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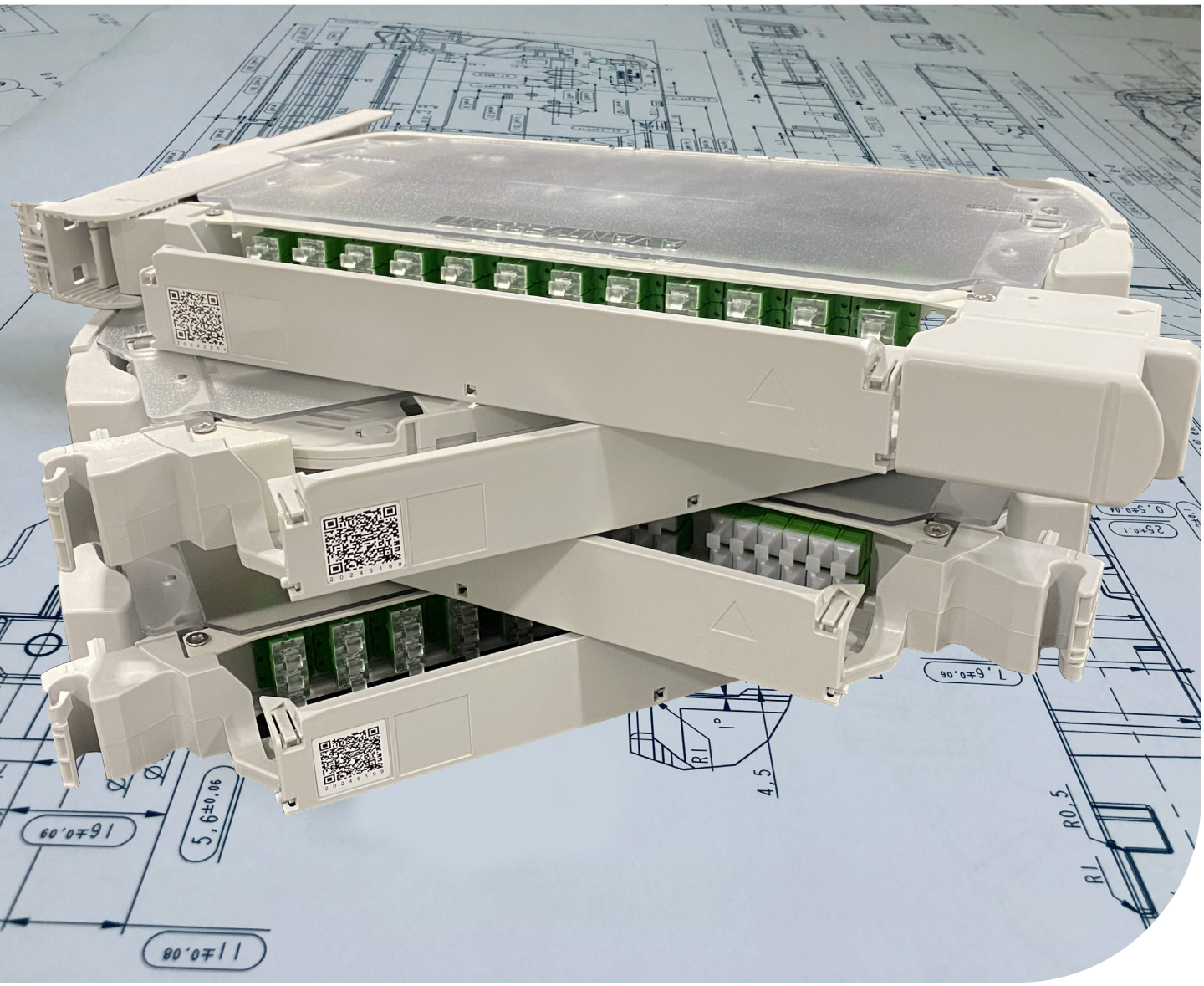
White paper



Eco-design at Aginode

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Introduction

Aginode is a leading manufacturer of telecommunications network solutions. The company supplies operators, installers and distributors with a wide variety of components, including optical distribution modules, more commonly known as optical trays. These modules, located in the final section of fibre networks, are an essential element of FTTH (Fibre To The Home) public networks. Located in connection nodes and street cabinets, also known as sharing points, they enable the transition between active equipment generating the optical signal and the shared local loop that serves each home or business connected to fibre. Almost half of the subscriber modules installed in the French optical network have been designed, qualified, manufactured and tested by Aginode.

Until 2019, these modules were designed using methods similar to those used in data centers and were mainly made of metal. In 2019, Aginode renewed its range and created XPLORER™. These new modules have been specifically designed for FTTH networks and incorporate major technological advances. With regard to functionality these are: Modularity (possibility of configuration to operators' specific requirements), Simplicity (more intuitive installation and assembly), Symmetry (allows versatility of installations without the need to learn new ways of working, simplified ordering and stock management processes and improved logistical aspects) and Lightness (easier handling for operators and installers). To achieve these benefits, XPLORER™ minimizes the amount of metal used to in favour of a reinforced thermoplastic based material. This makes the module more robust and 2 to 3 times lighter than its predecessors.

This evolution has been accompanied by a general rethinking on the environmental impact of manufactured products. Indeed, from the 2015 reform of ISO 14001 to the **RoHS**[1] or **WEEE**[2] legislations, and including the requirements of our customers, life cycle thinking has become an integral part of the company's design strategy.

With this in mind, the following study was conducted, comparing environmental performance throughout the product life cycle to measure the extent to which the XPLORER™ range of optical modules represents an improvement over traditional modules.

[1]The European RoHS Directive (2011/65/EC) aims to limit the use of ten hazardous substances.

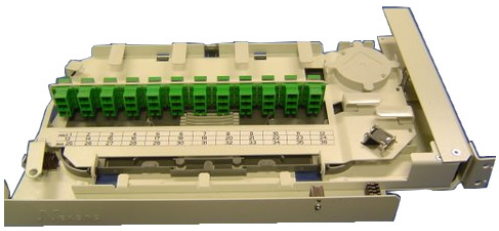
RoHS stands for «Restriction of the use of certain Hazardous Substances» in electrical and electronic equipment.

[2]WEEE stands for Waste Electrical and Electronic Equipment.

Case study

The selected reference product is the **POB**[1] 36, a 1U - 19'' optical tray that combines splicing and patching and allows a maximum of 36 fibres to be distributed.

POB 36 XPLORER™



POB 36 standard

This module, also known as the «collection tray», is an essential component and a highly standardized element of the FTTH streets cabinets. Located at the bottom of the cabinet, often on the right-hand side, it distributes fibres from the exchanges (or optical connection nodes), also known as transport fibres, to the different operators' modules, where they are patched (or split) **32 times**[2]. This simple and identical function for most operators has not changed since the first large-scale fibre optic deployments. It was, therefore, easy to compare the products and to measure the developments.

[1]POB stands for 'Plateau Optique de Brassage' (Optical Coupling Platform).

[2]Across most of the country, the FTTH network is split 64 times: this means that one optical fibre leaving a connection node will supply 64 customers. To do this, a first coupler (or splitter) is usually installed at the exit of the node, which will divide the signal into 2 (1 fibre from the central office (NRO) will feed 2 fibres from the transport). Then, in the cabinet, each operator will split the signal 32 times (1 transport fibre will feed 32 distribution fibres). Other architectures are also possible, ranging from 1 to 1 (point to point, no division) to 1 to 128 (1 fibre from the central office (NRO) will feed 128 customers).

Environmental approach

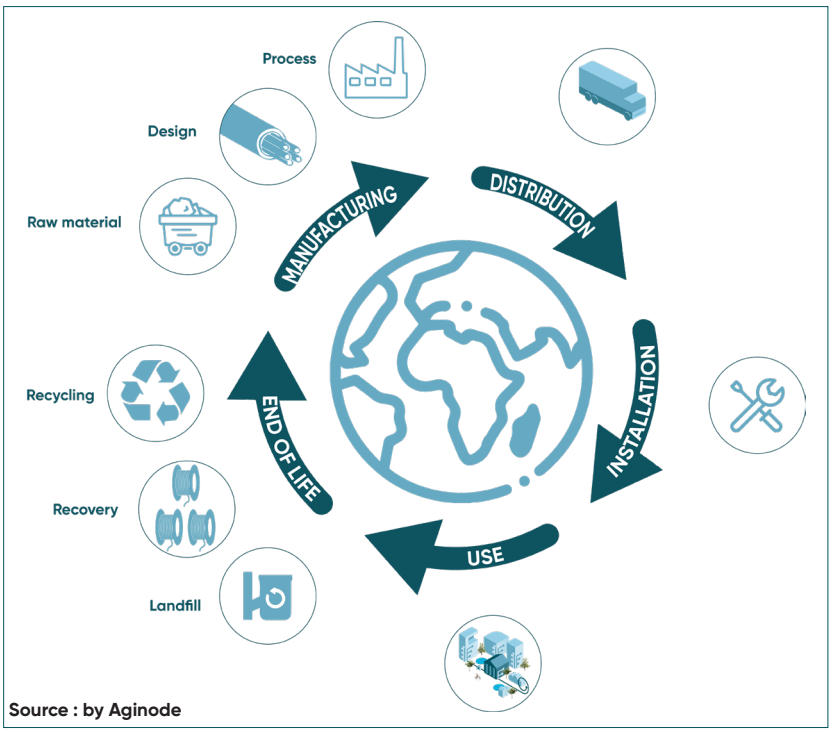
In this study, the reference used to standardize product evaluation is: «Protect and connect a connection point for 20 years at a 100% usage rate in compliance with the applicable standards».

The impact analysis methods used are those developed by the PEPecopassport® programme, an electrical and electronics industry reference that defines rules for the development of Product Environmental Profiles (PEP) in accordance with ISO 14025. The study assesses the life cycles of the different types of optical module, from extraction and processing of all raw materials to the end of life.

The system is segmented in accordance with the following consecutive life cycle stages:

- Manufacturing: extraction, transport, processing of raw materials and chemicals used to manufacture the module and its packaging, use of resources for manufacturing processes and treatment of production waste;
- Distribution: transport of the module to the installation site (local distribution, estimated 1000km by truck for delivery);
- Installation: end-of-life management of installation parts and packaging;
- Use: operation of the module under normal conditions, representation of energy consumption during the product's design life;
- End of life: waste collection and treatment process (assuming landfill disposal owing to the absence of a recycling channel for optical products).

Life cycle stages: from extraction to end of life



Source : by Aginode

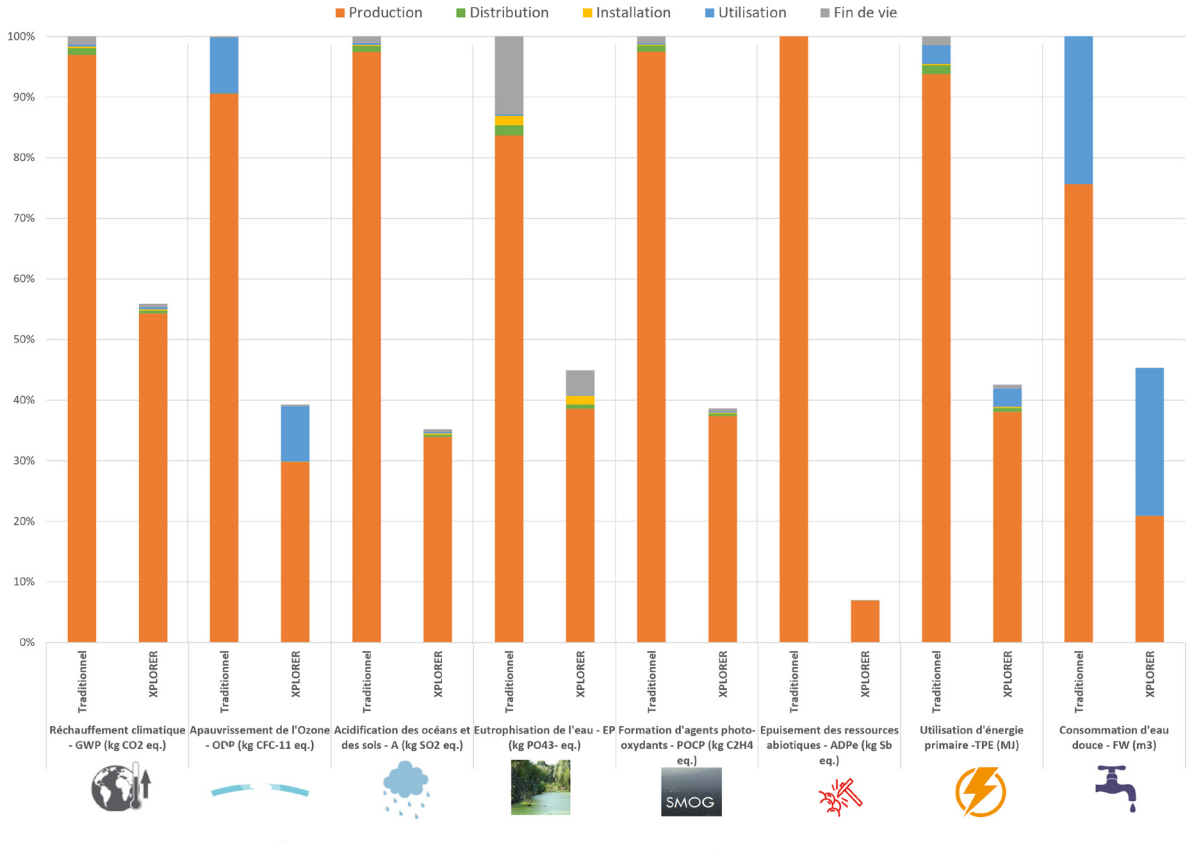
In this study, eight environmental indicators were assessed, including global warming (expressed in kg CO_2-eq), energy depletion (expressed in MJ), **abiotic**[1] resource depletion (in kg Sb-eq) and water depletion (m3).

[1]Abiotique mineral resource depletion (ADPe) (in kg eq Sb). This global indicator is based on concentration of reserves and de-accumulation rate. This indicator does not take into account depletion of fossil fuels as it often follows the same trends as the GWP indicator

Environmental performance

The graph below presents the results of our environmental impact assessment. The POB 36 Traditional is used as the reference (base 100). Here, we compare the performance of the XPLORER™ POB 36 to our reference on 8 environmental aspects. For each of these environmental aspects, we can visualise the impact of all stages of the product's life cycle (from manufacturing to end of life), each stage being represented by a different colour.

Comparison of the environmental impacts of a Traditional POB 36 and a POB 36 XPLORER™



Source : by Aginode
EIME software version 5.8.1 ; PEP-PCR-ed3-EN-2015 04 02 ; PSR-0001-ed3-EN-2015 10 16)

When analyzing the life cycle of our POB 36, the most impactful stages in the analysis are the extraction of raw materials, production, and packaging - as is the case with all telecom accessories. These three stages are all part of the first phase: manufacturing (orange in the graphic). As with all telecom accessories, the distribution, installation, usage and end-of-life phases only have a minor environmental impact.

Analysis of results:

- Environmental impact: greatly reduced for all manufacturing side indicators by switching from the traditional model to XPLORER™ ,
- Distribution: this has a greater effect for the 'traditional' units due to their weight (a traditional POB 36 is 2.6 times heavier than an XPLORER™),
- End of life: greater impact for 'traditional' units, again due to weight.

The environmental impact of manufacturing has been reduced on the 4 main indicators:
44% on global warming potential (GWP)
93% on Abiotic Depletion Potential (elements) (ADPe)
59% on total primary energy consumption (TPE)
72% on net use of fresh water (FW)

Manufacturing phase: Reduction in environmental impact by switching from a traditional module to an XPLORER™ module	**GWP**	**ADPe**	**TPE**	**FW**
	-44%	**-93%**	**-59%**	**-72%**

According to the life cycle assessment of the two POB 36s, the redesigned XPLORER™ product is functionally equal to the older unit, but with significantly lower environmental impact. To illustrate: the Traditional POB 36 will emit 565g CO2 eq. throughout its lifetime, compared to 316g CO2 eq. for the new generation XPLORER™.

Conclusions and perspectives

Based on the results of the comparative life cycle assessment, we can conclude that the eco-design efforts implemented in the POB 36 passive optical module redesign project have been beneficial. The new version of the product, POB 36 XPLORER™, significantly improves manufacturing - the main contributor to life cycle environmental impact, without any transfer of impact to other life cycle stages and environmental indicators.

Thanks to a lighter design that uses less material, the impact of manufacturing has been reduced considerably, which also has a direct impact on the distribution and end-of-life phases of the product.

The high-quality XPLORER™ range of optical modules offering multiple functions (combined or single, splicing, cross-connecting, coupling and storage) to meet the requirements of small and large-scale optical deployments. The entire range has been designed following the same eco-design principles used for the POB 36 XPLORER™ in order to make efficient use of raw materials and optimize manufacturing processes.

Eco-design is an integral part of Aginode' transition to a circular economy and carbon neutrality model.

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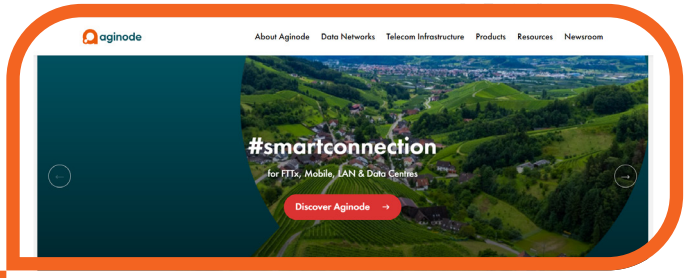

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