	15,3	0,0	24,0	0,0	0,0	8,5	51,2
76 million	TEC Unit/year (kWh/a)	1,2	5,6	0,0	8,8	0,0	0,0	3,1	18,7
	Stock per year (TWh/a)	0,1	0,4	0,0	0,7	0,0	0,0	0,2	1,4

LoNA	Home IJ Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	34,0	17,0	0,0	4,0	0,0	1,5	0,5	
Stock	Use hours (h/d)	0,1	0,9	0,0	6,0	0,0	17,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	3,4	15,3	0,0	24,0	0,0	25,5	0,0	68,2
76 million	TEC Unit/year (kWh/a)	1,2	5,6	0,0	8,8	0,0	9,3	0,0	24,9
	Stock per year (TWh/a)	0,1	0,4	0,0	0,7	0,0	0,7	0,0	1,9

MeNA	Home IJ Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	34,0	17,0	0,0	4,0	0,0	1,5	0,5	
Stock	Use hours (h/d)	0,1	0,9	0,0	23,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	3,4	15,3	0,0	92,0	0,0	0,0	0,0	110,7
76 million	TEC Unit/year (kWh/a)	1,2	5,6	0,0	33,6	0,0	0,0	0,0	40,4
	Stock per year (TWh/a)	0,1	0,4	0,0	2,6	0,0	0,0	0,0	3,1

HiNA	Home IJ Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	34,0	17,0	0,0	4,0	0,0	1,5	0,5	
Stock	Use hours (h/d)	0,1	17,9	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	3,4	304,3	0,0	24,0	0,0	0,0	0,0	331,7
76 million	TEC Unit/year (kWh/a)	1,2	111,1	0,0	8,8	0,0	0,0	0,0	121,1
	Stock per year (TWh/a)	0,1	8,4	0,0	0,7	0,0	0,0	0,0	9,2

Explanatory notes:

Idle is equivalent to “ready mode”. The delay time after the print job is assumed to be 5 to 10 minutes. Then the device shifts into LowP 2.

LowP 2 is a sleep mode from which the product can resume operation within about 10 to 20 seconds.

LowP 4 is an off-mode with WOL

LowP 5 is an off-mode without WOL

Table 16: Home IJ Printer/MFD - Input data for scenarios of forecast year 2020

NoNA	**Home IJ Printer**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	27,2	13,6	0,0	3,2	0,0	1,1	0,4	
Stock	Use hours (h/d)	0,1	0,9	0,0	6,0	0,0	0,0	17,0	24,0
365 d/a	Mode Power (Wh/d)	2,7	12,2	0,0	19,2	0,0	0,0	6,0	40,1
84 million	TEC Unit/year (kWh/a)	1,0	4,5	0,0	7,0	0,0	0,0	2,2	14,6
	Stock per year (TWh/a)	0,1	0,4	0,0	0,6	0,0	0,0	0,2	1,2

LoNA	Home IJ Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	27,2	13,6	0,0	3,2	0,0	1,1	0,4	
Stock	Use hours (h/d)	0,1	0,9	0,0	6,0	0,0	17,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	2,7	12,2	0,0	19,2	0,0	17,9	0,0	52,0
84 million	TEC Unit/year (kWh/a)	1,0	4,5	0,0	7,0	0,0	6,5	0,0	19,0
	Stock per year (TWh/a)	0,1	0,4	0,0	0,6	0,0	0,5	0,0	1,6

MeNA	Home IJ Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	27,2	13,6	0,0	3,2	0,0	1,1	0,4	
Stock	Use hours (h/d)	0,1	0,9	0,0	23,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	2,7	12,2	0,0	73,6	0,0	0,0	0,0	88,6
84 million	TEC Unit/year (kWh/a)	1,0	4,5	0,0	26,9	0,0	0,0	0,0	32,3
	Stock per year (TWh/a)	0,1	0,4	0,0	2,3	0,0	0,0	0,0	2,7

HiNA	Home IJ Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	27,2	13,6	0,0	3,2	0,0	1,1	0,4	
Stock	Use hours (h/d)	0,1	17,9	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	2,7	243,4	0,0	19,2	0,0	0,0	0,0	265,4
84 million	TEC Unit/year (kWh/a)	1,0	88,9	0,0	7,0	0,0	0,0	0,0	96,9
	Stock per year (TWh/a)	0,1	7,5	0,0	0,6	0,0	0,0	0,0	8,1

Explanatory notes:

The general mode and use assumption is similar to the reference year 2010.

General improvement of power consumption per mode: 20%

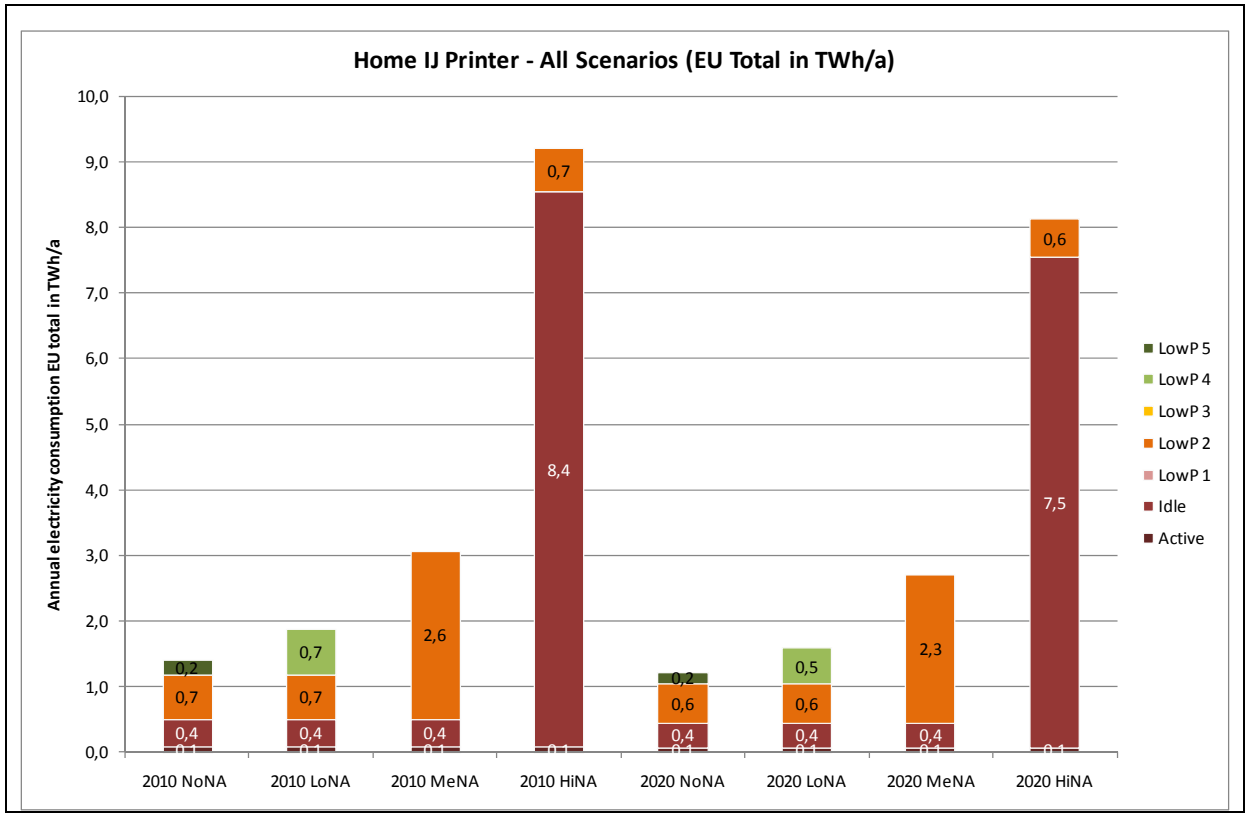


Figure 20: Home IJ Printer/MFD – Comparison of all scenarios (EU total)

Discussion of results:

The 20% improvement per mode is compensating the moderate increasing product stock. LoNA and MeNA (e.g. when MFD with fax is considered) are realistic use scenarios. Sleep mode duration (networked standby) is with about 2TWh per year still considerable in terms of overall energy consumption (e.g. MeNA 2020). Extended idle (ready) mode durations result in significantly increasing energy consumption (see HiNA).

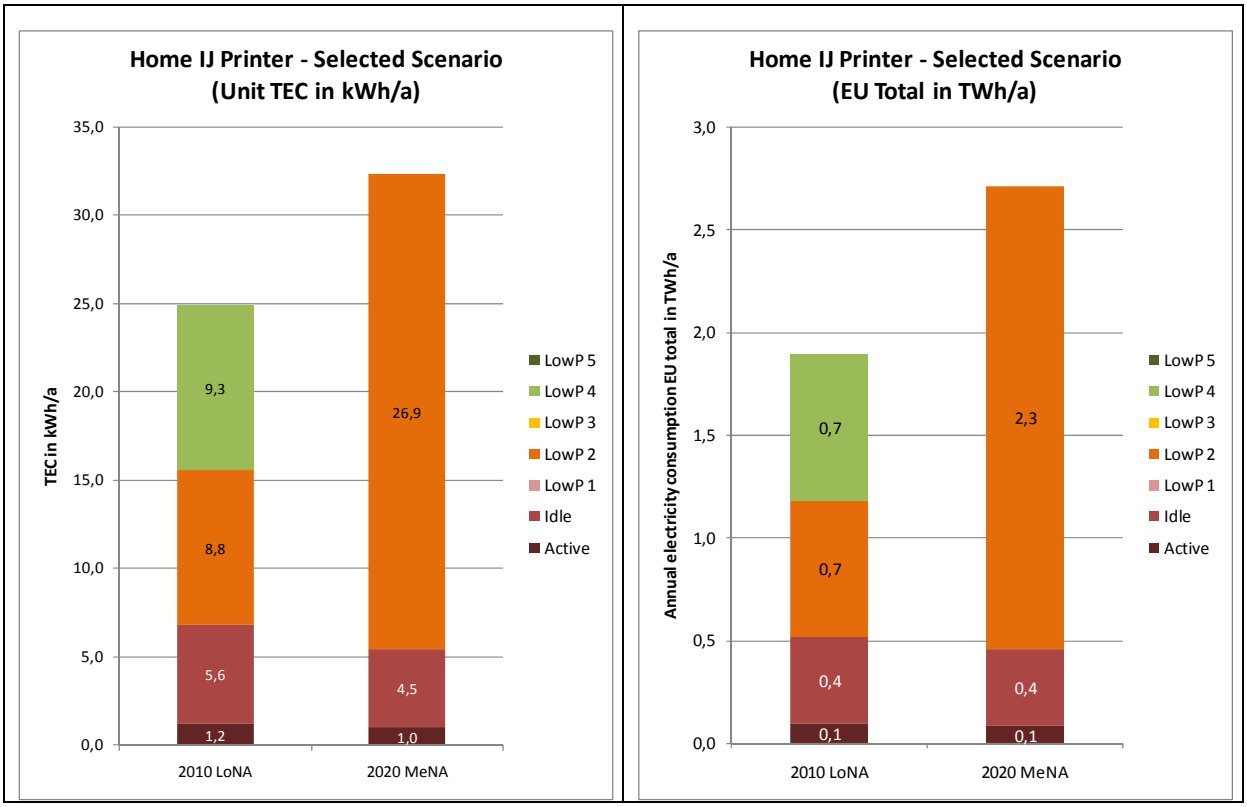


Figure 21: Home IJ Printer/MFD – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.9 Home EP Printer/MFD

Table 17: Home EP Printer - Input data for scenarios of reference year 2010

NoNA	**Home EP Printer**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	500,0	50,0	0,0	10,0	0,0	7,0	0,3	
Stock	Use hours (h/d)	0,1	0,9	0,0	6,0	0,0	0,0	17,0	24,0
365 d/a	Mode Power (Wh/d)	50,0	45,0	0,0	60,0	0,0	0,0	5,1	160,1
5 million	TEC Unit/year (kWh/a)	18,3	16,4	0,0	21,9	0,0	0,0	1,9	58,4
	Stock per year (TWh/a)	0,1	0,1	0,0	0,1	0,0	0,0	0,0	0,3

LoNA	Home EP Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	500,0	50,0	0,0	10,0	0,0	7,0	0,3	
Stock	Use hours (h/d)	0,1	0,9	0,0	6,0	0,0	17,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	50,0	45,0	0,0	60,0	0,0	119,0	0,0	274,0
5 million	TEC Unit/year (kWh/a)	18,3	16,4	0,0	21,9	0,0	43,4	0,0	100,0
	Stock per year (TWh/a)	0,1	0,1	0,0	0,1	0,0	0,2	0,0	0,5

MeNA	Home EP Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	500,0	50,0	0,0	10,0	0,0	7,0	0,3	
Stock	Use hours (h/d)	0,1	0,9	0,0	23,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	50,0	45,0	0,0	230,0	0,0	0,0	0,0	325,0
5 million	TEC Unit/year (kWh/a)	18,3	16,4	0,0	84,0	0,0	0,0	0,0	118,6
	Stock per year (TWh/a)	0,1	0,1	0,0	0,4	0,0	0,0	0,0	0,6

HiNA	Home EP Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	500,0	50,0	0,0	10,0	0,0	7,0	0,3	
Stock	Use hours (h/d)	0,1	17,9	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	50,0	895,0	0,0	60,0	0,0	0,0	0,0	1005,0
5 million	TEC Unit/year (kWh/a)	18,3	326,7	0,0	21,9	0,0	0,0	0,0	366,8
	Stock per year (TWh/a)	0,1	1,6	0,0	0,1	0,0	0,0	0,0	1,8

Explanatory notes:

Modes and use patterns are similar to IJ Printer/MFD.

During the investigation of exemplary products we observed that products featuring Energy Star Label or the Blue Angel Label have considerably lower ready and sleep mode power consumption and feature strict power management settings. For example idle mode for a similar product could be 50 Watt or 120 Watt. Such differences are influencing the impact of this product group to a large extent.

Table 18: Home EP Printer - Input data for scenarios of forecast year 2020

NoNA	**Home EP Printer**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	400,0	40,0	0,0	8,0	0,0	4,9	0,2	
Stock	Use hours (h/d)	0,1	0,9	0,0	6,0	0,0	0,0	17,0	24,0
365 d/a	Mode Power (Wh/d)	40,0	36,0	0,0	48,0	0,0	0,0	3,6	127,6
7 million	TEC Unit/year (kWh/a)	14,6	13,1	0,0	17,5	0,0	0,0	1,3	46,6
	Stock per year (TWh/a)	0,1	0,1	0,0	0,1	0,0	0,0	0,0	0,3

LoNA	Home EP Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	400,0	40,0	0,0	8,0	0,0	4,9	0,2	
Stock	Use hours (h/d)	0,1	0,9	0,0	6,0	0,0	17,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	40,0	36,0	0,0	48,0	0,0	83,3	0,0	207,3
7 million	TEC Unit/year (kWh/a)	14,6	13,1	0,0	17,5	0,0	30,4	0,0	75,7
	Stock per year (TWh/a)	0,1	0,1	0,0	0,1	0,0	0,2	0,0	0,5

MeNA	Home EP Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	400,0	40,0	0,0	8,0	0,0	4,9	0,2	
Stock	Use hours (h/d)	0,1	0,9	0,0	23,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	40,0	36,0	0,0	184,0	0,0	0,0	0,0	260,0
7 million	TEC Unit/year (kWh/a)	14,6	13,1	0,0	67,2	0,0	0,0	0,0	94,9
	Stock per year (TWh/a)	0,1	0,1	0,0	0,5	0,0	0,0	0,0	0,7

HiNA	Home EP Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	400,0	40,0	0,0	8,0	0,0	4,9	0,2	
Stock	Use hours (h/d)	0,1	17,9	0,0	6,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	40,0	716,0	0,0	48,0	0,0	0,0	0,0	804,0
7 million	TEC Unit/year (kWh/a)	14,6	261,3	0,0	17,5	0,0	0,0	0,0	293,5
	Stock per year (TWh/a)	0,1	1,8	0,0	0,1	0,0	0,0	0,0	2,1

Explanatory notes:

The general mode and use assumption is similar to the reference year 2010.

General improvement of power consumption per mode: 20%

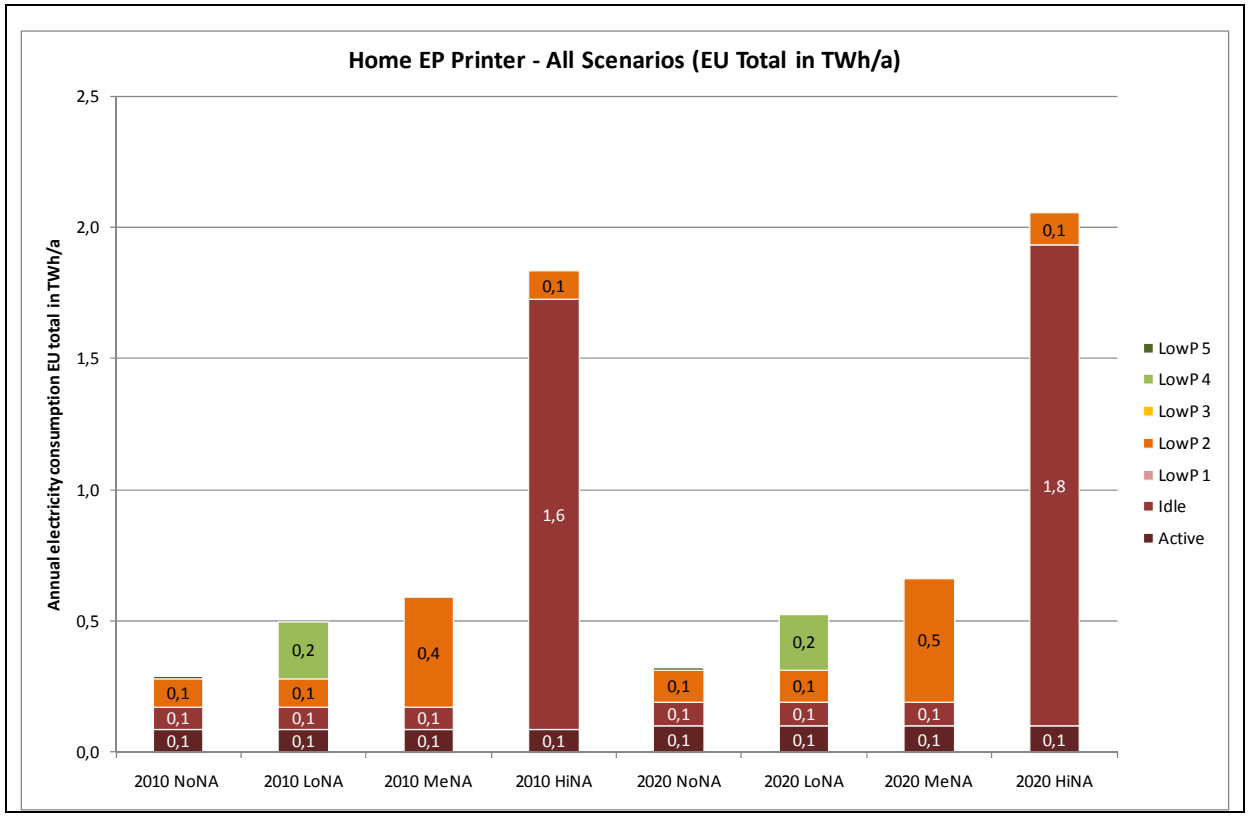


Figure 22: Home EP Printer – Comparison of all scenarios (EU total)

Discussion of results:

There are only slight changes in the 2010 and 2020 scenarios. The moderate increase in product stock 2020 is basically compensated by the assumed 20% improvement in power consumption. The energy consumption related to networked standby is about 0.5 to 1 TWh per year depending on the selected scenario.

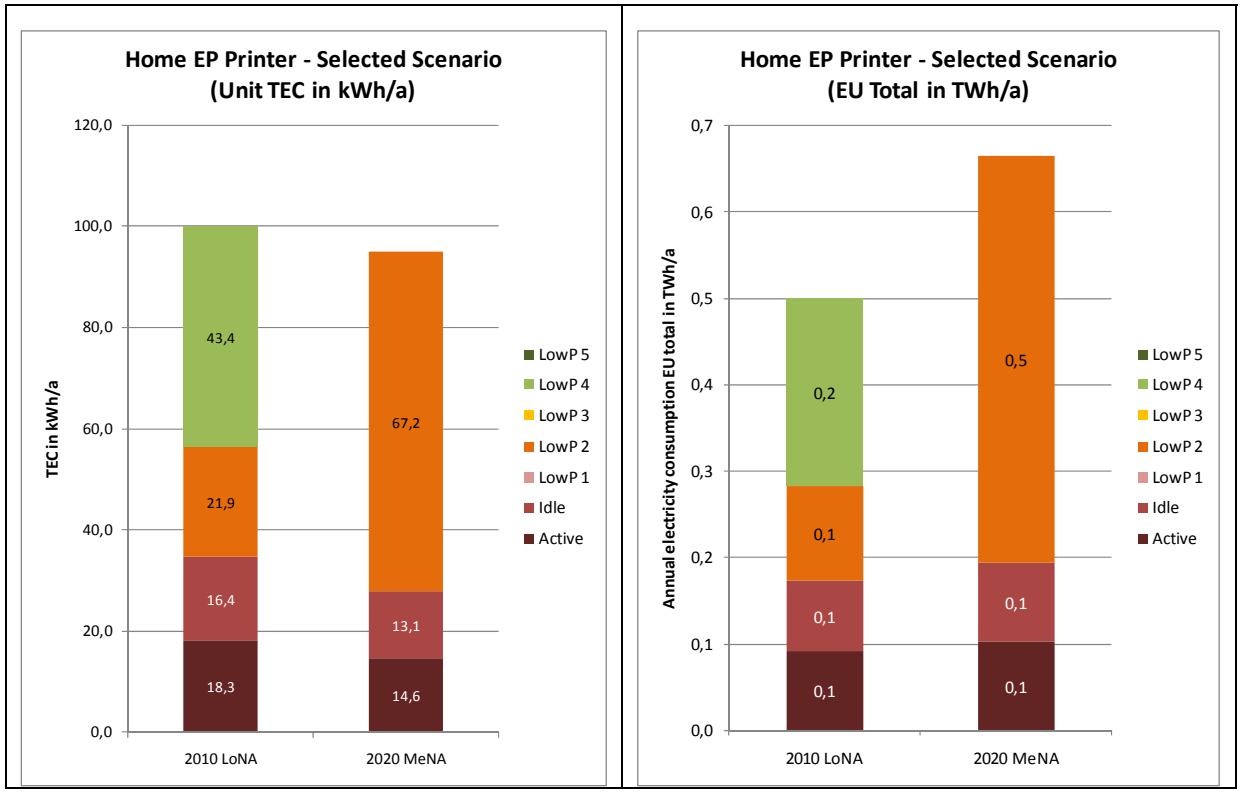


Figure 23: Home EP Printer – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.10 Home Simple Set Top Box

Table 19: Home Simple Set Top Box - Input data for scenarios of reference year 2010

NoNA	**Simple STB**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	0,0	0,0	0,0	0,0	2,0	0,2	
Stock	Use hours (h/d)	5,0	0,0	0,0	0,0	0,0	0,0	19,0	24,0
365 d/a	Mode Power (Wh/d)	80,0	0,0	0,0	0,0	0,0	0,0	3,8	83,8
151 million	TEC Unit/year (kWh/a)	29,2	0,0	0,0	0,0	0,0	0,0	1,4	30,6
	Stock per year (TWh/a)	4,4	0,0	0,0	0,0	0,0	0,0	0,2	4,6

LoNA	Simple STB	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	0,0	0,0	0,0	0,0	2,0	0,2	
Stock	Use hours (h/d)	5,0	0,0	0,0	0,0	0,0	19,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	80,0	0,0	0,0	0,0	0,0	38,0	0,0	118,0
151 million	TEC Unit/year (kWh/a)	29,2	0,0	0,0	0,0	0,0	13,9	0,0	43,1
	Stock per year (TWh/a)	4,4	0,0	0,0	0,0	0,0	2,1	0,0	6,5

MeNA	Simple STB	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	0,0	0,0	0,0	0,0	2,0	0,2	
Stock	Use hours (h/d)	9,0	0,0	0,0	0,0	0,0	15,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	144,0	0,0	0,0	0,0	0,0	30,0	0,0	174,0
151 million	TEC Unit/year (kWh/a)	52,6	0,0	0,0	0,0	0,0	11,0	0,0	63,5
	Stock per year (TWh/a)	7,9	0,0	0,0	0,0	0,0	1,7	0,0	9,6

HiNA	Simple STB	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	0,0	0,0	0,0	0,0	2,0	0,2	
Stock	Use hours (h/d)	18,0	0,0	0,0	0,0	0,0	6,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	288,0	0,0	0,0	0,0	0,0	12,0	0,0	300,0
151 million	TEC Unit/year (kWh/a)	105,1	0,0	0,0	0,0	0,0	4,4	0,0	109,5
	Stock per year (TWh/a)	15,9	0,0	0,0	0,0	0,0	0,7	0,0	16,5

Explanatory notes:

Simple STB (no conditional access, and return path) features only three modes:

Active mode duration correlates with average 4h of TV receiving and 1h recording of TV programmes. MeNA and HiNA scenarios consider longer active mode duration for users that do not use timer function.

LowP 4 is equivalent to passive standby (time function active). The 2W assumption reflects the amount of older models still in the market.

LowP 5 is off mode with losses.

LoNA and MeNA are most realistic scenarios.

Table 20: Home Simple Set Top Box - Input data for scenarios of forecast year 2020

NoNA	**Simple STB**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	12,8	0,0	0,0	0,0	0,0	1,4	0,1	
Stock	Use hours (h/d)	5,0	0,0	0,0	0,0	0,0	0,0	19,0	24,0
365 d/a	Mode Power (Wh/d)	64,0	0,0	0,0	0,0	0,0	0,0	2,7	66,7
123 million	TEC Unit/year (kWh/a)	23,4	0,0	0,0	0,0	0,0	0,0	1,0	24,3
	Stock per year (TWh/a)	2,9	0,0	0,0	0,0	0,0	0,0	0,1	3,0

LoNA	Simple STB	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	12,8	0,0	0,0	0,0	0,0	1,4	0,1	
Stock	Use hours (h/d)	5,0	0,0	0,0	0,0	0,0	19,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	64,0	0,0	0,0	0,0	0,0	26,6	0,0	90,6
123 million	TEC Unit/year (kWh/a)	23,4	0,0	0,0	0,0	0,0	9,7	0,0	33,1
	Stock per year (TWh/a)	2,9	0,0	0,0	0,0	0,0	1,2	0,0	4,1

MeNA	Simple STB	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	12,8	0,0	0,0	0,0	0,0	1,4	0,1	
Stock	Use hours (h/d)	9,0	0,0	0,0	0,0	0,0	15,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	115,2	0,0	0,0	0,0	0,0	21,0	0,0	136,2
123 million	TEC Unit/year (kWh/a)	42,0	0,0	0,0	0,0	0,0	7,7	0,0	49,7
	Stock per year (TWh/a)	5,2	0,0	0,0	0,0	0,0	0,9	0,0	6,1

HiNA	Simple STB	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	12,8	0,0	0,0	0,0	0,0	1,4	0,1	
Stock	Use hours (h/d)	18,0	0,0	0,0	0,0	0,0	6,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	230,4	0,0	0,0	0,0	0,0	8,4	0,0	238,8
123 million	TEC Unit/year (kWh/a)	84,1	0,0	0,0	0,0	0,0	3,1	0,0	87,2
	Stock per year (TWh/a)	10,3	0,0	0,0	0,0	0,0	0,4	0,0	10,7

Explanatory notes:

The product stock is shrinking gradually. Simple STBs might be used for secondary TV (e.g. with DVB-T).

Modes and use assumptions are similar to 2010 scenarios with a general power consumption improvement of 20% per mode. However, one might argue that no improvement in power consumption will occur due to the remaining older product stock in the market.

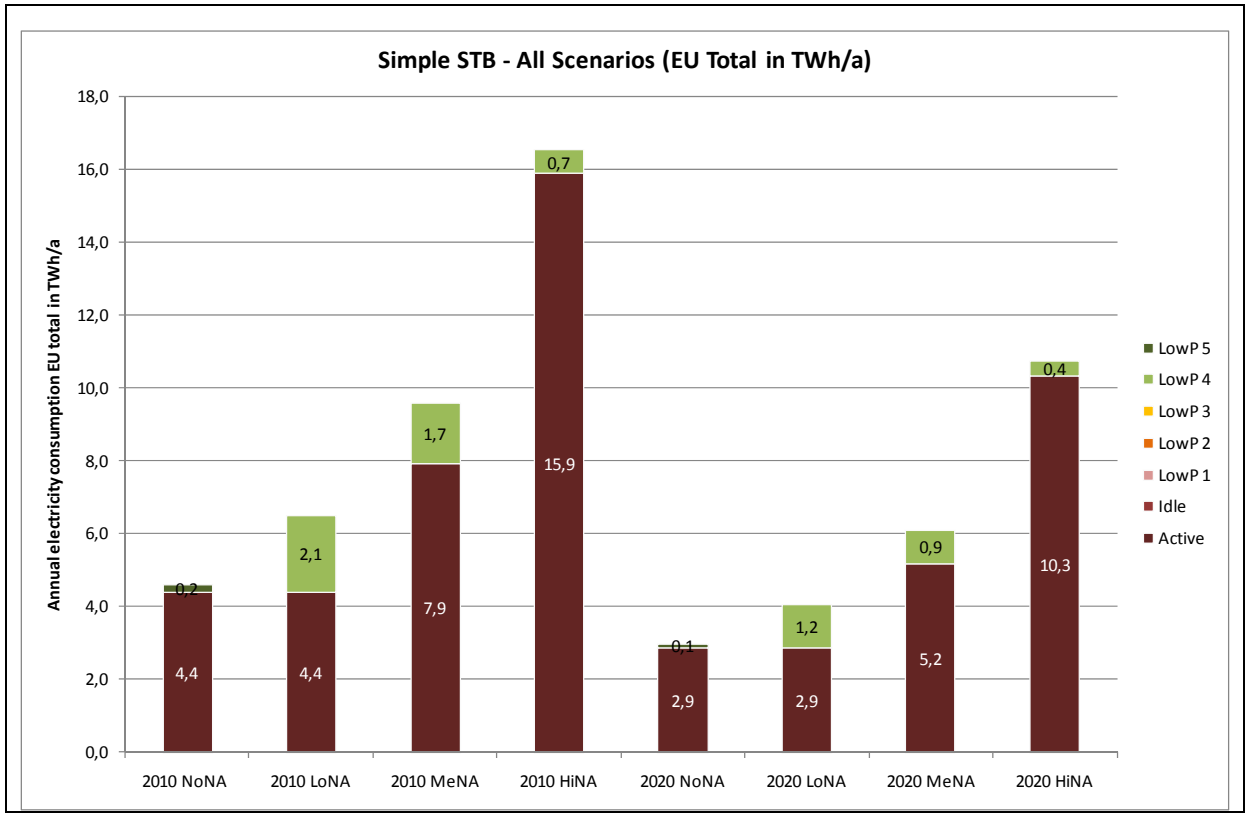


Figure 24: Home Simple Set Top Box – Comparison of all scenarios (EU total)

Discussion of results:

Active mode is dominant power consumption in all scenarios. Networked standby is typically accomplished by timer function. In the MeNA and HiNA scenarios we assume that the user is leaving the device partially in active and is not utilising passive standby. Through active mode the overall energy consumption is with 6 to 10 TWh/a for the reference year 2010 substantial. The 2020 scenarios are the consequent result of the reduced stock. Improvement potential is very limited.

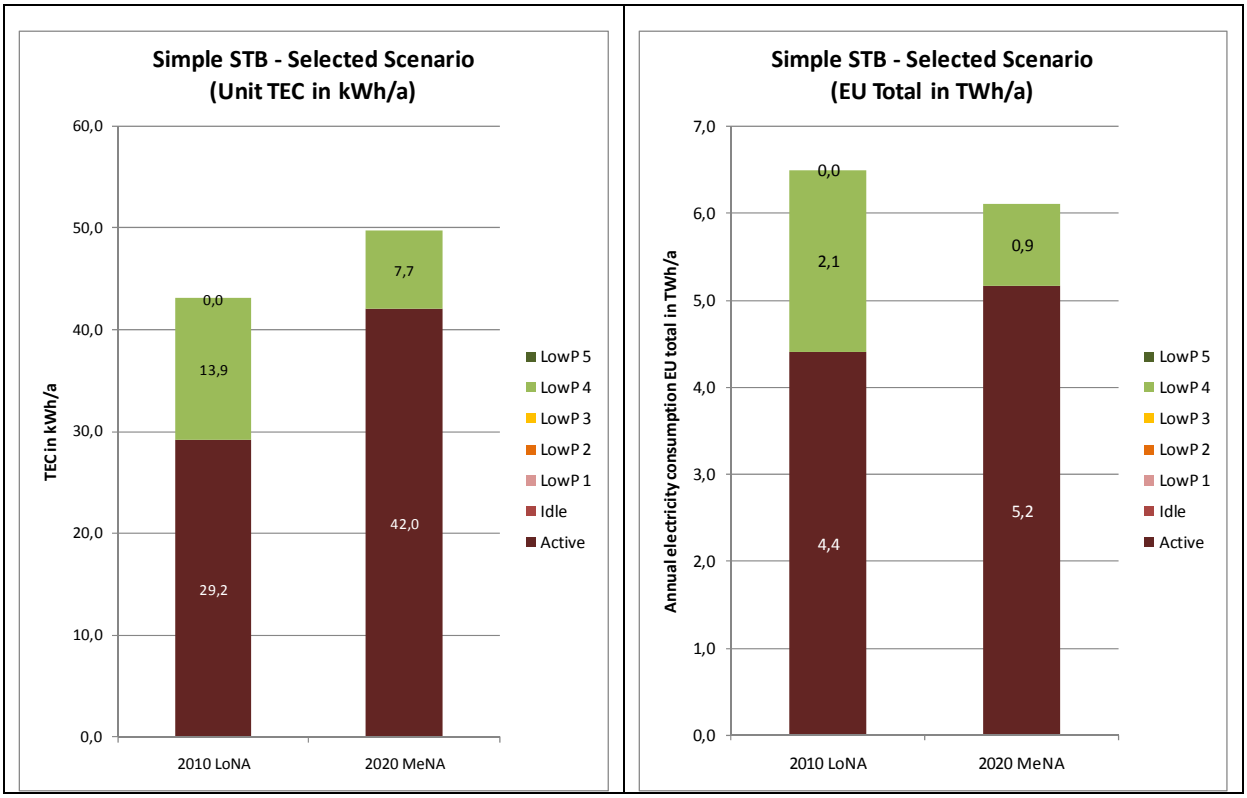


Figure 25: Home Simple Set Top Box – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.11 Home Complex Set Top Box

Table 21: Home Complex Set Top Box - Input data for scenarios of reference year 2010

NoNA	**Complex STB**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	0,0	0,0	10,0	0,0	0,7	0,2	
Stock	Use hours (h/d)	5,0	0,0	0,0	0,0	0,0	13,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	150,0	0,0	0,0	0,0	0,0	9,1	1,2	160,3
82 million	TEC Unit/year (kWh/a)	54,8	0,0	0,0	0,0	0,0	3,3	0,4	58,5
	Stock per year (TWh/a)	4,5	0,0	0,0	0,0	0,0	0,3	0,0	4,8

LoNA	Complex STB	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	0,0	0,0	10,0	0,0	0,7	0,2	
Stock	Use hours (h/d)	5,0	0,0	0,0	6,0	0,0	13,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	150,0	0,0	0,0	60,0	0,0	9,1	0,0	219,1
82 million	TEC Unit/year (kWh/a)	54,8	0,0	0,0	21,9	0,0	3,3	0,0	80,0
	Stock per year (TWh/a)	4,5	0,0	0,0	1,8	0,0	0,3	0,0	6,6

MeNA	Complex STB	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	0,0	0,0	10,0	0,0	0,7	0,2	
Stock	Use hours (h/d)	5,0	0,0	0,0	13,0	0,0	6,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	150,0	0,0	0,0	130,0	0,0	4,2	0,0	284,2
82 million	TEC Unit/year (kWh/a)	54,8	0,0	0,0	47,5	0,0	1,5	0,0	103,7
	Stock per year (TWh/a)	4,5	0,0	0,0	3,9	0,0	0,1	0,0	8,5

HiNA	Complex STB	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	0,0	0,0	10,0	0,0	0,7	0,2	
Stock	Use hours (h/d)	5,0	0,0	0,0	19,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	150,0	0,0	0,0	190,0	0,0	0,0	0,0	340,0
82 million	TEC Unit/year (kWh/a)	54,8	0,0	0,0	69,4	0,0	0,0	0,0	124,1
	Stock per year (TWh/a)	4,5	0,0	0,0	5,7	0,0	0,0	0,0	10,2

Explanatory notes:

Complex STB (with conditional access, and return path) features four modes:

Active mode duration correlates with average 4h of TV receiving and 1h recording of TV programmes. Power consumption in active is considerably higher than the simple STB due to integrated recording/storage capability (HDD), number of digital tuners and decoder.

LowP 2 is equivalent to active standby (high) which allows remote access and reactivation of the device for the service provider.

LowP 4 is equivalent to passive standby (time function active). The 0,7W assumption reflects good practice and voluntary agreement compliance in the market.

LowP 5 is off mode with losses.

LoNA and MeNA are most realistic scenarios.

Table 22: Home Complex Set Top Box - Input data for scenarios of forecast year 2020

NoNA	**Complex STB**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	0,0	0,0	8,0	0,0	0,5	0,1	
Stock	Use hours (h/d)	5,0	0,0	0,0	0,0	0,0	19,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	120,0	0,0	0,0	0,0	0,0	9,3	0,0	129,3
113 million	TEC Unit/year (kWh/a)	43,8	0,0	0,0	0,0	0,0	3,4	0,0	47,2
	Stock per year (TWh/a)	4,9	0,0	0,0	0,0	0,0	0,4	0,0	5,3

LoNA	Complex STB	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	0,0	0,0	8,0	0,0	0,5	0,1	
Stock	Use hours (h/d)	5,0	0,0	0,0	6,0	0,0	13,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	120,0	0,0	0,0	48,0	0,0	6,4	0,0	174,4
113 million	TEC Unit/year (kWh/a)	43,8	0,0	0,0	17,5	0,0	2,3	0,0	63,6
	Stock per year (TWh/a)	4,9	0,0	0,0	2,0	0,0	0,3	0,0	7,2

MeNA	Complex STB	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	0,0	0,0	8,0	0,0	0,5	0,1	
Stock	Use hours (h/d)	5,0	0,0	0,0	13,0	0,0	6,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	120,0	0,0	0,0	104,0	0,0	2,9	0,0	226,9
113 million	TEC Unit/year (kWh/a)	43,8	0,0	0,0	38,0	0,0	1,1	0,0	82,8
	Stock per year (TWh/a)	4,9	0,0	0,0	4,3	0,0	0,1	0,0	9,4

HiNA	Complex STB	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	0,0	0,0	8,0	0,0	0,5	0,1	
Stock	Use hours (h/d)	5,0	0,0	0,0	19,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	120,0	0,0	0,0	152,0	0,0	0,0	0,0	272,0
113 million	TEC Unit/year (kWh/a)	43,8	0,0	0,0	55,5	0,0	0,0	0,0	99,3
	Stock per year (TWh/a)	4,9	0,0	0,0	6,3	0,0	0,0	0,0	11,2

Explanatory notes:

The product stock is increasing due to necessary service contracts for HD and later 3D TV programmes.

Modes and use assumptions are similar to 2010 scenarios with a general power consumption improvement of 20% per mode. With the introduction of more advanced recording/storage technology (e.g. SDD) power consumption could improve even more.

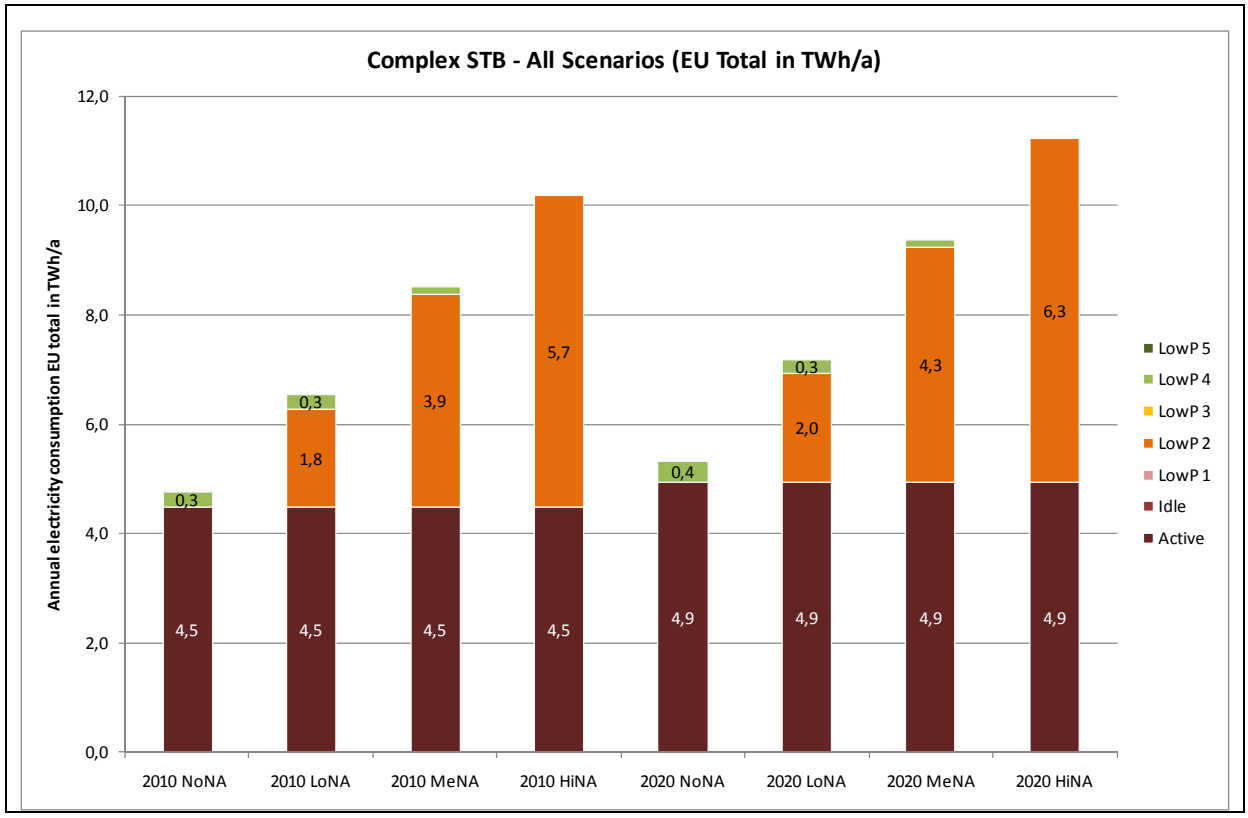


Figure 26: Home Complex Set Top Box – Comparison of all scenarios (EU total)

Discussion of results:

Active mode is dominant power consumption although LowP 2 (networked or active standby) is equally important in the MENA and HiNA scenarios. The overall energy consumption is with 7 to 11 TWh/a substantial also against the growing product stock and probably more intense utilization in the future. Improvement potential is given through power management and reduction of power consumption per mode.

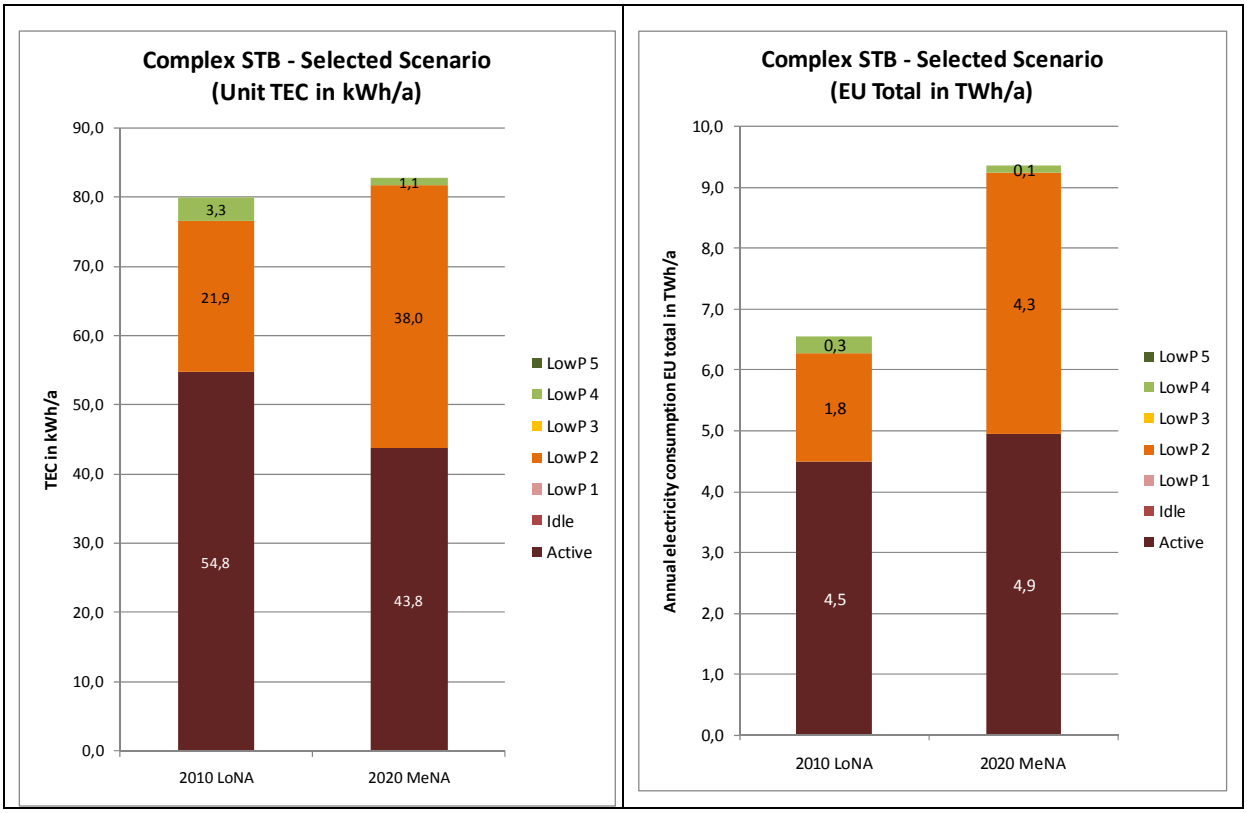


Figure 27: Home Complex Set Top Box – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.12 Home Simple TV

Table 23: Home Simple TV - Input data for scenarios of reference year 2010

NoNA	**Simple TV**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	150,0	0,0	0,0	0,0	0,0	1,8	0,2	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	0,0	20,0	24,0
365 d/a	Mode Power (Wh/d)	600,0	0,0	0,0	0,0	0,0	0,0	4,0	604,0
384 million	TEC Unit/year (kWh/a)	219,0	0,0	0,0	0,0	0,0	0,0	1,5	220,5
	Stock per year (TWh/a)	84,1	0,0	0,0	0,0	0,0	0,0	0,6	84,7

LoNA	Simple TV	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	150,0	0,0	0,0	0,0	0,0	1,8	0,2	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	14,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	600,0	0,0	0,0	0,0	0,0	25,2	1,2	626,4
384 million	TEC Unit/year (kWh/a)	219,0	0,0	0,0	0,0	0,0	9,2	0,4	228,6
	Stock per year (TWh/a)	84,1	0,0	0,0	0,0	0,0	3,5	0,2	87,8

MeNA	Simple TV	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	150,0	0,0	0,0	0,0	0,0	1,8	0,2	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	20,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	600,0	0,0	0,0	0,0	0,0	36,0	0,0	636,0
384 million	TEC Unit/year (kWh/a)	219,0	0,0	0,0	0,0	0,0	13,1	0,0	232,1
	Stock per year (TWh/a)	84,1	0,0	0,0	0,0	0,0	5,0	0,0	89,1

HiNA	Simple TV	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	150,0	0,0	0,0	0,0	0,0	1,8	0,2	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	20,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	600,0	0,0	0,0	0,0	0,0	36,0	0,0	636,0
384 million	TEC Unit/year (kWh/a)	219,0	0,0	0,0	0,0	0,0	13,1	0,0	232,1
	Stock per year (TWh/a)	84,1	0,0	0,0	0,0	0,0	5,0	0,0	89,1

Explanatory notes:

Simple TV cover both older analogue TVs and digital TVs but without conditional access. It is technically possible to wake-up the TV over network (SCART) e.g. in conjunction with STB booting. Simple TV has three modes:

Active mode, 4h on per day, power consumption reflects already larger but less mature displays in terms of energy efficiency.

LowP 4 is equivalent to passive standby. There are still older devices in the market that consume more than 1W.

LowP 5 is off-mode with losses.

Table 24: Home Simple TV - Input data for scenarios of forecast year 2020

NoNA	**Simple TV**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	120,0	0,0	0,0	0,0	0,0	1,3	0,1	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	0,0	20,0	24,0
365 d/a	Mode Power (Wh/d)	480,0	0,0	0,0	0,0	0,0	0,0	2,8	482,8
246 million	TEC Unit/year (kWh/a)	175,2	0,0	0,0	0,0	0,0	0,0	1,0	176,2
	Stock per year (TWh/a)	43,1	0,0	0,0	0,0	0,0	0,0	0,3	43,4

LoNA	Simple TV	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	120,0	0,0	0,0	0,0	0,0	1,3	0,1	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	14,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	480,0	0,0	0,0	0,0	0,0	17,6	0,8	498,5
246 million	TEC Unit/year (kWh/a)	175,2	0,0	0,0	0,0	0,0	6,4	0,3	181,9
	Stock per year (TWh/a)	43,1	0,0	0,0	0,0	0,0	1,6	0,1	44,8

MeNA	Simple TV	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	120,0	0,0	0,0	0,0	0,0	1,3	0,1	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	20,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	480,0	0,0	0,0	0,0	0,0	25,2	0,0	505,2
246 million	TEC Unit/year (kWh/a)	175,2	0,0	0,0	0,0	0,0	9,2	0,0	184,4
	Stock per year (TWh/a)	43,1	0,0	0,0	0,0	0,0	2,3	0,0	45,4

HiNA	Simple TV	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	120,0	0,0	0,0	0,0	0,0	1,3	0,1	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	20,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	480,0	0,0	0,0	0,0	0,0	25,2	0,0	505,2
246 million	TEC Unit/year (kWh/a)	175,2	0,0	0,0	0,0	0,0	9,2	0,0	184,4
	Stock per year (TWh/a)	43,1	0,0	0,0	0,0	0,0	2,3	0,0	45,4

Explanatory notes:

Mode and use assumption is similar to reference year 2010. Product stock is shrinking due to fewer analogue TVs and more complex TVs in the market. Power consumption improved by 20% in all modes. The considerable number of older, less mature TVs in secondary use influences the higher value of the active mode. New products could become a higher standby through HDMI-CEC wake-up. However, actual market data are not available in that respect.

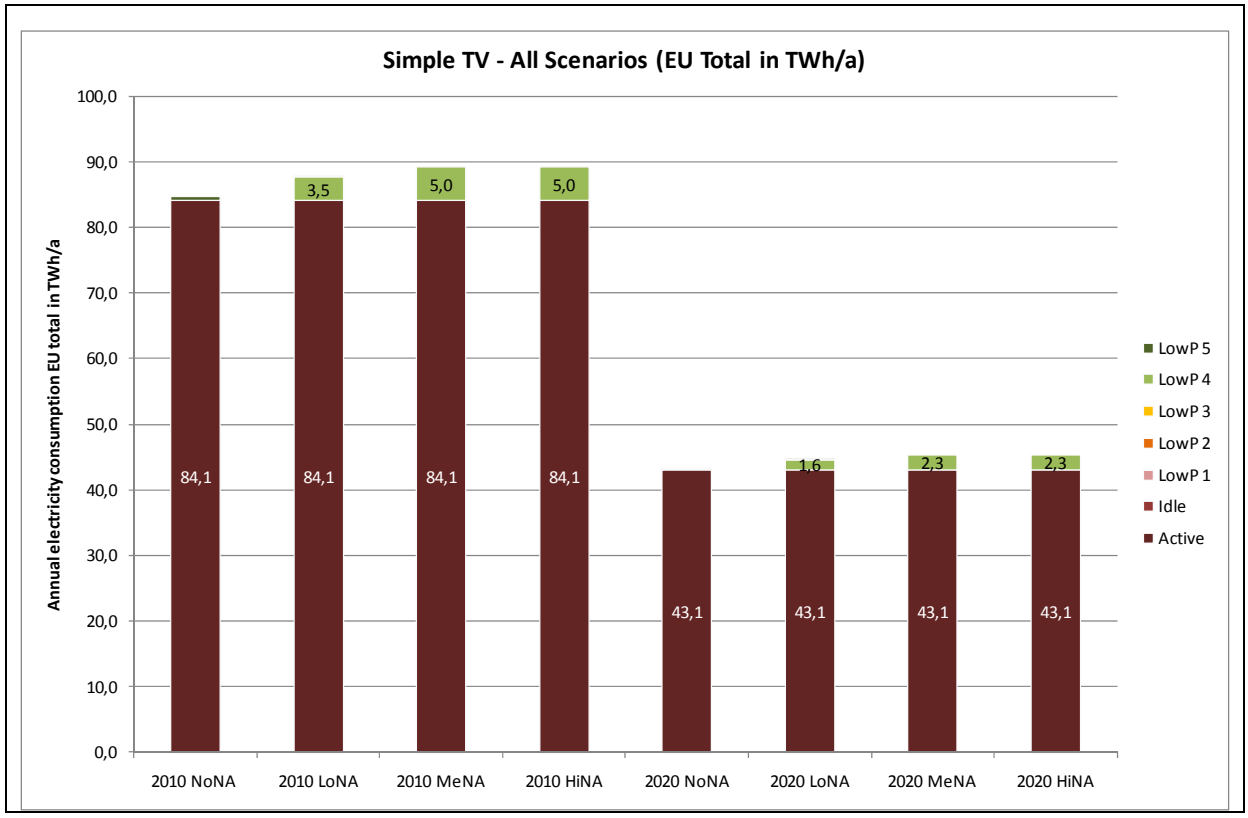


Figure 28: Home Simple TV – Comparison of all scenarios (EU total)

Discussion of results:

Active mode energy consumption is absolutely dominant. 2020 scenarios reflect shrinking product stock in the EU market. Improvement potential is related to the 2 to 5 TWh/a passive standby power.

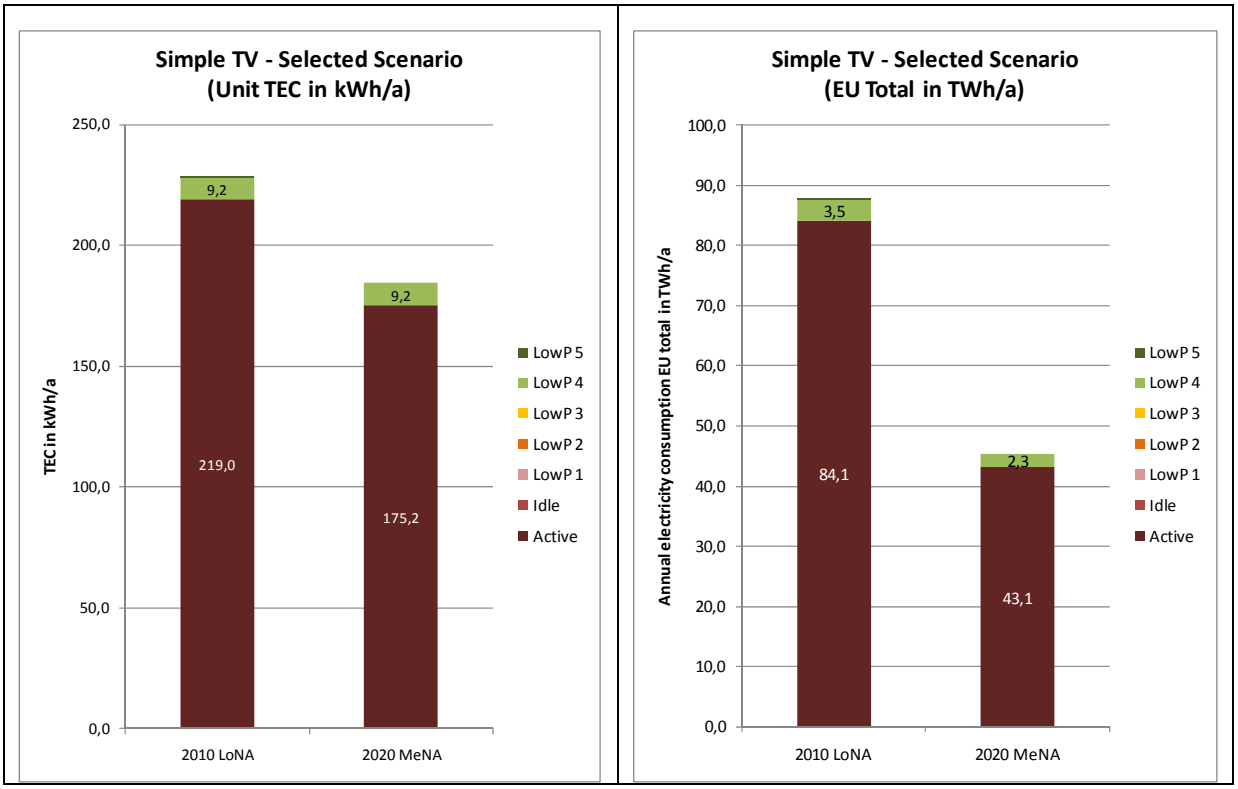


Figure 29: Home Simple TV – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.13 Home Complex TV

Table 25: Home Complex TV - Input data for scenarios of reference year 2010

NoNA	**Complex TV**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	170,0	0,0	0,0	20,0	0,0	0,7	0,2	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	14,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	680,0	0,0	0,0	0,0	0,0	9,8	1,2	691,0
20 million	TEC Unit/year (kWh/a)	248,2	0,0	0,0	0,0	0,0	3,6	0,4	252,2
	Stock per year (TWh/a)	5,0	0,0	0,0	0,0	0,0	0,1	0,0	5,0

LoNA	Complex TV	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	170,0	0,0	0,0	20,0	0,0	0,7	0,2	
Stock	Use hours (h/d)	4,0	0,0	0,0	6,0	0,0	14,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	680,0	0,0	0,0	120,0	0,0	9,8	0,0	809,8
20 million	TEC Unit/year (kWh/a)	248,2	0,0	0,0	43,8	0,0	3,6	0,0	295,6
	Stock per year (TWh/a)	5,0	0,0	0,0	0,9	0,0	0,1	0,0	5,9

MeNA	Complex TV	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	170,0	0,0	0,0	20,0	0,0	0,7	0,2	
Stock	Use hours (h/d)	4,0	0,0	0,0	14,0	0,0	6,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	680,0	0,0	0,0	280,0	0,0	4,2	0,0	964,2
20 million	TEC Unit/year (kWh/a)	248,2	0,0	0,0	102,2	0,0	1,5	0,0	351,9
	Stock per year (TWh/a)	5,0	0,0	0,0	2,0	0,0	0,0	0,0	7,0

HiNA	Complex TV	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	170,0	0,0	0,0	20,0	0,0	0,7	0,2	
Stock	Use hours (h/d)	4,0	0,0	0,0	20,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	680,0	0,0	0,0	400,0	0,0	0,0	0,0	1080,0
20 million	TEC Unit/year (kWh/a)	248,2	0,0	0,0	146,0	0,0	0,0	0,0	394,2
	Stock per year (TWh/a)	5,0	0,0	0,0	2,9	0,0	0,0	0,0	7,9

Explanatory notes:

Complex TV is a state-of-the-art digital HD or 3D TVs with integrated digital tuners, optional decoders and recording/storage. It is technically possible to wake-up the TV over network (HDMI-CEC, LAN or WiFi) e.g. in conjunction with provider service access or booting of a connected media center. Complex TV has four modes:

Active mode with 4h use duration per day. Higher power consumption reflects typically larger and more complex fullHD/3D display (mid-/high- end devices).

LowP 2 is equivalent to active standby. Current product's power consumption varies largely between a few Watts and more than 30 Watt (check on-line blogs for specific products).

LowP 4 is equivalent to passive standby. Most products consume less than 1W.

LowP 5 is off-mode with losses.

Table 26: Home Complex TV - Input data for scenarios of forecast year 2020

NoNA	**Complex TV**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	136,0	0,0	0,0	16,0	0,0	0,5	0,1	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	14,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	544,0	0,0	0,0	0,0	0,0	6,9	0,8	551,7
164 million	TEC Unit/year (kWh/a)	198,6	0,0	0,0	0,0	0,0	2,5	0,3	201,4
	Stock per year (TWh/a)	32,6	0,0	0,0	0,0	0,0	0,4	0,1	33,0

LoNA	Complex TV	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	136,0	0,0	0,0	16,0	0,0	0,5	0,1	
Stock	Use hours (h/d)	4,0	0,0	0,0	0,0	0,0	20,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	544,0	0,0	0,0	0,0	0,0	9,8	0,0	553,8
164 million	TEC Unit/year (kWh/a)	198,6	0,0	0,0	0,0	0,0	3,6	0,0	202,1
	Stock per year (TWh/a)	32,6	0,0	0,0	0,0	0,0	0,6	0,0	33,2

MeNA	Complex TV	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	136,0	0,0	0,0	16,0	0,0	0,5	0,1	
Stock	Use hours (h/d)	4,0	0,0	0,0	14,0	0,0	6,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	544,0	0,0	0,0	224,0	0,0	2,9	0,0	770,9
164 million	TEC Unit/year (kWh/a)	198,6	0,0	0,0	81,8	0,0	1,1	0,0	281,4
	Stock per year (TWh/a)	32,6	0,0	0,0	13,4	0,0	0,2	0,0	46,1

HiNA	Complex TV	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	136,0	0,0	0,0	16,0	0,0	0,5	0,1	
Stock	Use hours (h/d)	4,0	0,0	0,0	20,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	544,0	0,0	0,0	320,0	0,0	0,0	0,0	864,0
164 million	TEC Unit/year (kWh/a)	198,6	0,0	0,0	116,8	0,0	0,0	0,0	315,4
	Stock per year (TWh/a)	32,6	0,0	0,0	19,2	0,0	0,0	0,0	51,7

Explanatory notes:

Power consumption of Complex TV has improved by 20% in all modes. For active mode one might argue that LED backlights and other technologies have a larger improvement potential. This is basically right, but we have to consider the changing system requirements e.g. in conjunction with full HD, 4K or 3D. Particularly 3D will in conjunction with active shutter glasses will require higher luminescence setting which results in about 20% more energy demand of the TV. The important aspect is however the networked standby capability which is covered by LowP 4. We assume a >20% improvement in that respect but due to the installed base of older TVs further overall improvement until 2010 is not realistic. TVs have by 2020 multiple network options.

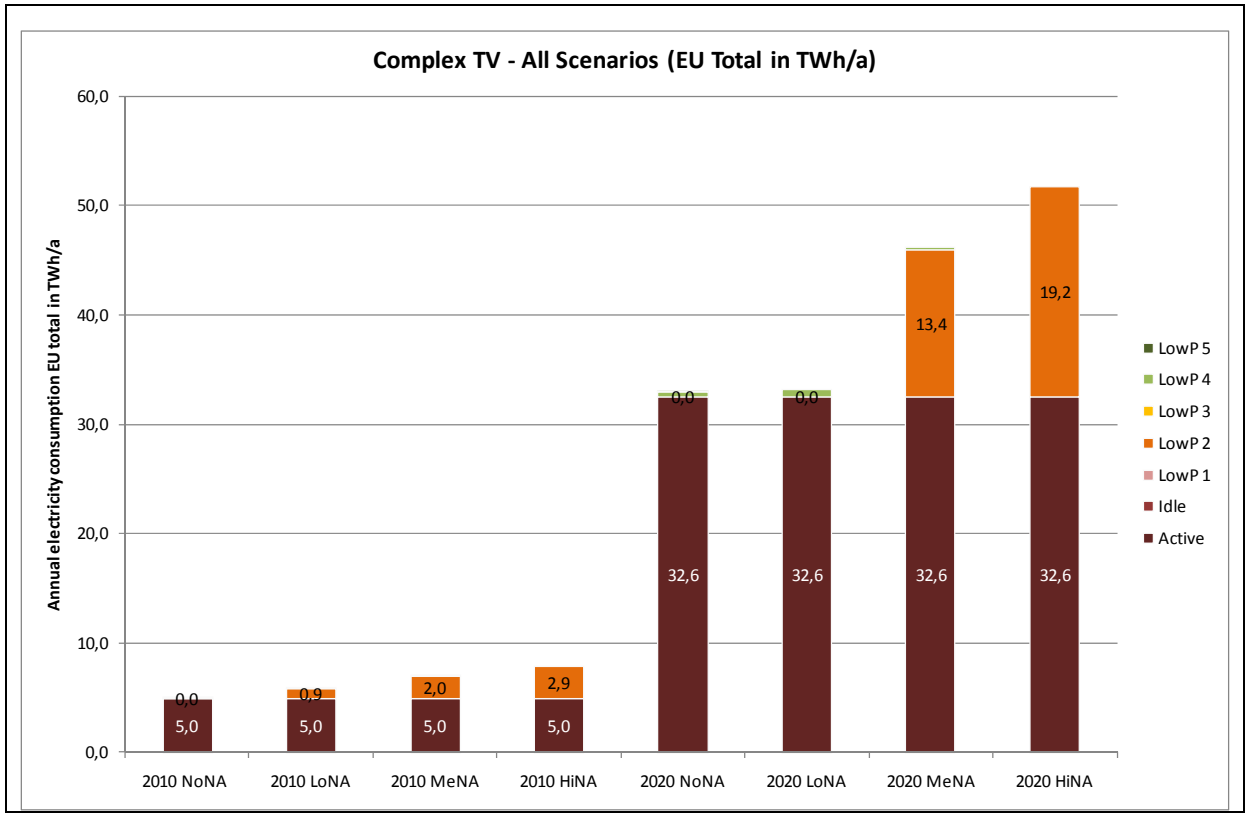


Figure 30: Home Complex TV – Comparison of all scenarios (EU total)

Discussion of results:

The overall development reflects an increasing product stock of complex TVs and has to be seen in conjunction to the decrease in simple TVs. The power consumption of LowP 2 in the MeNA 2020 is with about 13 TWh/a considerable and needs to be addressed. Depending on the actual product configuration and utilization networked standby is an issue.

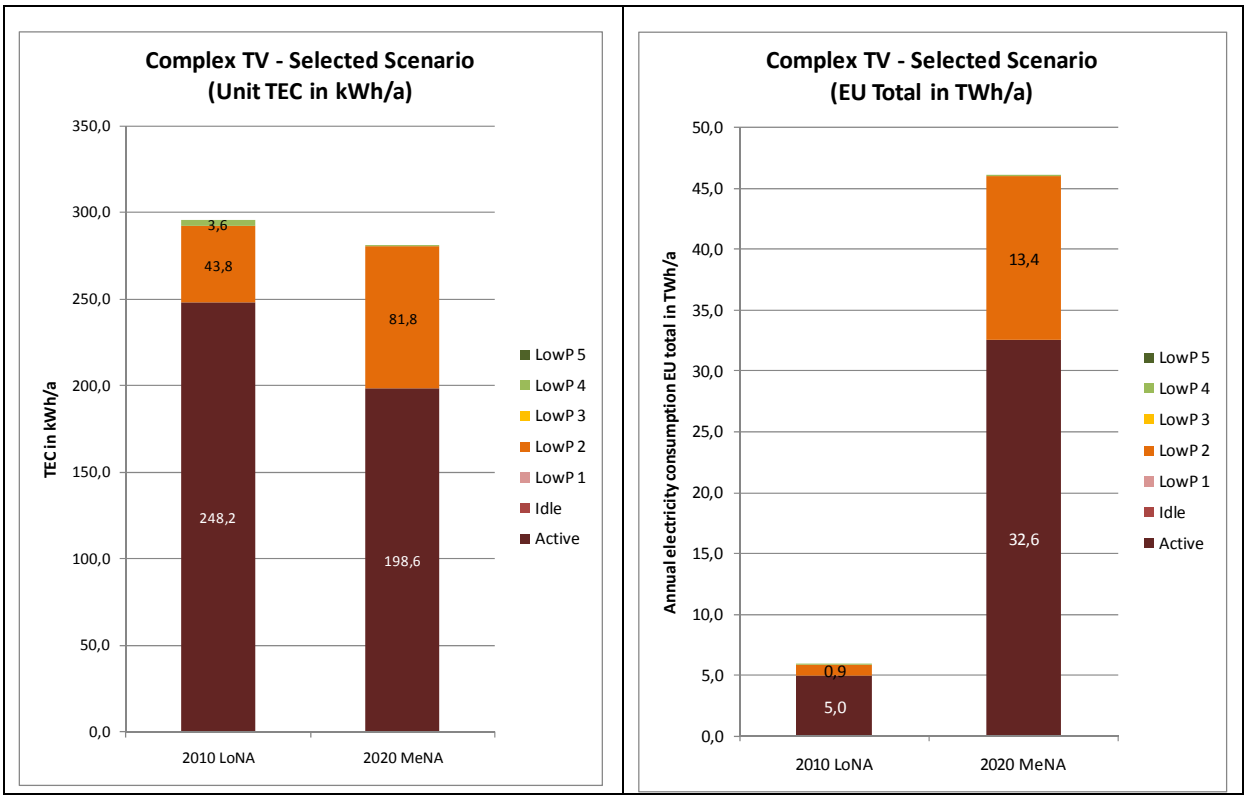


Figure 31: Home Complex TV – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.14 Home Simple Player/Recorder

Table 27: Home Simple Player/Recorder - Input data for scenarios of reference year 2010

NoNA	**Simple Player Recorder 2010**								
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	16,0	0,0	0,0	4,5	0,0	1,0	
Stock	Use hours (h/d)	1,5	0,5	0,0	0,0	0,0	0,0	22,0	24,0
365 d/a	Mode Power (Wh/d)	30,0	8,0	0,0	0,0	0,0	0,0	22,0	60,0
233 million	TEC Unit/year (kWh/a)	11,0	2,9	0,0	0,0	0,0	0,0	8,0	21,9
	Stock per year (TWh/a)	2,6	0,7	0,0	0,0	0,0	0,0	1,9	5,1

LoNA	Simple Player Recorder 2010								
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	16,0	0,0	0,0	4,5	0,0	1,0	
Stock	Use hours (h/d)	1,5	0,5	0,0	0,0	6,0	0,0	16,0	24,0
365 d/a	Mode Power (Wh/d)	30,0	8,0	0,0	0,0	27,0	0,0	16,0	81,0
233 million	TEC Unit/year (kWh/a)	11,0	2,9	0,0	0,0	9,9	0,0	5,8	29,6
	Stock per year (TWh/a)	2,6	0,7	0,0	0,0	2,3	0,0	1,4	6,9

MeNA	Simple Player Recorder 2010								
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	16,0	0,0	0,0	4,5	0,0	1,0	
Stock	Use hours (h/d)	1,5	0,5	0,0	0,0	16,0	0,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	30,0	8,0	0,0	0,0	72,0	0,0	6,0	116,0
233 million	TEC Unit/year (kWh/a)	11,0	2,9	0,0	0,0	26,3	0,0	2,2	42,3
	Stock per year (TWh/a)	2,6	0,7	0,0	0,0	6,1	0,0	0,5	9,9

HiNA	Simple Player Recorder 2010								
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	16,0	0,0	0,0	4,5	0,0	1,0	
Stock	Use hours (h/d)	1,5	0,5	0,0	0,0	22,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	30,0	8,0	0,0	0,0	99,0	0,0	0,0	137,0
233 million	TEC Unit/year (kWh/a)	11,0	2,9	0,0	0,0	36,1	0,0	0,0	50,0
	Stock per year (TWh/a)	2,6	0,7	0,0	0,0	8,4	0,0	0,0	11,7

Explanatory notes:

The product group describes currently installed base of VCR, DVD, BluRay, and HDD (single media) Player/Recorder devices.

We consider that such product could feature up to four modes:

Active mode is actively playing or recording content. We assume an average 1,5h per day (one movie).

Idle mode is an active mode where the product is ready but no content is played or recorded.

LowP 3 is equivalent to passive standby where a timer is running. The somewhat higher power consumption of 4.5 Watt reflects the situation that there are still a substantial number of older devices in the market.

LowP 5 is equivalent to off-mode with losses. The 1 Watt considers a number of older devices still in the market.

Table 28: Home Simple Player/Recorder - Input data for scenarios of forecast year 2020

NoNA	**Simple Player Recorder 2020**								
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	12,8	0,0	0,0	3,6	0,0	0,8	
Stock	Use hours (h/d)	1,5	0,5	0,0	0,0	0,0	0,0	22,0	24,0
365 d/a	Mode Power (Wh/d)	24,0	6,4	0,0	0,0	0,0	0,0	17,6	48,0
174 million	TEC Unit/year (kWh/a)	8,8	2,3	0,0	0,0	0,0	0,0	6,4	17,5
	Stock per year (TWh/a)	1,5	0,4	0,0	0,0	0,0	0,0	1,1	3,0

LoNA	Simple Player Recorder 2020								
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	12,8	0,0	0,0	3,6	0,0	0,8	
Stock	Use hours (h/d)	1,5	0,5	0,0	0,0	6,0	0,0	16,0	24,0
365 d/a	Mode Power (Wh/d)	24,0	6,4	0,0	0,0	21,6	0,0	12,8	64,8
174 million	TEC Unit/year (kWh/a)	8,8	2,3	0,0	0,0	7,9	0,0	4,7	23,7
	Stock per year (TWh/a)	1,5	0,4	0,0	0,0	1,4	0,0	0,8	4,1

MeNA	Simple Player Recorder 2020								
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	12,8	0,0	0,0	3,6	0,0	0,8	
Stock	Use hours (h/d)	1,5	0,5	0,0	0,0	16,0	0,0	6,0	24,0
365 d/a	Mode Power (Wh/d)	24,0	6,4	0,0	0,0	57,6	0,0	4,8	92,8
174 million	TEC Unit/year (kWh/a)	8,8	2,3	0,0	0,0	21,0	0,0	1,8	33,9
	Stock per year (TWh/a)	1,5	0,4	0,0	0,0	3,7	0,0	0,3	5,9

HiNA	Simple Player Recorder 2020								
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	16,0	12,8	0,0	0,0	3,6	0,0	0,8	
Stock	Use hours (h/d)	1,5	0,5	0,0	0,0	22,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	24,0	6,4	0,0	0,0	79,2	0,0	0,0	109,6
174 million	TEC Unit/year (kWh/a)	8,8	2,3	0,0	0,0	28,9	0,0	0,0	40,0
	Stock per year (TWh/a)	1,5	0,4	0,0	0,0	5,0	0,0	0,0	7,0

Explanatory notes:

Modes and use patterns similar to the reference year 2010. General power consumption improvement per mode is 20%.

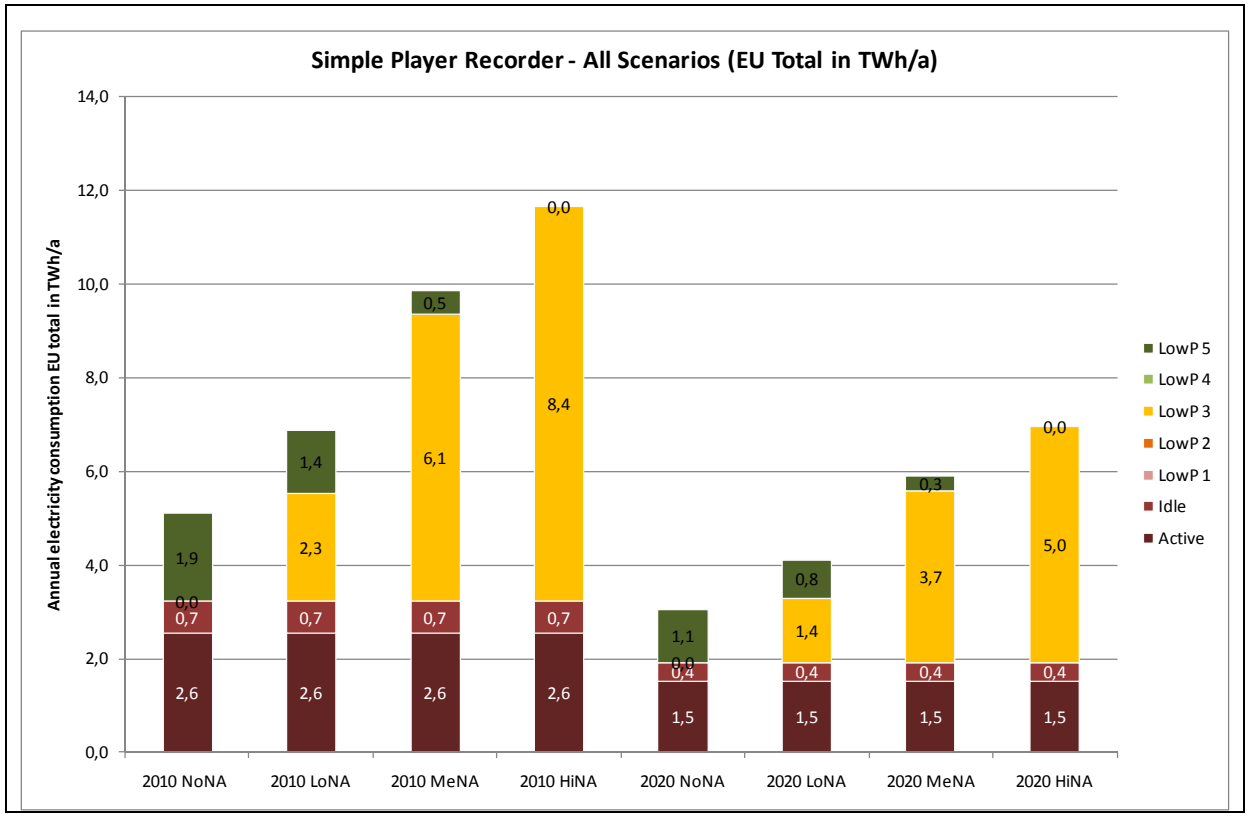


Figure 32: Home Simple Player/Recorder – Comparison of all scenarios (EU total)

Discussion of results:

This product group is to some extend fading out due to more media center-type devices and other media recording/storage options in the market. The energy consumption of the low power modes are however with about 4 TWh per year still considerable.

Figure 33: Home Simple Player/Recorder – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.15 Home Media Center

Table 29: Home Media Center - Input data for scenarios of reference year 2010

NoNA	**Media Center**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	35,0	30,0	0,0	10,0	1,5	0,0	0,3	
Stock	Use hours (h/d)	3,0	1,0	0,0	0,0	4,0	0,0	16,0	24,0
365 d/a	Mode Power (Wh/d)	105,0	30,0	0,0	0,0	6,0	0,0	4,8	145,8
0,5 million	TEC Unit/year (kWh/a)	38,3	11,0	0,0	0,0	2,2	0,0	1,8	53,2
	Stock per year (TWh/a)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

LoNA	Media Center	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	35,0	30,0	0,0	10,0	1,5	0,0	0,3	
Stock	Use hours (h/d)	3,0	1,0	0,0	4,0	16,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	105,0	30,0	0,0	40,0	24,0	0,0	0,0	199,0
0,5 million	TEC Unit/year (kWh/a)	38,3	11,0	0,0	14,6	8,8	0,0	0,0	72,6
	Stock per year (TWh/a)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

MeNA	Media Center	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	35,0	30,0	0,0	10,0	1,5	0,0	0,3	
Stock	Use hours (h/d)	3,0	1,0	0,0	20,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	105,0	30,0	0,0	200,0	0,0	0,0	0,0	335,0
0,5 million	TEC Unit/year (kWh/a)	38,3	11,0	0,0	73,0	0,0	0,0	0,0	122,3
	Stock per year (TWh/a)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1

HiNA	Media Center	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	35,0	30,0	0,0	10,0	1,5	0,0	0,3	
Stock	Use hours (h/d)	3,0	9,0	0,0	12,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	105,0	270,0	0,0	120,0	0,0	0,0	0,0	495,0
0,5 million	TEC Unit/year (kWh/a)	38,3	98,6	0,0	43,8	0,0	0,0	0,0	180,7
	Stock per year (TWh/a)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1

Explanatory notes:

Media Center is a new product group incorporating TV receiver and media player/recording capability including DVD, BluRay, HDD or SDD.

The media center could feature five modes:

Active mode which means the devices is receiving, recoding or playing content. We assume that such a device is more actively used in comparison to single media player/recorder. Active and idle duration is in total similar to daily TV utilization.

Idle mode is an active mode where the product is ready but no content is played or recorded.

LowP 2 is equivalent to active standby with fast play/quick start option and/or remote activation over network capability. Power consumption level reflects status of current devices in the market.

LowP 3 is equivalent to passive standby where a timer is running. The passive standby reflects already legal compliance with the standby regulation.

LowP 5 is equivalent to off-mode with losses.

Table 30: Home Media Center - Input data for scenarios of forecast year 2020

NoNA	**Media Center**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	28,0	24,0	0,0	8,0	1,2	0,0	0,2	
Stock	Use hours (h/d)	3,0	1,0	0,0	0,0	4,0	6,0	16,0	30,0
365 d/a	Mode Power (Wh/d)	84,0	24,0	0,0	0,0	4,8	0,0	3,8	116,6
20 million	TEC Unit/year (kWh/a)	30,7	8,8	0,0	0,0	1,8	0,0	1,4	42,6
	Stock per year (TWh/a)	0,6	0,2	0,0	0,0	0,0	0,0	0,0	0,9

LoNA	Media Center	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	28,0	24,0	0,0	8,0	1,2	0,0	0,2	
Stock	Use hours (h/d)	3,0	1,0	0,0	4,0	16,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	84,0	24,0	0,0	32,0	19,2	0,0	0,0	159,2
20 million	TEC Unit/year (kWh/a)	30,7	8,8	0,0	11,7	7,0	0,0	0,0	58,1
	Stock per year (TWh/a)	0,6	0,2	0,0	0,2	0,1	0,0	0,0	1,2

MeNA	Media Center	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	28,0	24,0	0,0	8,0	1,2	0,0	0,2	
Stock	Use hours (h/d)	3,0	1,0	0,0	20,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	84,0	24,0	0,0	160,0	0,0	0,0	0,0	268,0
20 million	TEC Unit/year (kWh/a)	30,7	8,8	0,0	58,4	0,0	0,0	0,0	97,8
	Stock per year (TWh/a)	0,6	0,2	0,0	1,2	0,0	0,0	0,0	2,0

HiNA	Media Center	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	28,0	24,0	0,0	8,0	1,2	0,0	0,2	
Stock	Use hours (h/d)	3,0	9,0	0,0	12,0	0,0	0,0	0,0	24,0
365 d/a	Mode Power (Wh/d)	84,0	216,0	0,0	96,0	0,0	0,0	0,0	396,0
20 million	TEC Unit/year (kWh/a)	30,7	78,8	0,0	35,0	0,0	0,0	0,0	144,5
	Stock per year (TWh/a)	0,6	1,6	0,0	0,7	0,0	0,0	0,0	2,9

Explanatory notes:

Mode and use pattern is similar to reference year 2010. General power consumption improvement per mode is 20%. We assume that product stock could increase more dynamic (10% of European Households uses such a device in 2020.

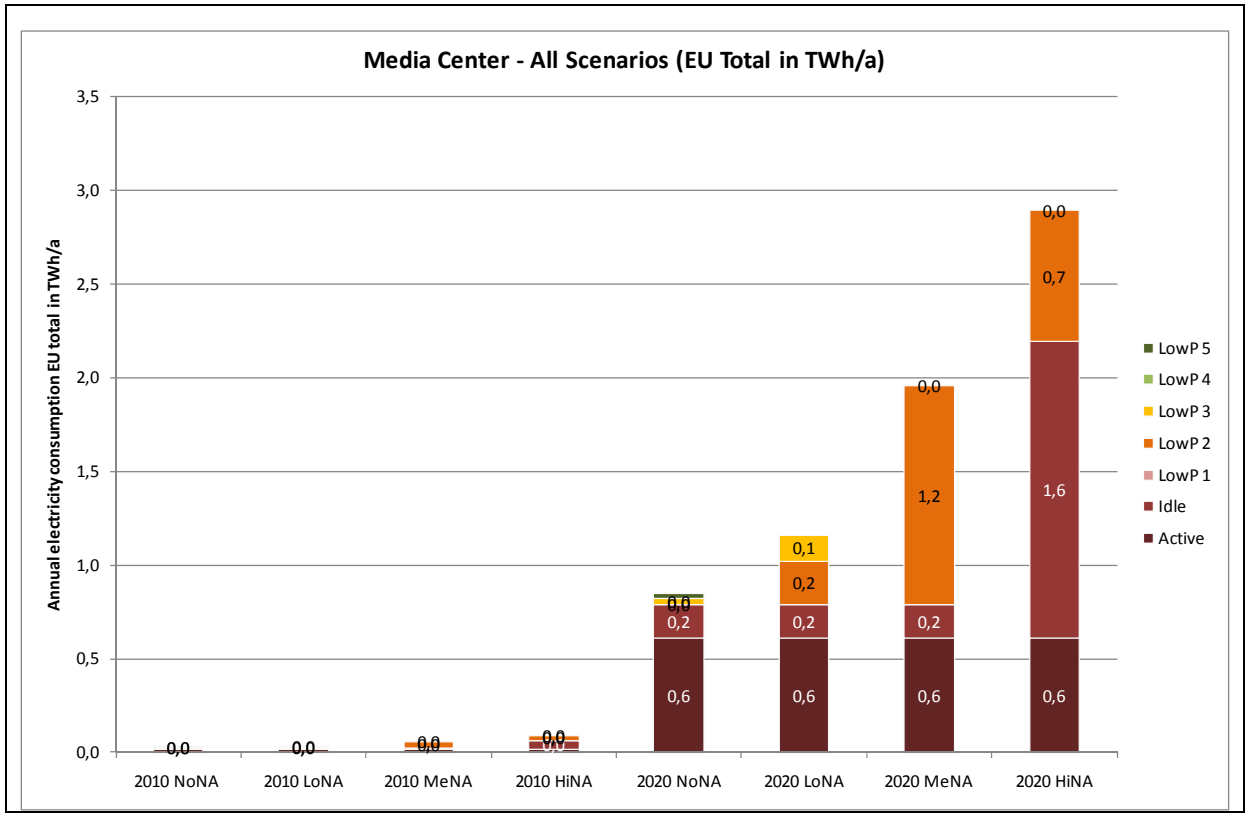


Figure 34: Home Media Center – Comparison of all scenarios (EU total)

Discussion of results:

This new product group is with increasing stock and depending on its functional configuration potentially relevant for networked standby. Due to the fact that high network availability could become a likely scenario related energy consumption is in a range of 1 to 2 TWh per year.

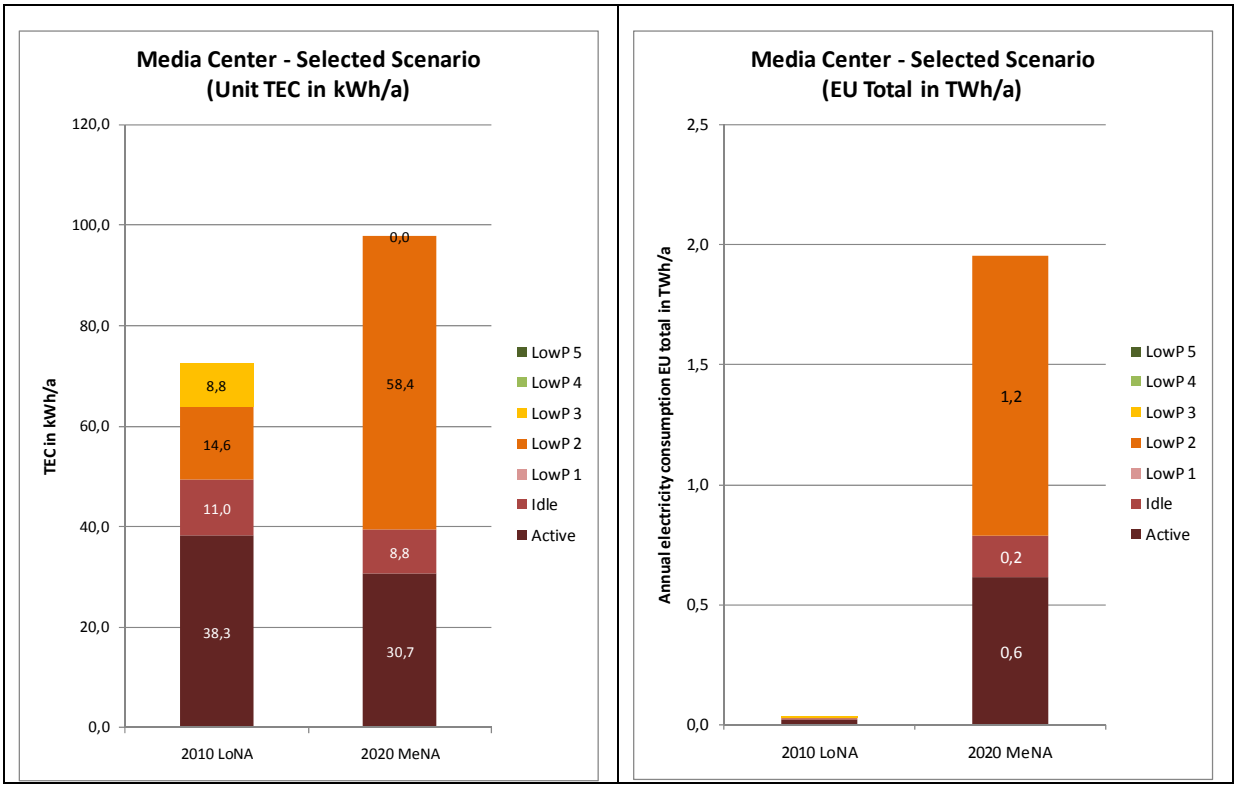


Figure 35: Home Media Center – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.16 Office Phone

Table 31: Office Phone - Input data for scenarios of reference year 2010

NoNA	**Office Phones**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	6,0	5,0	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	4,0	20,0	0,0	0,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	24,0	100,0	0,0	0,0	0,0	0,0	0,0	124,0
75 million	TEC Unit/year (kWh/a)	5,8	24,0	0,0	0,0	0,0	0,0	0,0	29,8
	Stock per year (TWh/a)	0,4	1,8	0,0	0,0	0,0	0,0	0,0	2,2

LoNA	Office Phones	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	6,0	5,0	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	4,0	20,0	0,0	0,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	24,0	100,0	0,0	0,0	0,0	0,0	0,0	124,0
75 million	TEC Unit/year (kWh/a)	5,8	24,0	0,0	0,0	0,0	0,0	0,0	29,8
	Stock per year (TWh/a)	0,4	1,8	0,0	0,0	0,0	0,0	0,0	2,2

MeNA	Office Phones	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	6,0	5,0	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	4,0	20,0	0,0	0,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	24,0	100,0	0,0	0,0	0,0	0,0	0,0	124,0
75 million	TEC Unit/year (kWh/a)	5,8	24,0	0,0	0,0	0,0	0,0	0,0	29,8
	Stock per year (TWh/a)	0,4	1,8	0,0	0,0	0,0	0,0	0,0	2,2

HiNA	Office Phones	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	6,0	5,0	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	4,0	20,0	0,0	0,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	24,0	100,0	0,0	0,0	0,0	0,0	0,0	124,0
75 million	TEC Unit/year (kWh/a)	5,8	24,0	0,0	0,0	0,0	0,0	0,0	29,8
	Stock per year (TWh/a)	0,4	1,8	0,0	0,0	0,0	0,0	0,0	2,2

Explanatory notes:

Table 32: Office Phones - Input data for scenarios of forecast year 2020

NoNA	**Office Phones**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	4,8	4,0	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	4,0	20,0	0,0	0,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	19,2	80,0	0,0	0,0	0,0	0,0	0,0	99,2
85 million	TEC Unit/year (kWh/a)	4,6	19,2	0,0	0,0	0,0	0,0	0,0	23,8
	Stock per year (TWh/a)	0,4	1,6	0,0	0,0	0,0	0,0	0,0	2,0

LoNA	Office Phones	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	4,8	4,0	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	4,0	20,0	0,0	0,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	19,2	80,0	0,0	0,0	0,0	0,0	0,0	99,2
85 million	TEC Unit/year (kWh/a)	4,6	19,2	0,0	0,0	0,0	0,0	0,0	23,8
	Stock per year (TWh/a)	0,4	1,6	0,0	0,0	0,0	0,0	0,0	2,0

MeNA	Office Phones	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	4,8	4,0	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	4,0	20,0	0,0	0,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	19,2	80,0	0,0	0,0	0,0	0,0	0,0	99,2
85 million	TEC Unit/year (kWh/a)	4,6	19,2	0,0	0,0	0,0	0,0	0,0	23,8
	Stock per year (TWh/a)	0,4	1,6	0,0	0,0	0,0	0,0	0,0	2,0

HiNA	Office Phones	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	4,8	4,0	0,0	0,0	0,0	0,0	0,0	
Stock	Use hours (h/d)	4,0	20,0	0,0	0,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	19,2	80,0	0,0	0,0	0,0	0,0	0,0	99,2
85 million	TEC Unit/year (kWh/a)	4,6	19,2	0,0	0,0	0,0	0,0	0,0	23,8
	Stock per year (TWh/a)	0,4	1,6	0,0	0,0	0,0	0,0	0,0	2,0

Explanatory notes:

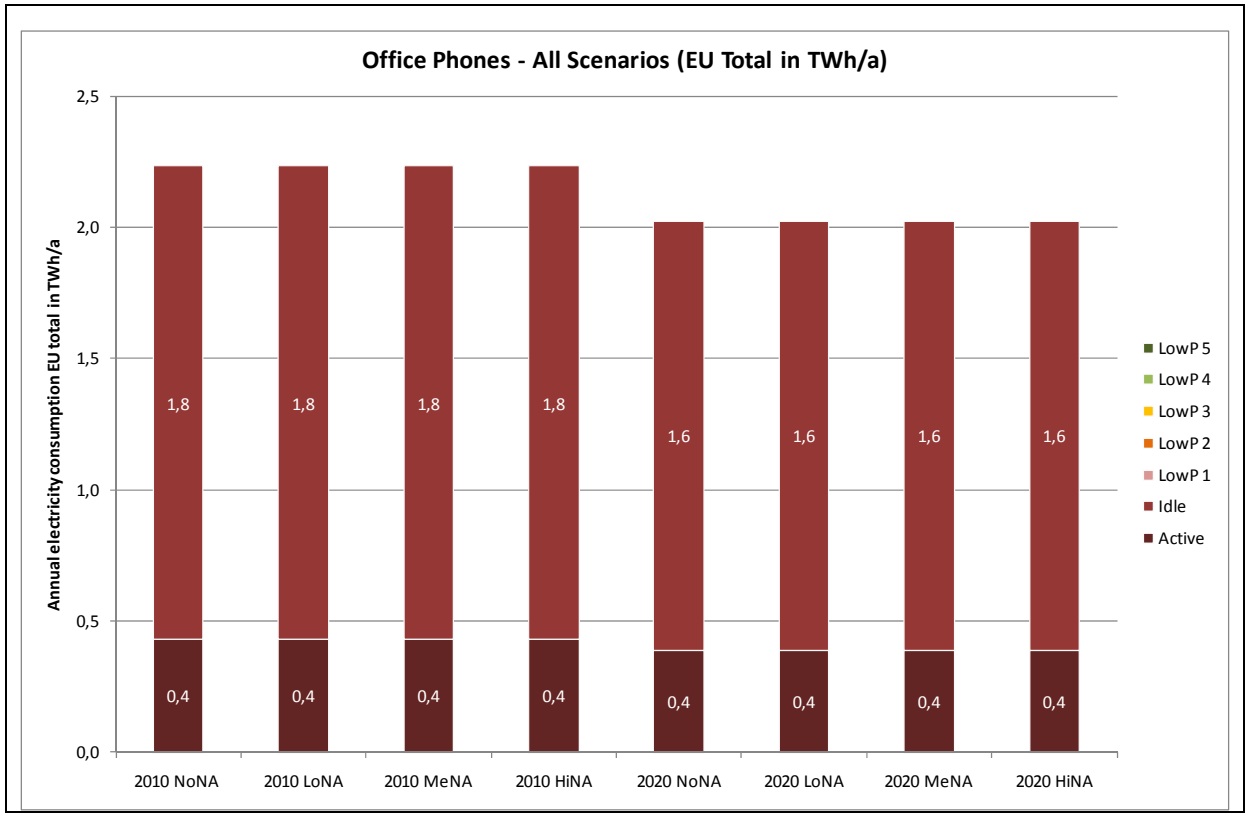


Figure 36: Office Phones – Comparison of all scenarios (EU total)

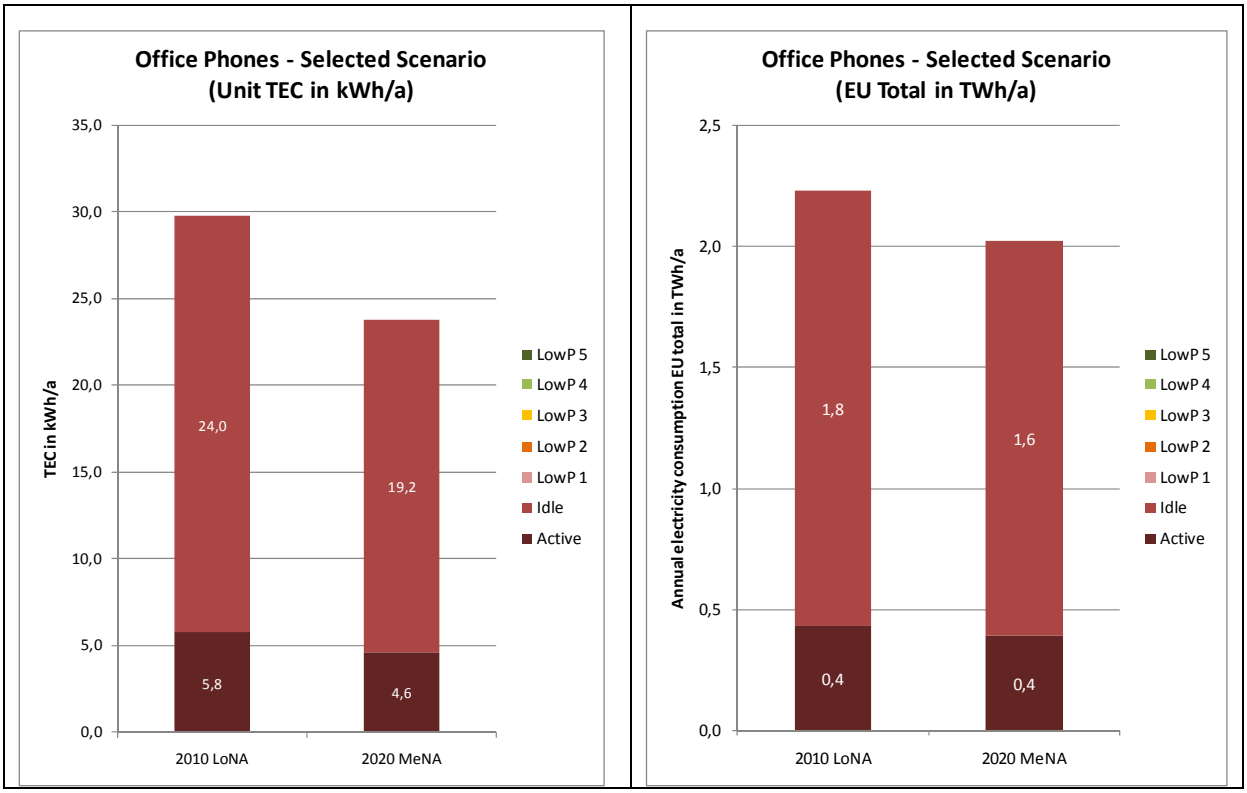


Figure 37: Office Phones – Comparison of selected scenarios TEC and EU total

5.3.17 Office Desktop PC

Table 33: Office Desktop PC - Input data for scenarios of reference year 2010

NoNA	**Office Desktop PC**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	60,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	7,0	5,0	0,0	0,0	2,0	0,0	10,0	24,0
240 d/a	Mode Power (Wh/d)	420,0	250,0	0,0	0,0	8,0	0,0	15,0	693,0
60 million	TEC Unit/year (kWh/a)	100,8	60,0	0,0	0,0	1,9	0,0	3,6	166,3
	Stock per year (TWh/a)	6,0	3,6	0,0	0,0	0,1	0,0	0,2	10,0

LoNA	Office Desktop PC	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	60,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	7,0	5,0	0,0	2,0	0,0	10,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	420,0	250,0	0,0	9,4	0,0	22,0	0,0	701,4
60 million	TEC Unit/year (kWh/a)	100,8	60,0	0,0	2,3	0,0	5,3	0,0	168,3
	Stock per year (TWh/a)	6,0	3,6	0,0	0,1	0,0	0,3	0,0	10,1

MeNA	Office Desktop PC	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	60,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	7,0	5,0	0,0	12,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	420,0	250,0	0,0	56,4	0,0	0,0	0,0	726,4
60 million	TEC Unit/year (kWh/a)	100,8	60,0	0,0	13,5	0,0	0,0	0,0	174,3
	Stock per year (TWh/a)	6,0	3,6	0,0	0,8	0,0	0,0	0,0	10,5

HiNA	Office Desktop PC	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	60,0	50,0	25,0	4,7	4,0	2,2	1,5	
Stock	Use hours (h/d)	7,0	11,0	0,0	6,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	420,0	550,0	0,0	28,2	0,0	0,0	0,0	998,2
60 million	TEC Unit/year (kWh/a)	100,8	132,0	0,0	6,8	0,0	0,0	0,0	239,6
	Stock per year (TWh/a)	6,0	7,9	0,0	0,4	0,0	0,0	0,0	14,4

Explanatory notes:

Product mode assumptions are similar to the home desktop PCs.

The utilization of the PCs in the office environment is more intensive in comparison to home use.

Table 34: Office Desktop PC - Input data for scenarios of forecast year 2020

NoNA	**Office Desktop PC**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	48,0	40,0	20,0	3,8	3,2	1,8	1,2	
Stock	Use hours (h/d)	7,0	5,0	0,0	0,0	2,0	0,0	10,0	24,0
240 d/a	Mode Power (Wh/d)	336,0	200,0	0,0	0,0	6,4	0,0	12,0	554,4
70 million	TEC Unit/year (kWh/a)	80,6	48,0	0,0	0,0	1,5	0,0	2,9	133,1
	Stock per year (TWh/a)	5,6	3,4	0,0	0,0	0,1	0,0	0,2	9,3

LoNA	Office Desktop PC	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	48,0	40,0	20,0	3,8	3,2	1,8	1,2	
Stock	Use hours (h/d)	7,0	5,0	0,0	2,0	0,0	10,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	336,0	200,0	0,0	7,5	0,0	17,6	0,0	561,1
70 million	TEC Unit/year (kWh/a)	80,6	48,0	0,0	1,8	0,0	4,2	0,0	134,7
	Stock per year (TWh/a)	5,6	3,4	0,0	0,1	0,0	0,3	0,0	9,4

MeNA	Office Desktop PC	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	48,0	40,0	20,0	3,8	3,2	1,8	1,2	
Stock	Use hours (h/d)	7,0	5,0	0,0	12,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	336,0	200,0	0,0	45,1	0,0	0,0	0,0	581,1
70 million	TEC Unit/year (kWh/a)	80,6	48,0	0,0	10,8	0,0	0,0	0,0	139,5
	Stock per year (TWh/a)	5,6	3,4	0,0	0,8	0,0	0,0	0,0	9,8

HiNA	Office Desktop PC	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	48,0	40,0	20,0	3,8	3,2	1,8	1,2	
Stock	Use hours (h/d)	7,0	11,0	0,0	6,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	336,0	440,0	0,0	22,6	0,0	0,0	0,0	798,6
70 million	TEC Unit/year (kWh/a)	80,6	105,6	0,0	5,4	0,0	0,0	0,0	191,7
	Stock per year (TWh/a)	5,6	7,4	0,0	0,4	0,0	0,0	0,0	13,4

Explanatory notes:

Mode and use assumptions are similar to reference year 2010. We gain assume a 20% general improvement in power consumption per mode.

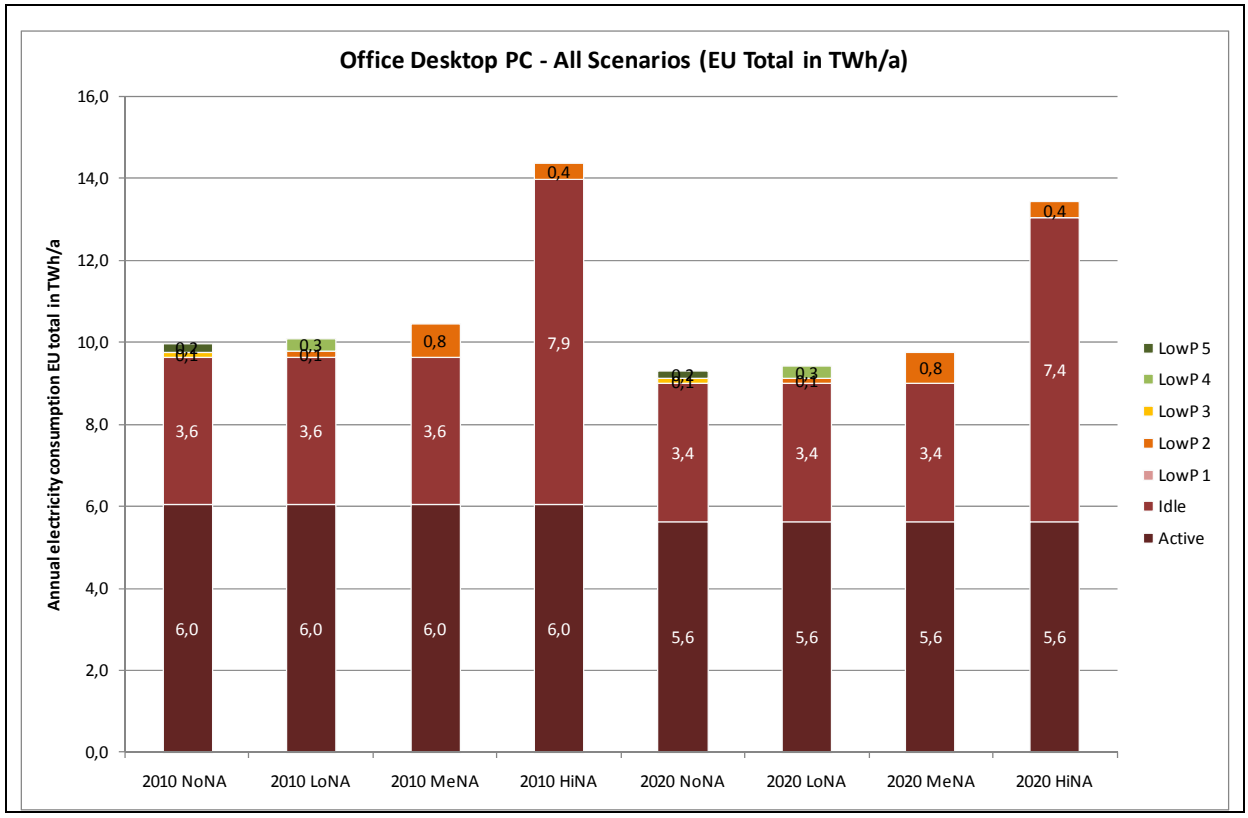


Figure 38: Office Desktop PC – Comparison of all scenarios (EU total)

Discussion of results:

The idle mode energy consumption provides with about 3.5 TWh per year a considerable improvement potential in conjunction with low power networked standby.

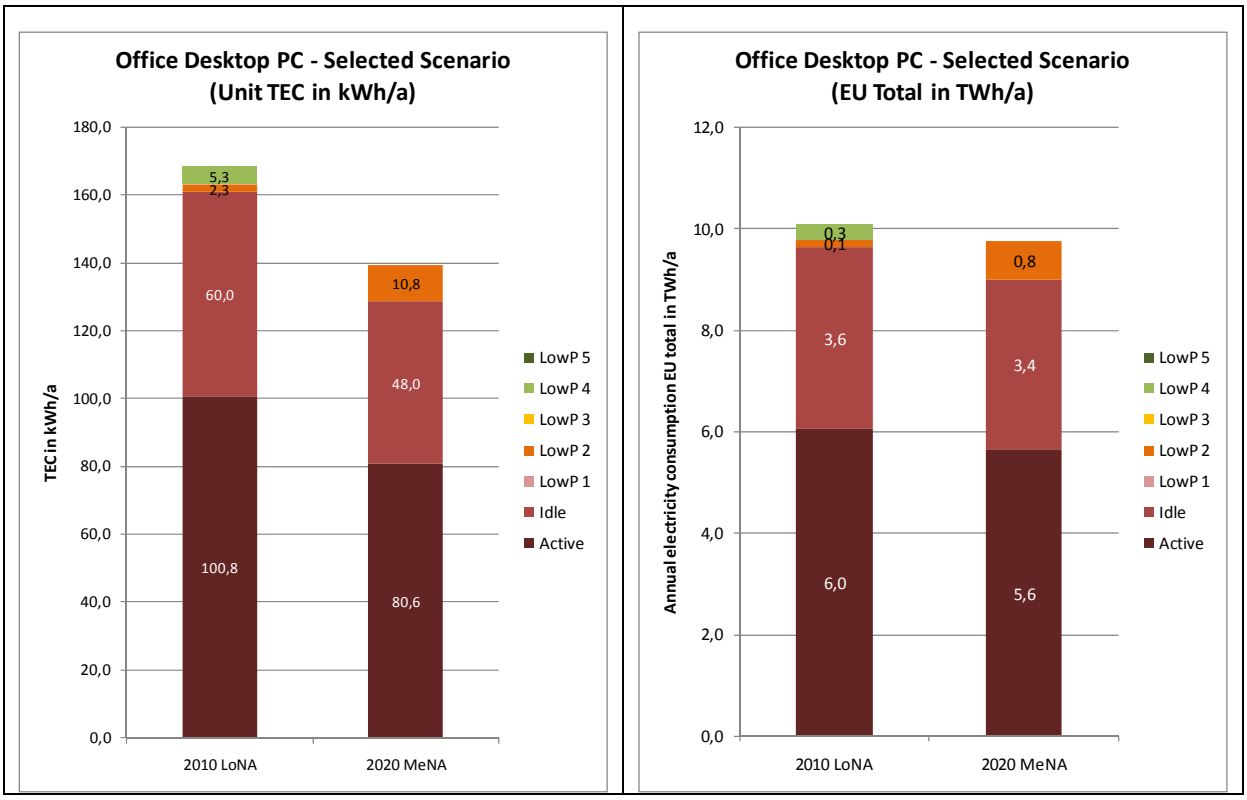


Figure 39: Office Desktop PC – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.18 Office Notebook PC

Table 35: Office Notebook PC - Input data for scenarios of reference year 2010

NoNA	**Office Notebook**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	20,0	10,0	2,7	2,0	1,5	0,8	
Stock	Use hours (h/d)	7,0	2,0	0,0	0,0	2,0	3,0	10,0	24,0
240 d/a	Mode Power (Wh/d)	210,0	40,0	0,0	0,0	4,0	4,5	8,0	266,5
45 million	TEC Unit/year (kWh/a)	50,4	9,6	0,0	0,0	1,0	1,1	1,9	64,0
	Stock per year (TWh/a)	2,3	0,4	0,0	0,0	0,0	0,0	0,1	2,9

LoNA	Office Notebook	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	20,0	10,0	2,7	2,0	1,5	0,8	
Stock	Use hours (h/d)	7,0	2,0	0,0	2,0	0,0	13,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	210,0	40,0	0,0	5,4	0,0	19,5	0,0	274,9
45 million	TEC Unit/year (kWh/a)	50,4	9,6	0,0	1,3	0,0	4,7	0,0	66,0
	Stock per year (TWh/a)	2,3	0,4	0,0	0,1	0,0	0,2	0,0	3,0

MeNA	Office Notebook	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	20,0	10,0	2,7	2,0	1,5	0,8	
Stock	Use hours (h/d)	7,0	2,0	0,0	15,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	210,0	40,0	0,0	40,5	0,0	0,0	0,0	290,5
45 million	TEC Unit/year (kWh/a)	50,4	9,6	0,0	9,7	0,0	0,0	0,0	69,7
	Stock per year (TWh/a)	2,3	0,4	0,0	0,4	0,0	0,0	0,0	3,1

HiNA	Office Notebook	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	30,0	20,0	10,0	2,7	2,0	1,5	0,8	
Stock	Use hours (h/d)	7,0	11,0	0,0	6,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	210,0	220,0	0,0	16,2	0,0	0,0	0,0	446,2
45 million	TEC Unit/year (kWh/a)	50,4	52,8	0,0	3,9	0,0	0,0	0,0	107,1
	Stock per year (TWh/a)	2,3	2,4	0,0	0,2	0,0	0,0	0,0	4,8

Explanatory notes:

Product mode assumptions are similar to the home notebook PCs.

Table 36: Office Notebook PC - Input data for scenarios of forecast year 2020

NoNA	**Office Notebook**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	16,0	8,0	2,2	1,6	1,2	0,6	
Stock	Use hours (h/d)	7,0	2,0	0,0	0,0	2,0	3,0	10,0	24,0
240 d/a	Mode Power (Wh/d)	168,0	32,0	0,0	0,0	3,2	3,6	6,4	213,2
68 million	TEC Unit/year (kWh/a)	40,3	7,7	0,0	0,0	0,8	0,9	1,5	51,2
	Stock per year (TWh/a)	2,7	0,5	0,0	0,0	0,1	0,1	0,1	3,5

LoNA	Office Notebook	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	16,0	8,0	2,2	1,6	1,2	0,6	
Stock	Use hours (h/d)	7,0	2,0	0,0	2,0	0,0	13,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	168,0	32,0	0,0	4,3	0,0	15,6	0,0	219,9
68 million	TEC Unit/year (kWh/a)	40,3	7,7	0,0	1,0	0,0	3,7	0,0	52,8
	Stock per year (TWh/a)	2,7	0,5	0,0	0,1	0,0	0,3	0,0	3,6

MeNA	Office Notebook	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	16,0	8,0	2,2	1,6	1,2	0,6	
Stock	Use hours (h/d)	7,0	2,0	0,0	15,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	168,0	32,0	0,0	32,4	0,0	0,0	0,0	232,4
68 million	TEC Unit/year (kWh/a)	40,3	7,7	0,0	7,8	0,0	0,0	0,0	55,8
	Stock per year (TWh/a)	2,7	0,5	0,0	0,5	0,0	0,0	0,0	3,8

HiNA	Office Notebook	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	24,0	16,0	8,0	2,2	1,6	1,2	0,6	
Stock	Use hours (h/d)	7,0	11,0	0,0	6,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	168,0	176,0	0,0	13,0	0,0	0,0	0,0	357,0
68 million	TEC Unit/year (kWh/a)	40,3	42,2	0,0	3,1	0,0	0,0	0,0	85,7
	Stock per year (TWh/a)	2,7	2,9	0,0	0,2	0,0	0,0	0,0	5,8

Explanatory notes:

Mode and use assumptions are similar to reference year 2010. We gain assume a 20% general improvement in power consumption per mode.

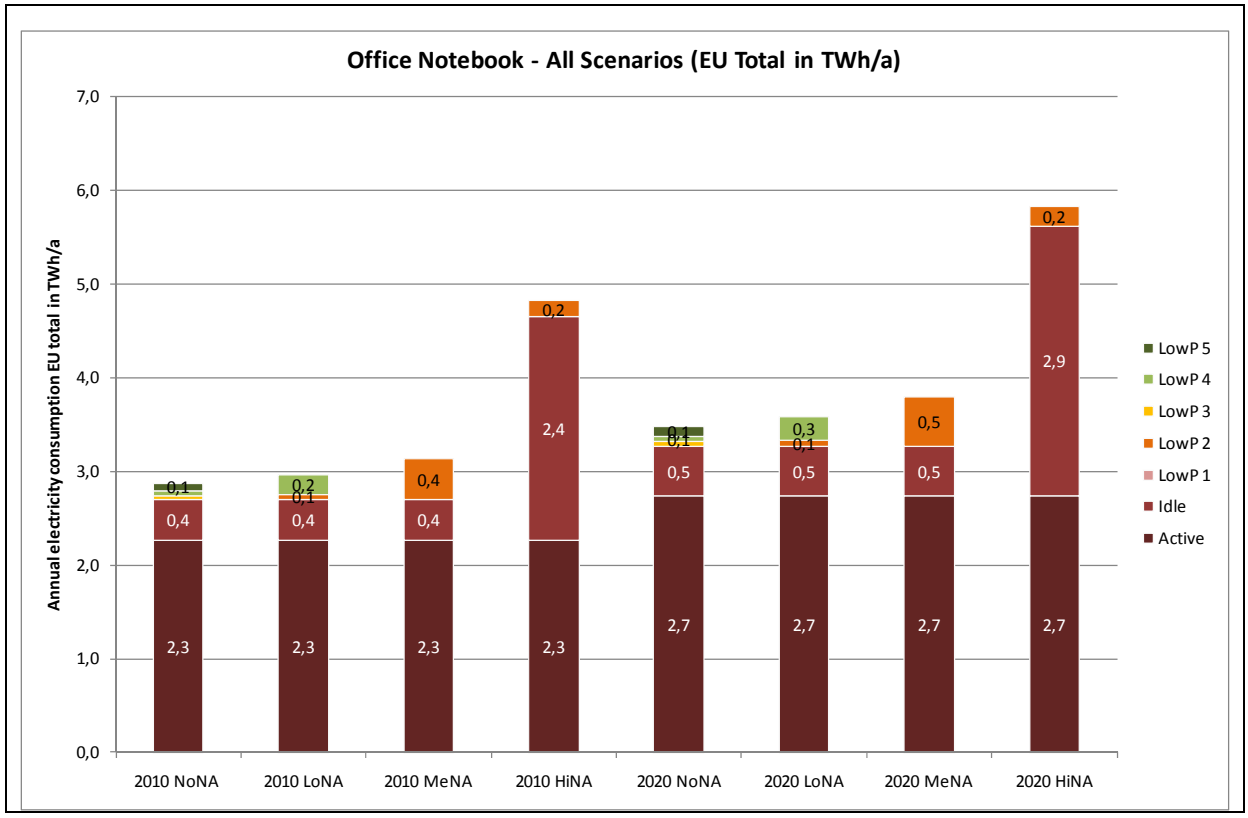


Figure 40: Office Notebook PC – Comparison of all scenarios (EU total)

Discussion of results:

Similar to the home notebooks this product group shows in the low and medium network availability scenarios a high level of energy efficiency. Networked standby relevant energy consumption is less than 1 TWh per year due to the generally good power management. Only the quite unrealistic HiNA scenario indicates a larger impact.

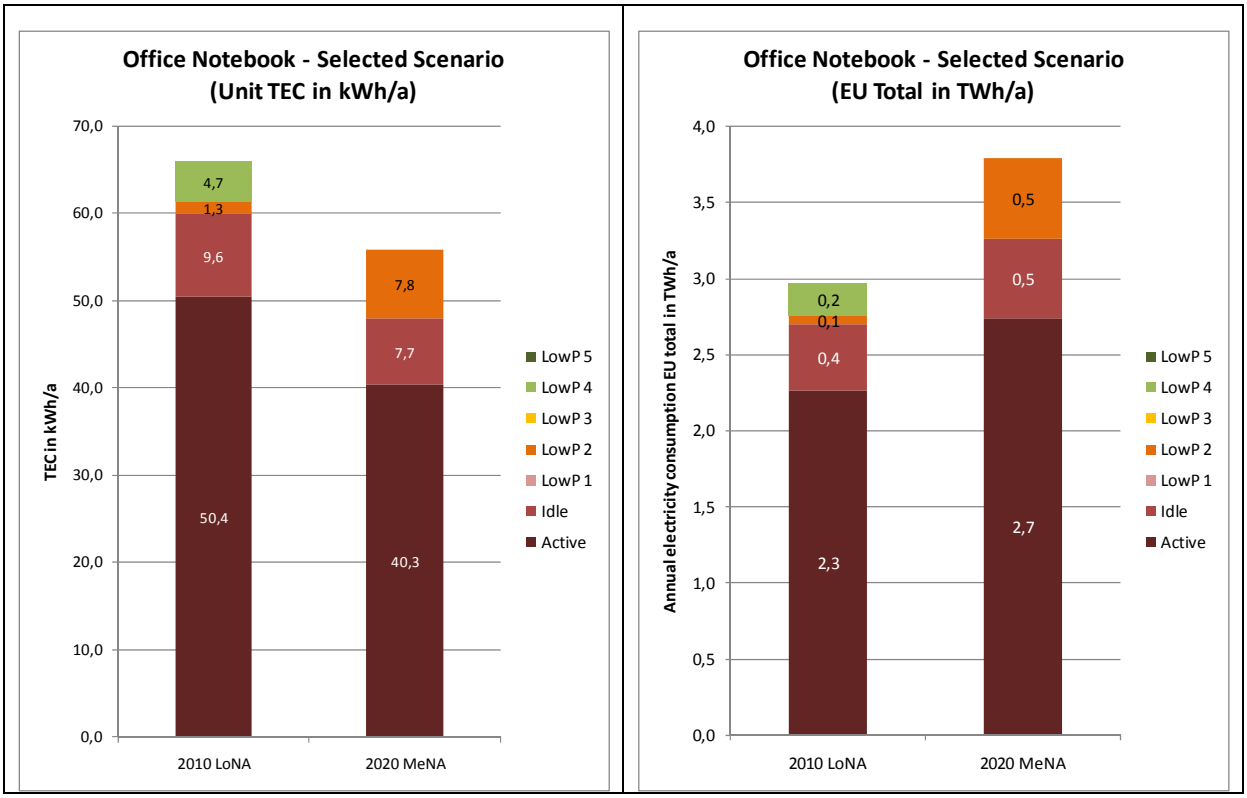


Figure 41: Office Notebook PC – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.19 Office Computer Display

Table 37: Office Computer Display - Input data for scenarios of reference year 2010

NoNA	**Office Display 22"**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	25,0	0,0	0,0	1,2	0,0	0,0	0,4	
Stock	Use hours (h/d)	7,0	0,0	0,0	3,0	0,0	0,0	14,0	24,0
240 d/a	Mode Power (Wh/d)	175,0	0,0	0,0	3,6	0,0	0,0	5,6	184,2
60 million	TEC Unit/year (kWh/a)	42,0	0,0	0,0	0,9	0,0	0,0	1,3	44,2
	Stock per year (TWh/a)	2,5	0,0	0,0	0,1	0,0	0,0	0,1	2,7

LoNA	Office Display 22"	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	25,0	0,0	0,0	1,2	0,0	0,0	0,4	
Stock	Use hours (h/d)	7,0	0,0	0,0	11,0	0,0	0,0	6,0	24,0
240 d/a	Mode Power (Wh/d)	175,0	0,0	0,0	13,2	0,0	0,0	2,4	190,6
60 million	TEC Unit/year (kWh/a)	42,0	0,0	0,0	3,2	0,0	0,0	0,6	45,7
	Stock per year (TWh/a)	2,5	0,0	0,0	0,2	0,0	0,0	0,0	2,7

MeNA	Office Display 22"	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	25,0	0,0	0,0	1,2	0,0	0,0	0,4	
Stock	Use hours (h/d)	7,0	0,0	0,0	17,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	175,0	0,0	0,0	20,4	0,0	0,0	0,0	195,4
60 million	TEC Unit/year (kWh/a)	42,0	0,0	0,0	4,9	0,0	0,0	0,0	46,9
	Stock per year (TWh/a)	2,5	0,0	0,0	0,3	0,0	0,0	0,0	2,8

HiNA	Office Display 22"	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	25,0	0,0	0,0	1,2	0,0	0,0	0,4	
Stock	Use hours (h/d)	7,0	0,0	0,0	17,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	175,0	0,0	0,0	20,4	0,0	0,0	0,0	195,4
60 million	TEC Unit/year (kWh/a)	42,0	0,0	0,0	4,9	0,0	0,0	0,0	46,9
	Stock per year (TWh/a)	2,5	0,0	0,0	0,3	0,0	0,0	0,0	2,8

Explanatory notes:

Product mode assumptions are similar to the home computer displays. The active-mode duration correlates to the average use of office desktop PCs.

Table 38: Office Computer Display - Input data for scenarios of forecast year 2020

NoNA	**Office Display 22"**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	0,0	0,0	1,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	7,0	0,0	0,0	3,0	0,0	0,0	14,0	24,0
240 d/a	Mode Power (Wh/d)	140,0	0,0	0,0	2,9	0,0	0,0	4,5	147,4
85 million	TEC Unit/year (kWh/a)	33,6	0,0	0,0	0,7	0,0	0,0	1,1	35,4
	Stock per year (TWh/a)	2,9	0,0	0,0	0,1	0,0	0,0	0,1	3,0

LoNA	Office Display 22"	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	0,0	0,0	1,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	7,0	0,0	0,0	11,0	0,0	0,0	6,0	24,0
240 d/a	Mode Power (Wh/d)	140,0	0,0	0,0	10,6	0,0	0,0	1,9	152,5
85 million	TEC Unit/year (kWh/a)	33,6	0,0	0,0	2,5	0,0	0,0	0,5	36,6
	Stock per year (TWh/a)	2,9	0,0	0,0	0,2	0,0	0,0	0,0	3,1

MeNA	Office Display 22"	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	0,0	0,0	1,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	7,0	0,0	0,0	17,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	140,0	0,0	0,0	16,3	0,0	0,0	0,0	156,3
85 million	TEC Unit/year (kWh/a)	33,6	0,0	0,0	3,9	0,0	0,0	0,0	37,5
	Stock per year (TWh/a)	2,9	0,0	0,0	0,3	0,0	0,0	0,0	3,2

HiNA	Office Display 22"	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	20,0	0,0	0,0	1,0	0,0	0,0	0,3	
Stock	Use hours (h/d)	7,0	0,0	0,0	17,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	140,0	0,0	0,0	16,3	0,0	0,0	0,0	156,3
85 million	TEC Unit/year (kWh/a)	33,6	0,0	0,0	3,9	0,0	0,0	0,0	37,5
	Stock per year (TWh/a)	2,9	0,0	0,0	0,3	0,0	0,0	0,0	3,2

Explanatory notes:

Mode and use assumptions are similar to reference year 2010. We gain assume a 20% general improvement in power consumption per mode.

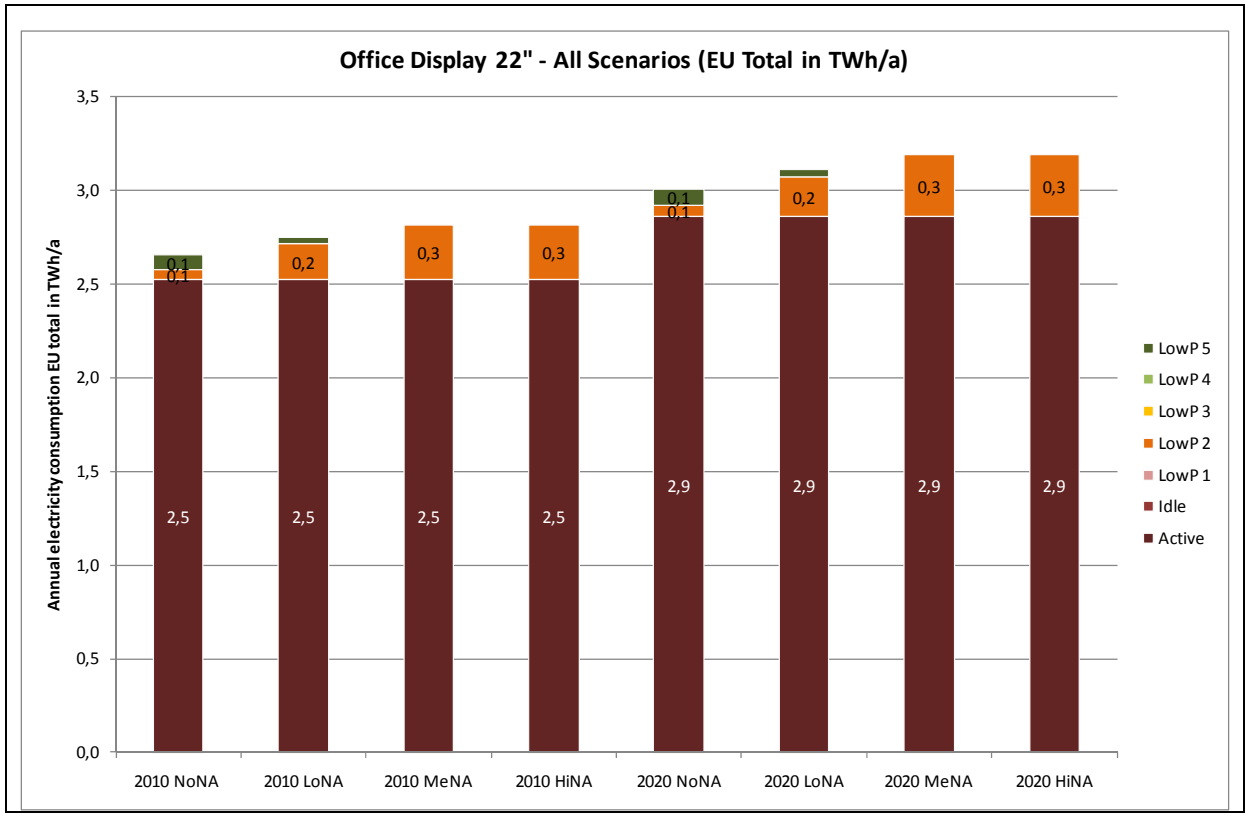


Figure 42: Office Computer Display – Comparison of all scenarios (EU total)

Discussion of results:

Due to the assumed intensive utilization is the overall impact of the low power modes with about 0.3 TWh per year rather small. If the display active utilization is less the impact of the lower power modes would increase. There is still some improvement potential.

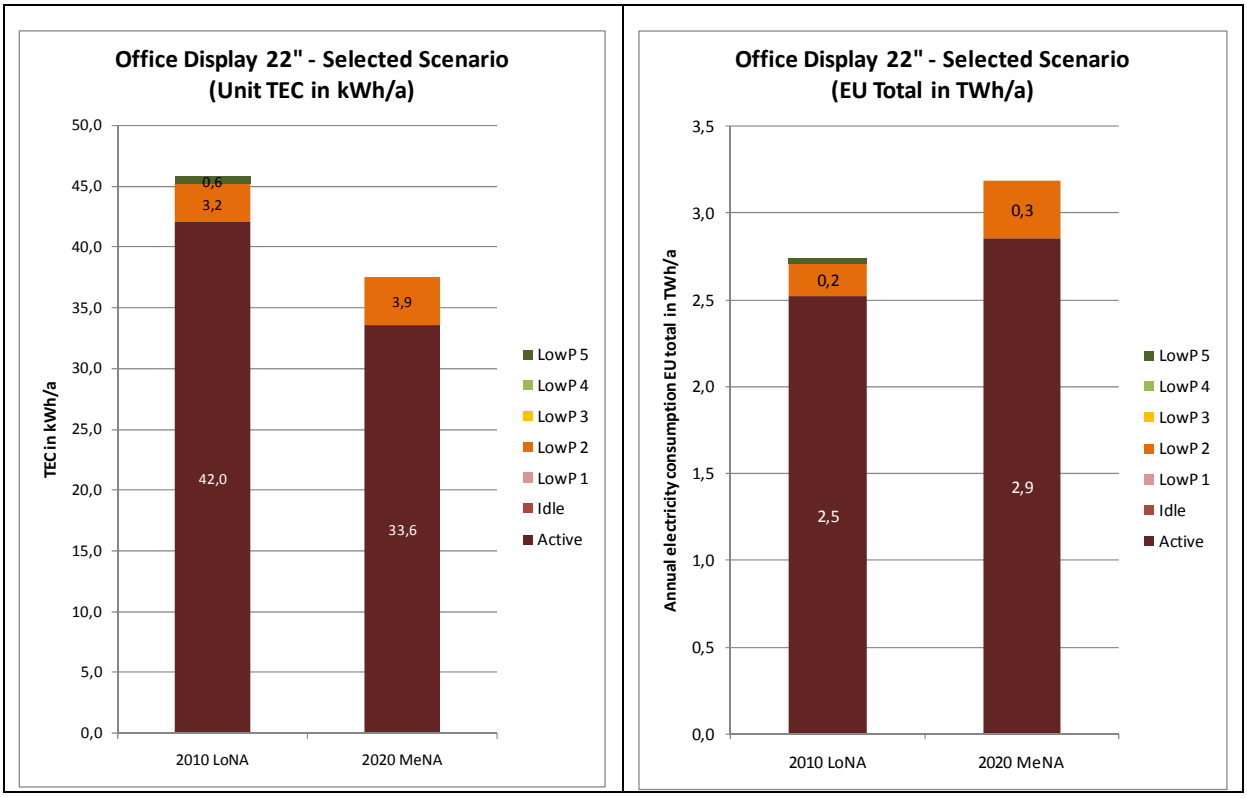


Figure 43: Office Computer Display – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.20 Office IJ Printer/MFD

Table 39: Office IJ Printer/MFD - Input data for scenarios of reference year 2010

NoNA	**Office IJ Printer/MFD**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	34,0	17,0	0,0	4,0	0,0	1,5	0,5	
Stock	Use hours (h/d)	0,5	2,0	0,0	7,5	0,0	2,0	12,0	24,0
240 d/a	Mode Power (Wh/d)	17,0	34,0	0,0	30,0	0,0	3,0	6,0	90,0
46 million	TEC Unit/year (kWh/a)	4,1	8,2	0,0	7,2	0,0	0,7	1,4	21,6
	Stock per year (TWh/a)	0,2	0,4	0,0	0,3	0,0	0,0	0,1	1,0

LoNA	Office IJ Printer/MFD	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	34,0	17,0	0,0	4,0	0,0	1,5	0,5	
Stock	Use hours (h/d)	0,5	2,0	0,0	7,5	0,0	14,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	17,0	34,0	0,0	30,0	0,0	21,0	0,0	102,0
46 million	TEC Unit/year (kWh/a)	4,1	8,2	0,0	7,2	0,0	5,0	0,0	24,5
	Stock per year (TWh/a)	0,2	0,4	0,0	0,3	0,0	0,2	0,0	1,1

MeNA	Office IJ Printer/MFD	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	34,0	17,0	0,0	4,0	0,0	1,5	0,5	
Stock	Use hours (h/d)	0,5	2,0	0,0	21,5	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	17,0	34,0	0,0	86,0	0,0	0,0	0,0	137,0
46 million	TEC Unit/year (kWh/a)	4,1	8,2	0,0	20,6	0,0	0,0	0,0	32,9
	Stock per year (TWh/a)	0,2	0,4	0,0	0,9	0,0	0,0	0,0	1,5

HiNA	Office IJ Printer/MFD	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	34,0	17,0	0,0	4,0	0,0	1,5	0,5	
Stock	Use hours (h/d)	0,5	17,5	0,0	6,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	17,0	297,5	0,0	24,0	0,0	0,0	0,0	338,5
46 million	TEC Unit/year (kWh/a)	4,1	71,4	0,0	5,8	0,0	0,0	0,0	81,2
	Stock per year (TWh/a)	0,2	3,3	0,0	0,3	0,0	0,0	0,0	3,7

Explanatory notes:

Product mode assumptions are similar to the home IJ Printer/MFDs. The average utilization is more intensive.

Table 40: Office IJ Printer/MFD - Input data for scenarios of forecast year 2020

NoNA	**Office IJ Printer/MFD**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	27,2	13,6	0,0	3,2	0,0	1,1	0,4	
Stock	Use hours (h/d)	0,5	2,0	0,0	7,5	0,0	2,0	12,0	24,0
240 d/a	Mode Power (Wh/d)	13,6	27,2	0,0	24,0	0,0	2,1	4,2	71,1
46 million	TEC Unit/year (kWh/a)	3,3	6,5	0,0	5,8	0,0	0,5	1,0	17,1
	Stock per year (TWh/a)	0,2	0,3	0,0	0,3	0,0	0,0	0,0	0,8

LoNA	Office IJ Printer/MFD	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	27,2	13,6	0,0	3,2	0,0	1,1	0,4	
Stock	Use hours (h/d)	0,5	2,0	0,0	7,5	0,0	14,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	13,6	27,2	0,0	24,0	0,0	14,7	0,0	79,5
46 million	TEC Unit/year (kWh/a)	3,3	6,5	0,0	5,8	0,0	3,5	0,0	19,1
	Stock per year (TWh/a)	0,2	0,3	0,0	0,3	0,0	0,2	0,0	0,9

MeNA	Office IJ Printer/MFD	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	27,2	13,6	0,0	3,2	0,0	1,1	0,4	
Stock	Use hours (h/d)	0,5	2,0	0,0	21,5	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	13,6	27,2	0,0	68,8	0,0	0,0	0,0	109,6
46 million	TEC Unit/year (kWh/a)	3,3	6,5	0,0	16,5	0,0	0,0	0,0	26,3
	Stock per year (TWh/a)	0,2	0,3	0,0	0,8	0,0	0,0	0,0	1,2

HiNA	Office IJ Printer/MFD	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	27,2	13,6	0,0	3,2	0,0	1,1	0,4	
Stock	Use hours (h/d)	0,5	17,5	0,0	6,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	13,6	238,0	0,0	19,2	0,0	0,0	0,0	270,8
46 million	TEC Unit/year (kWh/a)	3,3	57,1	0,0	4,6	0,0	0,0	0,0	65,0
	Stock per year (TWh/a)	0,2	2,6	0,0	0,2	0,0	0,0	0,0	3,0

Explanatory notes:

Mode and use assumptions are similar to reference year 2010. We gain assume a 20% general improvement in power consumption per mode.

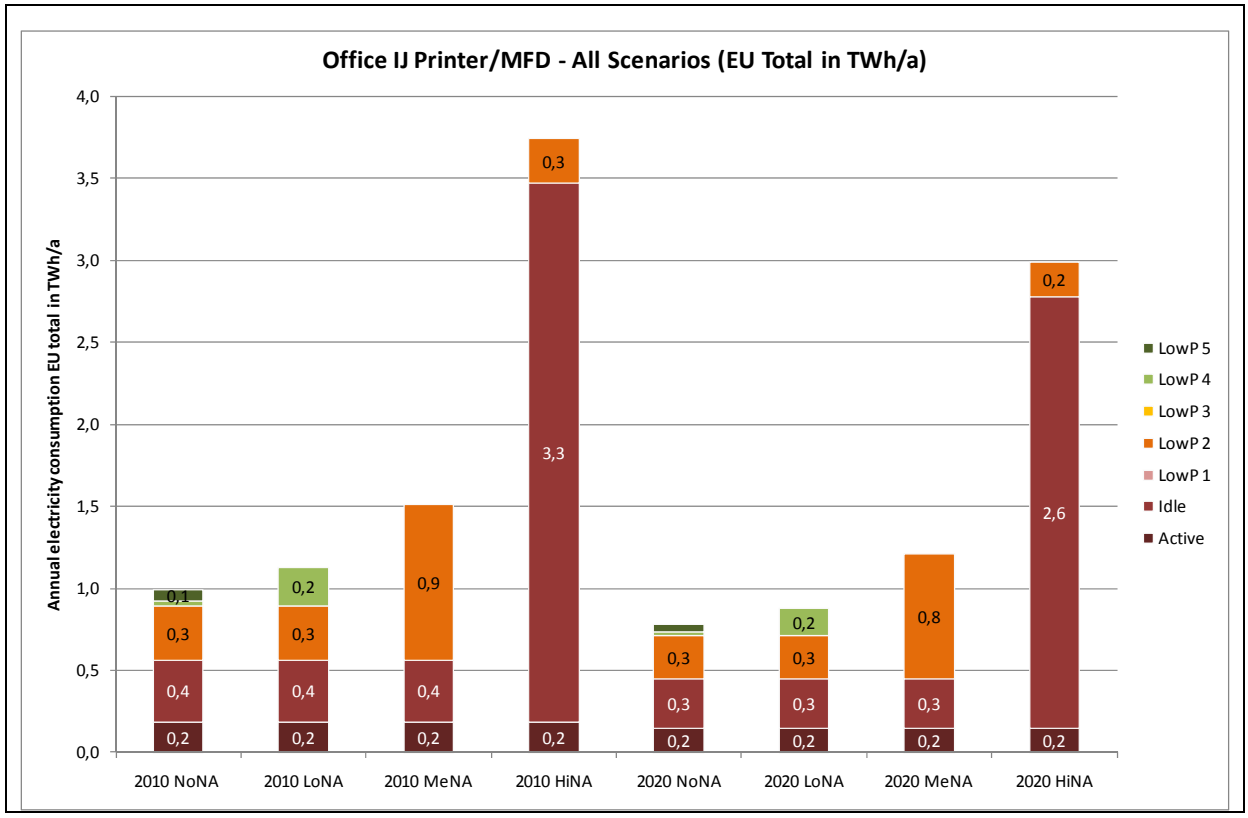


Figure 44: Office IJ Printer/MFD – Comparison of all scenarios (EU total)

Discussion of results:

The energy consumption of this product group is determined by ready and lower power modes. The HiNA scenario indicates the worst case. While the LoNA and MeNA scenarios indicate networked standby related energy consumption of about 1 TWh per year, the HiNA scenario would introduce a factor 3 to the overall energy impact.

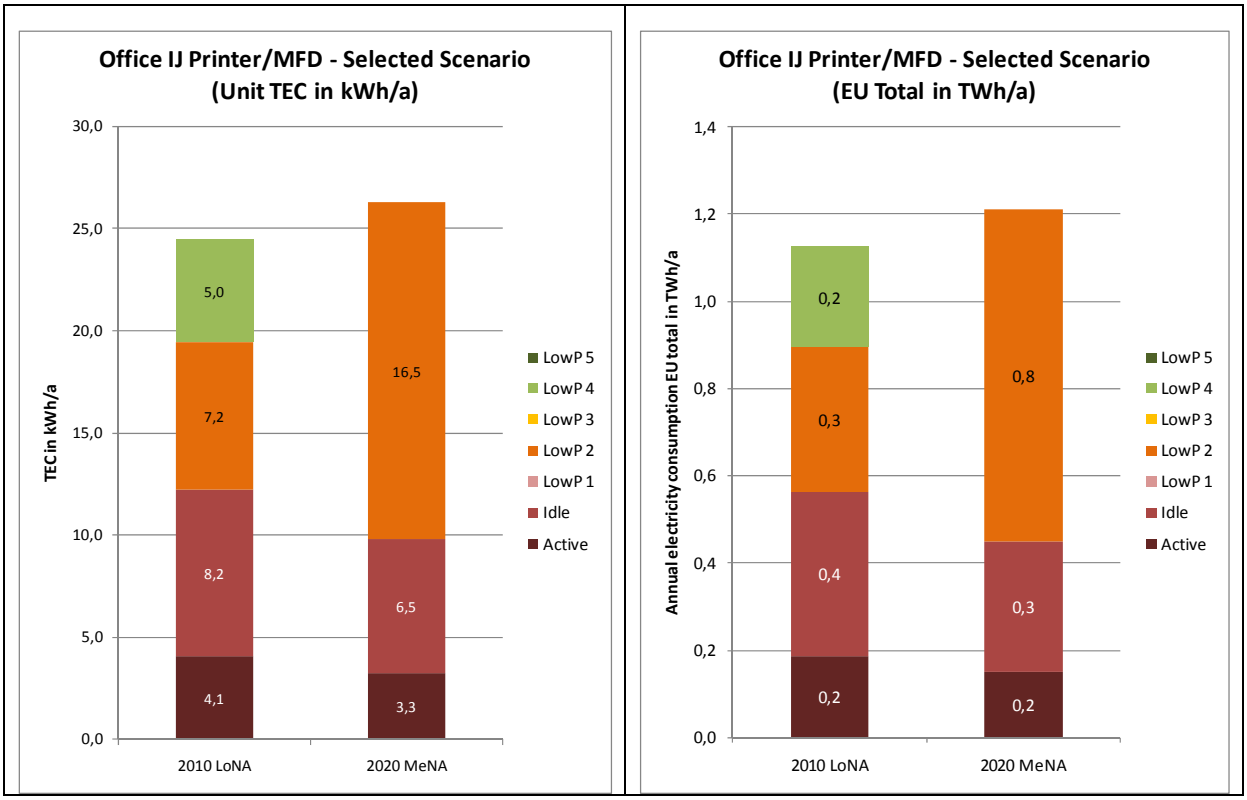


Figure 45: Office IJ Printer/MFD – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.3.21 Office EP Printer

Table 41: Office EP Printer - Input data for scenarios of reference year 2010

NoNA	**Office EP Printer**	**2010**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	800,0	80,0	0,0	10,0	0,0	7,0	0,3	
Stock	Use hours (h/d)	0,5	2,0	0,0	7,5	0,0	2,0	12,0	24,0
240 d/a	Mode Power (Wh/d)	400,0	160,0	0,0	75,0	0,0	14,0	3,6	652,6
18 million	TEC Unit/year (kWh/a)	96,0	38,4	0,0	18,0	0,0	3,4	0,9	156,6
	Stock per year (TWh/a)	1,7	0,7	0,0	0,3	0,0	0,1	0,0	2,8

LoNA	Office EP Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	800,0	80,0	0,0	10,0	0,0	7,0	0,3	
Stock	Use hours (h/d)	0,5	2,0	0,0	7,5	0,0	14,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	400,0	160,0	0,0	75,0	0,0	98,0	0,0	733,0
18 million	TEC Unit/year (kWh/a)	96,0	38,4	0,0	18,0	0,0	23,5	0,0	175,9
	Stock per year (TWh/a)	1,7	0,7	0,0	0,3	0,0	0,4	0,0	3,2

MeNA	Office EP Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	800,0	80,0	0,0	10,0	0,0	7,0	0,3	
Stock	Use hours (h/d)	0,5	2,0	0,0	21,5	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	400,0	160,0	0,0	215,0	0,0	0,0	0,0	775,0
18 million	TEC Unit/year (kWh/a)	96,0	38,4	0,0	51,6	0,0	0,0	0,0	186,0
	Stock per year (TWh/a)	1,7	0,7	0,0	0,9	0,0	0,0	0,0	3,3

HiNA	Office EP Printer	2010							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	800,0	80,0	0,0	10,0	0,0	7,0	0,3	
Stock	Use hours (h/d)	0,5	17,5	0,0	6,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	400,0	1400,0	0,0	60,0	0,0	0,0	0,0	1860,0
18 million	TEC Unit/year (kWh/a)	96,0	336,0	0,0	14,4	0,0	0,0	0,0	446,4
	Stock per year (TWh/a)	1,7	6,0	0,0	0,3	0,0	0,0	0,0	8,0

Explanatory notes:

Product mode assumptions are similar to the home EP Printer/MFDs. This product group represents a typical workgroup laser printer. The power management is reflected by the mode allocation in each scenario.

Table 42: Office EP Printer - Input data for scenarios of forecast year 2020

NoNA	**Office EP Printer**	**2020**							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	640,0	64,0	0,0	8,0	0,0	4,9	0,2	
Stock	Use hours (h/d)	0,5	2,0	0,0	7,5	0,0	2,0	12,0	24,0
240 d/a	Mode Power (Wh/d)	320,0	128,0	0,0	60,0	0,0	9,8	2,5	520,3
19 million	TEC Unit/year (kWh/a)	76,8	30,7	0,0	14,4	0,0	2,4	0,6	124,9
	Stock per year (TWh/a)	1,5	0,6	0,0	0,3	0,0	0,0	0,0	2,4

LoNA	Office EP Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	640,0	64,0	0,0	8,0	0,0	4,9	0,2	
Stock	Use hours (h/d)	0,5	2,0	0,0	7,5	0,0	14,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	320,0	128,0	0,0	60,0	0,0	68,6	0,0	576,6
19 million	TEC Unit/year (kWh/a)	76,8	30,7	0,0	14,4	0,0	16,5	0,0	138,4
	Stock per year (TWh/a)	1,5	0,6	0,0	0,3	0,0	0,3	0,0	2,6

MeNA	Office EP Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	640,0	64,0	0,0	8,0	0,0	4,9	0,2	
Stock	Use hours (h/d)	0,5	2,0	0,0	21,5	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	320,0	128,0	0,0	172,0	0,0	0,0	0,0	620,0
19 million	TEC Unit/year (kWh/a)	76,8	30,7	0,0	41,3	0,0	0,0	0,0	148,8
	Stock per year (TWh/a)	1,5	0,6	0,0	0,8	0,0	0,0	0,0	2,8

HiNA	Office EP Printer	2020							
	Value	*Active*	*Idle*	*LowP 1*	*LowP 2*	*LowP 3*	*LowP 4*	*LowP 5*	*Total*
	Power (W)	640,0	64,0	0,0	8,0	0,0	4,9	0,2	
Stock	Use hours (h/d)	0,5	17,5	0,0	6,0	0,0	0,0	0,0	24,0
240 d/a	Mode Power (Wh/d)	320,0	1120,0	0,0	48,0	0,0	0,0	0,0	1488,0
19 million	TEC Unit/year (kWh/a)	76,8	268,8	0,0	11,5	0,0	0,0	0,0	357,1
	Stock per year (TWh/a)	1,5	5,1	0,0	0,2	0,0	0,0	0,0	6,8

Explanatory notes:

Mode and use assumptions are similar to reference year 2010. We gain assume a 20% general improvement in power consumption per mode.

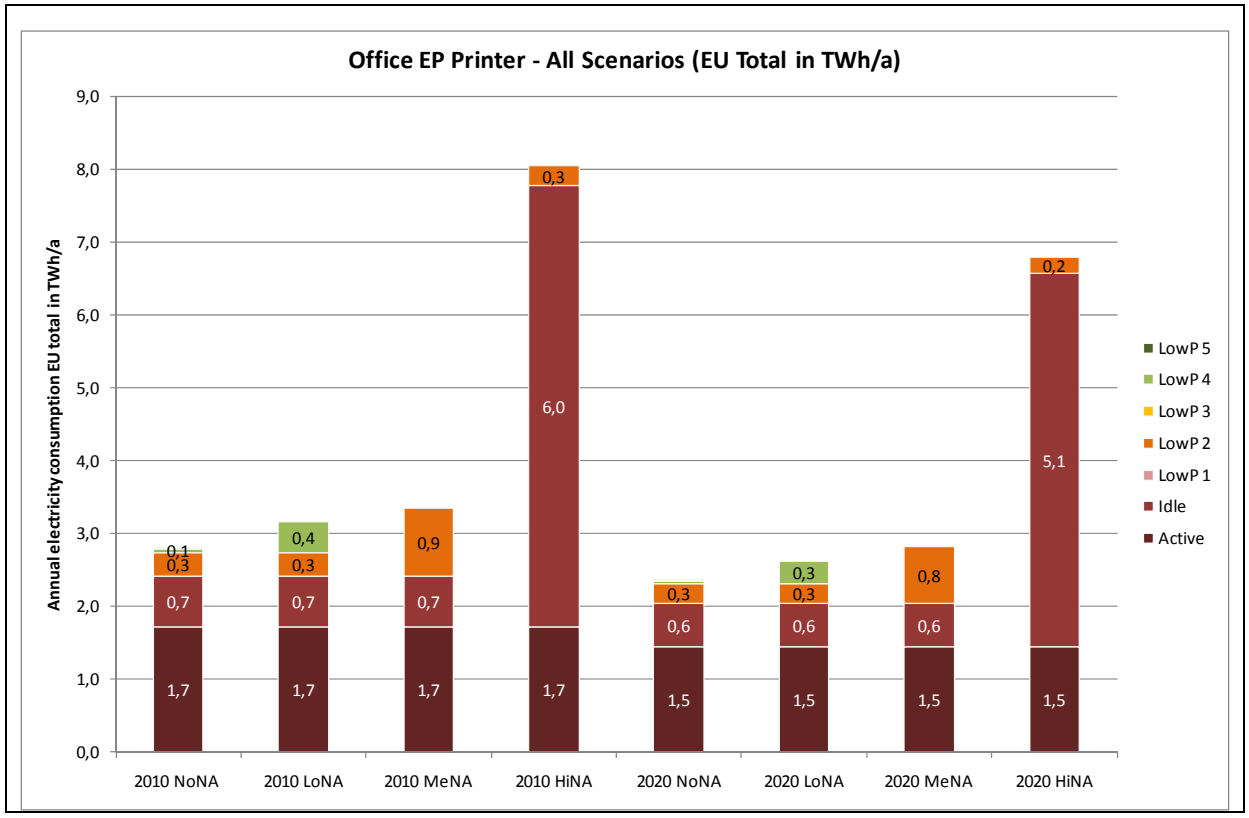


Figure 46: Office EP Printer – Comparison of all scenarios (EU total)

Discussion of results:

The overall energy impact of this product groups depends on the actual utilization. Active mode and ready (idle) are highly considerable. The industry has displayed in the past years great awareness for power management. This resulted in an improvement of the product's overall energy efficiency. The LoNA and MeNA scenarios display good practice leading to a networked standby related energy impact of about 1 TWh per year. The HiNA scenario indicates the worst case resulting in a factor 5 higher impact.

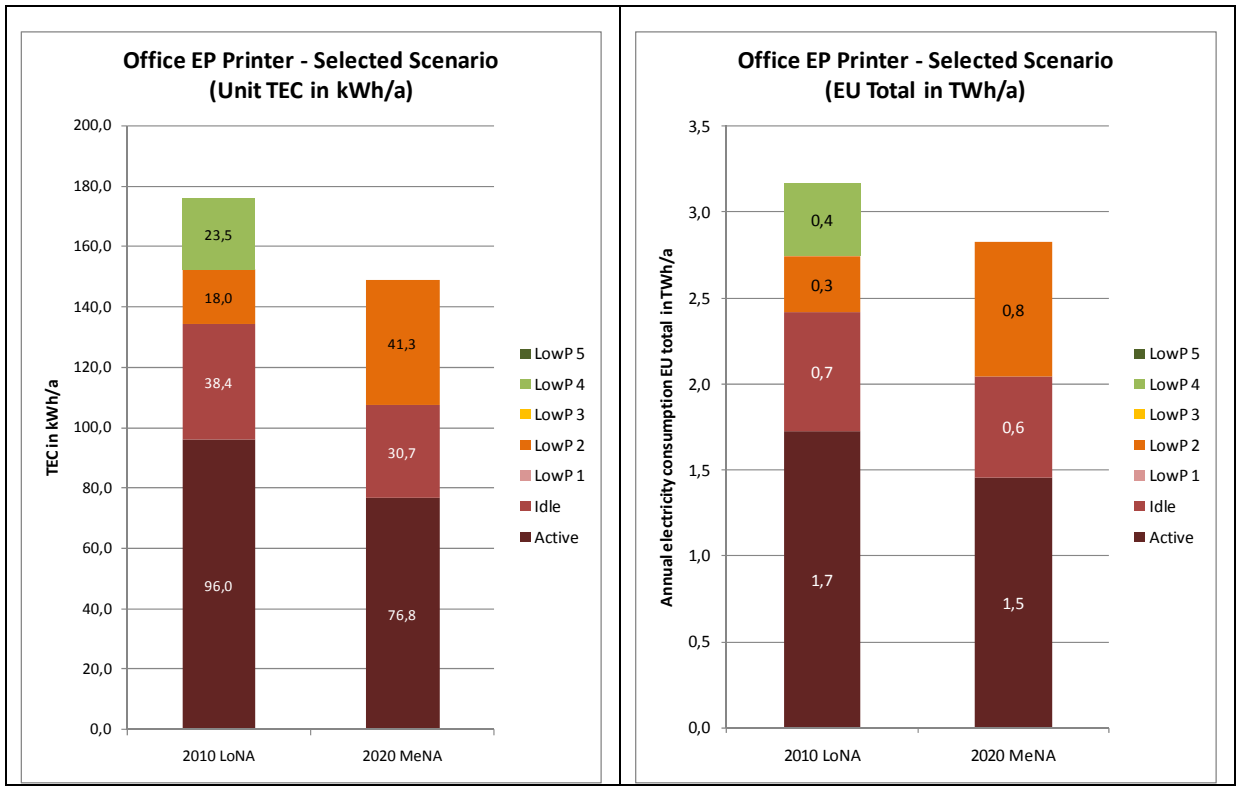


Figure 47: Office EP Printer – Comparison of selected scenarios TEC and EU total

The selected scenarios for the base case are LoNA 2010 to MeNA 2020.

5.4 EU-Totals and Life Cycle Costs

5.4.1 Selection of Base Case

In this subtask we summarize and evaluate the aggregated results from the individual product cases. Figure 48 below shows the aggregated EU-totals for all scenarios.

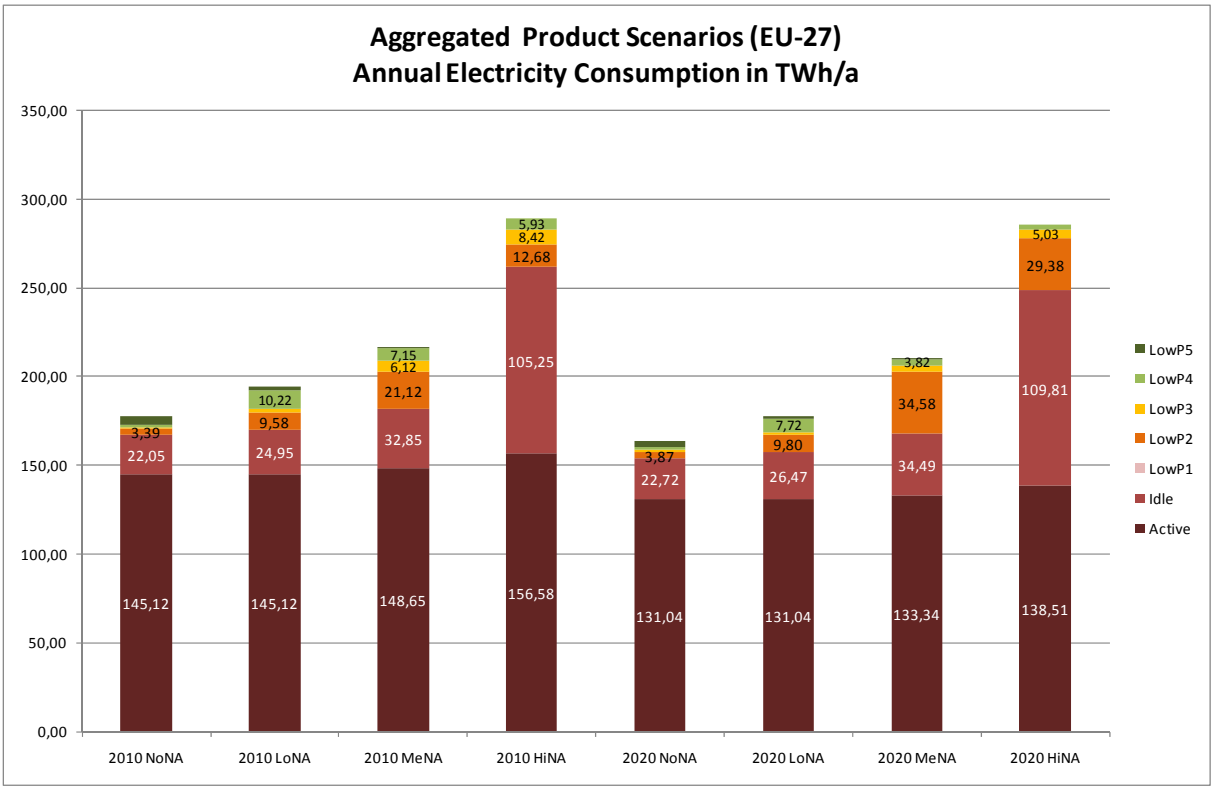


Figure 48: Aggregated Product Scenarios (EU-Totals)

For our base case we have selected the LoNA 2010 scenario and the MeNA 2020 scenario (see Figure 49). Please note that both scenarios are not “real-life” scenarios due to our assessment concept, which reflects different levels of network availability. A real-life scenario would distinguish different network availability levels between individual products and product groups. Networking products would demand high network availability while some client-type products might only require low or no network availability. But as we explained at the beginning of this task report; for the assessment of networked standby we needed a more structured approach that breaks the complexity of the real-life situation.

The LoNA 2010 scenario seems to be a justified reference point for the base case. This scenario reflects a situation where medium and high network availability is less often employed. Most products are put into a low power mode (standby/off) when not actively used. The LoNA 2010 scenario aggregates a total of 21 product cases. This is a sufficient number of products for the base case assessment and we estimate about 75% of the possible product scope for networked standby.

The base case is not a single reference year scenario. It includes estimate of the situation in 2020. We selected the MeNA 2020 scenario for the forecast representing a shift towards medium network availability. The MeNA 2020 scenario considers that most products will remain in a power state that allows relative fast resume time to application. In the subsequent base case analysis we will use the other scenarios, particularly the HiNA scenario, for comparison and the later discussion of improvement potentials.

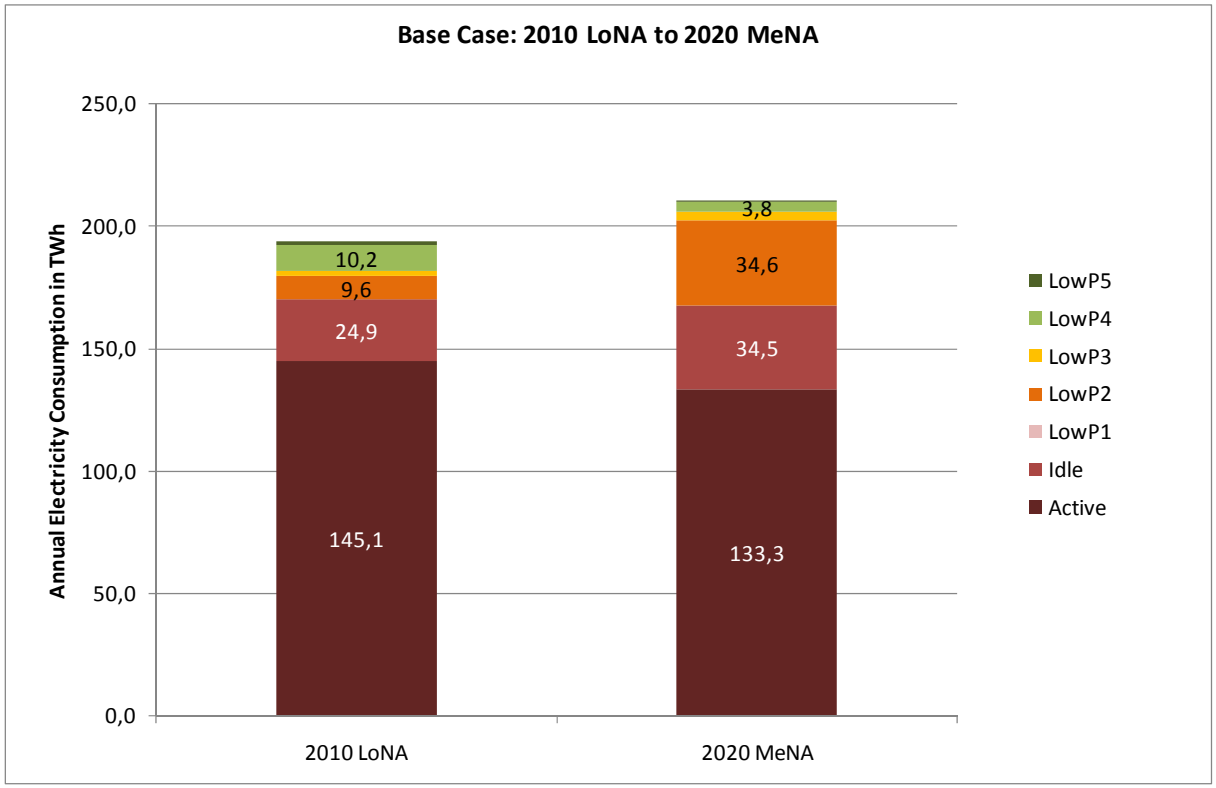


Figure 49: Base Case

Note that the EU-Totals in Figure 48 and Figure 49 are not Terrawatthours of “networked standby”. The calculations include – by necessity – active mode, idle operation not connected to network activity and standby and off without network functionality. The further analysis will outline, which parts of the totals are fully or partially effects of networked standby. For better comparison the following Figure 50 shows the base case without active and LowP 5 (off) mode.

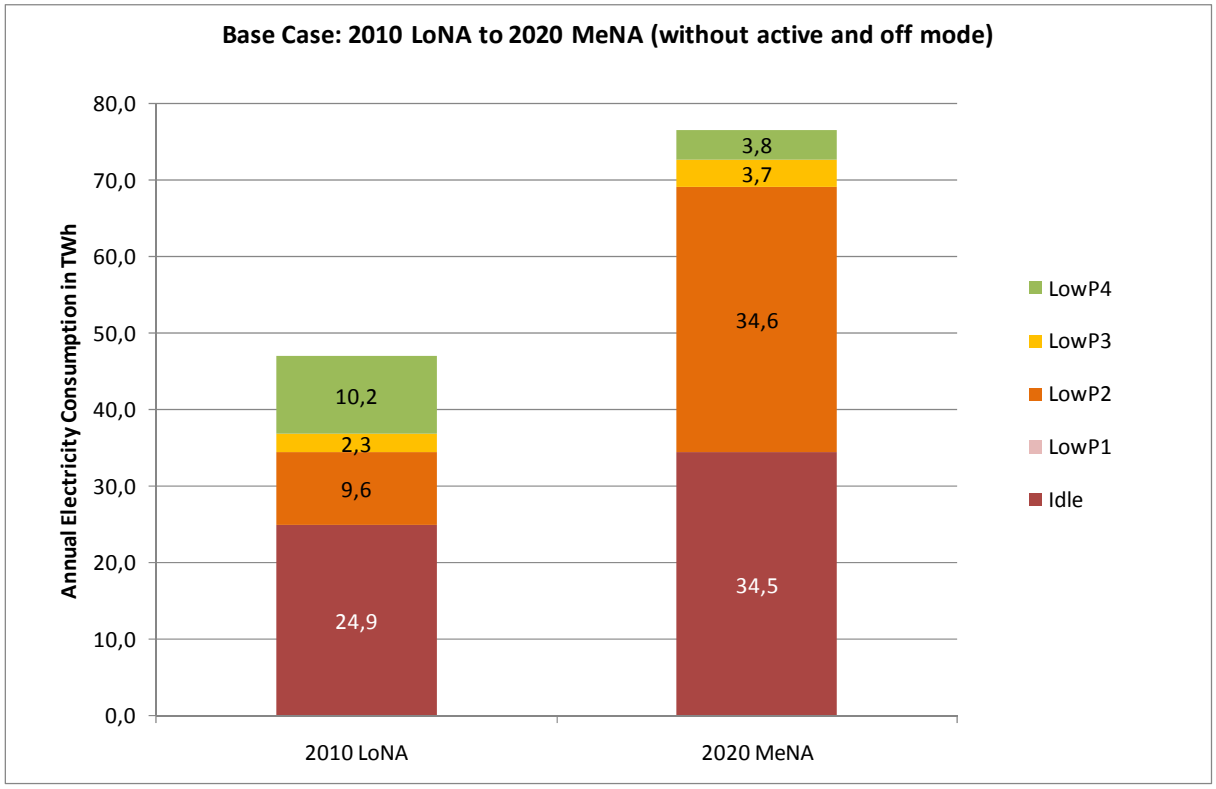


Figure 50: Base case without active and off mode

5.4.2 Base Case Analysis

The horizontal comparison of the 2010 scenarios with the 2020 scenarios shows an overall improvement in total power consumption (see Figure 48). This is a direct result of our general assumption that the mode-specific power consumption will have improved by 20% in 2020. The selected base case (Figure 49) indicating a shift to medium network availability results however in an overall increase in annual energy consumption from 194 TWh to 210 TWh. One reason for this increase is the shift to medium network availability. Another reason is the increase stock of some product groups.

With respect to total active mode energy consumption the base case reflects the assumed 20% improvement per mode. This assumption results in a strong reduction in power consumption per product unit. Again, we have made this general (constant) assumption across all product groups in order to indicate existing improvement potential on the one hand and reduce the number of variables in the scenarios on the other hand. The accumulated active mode power consumption will shrink by about 12 TWh from 145 TWh (LoNA 2010) to 133 TWh (MeNA 2020). The active mode represents about 75% of total energy consumption in LoNA 2010. This proportion changes with respect to MeNA 2020, where active mode is

less than 65% of total energy consumption. This development indicates a shift in the power distribution per mode.

The idle mode's total energy consumption of the LoNA 2010 scenario is 25 TWh or only 13% of the total energy consumption (see Figure 50). In the MeNA 2020 scenario this situation changes with idle mode accounting for 16% of total or 34.5 TWh per year. Home gateways, telephones, desktop computers and game consoles are the product groups with considerable idle mode energy consumption. That is not surprising, keeping in mind that these product groups are representing high and medium network availability. With respect to the single unit (TEC), the idle mode power consumption is with about 50% to 70% of total even more dominant for these product groups. The Figure 51 below seems to indicate another aspect: The consumer electronic products including televisions and set-top-boxes are insignificant. That is not really the case. Idle could be recognized as a mode also in such product groups. For the moment however, they are in active or in (passive) standby.

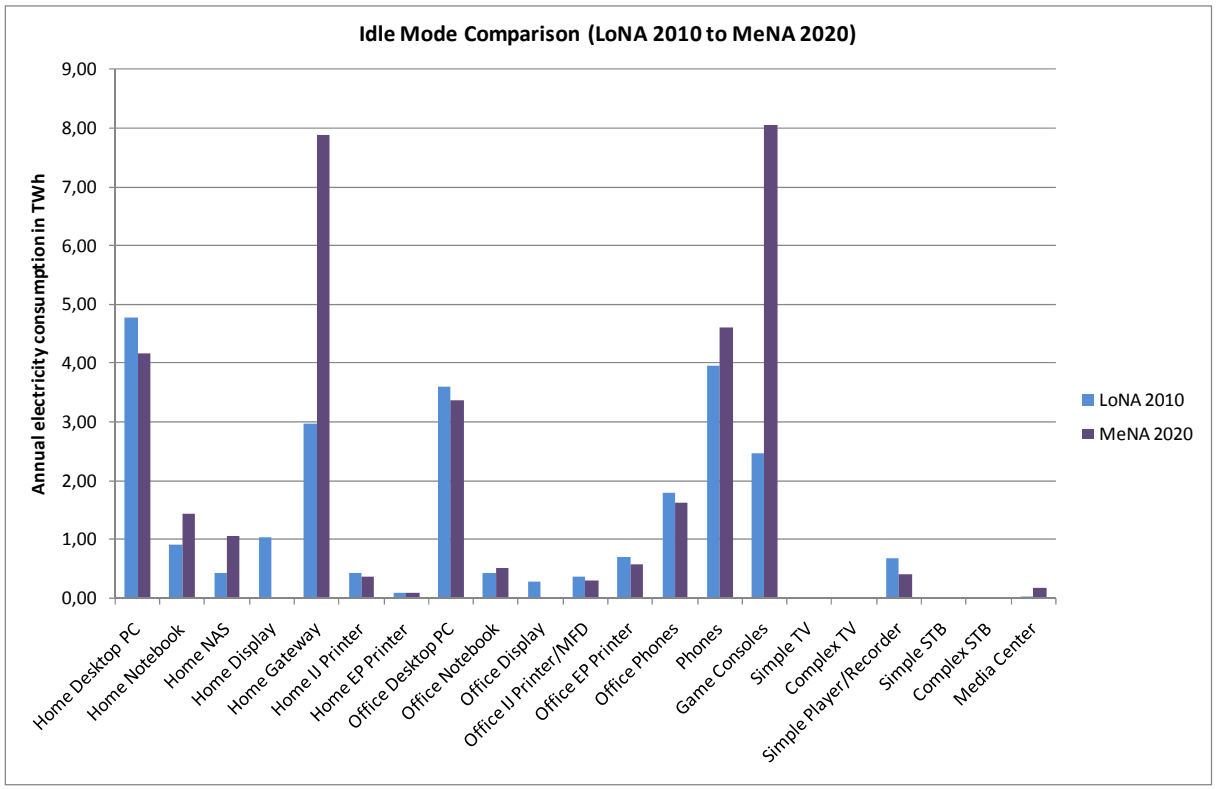


Figure 51: Idle mode comparison LoNA 2010 and MeNA 2020

If we compare now the HiNA scenarios with the LoNA or MeNA scenarios the importance of idle mode becomes absolutely apparent. According to the HiNA 2020 scenario the idle mode energy consumption would be 110 TWh per year. This value indirectly indicates (in the worst case) networked standby energy demand and the necessity for improvements before we end up in such a situation.

Depending on the individual network availability scenario low power modes including the different sleep, active and passive standby, and off modes are accounting for about 10% to 15% of total energy consumption. In the LoNA 2010 scenario the low power modes are accounting for 24 TWh, which is only 12% of total. In the MeNA 2020 scenario the situation is much different. The low power modes account for more than 42 TWh per annum or about 20% of total annual energy consumption. This higher value shows the impact of the LowP2 mode, a medium network availability (sleep) mode capable of wake-up over network and with a resume time to application of <10 seconds.

5.4.3 Energy Impact and Costs

Task 2 covered the electricity tariff: The price of electricity in each of the EU-27 Member States is listed in Table 2-10, as well as an EU-27 average. To account for the trend of increasingly expensive electricity, this task will use 0.20 €/kWh as the electricity price. Figure 52 below shows the calculation of the annual electricity costs according to the individual scenario.

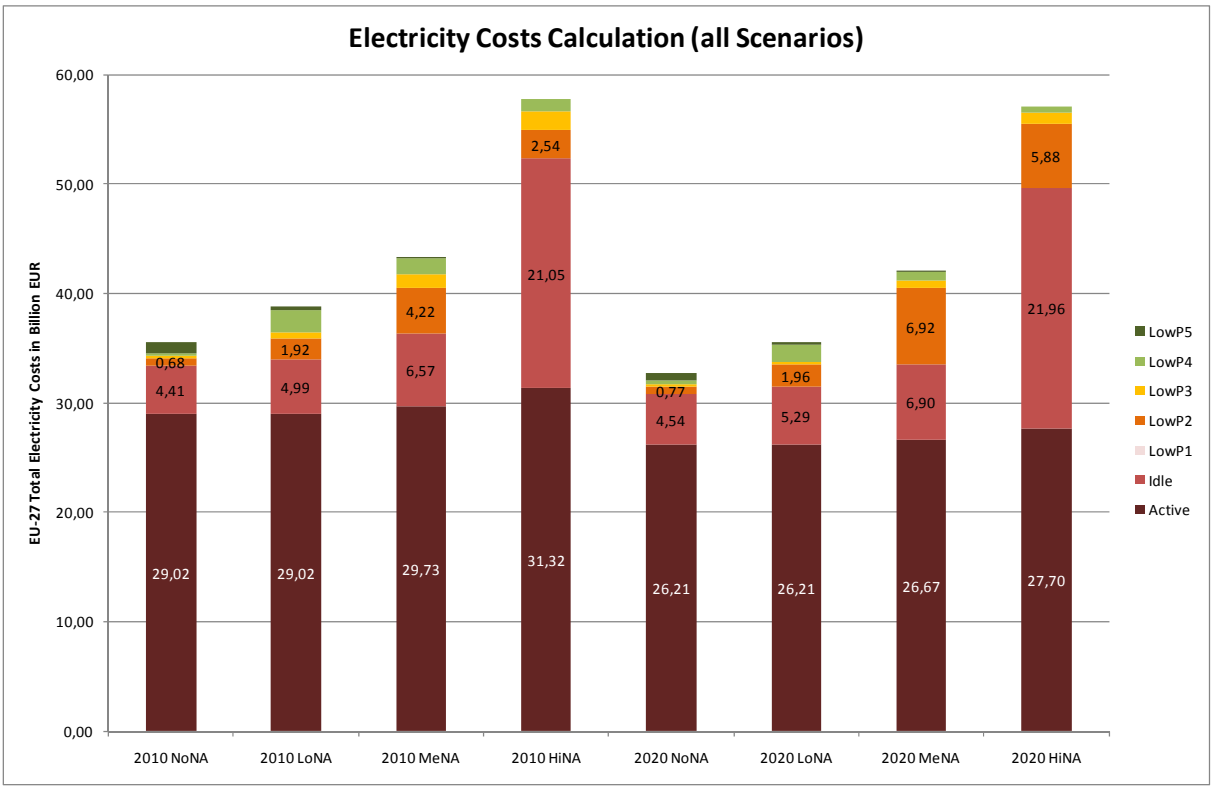


Figure 52: Electricity costs all scenarios (in Billion EUR)

The LoNA 2010 scenario total electricity consumption of 194 TWh equals:

- An electricity cost factor of 38.8 Billion EUR

- Global Warming Potential (GWP100) of 90 Million Tons CO2eq.[1]

The MeNA 2020 scenario total electricity consumption of 210 TWh equals:

- An electricity cost factor of 42 Billion EUR
- Global Warming Potential (GWP100) of 97 Million Tons CO2eq

5.4.4 Impact Assessment and Conclusions

At this point we like to summarize and discuss the results of the base case assessment. For the purpose of this impact assessment we selected 21 product groups. Based on a comparison with the reference study TREN Lot 6 “Standby and off-mode” losses we estimate that the selected product groups represent about 75% of the product scope that need to be considered horizontally with respect to networked standby.

For each product group we developed harmonized scenarios reflecting different levels of network availability (see chapter 5.2.2). In the selected base case (LoNA 2010 to MeNA 2020) we assumed that the demand for network availability will increase between 2010 and 2020. The HiNA scenario demonstrates a worst case situation. The single scenarios have been calculated based on a set of mode assumptions (power/use) reflecting averaged product configurations and use patterns. We calculated the single unit’s annual energy consumption differentiating active and low power modes. We also calculated the annual energy impact for EU-27 total product stock. The distinction of various modes helped to analyze different levels of network availability (networked standby). Through this approach we tried to indicate that networked standby is a multi-mode issue.

The results of these scenarios (base case) indicate that the business-as-usual case of growing network availability requires more energy. High network availability is currently often related to prolonged idle mode. Low power modes with equal functionality do not exist in all product groups. Notebook computers, however, are a good example which shows that power management is able to support high product performance and network availability.

With respect to the selected base case (MeNA 2020) the energy consumption of Idle and LowP 2 accounts together for about 70 TWh per year or over 30% of total annual energy consumption. This is a considerable amount of energy. The LowP 2 reflects to some extent existing power management solutions. The Idle mode is an indicator for further improvement potential. A part of idle mode is certainly caused by the user requirement for prolonged

[1] Calculated based on MEEuP EcoReport 2005

network availability, and if no convenient low power mode with a similar capability is offered, many more products would remain in idle in the future.

Networking-type and server-type products such as home gateways, telephones, desktop computers, but also the growing number of media consumer electronic products are examples, which require a substantial amount of energy for network availability. If these products would remain active/idle all the time the environmental impact would drastically increase. Network availability needs to be addressed holistically and with respect to all power states.

In order to show a rough order of magnitude related to networked standby (and possible overhead to our 21 product cases) we can make the following calculation. If we assume that in 2020 each household in the EU-27 (205 million) runs an additional device with about 6W (networked standby) over 24h per day throughout the year (395 days) the resulting energy consumption would amount to 10.8 TWh. If we furthermore assume that each office (85 million) runs a similar device throughout the year another 4.5 TWh would be required. These figures alone indicate an additional 15 TWh per year overhead to our existing case studies.

The scenarios finally demonstrate that a discussion and improvement of energy consumption related to networked standby requires a distinction of networked availability levels (e.g. through QoS requirements for individual products) and to some extent a product by product approach. In order to improve energy efficiency with respect to networked standby a consistent utilization of functional low power modes is clearly an option. The availability of respective functional low power modes – modes that allow the wake-up over the network – is however the first precondition. We have seen that such options exist in some product sectors. Secondly, the employment of such functional low power modes has to be realized by an advanced power management scheme. With respect to the individual product cases it also becomes apparent that the overall product performance, which is characteristically reflected by the power demand of active and idle, will influence the power consumption levels in support of higher network availability.

Against that background we would like to conclude this assessment and formulate a first tentative differentiation for the further work. We consider a distinction of “high” and “medium” network availability as very important and useful analytical tool. Particularly high network availability and to some extent medium network availability are product-specific issues with a large technological spectrum, individual network services and field of application. Products associated to high and medium network availability should be addressed, where possible, in a vertical way in order to improve efficiency. The further steps of the study will show the improvement potentials in this area. However, an approach towards new products (that are currently not covered vertically) should be developed as well. This objective is in the clear interest of the study.

Low network availability, as an additional mass phenomenon, is less product-specific and could more directly be addressed in a horizontal way. In Task 4 we have investigated some of these product developments in conjunction with smart home and multimedia. Lower component costs and miniaturization basically allows creating network availability for many products. The important aspect for the utilization of such capability is the network service that a product provides (to the end user or service provider). With respect to eco-design it is necessary to find a balance between network availability and overall energy consumption.

The BAT analysis and the improvement options will strengthen the points of proper power management and of implementing (new) network availability states, which are not effectively constant idling. When idle mode is the only or the most convenient mode to satisfy the user requirements (be it real, instant network access or the faint possibility of a remote access at some undefined point) we are approaching the worst case scenario (HiNA) with a tremendous increase in energy consumption. Technologically, the same or a very similar product reaction should already be possible at much lower power levels.