Draft version

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Report

Preparatory Studies for Product Group in the Ecodesign Working Plan 2012-2014: Lot 8- Power Cables DRAFT Task 2 report (2nd version)

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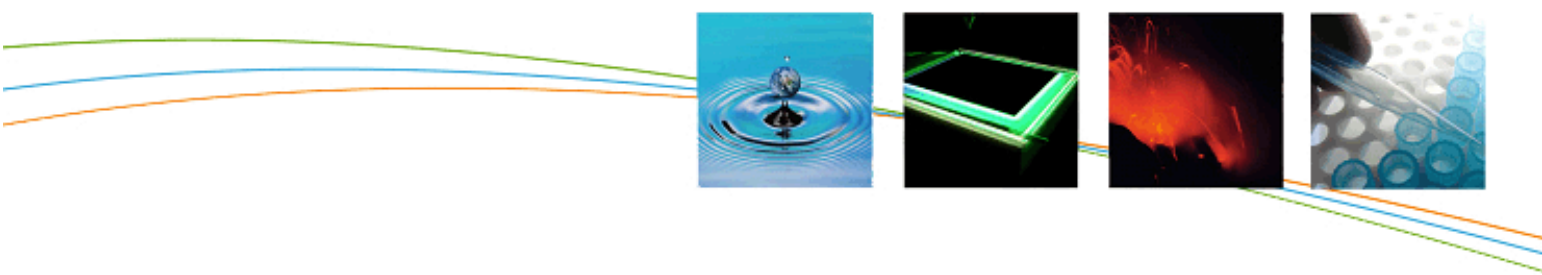

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EXECUTIVE SUMMARY

VITO is performing the preparatory study for the new upcoming eco-design directive for Energy-related Products (ErP) related to power cables, on behalf of the European Commission (more info http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm).

In order to improve the efficient use of resources and reduce the environmental impacts of energy-related products the European Parliament and the Council have adopted Directive 2009/125/EC (recast of Directive 2005/32/EC) establishing a framework for the setting Ecodesign requirements (e.g. energy efficiency) for energy-related products in the residential, tertiary, and industrial sectors. It prevents disparate national legislations on the environmental performance of these products from becoming obstacles to the intra-EU trade and contributes to sustainable development by increasing energy efficiency and the level of protection of the environment, taking into account the whole life cycle cost. This should benefit both businesses and consumers, by enhancing product quality and environmental protection and by facilitating free movement of goods across the EU. It is also possible to introduce binding information requirements for components and sub-assemblies.

The MEErP methodology (Methodology for the Eco-design of Energy Using Products) allows the evaluation of whether and to which extent various energy-using products fulfil the criteria established by the ErP Directive for which implementing measures might be considered. The MEErP model translates product specific information, covering all stages of the life of the product, into environmental impacts (more info http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/methodology/index_en.htm).

The tasks in the MEErP entail:
Task 1 - Scope (definitions, standards and legislation);
Task 2 – Markets (volumes and prices);
Task 3 – Users (product demand side);
Task 4 - Technologies (product supply side, includes both BAT and BNAT);
Task 5 – Environment & Economics (Base case LCA & LCC);
Task 6 – Design options;
Task 7 – Scenarios (Policy, scenario, impact and sensitivity analysis).
Tasks 1 to 4 can be performed in parallel, whereas 5, 6 and 7 are sequential.
Task 0 or a Quick-scan is optional to Task 1 for the case of large or inhomogeneous product groups, where it is recommended to carry out a first product screening. The objective is to re-group or narrow the product scope, as appropriate from an ecodesign point of view, for the subsequent analysis in tasks 2-7.

The preparatory phase of this study is to collect data for input in the MEErP model an executive Summary of the complete study will be elaborated at completion of the draft final report.

Comment: This report is currently a working progress, as some parts of the study are missing comments and data from the stakeholders, therefore it shall not be viewed as a full report.

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LIST OF ACRONYMS

Al	Aluminium
Avg	Average
CSA	conductor Cross-Sectional Area
Cu	Copper
EC	European Commission
ERP	Energy Related Product
EU	European Union
LCA	Life Cost Analysis
LCC	Life Cost Calculation
LV	Low Voltage
MEErP	Methodology for Ecodesign of Energy related Products
MEEuP	Methodology for Ecodesign of Energy using Products
PRODCOM	PRODuction COMmunautaire
PVC	Polyvinylchloride
SME	Small and Medium sized Enterprise
TBC	To Be Completed
TBD	To Be Defined
VAT	Value Added Tax
Vac	Voltage Alternate Current
VITO	Flemish institute for Technological Research

Use of text background colours

Blue: draft text
Yellow: text requires attention to be commented
Green: text changed in the last update

CHAPTER 2 MARKETS

The objective of Task 2 is to present the economic and market analysis related to the products. The aims are:

- to place the product group within the total of EU industry and trade policy (subtask 2.1);
- To provide market and cost inputs for the EU-wide environmental impact of the product group (subtask 2.2);
- To provide insight in the latest market trends so as to indicate the place of possible Eco-design measures in the context of the market-structures and ongoing trends in product design (subtask 2.3, also relevant for the impact analyses in Task 3); And finally,
- To provide a practical data set of prices and rates to be used in a Life Cycle Cost (LCC) calculation (Subtask 2.4).

Summary of results:
TBC

Comment: This report is currently a working progress, as some parts of the study are missing comments and data from the stakeholders, therefore it shall not be viewed as a full report.

2.1 Generic economic data

2.1.1 Definition of 'Generic economic data' and objective

"Generic economic data" gives an overview of production and trade data as reported in the official EU statistics. It places the power cables within the total of EU industry and trade. To investigate the market, Europroms -Prodcom statistics are screened, and verified with recent data from stakeholders.

2.1.2 PRODCOM data

The PRODCOM statistics (published by EUROSTAT) have the advantage of being the official European Union (EU) source. PRODCOM data is based on manufactured goods whose definitions are standardised across the EU thus guaranteeing comparability. Although it is used and referenced in other EU policy documents regarding trade and economic policy, it does have its limitations. Many data points are unknown, estimated, confidential and therefore not available.

Based on the scope defined in task 1 only one relevant category (see Table 2-1) for this study has been found in the PRODCOM database.

Table 2-1: ProdCom data relevant NACE code

Prodcom Nace code	Description
27321380	Other electric conductors, for a voltage <= 1000 V, not fitted with connectors

The market data in quantity of units and monetary value (see Table 2-2) was obtained for the NACE code 27321380 from EUROSTAT for the years 2007 – 2012.

Table 2-2: EU27 ProdCom data on NACE code 27321380

Year	Quantity in kTon				Value in million €			
	Production	Import	Export	Apparent EU consumption	Production	Import	Export	Apparent EU consumption
1995*								
2007	1550				9300			
2008	2171				11648			
2009	1920				8400			
2010	2200				11100			
2011	2280				12600			
2012	2128				12300			

Table 2-3: Value per kg conductor based on ProdCom data (NACE code 27321380)

Year	Value in 1000 €	Quantity in Ton	€/kg
2007	9300000	1550000	6.00
2008	11647510	2171223	5.36
2009	8400000	1920000	4.38
2010	11100000	2200000	5.05
2011	12600000	2280000	5.53
2012	12300000	2128632	5.78
Average			**5.35**

Table 2-3 shows that the average value per kilo cable is **5.35** EURO/kg for the years 2007 till 2012.

Note: The ProdCom data include a broad range of electrical wires and cables, such as wires and cables for electrical installations inside and outside the buildings (e.g. LV distribution cables), wires and cables for data communication (coax cables are excluded), flexible cords, wires for internal wiring of control panels, instrumentation cables, elevator cable, and others. The category includes cables and wires with conductors made of copper, aluminium or any other material.

As such the PRODCOM data can only be used as a reality check, an upper limit to verify figures from other sources.
TBC

2.1.3 Generic economic data

For 2007 the global (world) copper demand was 24,2 million tonnes, of which 48% was used in manufacture of electric cable[1], or about 11 million tonnes.

Amount of copper sold in year xxx for use in power cables: xxx
Amount of aluminium sold in year xxx for use in power cables: xxx

2.1.4 Generic economic data: conclusion

TBC

2.2 Market and stock data

2.2.1 Sales data

2.2.1.1 Sales data from EU cable industry associations

To verify the ProdCom data with recent data from stakeholders a questionnaire was sent to the cable manufacturers[2].

Extra responses are needed to guarantee anonymity, stakeholders are still invited to use the enquiry form and to reply.

2.2.1.2 Sales of power cables in Europe according to working plan[3]

Table 2-4: Sales of power cables (kTon Copper)

Annual Sales (kTons eq. Copper)	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Industry	226	245	241	253	266	279	293
Services	202	219	216	227	238	250	263
Residential	284	308	303	318	334	351	368
Total	712	772	760	798	838	880	924

[1] Source: www.eurocopper.eu> marketdata, EGEMIN study 2011 Modified Cable Sizing Strategies
[2] questionnaire for cable manufacturers, sent in context of this study, September 30th, 2013
[3] Study of the Amended Ecodesign Working Plan, Final report Task 3 – version 6 Dec. 2011

Table 2-4 shows that annual sales of wiring, expressed as kilotons equivalent copper, is estimated to be some 760 kton in 2010, and expected to increase to 924 kton in 2030.

2.2.1.3 CRU Wire and Cable Quarterly report

Table 2-3 and Table 2-5 are extracted from the CRU[4] Wire and Cable Quarterly, Q3 2013 report[5]. Please note that CRU includes Russia and all of East Europe in Europe!

Building & Construction is part of the Insulated cables, which also includes power distribution cables and diverse industrial cables etc. from low to high voltage. Winding wire is enamelled wire (magnetic wire) in transformers.

Table 2-5: kTons of conductor for Europe 2013f (source: CRU Wire and Cable Quarterly, Q3 2013)

000 tons conductor content by region (2013f)		
Europe	**Cu**	**Al**
Bare Overhead Conductors	0	306
Insulated Cables	1828	531
Winding Wire	424	38
Subtotal	**2252**	**874**

Table 2-6: European consumption of wire & cable by type ('000 ton conductor independent of metal, 2013f) (source: CRU Wire and Cable Quarterly, Q3 2013)

Europe	
LV Energy	1073
Power Cable	1114
External Telecom	68
Internal/Data	218
Winding Wire	465
Sub-Total	**2938**

In the CRU report the following product sectors are used (Table 2-6):

- LV Energy: all cable whose primary function is the transmission of energy and rated at below 1kVac;
- Power Cable: comprises all energy cable rated at 1kVac and above;
- External Telecom: metallic cable used in telecommunication networks installed outside buildings;
- Internal/Data: all other types of cable used for the transmission of voice/data, including internal telephone cable, LAN data cable and all types of co-axials;
- Winding Wire: all types of round and flat enamelled and taped wire used in the windings of motors, transformers etc;
- Fibre Optic Cable: all types of cable containing optical fibres.

Note: there is a small mismatch between the Table 2-5 and Table 2-6 because some cables that are produced in Europe can be exported or others can be imported to fit the consumption in the second table.

[4] http://www.crugroup.com/about-cru/industries_we_cover/wirecable/
[5] http://www.crugroup.com/about-cru/industries_we_cover/wirecable/

Based upon Table 2-6 one can conclude that about 37 % (= 1073/2938) of wire and cable consumption in Europe is for LV energy cables. This category, however, includes among others the sales of cables for the LV distribution grid, LV cables for industry and OEM application, meaning automotive, rolling stock, and so on. As such these figures can only be used as an upper limit to verify data from other sources.

TBC

2.2.2 Stock data

Power cables are used in all type of buildings both residential and non-residential (industry and service). The annual sale depends on the amount of new buildings and building renovations. Especially building renovation is considered to increase in the coming years.

2.2.2.1 Stock data according to working plan

As illustrated in Table 2-7 the total amount of copper installed in buildings ('stock') is estimated to be some 18788 kTon in 2010, expected to increase to 21583 kTon in 2030.

Table 2-7: Total amount of copper installed in buildings[6]

Stock (kTons eq. Copper)	***2000***	***2005***	***2010***	***2015***	***2020***	***2025***	***2030***
Industry	*5991*	*6102*	*6538*	*6951*	*7395*	*7453*	*7511*
Services	*4338*	*4419*	*4734*	*5033*	*5355*	*5397*	*5439*
Residential	*6886*	*7014*	*7515*	*7989*	*8500*	*8567*	*8633*
Total	*17215*	*17536*	*18788*	*19974*	*21250*	*21417*	*21583*

2.2.2.2 Building stock

2.2.2.2.1 BPIE

BPIE[7] estimates that there are **24 billion m²** of useful floor space (industry floor space excluded?) in the EU27 countries. The residential stock is the biggest segment with an EU floor space of **75%** of the building stock. Within the residential sector, different types of single family houses (e.g. detached, semi-detached and terraced houses) and apartment blocks are found. Apartment blocks may accommodate several households typically ranging from 2-15 units or in some cases holding more than 20-30 units (e.g. social housing units or high rise residential buildings).

[6] Study of the Amended Ecodesign Working Plan, Final report Task 3 – version 6 Dec. 2011

[7] BPIE study: Europe's buildings under the microscope – October 2011

2.2.2.2.2 Ecofys report

The Ecofys study "Panorama of the European non-residential construction sector, 9 December 2011"[8] was conducted by investigating five reference countries (Sweden, Germany, Poland, Hungary and Spain) and extrapolating the results to European scale. The number of buildings and the total floor area of these buildings are shown per building group in Table 2-8 and Table 2-9.

Table 2-8: Extrapolated EU27 non–residential building stock[8] (year 2009?)

	Non-government owned offices	Trade facilities	Gastronomic facilities	Health facilities	Educational facilities	Industrial buildings	Public buildings	Other buildings	Total
Northern Europe EU27									
Buildings	27,134	16,679	6,597	20,288	59,247	194,613	27,134	26,885	**356,547**
Floor area [Mio m²]	47.7	29.3	11.6	35.6	104.1	194.6	9.0	47.2	**479.1**
Western Europe EU27									
Buildings	1,200,354	1,192,100	1,465,150	121,663	144,214	1,180,094	871,799	642,660	**6,818,034**
Floor area [Mio m²]	917.4	1,490.1	596.0	781.1	905.4	1,180.1	871.8	642.7	**7.384.6**
North Eastern Europe EU27									
Buildings	39,860	333,388	85,764	19,043	37,356	275,103	168,553	1,124,362	**2,083,428**
Floor area [Mio m²]	53.1	213.8	35.0	15.5	99.3	349.3	135.0	360.3	**1,261.2**
South Eastern Europe EU27									
Buildings	4,627	734,185	232,186	19,887	56,246	204,413	159,798	103,114	**1,514,456**
Floor area [Mio m²]	36.1	131.7	124.7	46.3	63.7	316.4	92.3	141.2	**952.5**
Southern Europe EU27									
Buildings	86,395	312,650	118,469	52,653	158,694	522,299	25,090	396,655	**1,672,906**
Floor area [Mio m²]	117.7	426.0	161.4	71.7	216.2	711.6	34.2	540.4	**2,279.2**
Total EU27									
Buildings EU27	1,358,370	2,589,001	1,908,167	233,535	455,757	2,376,522	1,230,343	2,293,676	**12,455,371**
Floor area EU27	1,171.9	2,291.0	928.7	950.2	1,388.7	2,752.0	1,142.3	1,731.8	**12,356.6**

[8] Ecofys report, Panorama of the European non-residential construction sector, 9 December 2011

Table 2-9: Number of non-residential buildings in the EU27 [1,000 units][9]

Age structure	Private offices	Trade facilities	Gastro-nomic facilities	Health facilities	Educa-tional facilities	Industrial buildings	Public buildings	Other buildings	Total
Until 1980	594.2	1,566.7	1,291.4	143.9	333.7	1,636.2	687.4	1.841.1	**8.102.7**
1980 -1989	223.1	329.7	373.5	29.9	71.7	329.3	173.5	183.6	**1701.8**
1990 -1999	373.3	459.1	207.2	38.4	56.1	237.1	318.1	505.7	**2,190.9**
2000-2009	197.3	481.3	99.7	35.3	22.2	377.6	177.0	601.0	**1,999.5**
Total	**1,387.8**	**2,836.8**	**1,971.8**	**247.6**	**483.1**	**2,580.2**	**1,356.0**	**3,131.4**	**13,994.8**

Table 2-10: Floor area of the non-residential building stock in the EU27 [Mio m²][9]

Age structure	Private offices	Trade facilities	Gastro-nomic facilities	Health facilities	Educa-tional facilities	Industrial buildings	Public buildings	Other buildings	Total
Until 1980	507.6	1,247.5	609.2	611.8	1,124.5	1,867.0	619.3	1,190.3	**7,783.1**
1980 -1989	185.8	272.1	176.0	121.7	152.4	362.5	169.0	205.6	**1,642.2**
1990 -1999	307.4	409.4	97.4	123.1	124.6	219.4	279.0	202.9	**1,757.1**
2000-2009	210.3	520.2	71.7	104.9	60.6	561.5	175.7	400.1	**2,108.2**
Total	**1,211.2**	**2,449.2**	**954.3**	**961.5**	**1.462.1**	**3,010.4**	**1,242.9**	**1,999.0**	**13,290.6**

2.2.2.2.3 MEErP

2.2.2.2.4 Euroconstruct data

To be completed

2.2.2.2.5 Relation between stock and loading

Building stock data and energy consumption can be used to calculate the energy consumption per square meter and per sector. Table 2-11 shows the final consumption of electricity in TWh per year for EU28 according Eurostat.

[9] Ecofys report, Panorama of the European non-residential construction sector, 9 December 2011

Table 2-11 EU28 annual final consumption of electricity by industry and households/services in TWh[10]

	Final annual energy consumption in TWh											
Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Industry	1075	1081	1089	1120	1133	1131	1142	1119	966	1030	1037	1008
Services & households	1448	1469	1528	1561	1586	1640	1647	1683	1687	1750	1688	1726
Total	2523	2550	2616	2681	2719	2771	2789	2802	2654	2779	2725	2734

The origin of the consumption is shown in Figure 2-1.

[10] Eurostat, http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=ten00094

Figure 11 EU-27, 2007

Energy consumption by origin

(VHK 2011)

Figure 2-1 Energy consumption by origin, EU-27,2007 (VHK 2011)[36]

2.2.2.3 Power cable stock

STOCK DATA: Estimation of the amount of copper of fixed wired conductors and cables in residential and non-residential buildings

Table 2-12: Stock of LV cables & wires in residential buildings[11]

Avg living area	109	m²
Avg Cu/100m²	**29.1**	kg/100m²
EU 27 Building Floor space	2,40E+10	m²
Residential Floor space	1,80E+10	m² (75% total building Floor space)
Total Cu	**5241**	kTon

Remark: Study of the Amended Ecodesign Working Plan, Final report Task 3 (v. 16 Dec. 2011)– residential = 7515kTon (= **41.75** kg/100m²) in 2010.

The diversity in terms of typology within the non-residential sector is vast. Compared to the residential sector, this sector is more complex and heterogeneous. It includes types such as offices, shops, hospitals, hotels, restaurants, supermarkets, schools, universities and sports centres while in some cases multiple functions exist in the same building. The non-residential stock counts for about 25%[12] of the total EU27 Building floor space.

Table 2-13: Stock of LV cables and wires in non-residential buildings - Services[13]

Avg Cu/100m²	**54**	kg/100m²
EU 27 Building Floor space	2.40E+10	m²
Floor space	6.00E+09	m² (25% total building Floor space)
Total Cu	**3250**	kTon

Remark: Study of the Amended Ecodesign Working Plan, Final report Task 3 (v. 16 Dec. 2011)– Services = 4734 kTon = **78.9** kg/100m²

[11] Source: CuIoU survey European Copper Institute

[12] Europe's Buildings under the Microscope (2011), http://www.bpie.eu/documents/BPIE/HR_%20CbC_study.pdf

[13] Source: CuIoU survey European Copper Institute

Table 2-14: Stock of LV cables and wires in non-residential buildings - Industry[14]

Avg Cu/100m²	**139**	kg/100m²
EU 27 Building Floor space	2.40E+10	m²
Floor space	2752E+06	m²
Total Cu	**3825**	kTon

Remark: Study of the Amended Ecodesign Working Plan, Final report Task 3 (v. 16 Dec. 2011)– Industry = 6538 kTon

General assumption – see working plan:
Stock in non-residential buildings = 1.5 times stock in residential buildings. This means 1.5 x 5241 kTon= **7861** kTon as a total amount of copper used in non-residential (services + industry) buildings (Workplan= 11272 kTon)

The amount of copper and circuits in an real office building[15] is shown in Table 2-15 as an example.

Table 2-15: Example of an rea office building[15]

Amount of Lighting circuits	33
Amount of Socket outlet circuits	62
Amount of Dedicated circuits	34
Amount of Main feeders	1
Amount of Sub feeders	11
Cu total (kg)	2851
Floorspace (m²)	3059
Cu (kg/100m²)	**93**

2.2.2.4 Distribution of power cables based upon cross sectional area

Distribution of LV cables in residential buildings shown in Table 2-16 and in non-residential buildings shown in Table 2-17 is based upon a survey of the European Copper Institute[16].

Table 2-16: Distribution of LV cables in the residential buildings[17]

CSA (mm²)	% Weight	% Length
1.5	23.4	27.5
2.5	38.9	40
4	6,6	4.9
6	9,3	5.7
10	6.1	<1

[14] Source: CuIoU survey European Copper Institute
[15] EnergyVille building, Waterschei, Belgium
[16] Source: CuIoU survey European Copper Institute
[17] Source: CuIoU survey European Copper Institute

Wires and cables with a CSA of 1.5 mm² are most common for lighting circuits; whereas 2.5 mm² wires and cables are most common for socket outlet circuits. These circuits counts for about 60.9 % of the total Copper used in fixed wired electrical installations in residential buildings.

Wires and cables with a CSA above 2.5 mm² are mostly used for dedicated circuits, e.g. electrical circuits for electrical heating, cooking, washing machine…
In residential buildings cables with a CSA of more than 10mm² are generally used for:

- connecting the LV circuit board to the main LV feeder in the street.
- connection between the LV main circuit board and sub LV circuit boards in the building (e.g. apartment).
- Equipotential- and secondary bonding.

Note: In the UK 1 mm² wiring is also used for lighting circuits. In Germany 1.5 mm² wire and cable are also used for socket outlet circuits.

Table 2-17: Distribution of LV cables in non-residential buildings[18]

CSA (mm²)	% Weight	% Length
1.5	2	15
2.5	13	58.6
4	2	4.9
6	3	5.1
10	3	3.2
16	3	2.4
25	4	2
35	6	1.9
50	5	1.2
70	11	1.8
95	12	1.4
120	9	0.9
150	6	0.4
185	13	0.8
240	7	0.4
300	0	0
400	3	0.1
500	0	0
600	0	0

Wires and cables with a csa of 1.5 mm² are most common for lighting circuits; whereas 2.5 mm² wires and cables are most common for socket outlet circuits. These circuits counts for about 15 % of the total Copper used in fixed wired electrical installations in non-residential buildings. The total length of these cables counts for 73.6% of the total length of the installed cables.

[18] Source: CuIoU survey European Copper Institute

2.2.3 New sales rate

The new sales are directly related to construction of new buildings. Hence, the new sales of power cables will be equal to the power cable stock of the previous year multiplied by the buildings stock growth rate.

2.2.3.1 BPIE

In terms of growth, annual construction rates in the residential sector are around 1% over the period between 2005 and 2010 (BPIE)[19]. Except The Netherlands (in the case of multi-family houses), all other countries experienced a decrease in the rate of new build in recent years, reflecting the impact of the current financial crisis in the construction Sector (BPIE).

2.2.3.2 Ecofys

The Ecofys study[23] estimates the overall new construction rate for the non-residential buildings at **2.1%** and the new construction rate for the industrial buildings at **3.1%** (see Table 2-19).

2.2.4 Replacement sales rate

The replacement sales are directly related to the building renovations. However, renovations do not always include a replacement of the electric wiring. Hence, the replacement sales rate needs to be corrected downwards.

The renovation rates of buildings will have a large impact on future market trends. In the BPIE study 'Europe's buildings under the microscope – A country-by-country review of the energy performance of building' [20] three scenarios of renovation rates (in combination with different renovation depths) are considered.

Public buildings are in the limelight at the moment due to the policies requiring to become close to zero energy building standards by the end of 2018 and a sectoral renovation rate of **at least 3%** is recommended.

Most estimates of overall renovation rates (other than those relating to single energy saving measures) are mainly between around 0.5% and 2.5% of the building stock per year.

2.2.4.1 Working Plan

In the Working plan the refurbishment rate has been set at **3%** following the rationale applied for thermal insulation products.

[19] http://www.bpie.eu/
[20] http://www.bpie.eu/documents/BPIE/HR_%20CbC_study.pdf

2.2.4.2 BPIE

In the BPIE study[21], it is assumed that the current (2011) prevailing renovation rate across Europe is **1%** .

2.2.4.3 Ecofys

The Ecofys study[23] estimates the overall renovation rate for the non-residential building sector at **12.4%** (see Table 2-19).

The Heinze [22] [23] study allows a better understanding of the non-residential modernisation market in Germany. The study is based on an extensive architect survey and investigates what kind of modernisation activities are typically realized in building renovations. The study indicates that in **59%** of all renovation activities in Germany the power cables are replaced.

2.2.4.4 Euroconstruct

Euroconstruct [24] is a European research group for research and analysis of the construction industry, which includes 19 European countries (the EC19 countries include Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, Czech Republic, Hungary, Poland and Slovak Republic). GDP and construction output in Euroconstruct countries is shown in Figure 2-2. Construction output per segments is listed in Table 2-18.

[21] Europe's Buildings under the Microscope (2011), http://www.bpie.eu/documents/BPIE/HR_%20CbC_study.pdf
[22] Modernisierungsmarkt 2008 - Modernisierungsaktivitäten von Bewohnern und privaten Vermietern im Wohnungsbau: Produktbereich Dach. Heinze GmbH. (Unpublished). German.
[23] Ecofys report, Panorama of the European non-residential construction sector, 9 December 2011
[24] http://www.euroconstruct.org/

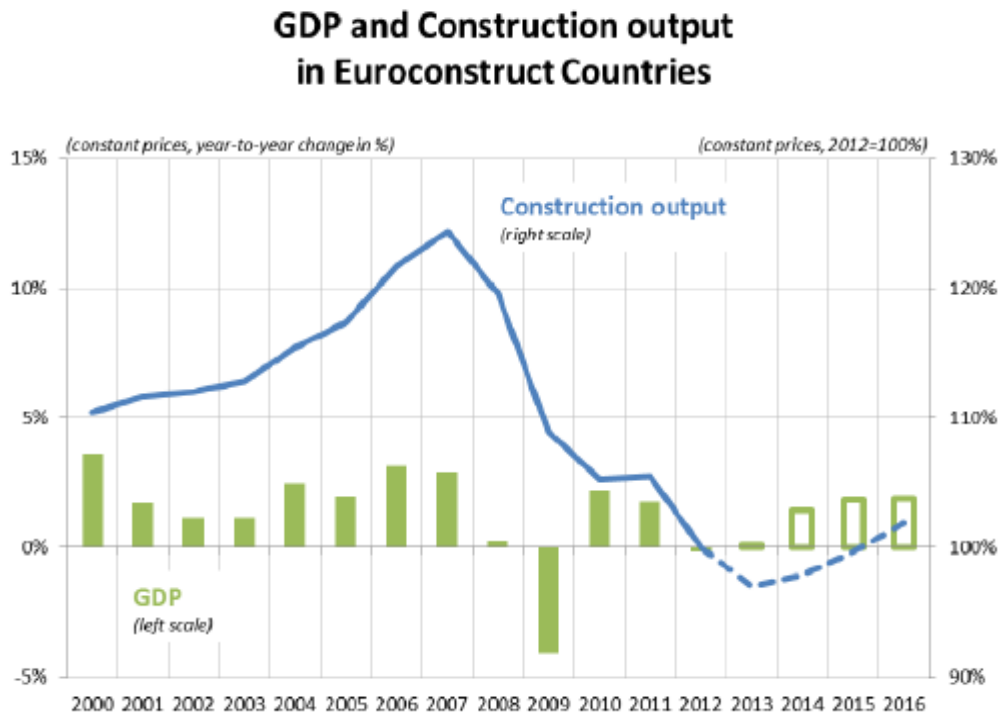

Figure 2-2 GDP and Construction output in Euroconstruct Countries[25]

Table 2-18: Construction Output by Segments[25]

Construction Output by Segments (EC19)

(% change in real terms)

				Estimate	Forecasts		Outlook
Country	2010	2011	2012	2013	2014	2015	2016
Residential	-1,9	1,9	-4,2	-2,2	1,4	2,2	2,3
Non-Residential	-5,3	0,0	-4,6	-3,4	0,0	1,4	2,3
Civil Engineering	-3,6	-2,4	-8,2	-4,0	1,2	1,6	1,7
Total construction output	-3,4	0,3	-5,2	-3,0	0,9	1,8	2,2

2.2.4.5 Conclusion:

The assumption for this study is:

Residential replacement sales rate = 1% x 59% = 0.59%.

[25] 76th Euroconstruct conference, Prague, 28-29th November 2013, press release, http://www.euroconstruct.org/

Non-Residential replacement sales rate = 12% x 59% = 7.08%.

Table 2-19: Summary of metabolism rates in representative countries and EU27[26]

	Germany	Hungary	Poland	Spain	Sweden	EU27 (weighted)
New construction rate						
Private offices	0.7 %	4.0%	5.3 %	4.7 %	1.2 %	**2.6 %**
Trade facilities	2.4 %	1.9 %	4.4 %	1.5 %	3.5 %	**2.4 %**
Gastronomic facilities	0.1 %	0.9 %	2.6 %	1.4 %	1.8 %	**0.9 %**
Health facilities	1.4 %	0.8 %	3.1 %	3.1%	0.5 %	**2.0 %**
Educational facilities	1.4 %	0.8 %	1.0 %	0.5%	0.4 %	**1.0 %**
Industrial buildings	3.5 %	1.7 %	1.9 %	3.5 %	1.3 %	**3.1 %**
Public buildings	0.9 %	0.7 %	5.3 %	4.0 %	n.a. %	**2.2 %**
Other buildings	1.0 %	2.7 %	1.6 %	8.4 %	2.5 %	**3.2 %**
Total (weighted)	**1.0 %**	**1.7 %**	**2.3 %**	**4.2 %**	**1.3 %**	**2.1 %**
Demolition rate						
Non-residential sector	0.29 %	n.a.	n.a.	0.1 %	0.6 %*	**0.2 %**
Renovation rate						
Overall renovation rate	**11.0 %**	**6.2 %**	**5.6 %**	**20.1 %**	**14.3 %**	**12.4 %**
Energy related renovation rate	2.3 %	1.7 %	1.2 %	4.1 %	2.8 %	**2.6 %**
Not energy related renovation rate	8.7 %	4.5 %	4.4 %	16.0 %	11.4 %	**9.8 %**

2.2.5 Market and stock data Summary

Table 2-20 shows the stock growth and sales rates per sector. The stock in the Working Plan for year 2010 is used as the reference. In Table 2-28 the absolute values of stock and sales are calculated based upon the figures in Table 2-20.

[26] Ecofys report, Panorama of the European non-residential construction sector, 9 December 2011

Table 2-20: Summary of stock, growth rates and sales

Sector	Stock growth rate	Replacement sales rate	New sales rate	Total sales rate	Stock (Reference year: 2010)
Unit	**% p.a.**	**% p.a.**	**% p.a.**	**% p.a.**	**kTon Cu**
Residential sector	1.00%	0.59%	1.00%	1.59%	7515
Services sector	2.10%	7.08%	2.10%	9.18%	4734
Industry sector	3.10%	7.08%	3.10%	10.18%	6538
Total sector (weighted)	2.01%	4.48%	2.01%	6.49%	18787

Table 2-21: Summary of stock data

Sector	Building floor area	Amount of Cu material per 100m² empirical	Amount of Cu material per 100m² according working plan
Unit	Million m²	kg/100m²	kg/100m²
Residential	18000	29.1	41.75
Services	6000	54	78.9
Industry	2752	139	237

2.3 Market trends

Power cables are used in all type of buildings both residential and non-residential (industry and services). The annual sales depends on the quantity of new buildings and building renovations. Especially building renovation is considered to increase in the coming years.

Power cables are a mature product and available in standardized sizes.

2.3.1 Market production structures

Most cables in buildings use copper conductors. In Europe the largest copper Mine is located in Bulgaria (110000 metric ton per year). Production of copper in Europe is mainly located in Belgium (118000 metric ton), Bulgaria (284000 metric ton) and Germany (591000 metric ton) (source: US Geological Survey).

Cable manufacturers are grouped in the 'Europacable' association. Some of the main manufacturers of power cables are listed by alphabetical order:

- Brugg Cables, www.bruggcables.com, Switzerland
- General Cable, www.generalcable.es, Spain
- Hellenic Cables, www.cablel.com, Greece
- Italian Cable Company, www.icc.it, Italy

- Kabelwerk Eupen, www.eupen.com, Belgium
- Leoni, www.leoni.com, Germany
- Nexans, www.nexans.com, France
- Nkt cables, www.nktcables.com, Denmark
- Prysmian Group, www.prysmiangroup.com, Italy
- Reka Cables, www.reka.fi, Finland
- SKB Gruppe, www.skb-gruppe.at, Austria
- TELE-FONIKA Kable, www.tfkable.com, Poland
- TKF, www.tkf.nl, Netherlands
- Tratos Cavi, www.tratos.eu, Italy
- Waskönig+Walter, www.waskoenig.de, Germany
  TBC

Aluminium conductors are still used for bulk power distribution and large feeder circuits, but not as such in buildings. They are seldom used indoor, because connections are more difficult to avoid cold-flow under pressure which causes screw clamped connections may get loose over time. Also aluminium forms an insulating oxide layer on the surface and therefore needs an antioxidant paste at joints.

Depending on their final application, the power cables are sold to the end user through variety of channels such as directly from manufacturers, via wholesalers, via distributors or via installer. The product distribution channels of power cables are mostly business-to-business, as these products usually need professional installation (safety hazards,…). Cables are installed by electrical contractors, e.g. those represented by European Association of Electrical Contractors (www.aie.org). A fraction of the sales is distributed via retail and is mainly installed in the residential sector.

2.3.2 General trends in product design and product features; feedback from consumer associations

Power cables are a mature product and available in standardized sizes.
There is a trend to use low smoke halogen free cables in buildings.

2.4 Consumer expenditure base data

The cable price is proportional to the copper price and therefore the cable price can be expressed in €/ (CSA [mm²] x l [m] x N) wherein CSA means Cross-Sectional-Area,l means Length and N means number of cores. Hence, the product unit is (CSA [mm²] x l [m] x N).

2.4.1 Purchase price

The average user price for Copper wire (PVC insulated) - VAT exclusive - fluctuates nowadays around 0.075€/ (mm²x m x 1 core)[27]. Copper is becoming a scarce resource and an increased demand caused by the use of wires with an increased cross-sectional area may result in even higher market prices.
The price of cable can be calculated as[28] :

[27] Based on online survey of cable prices offered in web shops
[28] Comments of Europacable – first stakeholder meeting

Cable price = K1 x copper price + K2

Where K1 and K2 are constants, and K2 is reflecting the plastics, labour costs and other added values.

2.4.2 Product cost

An average value of 5.3 €/kg (see Table 2-3) is equivalent to 5.3 €/112,4 m for a CSA of 1mm² (copper), or **0.047** €/ mm² x m.
The cost of cable can be calculated as[29]:

Cable cost = K1 x copper price + K2

Where K1 and K2 are constants, and K2 is reflecting the plastics, labour costs and other added values.

Table 2-22: product cost per production unit based upon copper price

LME	€/100kg	CSA(mm²)	length(m)	ρ (kg/m³)	V(m³)	Kg	€/mm².m
okt/13	535	1	1	8900	0,000001	0,0089	0,047615

Note that the average ProdCom product cost in Table 2-3,i.e. 0.047 is almost the same as the value in Table 2-22, i.e. 0.047615.

Copper prices are very volatile[30], therefore it is common to correct cable prices with a surcharge[31] depending on the market price.

2.4.3 Installation costs

Cable installation time and installation cost depend on the length of the cable, the CSA of the cable and the difficulty for installation (accessibility). The cable installation time does not take into account the installation of the cable fixing system (cable tray, cable ladder,…) to which the cable is mounted. The calculation of the installation time is based on a normal accessibility to the cable fixing system (normal working height, no obstacles…). The installation time of a cable with section CSA, length L is calculated with formula 2.1.

$$T_{CSA} = Tm_{CSA} \cdot L + Te_{CSA} \quad \text{(formula 2.1)}$$

Where
T_{CSA} = time to install a cable with section CSA and length L
Tm_{CSA} = time to install one meter cable with section CSA without connecting it
L = length of the cable to install
Te_{CSA} = time to connect the ends of a cable of section CSA

[29] See comments of Europacable – first stakeholder meeting
[30] http://www.ems-power.com/ems-metallkurse/ems-metallkurse.de.shtml
[31] http://www.igus.de/_Product_Files/Download/pdf/copper_en.pdf

The average hourly rates in the EU-28 are shown in Table 2-23 and are used as the installer's hourly rate. Installation times are listed per cable section in Table 2-24.

Table 2-23 hourly rates in EU-28[32]

	2008	2010	2011	2012	2013	Non-wage costs (% of total), 2013	Change 2013/2008, %
EA17	25.7	26.9	27.5	28	28.4	25.90%	10.40%
EA18	25.5	26.7	27.3	27.8	28.2	25.90%	10.40%
EU28	21.5	22.4	22.9	23.4	23.7	23.70%	10.20%
Belgium	32.9	35.3	36.3	37.2	38	27.40%	15.40%
Bulgaria	2.6	3.1	3.3	3.6	3.7	15.80%	44.10%
Czech Republic	9.2	9.8	10.5	10.5	10.3	26.80%	12.40%
Denmark	34.4	36.7	37.3	38	38.4	12.40%	11.70%
Germany	27.9	28.8	29.6	30.5	31.3	21.80%	12.20%
Estonia	7.8	7.6	7.9	8.4	9	26.70%	15.20%
Ireland	28.9	28.9	28.7	29	29	13.80%	0.50%
Greece	16.7	17	16.2	15	13.6	19.10%	-18.60%
Spain	19.4	20.7	21.2	21	21.1	26.60%	8.70%
France	31.2	32.6	33.6	34.3	34.3	32.40%	9.90%
Croatia	9.2	8.6	8.7	8.7	8.8	15.40%	-4.00%
Italy	25.2	26.8	27.2	27.6	28.1	28.10%	11.40%
Cyprus	16.7	17.7	18	18	17.2	16.60%	2.60%
Latvia	5.9	5.5	5.7	6	6.3	20.60%	7.10%
Lithuania	5.9	5.4	5.5	5.8	6.2	28.50%	5.00%
Luxembourg	31	32.9	33.9	34.7	35.7	13.40%	15.40%
Hungary	7.8	7	7.3	7.5	7.4	24.60%	-5.20%
Malta	11.3	11.9	12.2	12.5	12.8	8.00%	13.90%
Netherlands	29.8	31.1	31.6	32.3	33.2	24.70%	11.70%
Austria	26.4	28	29	30.5	31.4	26.70%	18.90%
Poland	7.6	7.2	7.3	7.4	7.6	16.70%	0.10%
Portugal	12.2	12.6	12.6	11.6	11.6	19.30%	-5.10%
Romania	4.2	4.1	4.2	4.1	4.6	23.20%	10.60%
Slovenia	13.9	14.6	14.9	14.9	14.6	14.70%	4.90%
Slovakia	7.3	7.7	8	8.3	8.5	27.40%	17.00%
Finland	27.1	28.8	29.5	30.8	31.4	22.10%	15.90%
Sweden	31.6	33.6	36.4	39.2	40.1	33.30%	26.90%
United Kingdom	20.9	20	20.1	21.6	20.9	15.30%	-0.30%
Norway	37.8	41.6	44.5	48.5	48.5	18.90%	28.20%

[32] Labour costs in the EU28,eurostat news release 49/2014, 27 March 2014

Table 2-24 installation times[33]

Section	Installation time per meter	Installation time for the cable ends
mm2	Min	Min
1	1.75	5
1.5	2.45	7
2.5	3.15	9
4	3.85	12
6	5.25	12
10	5.95	15
16	7	17
25	8.75	20.4
35	9.8	25.5
50	10.5	30.6
70	11.9	36
95	12.6	45
120	14	45
150	15.75	60
185	17.5	60
240	21	85
300	24.5	120
400	28	200
500	35	360
630	42	480

The installation cost is composed of a cost to design (and verify or certify) the circuit plus the cost to install the cable. This is modelled with formula 2.2:

$$C_I = C_E + T_{CSA} \cdot hr \qquad \text{(formula 2.2)}$$

Where

C_I = installation cost (EURO)
C_E= engineering/design/certification cost (EURO)
T_{CSA} = time to install a cable with section CSA and length L
hr = hourly rate (EURO/hour)

Unless impacted by a measure proposed in later tasks C_E will be set tot 0.

TBC
Stakeholders are invited to provide input on an approach, e.g. labour hours per m and labour cost per hour? Per categories of CSA?

[33] EUROPEAN COPPER INSTITUTE, UTILISATION RATIONNELLE DES ENERGIES APPLIQUEE AU DIMENSIONNEMENT DES NOUVELLES INSTALLATIONS ELECTRIQUES

2.4.4 Repair and Maintenance costs

No repair, nor maintenance costs are applicable to power cables. Once installed a power cable is unlikely to become faulty, unless inappropriate use or damage by external factors (third party damages the cable) is the cause.

2.4.5 Disposal costs/benefits

For methods on recycling see task 3.

As power cables have positive scrap value, it is an advantage for a company to send the old power cables for scrap and avoid disposal costs. It is assumed that there is no disposal cost required for the handling of power cables at their end-of-life.

The positive scrap value for the owner of the cable should be about 70% of the copper price (fluctuates). For instance, calculation of the positive scrap value based upon May 2014th figures results in €3500/ton / €5300/ton = 66%.

Copper price – Scrap: ~ € 3500/ton[34] (05/2014)
Primary Copper price: ~€ 5300/ton[35] (05/2014)

2.4.6 Energy rates

Table 2-25 presents the average financial rates in the EU-27 suggested in the MEErP 2011 Methodology. These rates will be used in this preparatory study according the MEErP methodology[36]. The calculated rates per year (reference year = 2011) are listed in Error! **Not a valid bookmark self-reference.** shows the calculated annual electricity rates for the domestic and non-domestic sector, based upon the figures in Table 2-25 (reference year 2011).

Table 2-27.

Table 2-25 Generic energy rates in EU-27 (1.1.2011)[36]

	Unit	domestic incl.VAT	Long term growth per yr	non-domestic excl. VAT
Electricity	€ / kWh	0.18	5%	0.11
Energy escalation rate*	%	4%		
*= real (inflation-corrected) increase				

2.4.7 Financial rates

Table 2-26 presents the average financial rates in the EU-27 suggested in the MEErP 2011 Methodology.

[34] http://www.scrapmonster.com/european-scrap-prices
[35] http://www.cablebel.be/index-site.php
[36] VHK, MEErP 2011 METHODOLOGY PART 1.

Table 2-26 Generic financial rates in EU-27[37]

	Unit	domestic incl.VAT	non-domestic excl. VAT
Interest	%	7.7%	6.5%
Inflation rate	%	2.1%	
Discount rate (EU default)	%	4%	
VAT	%	20%	

2.5 Recommendations

A new enquiry will be proposed to gather more data on stock, cable sales and installation times.
TBC

[37] VHK, MEErP 2011 METHODOLOGY PART 1.

ANNEX 2-A

Error! Not a valid bookmark self-reference. shows the calculated annual electricity rates for the domestic and non-domestic sector, based upon the figures in Table 2-25 (reference year 2011).

Table 2-27 Annual electricity rates per year for domestic and non-domestic sector

year	Electricity rate domestic incl. VAT (€/kWh)	Electricity rate non-domestic incl. VAT (€/kWh)
1990	0.08	0.05
1991	0.08	0.05
1992	0.09	0.05
1993	0.09	0.05
1994	0.09	0.06
1995	0.10	0.06
1996	0.10	0.06
1997	0.10	0.06
1998	0.11	0.07
1999	0.11	0.07
2000	0.12	0.07
2001	0.12	0.07
2002	0.13	0.08
2003	0.13	0.08
2004	0.14	0.08
2005	0.14	0.09
2006	0.15	0.09
2007	0.15	0.09
2008	0.16	0.10
2009	0.17	0.10
2010	0.17	0.11
2011	0.18	0.11
2012	0.19	0.11
2013	0.19	0.12
2014	0.20	0.12
2015	0.21	0.13
2016	0.22	0.13
2017	0.23	0.14
2018	0.24	0.14
2019	0.25	0.15
2020	0.26	0.16
2021	0.27	0.16
2022	0.28	0.17
2023	0.29	0.18
2024	0.30	0.18
2025	0.31	0.19
2026	0.32	0.20
2027	0.34	0.21
2028	0.35	0.21
2029	0.36	0.22
2030	0.38	0.23

Table 2-28 shows the calculated stock and sales in absolute terms based upon the figures in Table 2-20 shows the stock growth and sales rates per sector. The stock in the Working Plan for year 2010 is used as the reference. In Table 2-28 the absolute values of stock and sales are calculated based upon the figures in Table 2-20.
Table 2-20.

Table 2-28 Stock and sales per year and sector

	Residential					Services					Industry				
	Stock	Stock growth	Replacement sales	New sales	Total sales	Stock	Stock growth	Replacement sales	New sales	Total sales	Stock	Stock growth	Replacement sales	New sales	Total sales
Year	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu	kTon Cu
1990	6159					3124					3550				
1991	6220	62	36	62	98	3190	66	221	66	287	3660	110	251	110	361
1992	6283	62	37	62	99	3257	67	226	67	293	3774	113	259	113	373
1993	6345	63	37	63	100	3325	68	231	68	299	3891	117	267	117	384
1994	6409	63	37	63	101	3395	70	235	70	305	4011	121	275	121	396
1995	6473	64	38	64	102	3466	71	240	71	312	4136	124	284	124	408
1996	6538	65	38	65	103	3539	73	245	73	318	4264	128	293	128	421
1997	6603	65	39	65	104	3613	74	251	74	325	4396	132	302	132	434
1998	6669	66	39	66	105	3689	76	256	76	332	4533	136	311	136	448
1999	6736	67	39	67	106	3767	77	261	77	339	4673	141	321	141	461
2000	6803	67	40	67	107	3846	79	267	79	346	4818	145	331	145	476
2001	6871	68	40	68	108	3926	81	272	81	353	4967	149	341	149	490
2002	6940	69	41	69	109	4009	82	278	82	360	5121	154	352	154	506
2003	7009	69	41	69	110	4093	84	284	84	368	5280	159	363	159	521
2004	7079	70	41	70	111	4179	86	290	86	376	5444	164	374	164	538
2005	7150	71	42	71	113	4267	88	296	88	384	5612	169	385	169	554
2006	7222	72	42	72	114	4356	90	302	90	392	5786	174	397	174	571
2007	7294	72	43	72	115	4448	91	308	91	400	5966	179	410	179	589
2008	7367	73	43	73	116	4541	93	315	93	408	6151	185	422	185	607
2009	7441	74	43	74	117	4637	95	322	95	417	6341	191	435	191	626
2010	7515	74	44	74	118	4734	97	328	97	426	6538	197	449	197	646
2011	7590	75	44	75	119	4833	99	335	99	435	6741	203	463	203	666
2012	7666	76	45	76	121	4935	102	342	102	444	6950	209	477	209	686
2013	7743	77	45	77	122	5039	104	349	104	453	7165	215	492	215	707
2014	7820	77	46	77	123	5144	106	357	106	463	7387	222	507	222	729
2015	7898	78	46	78	124	5252	108	364	108	472	7616	229	523	229	752
2016	7977	79	47	79	126	5363	110	372	110	482	7852	236	539	236	775
2017	8057	80	47	80	127	5475	113	380	113	492	8096	243	556	243	799
2018	8138	81	48	81	128	5590	115	388	115	503	8347	251	573	251	824
2019	8219	81	48	81	129	5708	117	396	117	513	8605	259	591	259	850
2020	8301	82	48	82	131	5828	120	404	120	524	8872	267	609	267	876
2021	8384	83	49	83	132	5950	122	413	122	535	9147	275	628	275	903
2022	8468	84	49	84	133	6075	125	421	125	546	9431	284	648	284	931
2023	8553	85	50	85	135	6202	128	430	128	558	9723	292	668	292	960
2024	8638	86	50	86	136	6333	130	439	130	569	10025	301	688	301	990
2025	8725	86	51	86	137	6466	133	448	133	581	10335	311	710	311	1021
2026	8812	87	51	87	139	6601	136	458	136	594	10656	320	732	320	1052
2027	8900	88	52	88	140	6740	139	467	139	606	10986	330	754	330	1085
2028	8989	89	53	89	142	6882	142	477	142	619	11327	341	778	341	1118
2029	9079	90	53	90	143	7026	145	487	145	632	11678	351	802	351	1153
2030	9170	91	54	91	144	7174	148	497	148	645	12040	362	827	362	1189
Total			1776	3011	4787			13653	4050	17703			19389	8489	27878